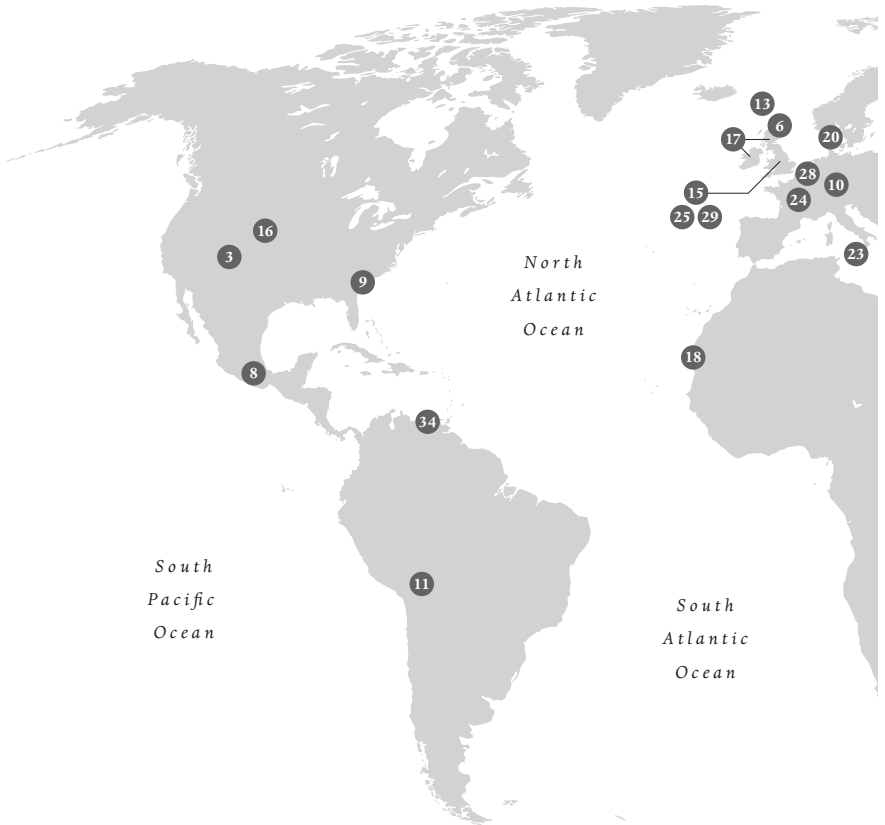
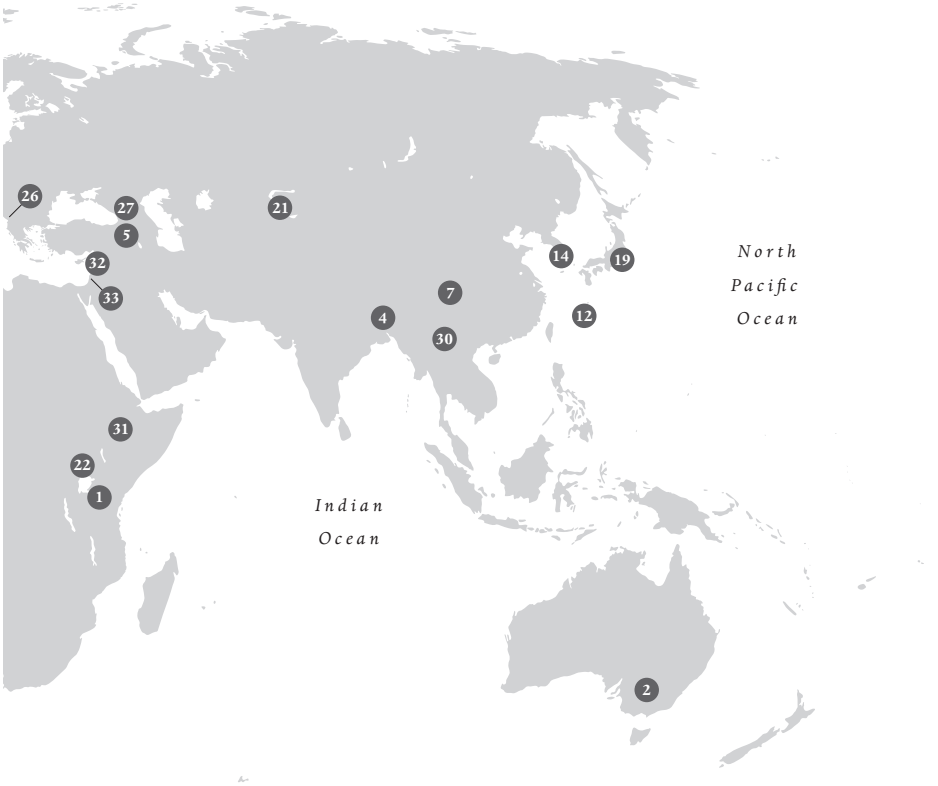
Contents



1 Hadza Honey (Lake Eyasi, Tanzania)
2 Murnong (Southern Australia)
3 Bear Root (Colorado, USA)
4 Memang Narang (Garo Hills, India)
5 Kavılca Wheat (Büyük Çatma, Anatolia)
6 Bere Barley (Orkney, Scotland)
7 Red Mouth Glutinous Rice (Sichuan, China)
8 Olotón Maize (Oaxaca, Mexico)
9 Geechee Red Pea (Sapelo Island, Georgia, USA)
10 Alb Lentil (Swabia, Germany)
11 Oca (Andes, Bolivia)
12 O-Higu Soybean (Okinawa, Japan)
13 Skerpikjøt (Faroe Islands)
14 Black Ogye Chicken (Yeonsan, South Korea)
15 Middle White Pig (Wye Valley, England)
16 Bison (Great Plains, USA)
17 Wild Atlantic Salmon (Ireland and Scotland)
18 Imraguen Butarikh (Banc D'Arguin, Mauritania)



19 Shio-Katsuo (Nishiizu, Southern Japan)
20 Flat Oyster (Limfjorden, Denmark)
21 Sievers Apple (Tian Shan, Kazakhstan)
22 Kayinja Banana (Uganda)
23 Vanilla Orange (Ribera, Sicily)
24 Salers (Auvergne, Central France)
25 Stichelton (Nottinghamshire, England)
26 Mishavinë (Accursed Mountains, Albania)
27 Qvevri Wine (Georgia)
28 Lambic Beer (Pajottenland, Belgium)
29 Perry (Three Counties, England)
30 Ancient Forest Pu-Erh Tea (Xishuangbanna, China)
31 Wild Forest Coffee (Harenna, Ethiopia)
32 Halawet el Jibn (Homs, Syria)
33 Qizha Cake (Nablus, West Bank)
34 Criollo Cacao (Cumanacoa, Venezuela)

Introduction

In eastern Turkey, in a golden field overshadowed by grey mountains, I reached out and touched an endangered species. Its ancestors had evolved over millions of years and migrated here long ago. It had been indispensable to life in the villages across this plateau, but its time was running out. 'Just a few fields left,' the farmer said. 'Extinction will come easily.' This endangered species wasn't a rare bird or an elusive wild animal, it was food, a type of wheat: a less familiar character in the extinction story now playing out around the world, but one we all need to know.

The tall crop, heavy with grains, was ready to harvest. A whisper of a breeze made its surface swirl like a sea. To most of us, one field of wheat might look much like any other, but this crop was extraordinary. Kavilca (pronounced Kav-all-jah) had turned eastern Anatolian landscapes the colour of honey for four hundred generations (around 10,000 years). It was one of the world's earliest cultivated foods, and now one of the rarest.

How could this be possible? Wheat is an ubiquitous grass that covers more farmland than any other crop, grown on every continent except Antarctica. How can a food be close to extinction and yet at the same time appear to be everywhere? The answer is that one type of wheat is different to another. Each has a unique story to tell, and many varieties are at risk, including ones with important characteristics we need to combat crop diseases or climate change. Kavilca's rarity is emblematic of the mass extinction taking place in our food. We are losing diversity in all the crops that feed the world. Yet diversity was the rule for millennia; thousands of different types of wheat have been recorded, each one distinctive in the way it looked, grew and tasted. Few of these varieties have survived into the twenty-first

century. Instead, all over the world, from Punjab to Iowa, the Western Cape to East Anglia, wheat fields have been cloaked in a blanket of uniformity, and the same is happening to all our food, at a faster and faster pace.

Many aspects of our lives are becoming more homogeneous. We can shop from identical outlets, see the same brands and buy into the same fashions around the world. The same is true of our diet. In a short space of time it has become possible for us to eat the same food wherever we are, creating an edible form of uniformity. 'But hang on,' you might say, 'I eat a greater variety of foods than my parents or grandparents ever did.' And on one level, that is true. Whether you're in London, Los Angeles or Lima, you can eat sushi, curry, or McDonald's; bite into an avocado, banana or mango; sip a Coke, a Budweiser or a branded bottle of water – and all in a single day. What we're being offered appears at first to be diverse, until you realise it is the same kind of 'diversity' that is spreading around the globe in identical fashion; what the world buys and eats is becoming more and more the same.

Consider these facts: the source of much of the world's food – seeds – is mostly in the control of just four corporations; half of all the world's cheeses are produced with bacteria or enzymes manufactured by a single company; one in four beers drunk around the world is the product of one brewer; from the USA to China, most global pork production is based around the genetics of a single breed of pig; and, perhaps most famously, although there are more than 1,500 different varieties of banana, global trade is dominated by just one, the Cavendish, a cloned fruit grown in monocultures so vast their scale can only be comprehended from the view of an aeroplane or by satellite.

This level of uniformity, from the genetics of the world's most widely consumed crops, wheat, rice and maize, right through to the meals they become, has never been experienced before. The human diet has undergone more change in the last 150 years (roughly six generations) than in the entire previous one million years (around 40,000 generations). And in the last half a century, trade, technology and corporate power have extended these dietary changes right across the world. We are living and eating our way through one big unparalleled experiment.

For most of our evolution as a species, as hunter-gatherers and then as farmers, human diets were enormously varied. Our food was the product of a place and crops were adapted to a particular environment, shaped by the knowledge and the preferences of the people who lived there as well as the climate, soil, water and even altitude. This diversity was stored and passed on in the seeds farmers saved, in the flavours of the fruits and vegetables people grew, the breeds of animals they reared, the bread they baked, the cheeses they produced and the drinks they made.

Kavilca wheat is one of the survivors of disappearing diversity, but only just. Like all the endangered foods in this book, it has a distinctive history and a connection to a specific part of the world and its people. I came across it in a village called Büyük Çatma, north of the part of Turkey where the very first farmers began cultivating wheat 12,000 years ago. From the time when prehistoric tribes farmed this land and on through Roman, Ottoman, Soviet and then Turkish rule, Kavilca was the most important food source here. It is only during our lifetimes that this singular grain, perfectly adapted to its environment and with a taste like no other, has become endangered and pushed to the brink of extinction. The same is true of many thousands of other crops and foods. We should all know their stories and the reasons for their decline, not just as an exercise in food history or to satisfy culinary curiosity but also, as we'll see, because our survival depends on it.

Under the big open sky of eastern Anatolia, I watched the farmer as he worked until dusk, harvesting the last of the Kavilca wheat from his field. 'I want to plant Kavilca again next year,' the farmer said. 'But my neighbours? I'm not so sure.' I was witnessing the closing chapter of a story that had begun thousands of years before. It felt like a privilege but also a tragedy.

I reported on food stories for BBC radio for almost a decade before I realised the extent of the extinction process taking place. I had stumbled into food journalism, but for me, food soon became the perfect lens through which I could understand the inner workings of the world. Food shows us where real power lies; it can explain conflicts and wars; showcase human creativity and invention; account for the rise and fall of empires; and expose the causes and consequences of disasters. Food stories are perhaps the most essential stories of all.

My entry into food journalism took place during a crisis. It was 2008, and while the world was mostly focusing on the financial turmoil ripping through the banking system, a momentous food story was also unfolding. Wheat, rice and maize prices were spiralling to record highs, tripling on global markets at their peak. This pushed tens of millions of the poorest people on Earth towards hunger and also fuelled the tensions that later exploded into the Arab Spring. Riots and protests toppled governments in Tunisia and Egypt and helped trigger the conflict in Syria. For the first time in decades, people were asking serious questions about the future of our food. With 7.5 billion people on Earth and a projected 10 billion by 2050, crop scientists began telling the world that global harvests needed to increase by 70 per cent. Faced with these forecasts, the disappearance of one type of wheat like Kavilca might have seemed an irrelevance. Surely what the planet needed was more food? Calling for greater diversity seemed liked an indulgence. But now we're starting to realise that diversity is essential for our future.

Evidence of this shift in thinking came in September 2019 at the Climate Action Summit held at the United Nations headquarters in New York. Emmanuel Faber, who was then CEO of the dairy giant Danone, told the business leaders and politicians present that the food system the world had created over the last century was at a dead end. 'We thought with science we could change the cycle of life and its rules,' he said, that we could feed ourselves with monocultures and base most of the world's food supply on a handful of plants. This approach was now bankrupt, Faber explained. 'We've been killing life and now we need to restore it.'

Faber was making a pledge to save diversity backed by twenty global food businesses, including Unilever, Nestlé, Mars and Kellogg – companies with combined food sales in a hundred countries of about $500 billion. He said the world urgently needed to save the crops and 'the traditional seeds that are dying', and that agricultural biodiversity needed to be restored. At the event, Faber expressed concern that in parts of the dairy industry 99 per cent of the cows are a single breed, the Holstein. 'It's over-simplistic now,' he said of the global food system. 'We have a complete loss of diversity.'

If the businesses that helped create and spread homogeneity in our food are now voicing concerns over lost diversity, then we should all

take notice. The enormity of what we're losing is only now dawning on us; but if we act now, we can save it.

The endangered foods in this book are part of the bigger crisis unfolding across the planet: the loss of all kinds of biodiversity. Just as we are losing diversity in jungles and rainforests, we're losing it in fields and farms. But what exactly does 'biodiversity' mean when applied to food? Part of the answer lies at the end of a tunnel cut 135 metres deep into a mountain on the remote Arctic island of Svalbard. This is the most secure place scientists could find to build the world's largest seed vault, home of a collection of more than one million seeds, a living record of thousands of years of farming history. These seeds were sent to Svalbard for safekeeping, usually by governments but also by indigenous people looking to preserve their most precious and often endangered traditional foods. The collection represents one form of diversity being lost from our food: genetic diversity, or, put another way, the variation created since the dawn of agriculture by farmers all over the world. There are varieties of more than 1,000 different crops inside the vault, including 170,000 unique samples of rice, 39,000 samples of maize, 21,000 samples of potato and 35,000 samples of millet (there are also the wild relatives of all of these crops). And tucked away in one of the boxes of seed (all kept at –18°C) is a handful of Kavilca grains, just one of the 213,000 different samples of wheat being safeguarded. Diversity stored in a vault isn't the same as that tended by farmers growing crops we can eat, but it's a recognition of the importance of diversity and a way of keeping our options open.

In addition to the seeds at Svalbard, in other parts of the world collections of living diversity are managed by universities and other institutions. For example, at Brogdale in Kent, home of the UK's National Fruit Collection, there are 2,000 varieties of apple while at the University of California Riverside more than 1,000 different varieties of citrus are being conserved. Across the planet there are 8,000 livestock breeds (of cows, sheep, pigs and so on) being saved, mostly on small farms, many at risk of extinction. Much of our food supply has been narrowed down to a tiny fraction of this diverse array of plants and animals, and in some cases we are dependent on just one variety or a handful of breeds.

The rich profusion of diversity, provided by nature and guided by human hands, is not just one of the most beautiful features of our food and farming history. We nurtured diversity because we needed it and, in the creation of cuisines and the evolution of cultures, we have celebrated it. In the village of Büyük Çatma in eastern Turkey, farmers grew Kavilca for millennia because in the harshest, wettest, coldest winters, no other crop produced as much food. What's more, countless cooks experimented with the grain and used its distinctive textures and tastes to craft recipes, creating what we might refer to today as a food culture. Wherever you look in human history, all communities had their own versions of Kavilca, life-giving foods that forged identities or inspired rituals and religions, such as gods made of maize in Central America and oranges believed to repel spirits in South Asia. Whether plants or animals, these were unique genetic resources, all adapted to their place in the world. You can multiply Kavilca's story a million times, for each and every seed stored inside Svalbard, for all the ancient breeds of farm animals that still exist, and for every traditional style of cheese and bread made around the world. Each one of these foods is a piece of human history.

The decline in the diversity of our food, and the fact that so many foods have become endangered, didn't happen by accident: it is an entirely human-made process. The biggest loss of crop diversity came in the decades that followed the Second World War when, in an attempt to save millions from starvation, crop scientists found ways to produce grains such as rice and wheat on a phenomenal scale. To grow the extra food the world desperately needed diversity was sacrificed, as thousands of traditional varieties were replaced by a small number of new super-productive ones. These plants were designed to grow quickly and produce lots more grain. The strategy that ensured this – more agrochemicals, more irrigation, plus new genetics – came to be known as the 'Green Revolution'. And it worked spectacularly well, at least to begin with.

Because of it, grain production tripled, and between 1970 and 2020 the human population more than doubled. Leaving the environmental, dietary and social legacy of that strategy to one side (we will get there), the danger of creating more uniform crops is that, like a stock portfolio with just a few holdings, they become vulnerable to catastrophes. A

global food system that depends on just a narrow selection of plants – and only a very small number of varieties of these – is at greater risk of succumbing to diseases, pests and climate extremes.

Quite *how* vulnerable can be understood when you look across a field of Kavilca. As an older form of wheat, it stands taller than the modern varieties you're likely to see today. There are good evolutionary reasons for this; as they grow, longer stalks put distance between the ears of wheat and the soil, which is where most plant diseases live. One of these diseases is caused by a ruinous (and incredibly sneaky) fungus called *Fusarium graminearum*, which is spreading through Europe, Asia and the Americas. After tricking its way inside the wheat, it leaves behind a worthless crop and tonnes of grain made toxic to humans and animals. Once the fungus is in a field, it is impossible to remove.

The disease it causes (Fusarium head blight) creates billions of dollars of damage a year and presents a serious risk to future food security. The genetics of modern wheat makes it more susceptible to head blight than older varieties. Like most crop diseases spreading around the world, the problem is getting worse too. Climate change, particularly warmer, wetter weather, is accelerating the fungus's spread. Although the Green Revolution was based on ingenious science, it attempted to oversimplify nature, and this is starting to backfire on us. In creating fields of identical wheat, we abandoned thousands of highly adapted and resilient varieties. Far too often their valuable traits were lost forever. We're starting to see our mistake – there was wisdom in what went before.

Kavilca is just one endangered food, but it illustrates, as do all of the foods in this book, the interconnectedness of farming, food, environment, diet and health. The physicist Albert-László Barabási, an expert in unravelling complex networks both human-made and natural, argues that the driving force of science during the twentieth century was a relentless kind of reductionism; convinced by our own cleverness, we believed we were capable of deciphering nature in all its complexity and then overriding it. And yes, we have been brilliant at fathoming the constituent parts, but we have too often failed to understand nature as a whole. Like a child taking apart a favourite toy, Barabási says, we have no idea how to put it back together again. In riding reductionism, 'we run into the hard wall of complexity'.

The endangered foods in this book represent a time before that scientific reductionism took hold. These foods offered much more than a supply of calories delivered in ever greater quantities, they helped us work more in harmony with nature. Take, for example, a humble legume called the Swabian lentil, once grown widely in the Alps of southern Germany. Beloved for its flavour, the *Alb-linse* fed the people in this mountainous region because it was able to nourish the otherwise ungenerous soil. Or consider a rare variety of maize found high up in a village in Oaxaca, Mexico, that oozes a self-fertilising mucus which scientists believe could help reduce agriculture's dependence on fossil fuels. Many of the world's endangered foods are so complex that scientists are only just beginning to unlock their secrets.

Of the 6,000 plant species humans have eaten over time, the world now mostly eats just nine, of which just three – rice, wheat and maize – provide 50 per cent of all calories. Add potato, barley, palm oil, soy and sugar (beet and cane) and you have 75 per cent of all the calories that fuel our species. Since the Green Revolution, we eat more refined grains, vegetable oils, sugar and meat, and we depend on foods produced further and further away from the places we live. As thousands of foods have become endangered and extinct, a small number have risen to dominance. Often this has happened without us really noticing. Take soy, domesticated in China thousands of years ago, a bean relatively obscure outside Asia until the 1970s and now one of the world's most traded agricultural commodities. Used in feed for pigs, chickens, cattle and farmed fish, which in turn feed us, soy plays a starring role in an increasingly homogeneous diet eaten by billions of people. Seen in the context of 2 million years of human evolution, these dietary shifts taking place at a global level, all pointing towards uniformity, are unprecedented. This is happening as we're just beginning to understand the importance of diversity to our own health. The richer our gut microbiomes (the trillions of bacteria, fungi and other microbes we all host) the better for us. And the more diverse our diets, the richer our gut microbiomes become.

What an individual human diet looked like even a few thousand years ago isn't easy to untangle from the archaeological record, let alone further back in our evolution, but we do know it was far richer in diversity than the one most of us eat today. In the Jutland Peninsula

of western Denmark in 1950, peat diggers discovered the intact body of a man who had been executed (or possibly sacrificed) 2,500 years ago. The body had been so well protected in the wet, boggy conditions it was first thought to be the victim of a recent murder. Inside the man's stomach was a porridge made with barley, flax and the seeds of forty different plants, some of them gathered from the wild. In present-day East Africa, the Hadza, who are among the last of the world's hunter-gatherers, eat from a potential wild menu that consists of more than eight hundred plant and animal species, including numerous types of tubers, berries, leaves, small mammals, large game, birds and types of honey. The Hadza are a surviving link back to early-human diets. We can't replicate their diets in the industrialised world but we can learn from them nonetheless.

On top of the nutritional loss and genetic loss taking place, there is a cultural one. Over millennia, humans discovered myriad ways of cooking, crafting, baking, fermenting, smoking, drying and distilling their foods and drinks. The number of people in possession of many of the world's traditional food skills, and much of the world's ancient knowledge, is dwindling, from methods of cheese-making to techniques for preserving cuts of meat. These are essential parts of our heritage and are being lost. We look to paintings, sculptures, cathedrals and temples for the greatest examples of human creativity and vision, but we should also look to the endangered foods in this book, whether a cultivated red grain of rice from south-western China, a rare cheese from the Accursed Mountains of Albania, or a piece of cake baked in western Syria; each of these foods is the product of invention and imagination and the wisdom of generations of unknown cooks and farmers.

This book is definitely not a call to return to some kind of halcyon past. But it is a plea to consider what the past can teach us about how to inhabit the world now and in the future. Our current food system is contributing to the destruction of the planet: one million plant and animal species are now threatened with extinction; we clear swathes of forests to plant immense monocultures and then burn through millions of barrels of oil a day to make fertilisers to feed them. Out at sea, we have significantly altered 90 per cent of the oceans; marine wilderness is disappearing. And while we destroy biodiversity, we

extract tremendous quantities of water from rivers and aquifers to irrigate Green Revolution crops in a loan that cannot be repaid. Our food is both the cause and a victim of all of this harm. The productivity of a quarter of the land surface of the Earth has been seriously compromised, hampering our ability to grow food. We are farming on borrowed time.

I can't claim that the foods in this book will provide answers to all of these problems, but I believe they should be part of the solution. Bere barley, for example, is a food so perfectly adapted to the harsh environment of Orkney that no fertilisers or other chemicals are needed for it to grow. *Skerpikjøt*, a fermented hunk of sheep meat from the Faroe Islands, shows us how far our relationship with animals has changed – and needs to change again. And murnong, a juicy, nutritious and once abundant root from southern Australia, is proof that the world has much to learn from indigenous peoples about eating more in harmony with nature.

Many argue that the only serious answer to our food problems lies not in returning to a more diverse food system, but in launching a second Green Revolution, one based around biotechnology, such as transgenics and gene editing. But even that approach will depend on saving endangered foods. Crop breeders and other food scientists have joined in the race to save disappearing diversity because endangered plants and animals – including many featured in this book – are seen as possessing the genetic toolkit we need to tackle drought and disease, to contend with climate change and to improve the quality of our diets. Whichever path we take, we can't afford to let these foods go extinct.

The concept of being *endangered* and *at risk of extinction* is usually reserved for wildlife. Since the 1960s, the Red List, compiled by the International Union for Conservation of Nature, has catalogued vulnerable plant and animal species (around 105,000 at the time of writing), highlighting those at risk of extinction (nearly 30,000). It's only if you know something is about to disappear, the thinking goes, that you can galvanise action to save it.

A version of the Red List dedicated solely to food was created in the mid-1990s, in the small Piedmontese town of Bra, in northern Italy, when a group of friends realised that crops, animal breeds and traditional dishes were disappearing from their region. They created

an online catalogue for endangered foods and named it the Ark of Taste. Led by the journalist Carlo Petrini, the group had already set up the Slow Food organisation, which called on people 'to defend themselves against the universal madness of "the fast life" … escape the tediousness of "fast-food" [and] rediscover the rich varieties and aromas of local cuisines'. They saw that when a food, a local product or crop became endangered, so too did a way of life, knowledge and skill, a local economy and an ecosystem. Their call to respect diversity captured the imaginations of farmers, cooks and campaigners from around the world, who started to add their own endangered foods to the Ark.

The Ark of Taste inspired this book. As I write, it contains 5,312 foods from 130 countries, with 762 products on a waiting list ready to be assessed. Here, we will meet people saving endangered foods, including the farmer who showed me the rare field of Kavilca wheat and others like him. There are likely to be other champions in your own part of the world. These foods represent much more than sustenance. They are history, identity, pleasure, culture, geography, genetics, science, creativity and craft. And our future.

Food: A Very Brief History

[Biodiversity] is the assembly of life that took a billion years to evolve. It has eaten the storms – folded them into its genes – and created the world that created us. It holds the world steady.

E.O. Wilson, *The Diversity of Life*

To grasp the scale of the decline in the diversity of the world's food, we need to comprehend the almost incomprehensible amount of time it took for biodiversity to evolve. So huge is the timeline involved here, I'm going to call on the help of Kavilca wheat once more, to provide some useful points of reference.

Four and a half billion years before the first farmers planted Kavilca seeds, there was nothing on the menu. Earth was a fiery landscape with burning lava spouting from volcanoes and its surface bombarded by meteors. Geologists call this hellish time the Hadean period, after the Greek god of the underworld. One billion years later, the first microscopic organisms appeared, followed a further billion years later by forms of bacteria capable of using energy from the sun and water to produce nutrients. These first acts of photosynthesis produced oxygen and made it possible for more complex life forms to evolve. Fast-forward another one and a half billion years and multicellular life forms show up on Earth, and a mere 100 million after that, sponges and tiny, plate-like creatures called Placozoa evolved, perhaps the last common ancestors of all animals. But there was still nothing on Earth you and I would recognise as food.

Things started to become a little more interesting (at least from our point of view) 530 million years ago; the continents were dividing and different life forms proliferated in the oceans following the Cambrian Explosion, evolution's 'Big Bang'. This was the beginning of biodiversity as we know it. Shelled creatures resembling clams and snails appeared in the oceans, along with oyster-like bivalves, eel-like conodonts and *Nectocaris pteryx*, a kite-shaped, stalk-eyed, carnivorous ancestor of squid, octopus and cuttlefish. By the time the Earth entered its next geological age, the Ordovician, less than 500 million

years ago, most of the ancestors of all the major life forms that populate our world today had arrived. Plants made their big move from sea to land to begin a long, co-evolutionary journey with another life form, insects.

The first plants on land were mosses and ferns, which released spores into the air to reproduce. They also helped to break apart Earth's rocky surface, turning it into a substrate, which slowly developed into soil. Four hundred million years ago Earth's environment went from being moist and tropical to drier and (for most plants) more hostile. In response plants evolved preservation chambers that could provide an embryo protection as well as a store of food: seeds. Around 250 million years ago, some plants came up with the added evolutionary advantage of growing spectacular flowers and seductive fruits to attract the greatest number of insects and mammals to disperse grains of pollen and seeds. Grasses evolved 60 million years ago, a big moment in terms of our food history. Dinosaurs missed out on this food source by around 6 million years, but mammals, including humans, were waiting in the wings to reap the benefits; from these grasses came rice, maize, barley and wheat (at last, Kavilca is on its way!).

Six million years ago, ape-like hominids appeared, among them *Sahelanthropus tchadensis* (Sahel Man), a species that spent most of its time foraging among forest canopies, eating leaves, nuts, seeds, roots, fruits and insects. In Ethiopia 4 million years ago, a human ancestor called *Ardipithecus ramidus* (nicknamed Ardi) also climbed trees but spent a little more of its time finding food by walking on two feet. Then, 2 million years ago, Earth's climate changed and brought humans down from the trees and onto the ground. The wetlands of East Africa had become savannah and to survive our ancestors scavenged meat and hunted animals. In the Olduvai Gorge in northern Tanzania, early humans left behind stone tools used to strip flesh off carcasses and (perhaps more importantly) break into bones to gain access to the nutrient rich marrow. The human body changed again during this period; toes and forearms became shorter and legs longer as we turned into the long-distance runners of the animal kingdom, capable of tracking and killing larger creatures. Partly thanks to meat eating our teeth became smaller and our brains became bigger (three times larger than the brains of apes). The human gut also shrank in

size, but within it a complex ecosystem of trillions of microbes evolved, helping us adapt to more diverse diets.

Between 800,000 and 300,000 years ago, the use of fire and cooking expanded the human diet, turning inedible plants into food and making meat easier to digest. Sophisticated weapons made human hunters more lethal; half a million years ago, spears were being used to kill land animals. Later, lethal barbs crafted from bones helped our ancestors to haul giant catfish out of lakes. Seventy thousand years ago, our species *Homo sapiens* spread out of East Africa and began to establish its dominance over the planet. Sixty-five thousand years ago, a group of hunter-gatherers reached Australia, where they devised fish traps along rivers (and used lakes to practise aquaculture).

Containers made from animal skins were being used to move food around 30,000 years ago, and later, baskets woven from plant fibres. In China, 20,000 years ago, long before the birth of agriculture, new cooking technology was in use: pots for boiling and steaming wild rice. By then groups of humans had made the long trek from north-east Asia to the Americas, taking much of this know-how with them.

Then came one of the most momentous events in the history of *Homo sapiens*: the birth of agriculture. In the Black Desert, in present-day Jordan, Natufian hunter-gatherers had long ground up the seeds of wild grasses into rough flour, and mixed in pulverised plant roots to make a dough which they cooked over fire. Scientists in the twenty-first century who recreated this early form of flatbread described the taste as 'nutty and a little bitter'. This mixture of different ingredients is the earliest evidence of a cuisine. The Natufians who made that bread 13,000 years ago are the transitional link between millions of years of human hunter-gatherers and agriculture. In the Fertile Crescent, an arc of land that sweeps across Iraq, south-eastern Turkey, Syria, Lebanon, Israel and Jordan, the necessary wild plants, climate and imagination led humans to become settled farmers. Over the next few thousand years, through unconscious decisions, accidental discoveries and luck, some humans transformed the plants they found around them, selecting the biggest seeds and the grains easiest to harvest, domesticating and taming them. During this time human biology changed yet again as our saliva and our gut microbiomes evolved to break down the greater amounts of starch produced by agriculture.

Early in this transition from foraging to farming came emmer, a type of wheat that would go on to be prized by ancient Egyptians. One of the few surviving varieties of this early form of wheat is Kavilca.

Wheat was not domesticated alone of course. In the Fertile Crescent, the Neolithic food package also included chickpeas and lentils, followed by figs and dates. Hunter-gatherers in other parts of the world domesticated the wild plants that grew in their ecosystems: rice and millets along the Yangtze and Yellow River basins in China; corn, squash and beans in south-eastern Mexico; potatoes and quinoa around Lake Titicaca in the Andes; mung beans and millets in India; sorghum and cowpeas in sub-Saharan Africa; and bananas and sugar cane in Papua New Guinea. The transformation of wild plants into cultivated crops took thousands of years and involved more than 150 generations of farmers. Alongside plants, these early farmers domesticated all of the animal species kept as livestock today: cows, sheep, pigs and goats, as well as camels, llamas and yaks. This resulted in another biological change, the ability of adult humans in some parts of the world to digest milk more easily.

Around 3,500 years ago, the remarkable transition from humans being dependent on wild foods to mostly cultivated ones neared completion. No new plants or animals of significance to human diets have been domesticated since. Why? Partly because by then the plants most suited to farming had been encountered. Domestication was also a slow and arduous task. Why go to the trouble when trade and migration were opening up access to new plants transformed by other civilisations? Globalisation in the ancient world helped bring an end to the domestication effort.

As the suite of domesticated plants and animals spread all over the world, moved around by farmers from one region to another, they evolved and adapted in new environments. To paraphrase the botanist E.O. Wilson, they 'ate the storms', adjusted to the soils, the climate, the altitude (and human inclinations) and 'folded them into their genes'. This is how the world ended up with so many varieties of corn, rice and wheat and all the other food crops.

Through innovation and experimentation, humans transformed their food in more intricate ways. People in central Europe started preserving milk by reducing its water content and concentrating the fats and proteins, so making cheese; in the Caucasus, grapes were

crushed and converted into wine; in China, cooks deployed a wondrous process that turned inedible soybeans into white, silky blocks of tofu; in the Amazon, forest dwellers co-opted bacteria and yeasts to ferment a toxic tuber, cassava, into a safe and delicious food; and farmers in southern Mexico added toxic mineral lime to corn, to extract more nutrients from the grain and make a soft dough for tortillas.

Over millennia, food, cooking and eating became the most powerful expression of the human imagination. So, when a food becomes endangered, another seed lost, another skill forgotten, it is worth remembering the epic story of how they got here.

Part One
Wild

The question must be raised. Why farm? Hunter gatherers paint pictures, recite poetry, play musical instruments . . . they do everything farmers do . . . but they don't work as hard.

Jack Harlan, *Crops and Man*

We were born to eat wild. For most of our history, human survival meant foraging for plants, collecting nuts and seeds, and tracking and killing animals. By any measure, hunting and gathering has been our most successful lifestyle to date. In the late 1960s, the anthropologists Richard Lee and Irven DeVore estimated that of the 85,000 million people who had ever lived, 90 per cent were hunters and gatherers and only about 6 per cent lived as farmers. The barely significant number that remained were experimenting with life in the industrialised world. Our physiology, psychology, fears, hopes *and* dietary preferences have been shaped by our evolution as hunters and gatherers. Our bodies haven't changed that much but our way of life and our diets have, profoundly and at speed.

Of the 7.8 billion of us on the planet today, just a few thousand people continue to source most of their calories from the wild. Colonialism has historically played its part in this decline, and other forces are at work today. The farms, plantations and industries that feed most of us are destroying the habitats of many traditional societies. Manufactured and branded products from the industrialised world make it into the furthest reaches of the Amazon forest and the African savannah, in a form of neocolonialism through food. If the last of the hunter-gatherers ceased to exist – which could happen within our lifetimes – the world would lose valuable knowledge amassed over countless generations, and a link to the way of life that formed us. It would be a tragic end to a 2-million-year-long story.

But look more closely and it becomes clear that 'wild' food isn't just the preserve of the few remaining hunter-gatherers. Indigenous farming communities all over the world also still rely heavily on wild food. The Mbuti people in the Congo eat more than three hundred

different species of animals and plants in addition to the cassava and plantains they cultivate. Across India, 1,400 wild plant species feature in rural diets, including 650 different fruits. And whereas many indigenous people get the bulk of their calories from wheat, corn, rice and millet, most of their micronutrients (the vitamins and minerals) still come from wild food. Rice farmers in north-eastern Thailand, for instance, forage for a wild spinach found around the edges of their paddies, a food which complements the starchy grain they grow. The choice between the cultivated and uncultivated is not a binary one – it is more of a sliding scale. It has always been this way. The first farmers to sow seeds would have starved if they hadn't continued to hunt and forage for wild food, as would the hundreds of generations of farmers who followed. In more modern times all human societies which have experienced scarcity have looked to the wild for sustenance. At the beginning of the twentieth-century Sicilians who went hungry after poor harvests searched for snails to eat; Americans in the depression era turned to wild blackberries and dandelions; people in wartime Britain gathered nettles; and in China during the Great Famine of the 1950s, people looked to bitter grasses for survival.

Today, one billion people source at least a portion of their diet from the wild, whether for sustenance or pleasure (the figure is 3.3 billion if you include fish). In Oaxaca in southern Mexico, city dwellers queue at markets to satisfy cravings for toasted flying ants. In Maputo, Mozambique, affluent eaters pay top dollar for cuts of wild 'bush' meat. And on the outskirts of Moscow, New York, Tokyo and London, you can find urban foragers venturing into woodlands to find berries and mushrooms when they are in season. But even though the call of the wild remains strong, the practice and the knowledge of how to find and eat wild foods are disappearing. So too, of course, are the wild plants, animals and their habitats. By the time you get to the next full stop, the world will have lost the equivalent of a football pitch of primary forest. Deforestation to make way for monocultures of soy, palm oil and cattle has contributed to thousands of the world's wild food species becoming endangered or threatened with extinction. One source of hope is the world's indigenous people who make up less than 5 per cent of the total human population but inhabit 25 per cent of the world's land surface. In the twenty-first century they are among the most important stewards of the natural world and

defenders of biodiversity. The wild foods they protect are crucial for all of our future food security, including the 'crop wild relatives' that may hold the genetic keys to problems such as drought and disease resistance.

Wild foods are also becoming endangered at a time when we are struggling to understand what our diets should look like. We look to incomplete science for answers but ignore lessons already learned. Although wild foods provide less than 1 per cent of all of the calories consumed around the world today, they account for a much higher proportion of nutrients. Among hunter-gatherers such as the Hadza, rates of obesity, type 2 diabetes, heart disease and cancer are so low that cases are hard to find. This is partly because of the rich diversity of foods they eat and the high levels of fibre they consume (five times more than people in the industrialised world). Bitterness and sourness, both associated with wild foods, are often signals of health-giving properties. In the Peruvian Amazon, people gather camu camu (*Myrciaria dubia*), a fruit which resembles a cherry and contains twenty times more vitamin C than an orange.

The foods we are about to meet in this part all help to explain why wild foods matter. The answers to the mess we're in, environmentally and physically, will not, of course, include a return to the wild, but they can be informed by the knowledge that has carried our species this far, over millennia. We might not be able to imitate the hunter-gatherers that remain, but we can and should be inspired by the people who continue to venture into the wild.

I

Hadza Honey

Lake Eyasi, Tanzania

It was April, the rainy season. Short downpours had brought pockets of colour to the greens and browns of the East African savannah as small delicate flowers bloomed. Nectar was becoming abundant and, with it, honey. I was with a group of Hadza hunters, a scattered population of just over one thousand people. The tribe has lived in the dry bush of northern Tanzania, near the shore of Lake Eyasi, for tens of thousands of years, perhaps hundreds of thousands of years. Now, fewer than two hundred Hadza live fully as hunter-gatherers, making them the last people in Africa to practise no form of agriculture. The group I was with had walked far away from the camp and deep into the bush, led by a young man named Sigwazi. As he walked, he whistled.

This wasn't a melodious tune, more a series of angular ups and downs on a musical scale, each passage finished with a high-pitched twirl. To my ears there was no obvious musical pattern to follow but something in the bush was paying close attention to this whistle. Noticing movement above the trees, Sigwazi broke into a sprint, weaving through the scrub and around baobab trees as he continued the whistle. A wordless conversation was under way, an exchange between a human and a bird. Sigwazi looked towards the flutter of activity in the canopy, and there perched on a branch was an olive-grey bird the size of a starling.

Barring a few flashes of white on its tail, the bird looked plain and unassuming, but after a few more whistles from the hunter, it revealed itself to be exceptional. 'Ach-ech-ech-ech' came its reply to Sigwazi's whistle, signalling that a deal was on. The bird had agreed to lead the hunter to honey hidden among the branches of the giant baobabs. These trees are as wide as they are tall, living for up to a thousand

years, fed by a root system so deep that they can access water in periods of extreme drought. Finding a bees' nest concealed among the baobab's tall branches can take a hunter-gatherer several hours as they need to inspect tree after tree; with the assistance of a honeyguide, it takes a fraction of that time. The bird's scientific name captures its talent perfectly: *Indicator indicator*.

Somehow, over hundreds of thousands of years, the two species, humans and honeyguides, found a way of sharing their different skills. The bird can find the bees' nests but can't get to the wax it wants to eat without being stung to death. Humans, meanwhile, struggle to find the nests, but armed with smoke can pacify the bees. Theirs is the most complex and productive of any partnership between humans and wild animals.

To reach the most isolated Hadza camps from Dar es Salaam, Tanzania's largest city, involves an eighteen-hour drive by jeep. Their home is set among a patchwork of shrubs, rocks, trees and dust, a landscape occupied by humans for at least 2 million years. Looking out across the horizon of Hadza country, it's possible to see human history in microcosm. Just a few miles north is Laetoli, the site where a group of our distant ancestors walked through wet volcanic ash and left behind the earliest known human footprints. Even closer is the Olduvai Gorge, the place where some of the oldest stone tools and hand axes have been discovered. Within walking distance is the salt-water expanse of Lake Eyasi, where human skeletons, 130,000 years old, have been excavated.

The Hadza are no proxy for our Stone Age relatives; they are thoroughly modern humans. But their foraging way of life is the closest we have to that of early *Homo sapiens*, and the Hadza diet offers the best insight into the foods that fuelled our evolution. I watched the Hadza follow trails that were impossible for me to see, and read the earth as if it was a much-loved book, knowing exactly where golden Congolobe berries were ripest and Panjuako tubers were at their thickest, where long-snouted bush pigs were likely to feed and when the squirrel-like hyrax might gather. They picked up on sounds I didn't notice and paused to feel changes in the gentlest of breezes so they could approach animals undetected. It was still a month until the dry season, when the large game congregate around water, making them easier to find. For now, the easiest way of finding meat was to dig it out from underground,

which is why earlier Sigwazi had lured a porcupine from its den beneath a baobab tree. The offal (the heart, liver and kidney) were eaten on the spot, cooked for moments on a makeshift fire, but the carcass was carried back to camp, and shared among the rest of the group. Meat, however, isn't the Hadza's favourite food. Honey is, which is why the conversation with the honeyguide is so valuable.

The collaboration between human and bird was chronicled by Portuguese missionaries in the 1500s, but it took until 2016 for outsiders to understand the conversation more fully. When a team of scientists walked through the savannah playing loops of different recordings, they discovered that the attention of the honeyguide wasn't caught by just any human sound: the birds were listening out for specific phrases. In the case of the Yao people of Mozambique, this was 'brrr-hm … ', whereas in northern Tanzania the birds responded to the twists and twirls of the Hadza's whistles. These calls are passed down from one generation of hunter to another and, in each case, the researchers found, repeating the traditional phrases not only doubled the chance of being guided by a bird, but also tripled the chance of finding a bees' nest and honey.

What makes this even more remarkable is that the honeyguide is a brood parasite; it lays its eggs in other birds' nests. More brutal than the cuckoo, the chicks use their sharp-hooked bills to dispatch their rivals as they hatch. How the bird learns the skill of conversing with the Hadza we still don't know. One theory is that, just like the hunters, they are social learners; they watch and listen to their more experienced peers. It's possible this inter-species conversation predates the arrival of *Homo sapiens* and reaches back a million years or more to our ancestors' first use of fire and smoke. This idea is part of a compelling argument that it was honey and bee larvae, as much as meat, that made the human brain larger and helped us to outcompete all other species. Meat eating gets all the glory, the argument goes, because stone tools used in hunting turn up in the archaeological record, while evidence of eating honey does not. But there are plenty of other clues. Our closest relatives in the animal kingdom – chimpanzees, bonobos, gorillas and orangutans – all eagerly gorge on honey and bee larvae, nature's most energy-dense food. And in the earliest rock art discovered, inside caves in Spain, India, Australia and South Africa, there are depictions of honey collecting dating back at least 40,000 years.

But perhaps the most persuasive evidence of honey's importance to human evolution is the diets of the world's few remaining hunter-gatherers, including that of the Hadza. One-fifth of all of their calories across a year comes from honey, around half of which is the result of help from the honeyguide bird. The other half the Hadza can find themselves, as it comes from various species of bee that nest closer to the ground. Some are tiny, gnat-like and stingless, and produce a type of honey that is highly perfumed and delicately tangy. The Hadza find these nests by inspecting trees for the needle-sized tubes used by the bees to get inside the trunk. This type of honey, called *kanowa* or *mulangeko* in Hadzane (the Hadza's language), comes in modest, snack-like portions, and is gathered by chopping into the colonised section of tree. But on this occasion Sigwazi and the honeyguide wanted more. Together they were going to find the honey and wax of the larger (and more aggressive) *Apis mellifera scutellata*, the African honeybee.

Sigwazi watched as the bird he had attracted with his whistle hovered above one of the baobabs. This signalled there was honey; now it was time for Sigwazi to start climbing. He was short (five feet tall at most), wiry and slim. I figured his physique was the reason he was the member of the group chosen to climb the tree, but I came to realise it was more a question of bravery. Sigwazi was the one least concerned about disturbing a bees' nest, being stung or, worse still, falling thirty feet to the ground. He handed his bow and arrow to a fellow hunter, stripped off his ripped T-shirt and frayed shorts and removed the string of red and yellow beads from around his neck. By now almost naked, he started to chop up fallen branches with an axe and sharpen them into thin sticks. Baobabs are so soft and sponge-like that hunters can drive these pegs into their trunks with ease to create a makeshift ladder up towards the canopy. Swinging back and forth, Sigwazi made his way up the baobab, forcing a new peg in above his head as he climbed, clinging on, balancing and hammering all at once. As he neared the top of the tree another hunter climbed up behind and handed him a bunch of smouldering leaves. With these, Sigwazi closed in on the nest and immediately launched into a mid-air dance punctuated with high-pitched yelps. Bees were swarming around the honey thief and stinging as he scooped his hand into the nest and pulled out chunks of honeycomb. These rained down on the other Hadza hunters as

Sigwazi tossed them below. They cupped their hands to their mouths and started to feast, spitting out pieces of wax as they ate, leaving behind warm melting liquid that tasted both sweet and sour, bright and acidic like citrus. As I joined them I could feel writhing larvae inside my mouth and the crunch of dead bees. The honeyguide bird perched silently nearby, waiting for its share of the raid once the crowd of hunters had gone.

When the rest of the honey was taken back to the camp, women gathered armfuls of baobab pods, each one the size of two cupped hands. With bare feet, they brought their heels down to open the pods with a crunch. Inside were clusters of kidney-shaped seeds coated in a white powdery pulp which tasted like effervescent vitamin C tablets. The seeds, pulp, water and a little honey were placed into a bucket and stirred into a whirlpool with a stick. When everything settled, it looked like a thick creamy soup. Each sip fizzed in the mouth. This, I was told, is a food Hadza babies are weaned on.

Someone who had watched this exact scene long before me, as a 23-year-old Cambridge student, was James Woodburn. In 1957, to complete his PhD, he travelled to Tanzania in search of Africa's last hunter-gatherers. He followed two Italian ivory hunters tracking an elephant herd. Near Lake Eyasi, after the animals were killed and the tusks removed, Woodburn watched as Hadza hunters appeared out of the scrubland and into the clearing to take away the mountain of meat (elephants are the only big game that Hadza don't hunt – they say their poison is not strong enough to kill them). Woodburn followed the hunters back to their camp and spent the next two years living alongside them. To survive Hadza country without Hadza skills, he brought in supplies of rice and lentils to add to the small amounts of wild food he managed to forage for himself.

Woodburn learned to speak Hadzane (his language skills had been honed as a military interpreter), and gained new insights that brought the Hadza to wider attention in the 1960s. This included work carried out with paediatricians, which showed how exceptionally well nourished Hadza children were compared with their contemporaries in nearby farming communities. During the six decades that have followed, Woodburn has returned to Hadza country on a regular basis, staying with the tribe, studying their way of life and recording how

it has changed over time. Luckily for me, my visit to Hadza country coincided with one of his.

'They have stayed as hunter-gatherers because it is a life that makes sense to them,' Woodburn said as we sat by a campfire, the last of Sigwazi's porcupine crackling as it cooked, 'they regard it as a wonderful life.' It's a way of life that's endured, he believes, largely because of the autonomy it brings; no Hadza has control over another, a fact made possible because of the abundance of wild food around them. Apart from the very young and the very old, everyone in the camp is self-sufficient, each skilled enough to feed themselves, even children as young as six. 'Once this way of life stops making sense to them,' Woodburn said, 'it finally comes to an end.'

When Woodburn first met the Hadza, the outside world had stood at a distance. The foragers still didn't know which country they lived in and their knowledge of what lay beyond Hadza country came largely from encounters with neighbouring tribes – the Iraqw, the Datoga and the Isanzu. With these pastoralists and farmers, the Hadza traded meat, skins and honey for millet, maize, marijuana and metal (to make axes and arrowheads). Other things they knew about the outside world had been passed down the generations, including stories of abductions of their forebears. Tanzania was at the centre of the East African slave trade until the middle of the nineteenth century, which was why the Hadza, until recently, always ran from strangers who appeared in the bush. But in the mid-1960s, there was no avoiding the world outside. Following independence from Britain, the Tanzanian government, encouraged by American missionaries, attempted to settle the Hadza in villages by force. Hunter-gatherers from remote bush camps were taken away in trucks to purpose-built villages, escorted by armed guards. Many became ill from infections and died. Within two years, most of those who had survived returned to their camps and to foraging. Efforts to settle and convert the Hadza, not only to Christianity but also to agriculture, have continued. And yet, against the odds, their hunter-gatherer way of life – the life that makes sense to them – has persisted. Now, though, a new set of forces is bearing down on the Hadza. Agriculture is spilling over into their land and products made by the global food industry have reached the camps. Woodburn said he hadn't forseen the scale of these pressures on the Hadza. No one had.

*

One-third of the Earth's land surface is now dedicated to food production – a quarter of this for crops, three-quarters for grazing animals – and farming's expansion into the wild is continuing (nearly 4 million hectares of tropical rainforest are lost each year). Agriculture is reaching into parts of the world once thought impossible to be farmed. Among them, Hadza country. At the beginning of the twenty-first century, tens of thousands of hectares of land used by the Hadza was converted by outsiders into pasture for livestock or to grow crops each year. Along with it went some of the Hadza's access to wild foods, including giant baobab trees that take hundreds of years to grow. Supplies of nutritious baobab pods were depleted, and so were sources of honey. In 2012, after years of campaigning, the Hadza were awarded rights of occupancy over 150,000 hectares of land, but this still didn't stop the problem. Neighbouring tribes faced with water shortages caused by irrigation and climate change moved cattle closer to the Hadza's camps and waterholes. The cattle ate the vegetation that brought in game and disrupted migration routes which meant there was less for the Hadza to hunt. Across the whole of Africa, two-thirds of the continent's productive land is now at risk of becoming degraded, half of this severe enough to lead to desertification. The biggest cause is overgrazing of livestock.

The Hadza are ill-equipped to stop this encroachment; they have no possessions, no money and no leaders. They're skilled hunters but they avoid conflict. Instead of confronting tribes arriving on their land, they move deeper into the bush. But even here, farmers edge ever closer, expanding pasture and planting sorghum and corn, though there's barely enough water to irrigate crops. The Hadza have to contend with the effects of climate change too; they see its impact in the lack of water, disappearance of edible plants and decline in nectar and therefore quantity of honey they find. To survive, many rely on food from NGOs and missionaries. The last hunter-gatherers in Africa are being pinched from all sides.

A thirty-minute drive from Sigwazi's honey hunting, we reached a crossing point where different tribes gather to take water from a newly installed pump. Here, they also visit a small mudbrick hut lit by a single light bulb that hangs from the corrugated roof. Inside, from floor to ceiling, are shelves stacked with cans of sugary sodas and

packets of biscuits. We were hours from the nearest city, an enormous wilderness lay between us and the nearest road, and yet some of the biggest food and drink brands in the world had made it this far.

In the place where our ancestors first evolved, sugar in plastic bottles is replacing the sweetness of the food that helped to make us human, honey. Scientists who monitor birdlife in the savannah describe melancholy scenes of birds swooping down, calling 'ach-ech-ech-ech' in the hope of a reply, as their interaction with humans becomes rarer. The conversation between the two species, thousands, possibly millions of years in the making, may soon fall silent.

Encircling the mudbrick hut were newly planted fields of corn. I felt I could have been watching a film in which hundreds of thousands of years of human history was being played on fast-forward, from wild to farmed and from foraged to processed, bottled and branded.

2

Murnong

Southern Australia

For as long as anyone could remember, there were only a couple of places left where foragers were guaranteed to find murnong, a radish-like root with a crisp bite and the taste of sweet coconut. One was a cemetery on Forge Creek Road in the town of Bairnsdale, Victoria, where the plant's bright yellow flowers could be seen clustered around gravestones; the other was along a nearby railway track, where a line of tall fences protected the bullet-sized root and its shoots from grazing animals. Before European invaders arrived in the eighteenth century, the grasslands and rocky hillsides of Victoria had been covered in these plants, a crop that grew so thick that from a distance it seemed to form a blanket of yellow.

The first humans to make the journey from the Afro-Asian land mass to Australia did so more than 60,000 years ago, and when they arrived, the plants and animals they found would have been alien to them. But just as the Hadza do today, these hunter-gatherers knew that, armed with digging sticks, a guaranteed supply of food could be found underground. Seeds, fruits and honey are seasonal, but roots and tubers are available all year round, and as the storage organs of plants, they're energy-rich. In south-eastern Australia, the most important of these subterranean foods was murnong. For the tribes who lived here over tens of thousands of years, including the Wurundjeri, the Wathaurong, Gunditjmara and Jaara, the importance of this one root is hard to overstate. Without murnong, life in south-eastern Australia would have been precarious, perhaps impossible. But by the 1860s the food was as good as extinct, making its retreat into cemeteries and sidings, places where either the dead were resting or the living kept away, and knowledge of the plant was lost to generations of Aboriginal people.