# How the Potato Changed the World's History

BY WILLIAM H. MCNEILL

My title is not as absurd at it sounds, even though historians have only recently begun to take notice of how the spread of potatoes and other American food crops to the Old World—potatoes and maize in particular, but also tomatoes, peanuts and half a dozen other foods we now take for granted—changed human lives, often in quite drastic ways. Nor is the idea that potatoes made a difference for Europe a new one. In the early ninteenth century, for example, Ludwig Feuerbach and other radicals believed that "potato blood" was weakening the German people and delaying the revolution they looked forward to, while a long list of social improvers argued the contrary, beginning as early as 1664 with an obscure pamphlet written by one John Forster, whose title speaks for itself: *England's Happiness Increased: A sure and easy remedy against all succeeding dear years by a plantation of the roots called potatoes* (London, 1664).

Today, potatoes are a valued and important crop in China as well as in Europe and North America, and remain the staple food of Andean farmers in the South American altiplano. But only twice can one say that potatoes made a critical difference for world history: initially in the altiplano, where potatoes provided the principal energy source for the Inca Empire, its predecessors and its Spanish successor; and then subsequently in northern Europe, where potatoes, by feeding rapidly growing populations, permitted a handful of European nations to assert dominion over most of the world between 1750 and 1950. Elsewhere, potatoes were only a supplement to other foods, and had comparatively

minor impact on human affairs, so I will confine my remarks to the potato's special role in the altiplano and in northern Europe.

The plant botanists call *Solanum tuberosum* was native to the Andes and still grows wild there along with a large number of cultivated varieties—some of which we would not easily recognize as close kin to the potatoes we buy in our grocery stores. Exactly when such plants were first cultivated is uncertain: perhaps as early as 3000 B.C.E. and almost certainly before 2000 B.C.E.. Deliberate selection for desired characteristics altered wild ancestral varieties long before modern plant breeders did the same for the potatoes in use today. But some enduring features explain why this particular crop played a critical role in sustaining a succession of imperial states in the forbidding climate of the altiplano and did the same again for a handful of states in northern Europe a few centuries after Spanish conquistadors took over the Inca empire in 1532-33.

First of all, potatoes yield abundantly, and adapt readily to diverse climates so long as the weather remains cool and moist enough for the plants to gather sufficient water from the soil to form the starchy tubers. On the other hand, potatoes do not keep very well in storage. After a period of dormancy, even a little warmth provokes the eyes (i.e., buds) to use the energy resources stored in the tuber to sustain rapid growth of new shoots; and they start to grow regardless of whether they are lying where nature put them in the ground or are piled into storage cellars or bins. Moreover, during the period of dormancy, potatoes are vulnerable to moulds that feed on the stored tubers just as readily as people do, quickly turning them rotten. Storage for more than a few months is therefore impractical, even with modern temperature controls.

By comparison, harvested grain is very dry and cannot sprout or mould without exposure to additional moisture. Grain can therefore be stored for several years without much risk of rotting. Keeping mice and rats away required clay jars or similarly tight containers, which is why early pottery-making and grain farming were so closely associated. Reliable storage methods, in turn,

allowed tax and rent collectors of the Old World to gather sufficient grain into storehouses to sustain urban civilizations across millennia, starting about 3000 B.C.E.. In the altiplano, however, grain did not flourish nearly as well as potatoes, though the Incas did raise maize and another very nutritious seed crop, quinoa, in some protected valleys. But in the high plains around Lake Titicaca, potatoes alone were capable of maturing, and they flourished abundantly there on artificially raised fields built out into the marshy margins of the lake.

Mere abundance was not enough to make moist, perishable tubers capable of maintaining civilized society at 12,500 feet above sea level. Safe and reliable storage was also required. This was possible owing to the fact that even in those tropical latitudes freezing temperatures set in at night through much of the year. That climatic peculiarity allowed farmers of the high Andes to resort to a technique for preservation that is very familiar to us these days—frozen food—even without artificial refrigeration. Merely by exposing tubers to the night air, they converted potatoes into what the Incas called by a term the Spaniards rendered as *chuno*; and when stored in sealed, permanently-frozen underground storehouses, chuño could be kept for several years with no loss of nutritional value.

Oddly enough, Andean peoples shared year-round food storage in underground freezers with Eskimo whale hunters of Alaska; but only in the Andes did this mode of food preservation sustain the emergence of civilization, beginning about 100 CE. By collecting chuño as taxes from the peasants who worked the raised fields, and disbursing it from imperial storehouses to labor gangs, working at official command, it became possible to wage war, build roads, construct the monumental stone structures that still amaze visitors and sustain all the other aspects of imperial, civilized society in the altiplano, both before and after the Spanish conquest.

Given the topic of this paper, it is worth emphasizing that the collapse of the Inca state did not bring this unique basis for mobilizing labor to an end. Quite the contrary: its impact swiftly

extended world wide. For when the Spaniards discovered silver ore of extraordinary richness at Potosi in 1545, chuño was what fed the thousands of conscript miners who soon began to inundate the rest of the world with an unprecedented flood of silver. In Europe, the immediate political effect was to allow King Phillip II and his successors to pay for Spain's imperial fleets and armies. The windfall lasted for about a century before the ore ran out. Soon afterward, Spain's primacy in European politics and war came to an end. A secondary, unintended but equally significant effect of the massive influx of silver from Potosi was to contribute to worldwide monetary inflation. Persistently rising prices, in turn, upset traditional social patterns, altered economic relations and strained prevailing moral ideas—what happened to the just price?—not only in Spain and Western Europe, but in China and the rest of Asia as well.

In the high Andes, chuño, in effect, provided the principal fuel of empire, since human muscles did most of the work, and chuño was the indispensable food for labor gangs. Without it, nothing resembling Andean civilization could have arisen, and the Amerindian world would have lacked one of its most impressive, distinctive constituents. And chuño was what allowed a freshet of silver from the Spanish Empire in the Americas to upset prices and traditional human relationships and expectations among all the civilized peoples of the Old World. This then is how the cultivation of potatoes changed the world's history for the first time, initially on a merely American scale, then quite literally world wide.

The spread of potatoes to northern Europe also had genuinely global consequences, though immediate effects were of course local. Let me start this second chapter of my story with a few remarks about how the plant began its career in Europe. The first potatoes to reach European shores presumably traveled on Spanish ships returning from the Pacific coast of South America, but their arrival left no trace in existing records. Since, to begin with, grains familiar to Europeans were entirely absent from America, the earliest ships to visit the Peruvian coast had to rely on potatoes and maize as the best available substitutes for grain and undoubt-

edly stocked up on both for their lengthy return voyages. Then after reaching Spain, leftover tubers (and maize) came ashore with anonymous sailors who thought enough of the new foods to try growing them there.

Most of the Spanish landscape was too dry for potatoes to flourish. But in a few isolated mountain areas and along the moist Atlantic coast of northwestern Spain the plant did well. As a result, Basque fishermen (who had begun to harvest the Grand Banks of Newfoundland some decades before Columbus sailed) soon began to use them as ships stores for their voyages across Atlantic waters. Before long, Basque fishermen who customarily came ashore in western Ireland to dry their catch, introduced the potato to that island. No records tell when it happened, but a few people probably started to grow potatoes along the western shores of Ireland several generations before the Cromwellian wars (1649-52) compelled the defeated Irish, driven westward and confined to the province of Connaught, to rely on the new crop for survival (McNeill, 1948).

Spanish ships also carried potatoes to Italy where they spread into gardens of the Po valley by about 1560. Potatoes traveled thence along the so-called "Spanish road," that connected Spain's imperial provinces in northern Italy with the Low Countries. When the Dutch wars broke out (1567-1609) rebel seamen—the so-called Sea Beggars—made the sea unsafe for Spanish ships, so thousands of Spanish soldiers and their supplies had to travel to Italy by sea and then proceed overland, crossing the Alps and marching north through Franche Compté, Alsace, and the Rhinelands (Parker, 1972). Potatoes soon took root wherever they set foot. That was because villagers along the route swiftly discovered that by leaving the tubers in the ground and digging them only as needed for their own consumption, they could safely survive even the most ruthless military requisitioning.[1] Foraging parties were unwilling to dig for their food when stores of grain were available in barns. And even after potato consumption became so commonplace that hungry soldiers might be compelled to dig potatoes because grain had disappeared from the neighborhood

barns, they were unlikely to linger long enough to take everything, as foraging detachments commonly did when requisitioning grain.

From a demographic point of view, therefore, the spread of potatoes to European gardens and fields radically reduced the destructive consequences of warfare. Limits on transport had long required field armies to gather most of the food they needed from the countryside where they were operating. And even after legal procedures for military requisitioning diminished the destructive effect of violent seizures by promising and sometimes delivering monetary payments at a later date, delay could be fatal for those whose stocks of food had been carried off.

As a result, wherever the local population depended on stored grain for survival, outright starvation was the usual and expected result of every extended campaign. Consequently, as the size of European armies increased after 1450 the demographic as well as the monetary costs of war mounted rapidly. The Thirty Years War (1618-48) turned out to be the climax of this destructive process, and the devastation it brought to most of Germany was remembered afterward with special horror largely because it was the last war fought in northern Europe before potatoes became widespread enough to cushion the human cost of military requisitioning by forestalling rural starvation.

In fact, the value of potatoes in time of war was so enormous that every military campaign on European soil after about 1560 resulted in an increase in potato acreage, down to and including World War II. Natural suspicion of a new food, and diverse rumors about the danger of eating potatoes—they were, for example, accused of spreading leprosy so that the Parliaments of Franche Compté and of Burgundy both prohibited their cultivation in the seventeenth century—were outweighed by the simple fact that potatoes could keep a peasant family alive even when soldiers broke into their barns and made off with the grain harvest, perhaps leaving a chit of paper behind which might or might not eventually result in some sort of payment from public authorities.

As peasant communities discovered this simple fact, their reluctance to experiment with an utterly new food crop evaporated. Potatoes accordingly spread in unrecorded ways from one village to another along the Spanish Road and then more erratically both east and west of it into the Low Countries, western France and southwestern Germany.

Botanists soon noticed what was happening. The earliest known record showing that potatoes were being grown in Europe dates from 1588 when Carolus Clusius made a water color of what he called "Papas Peruanorum." He collected his specimen from Mons in Belgium, but thirteen years later when he published a description of the potato in his *Rariorum plantarum historia* (Antwerp, 1601) he reported that the tubers were "common" in northern Italy and used both as animal fodder and for human consumption. Clusius' words are the sole basis for assigning a date of about 1560 for the establishment of the plant in Italy.[2]

This was not, however, the earliest published description of the potato. That distinction belongs instead to a handsome folio compiled by an English botanist, John Gerard, and entitled *Herball, or General historie of plantes* (London, 1597). In 1580, Francis Drake had introduced potatoes into England along with his other Spanish booty when he returned from his famous circumnavigation of the earth. Gerard was so pleased with his knowledge of the new plant that he prepared a full-page woodcut, showing stems, leaves, flowers, roots and tubers in clear and unambiguous detail, for the frontispiece for his book; and by calling it "potatoes of Virginia" he introduced a confusion into British and European learning that was not definitively dispelled until the nineteenth century.

After potatoes thus achieved botanical recognition, a few upper-class Europeans were attracted to them as reputed aphrodisiacs. But confusion between sweet potatoes from Caribbean coastlands and *Solanum tuberosum* from the Pacific coasts of South America (not to mention another root, vulgarly known as Jerusalem artichokes, that did come from Virginia) set in at once; and what we know as the common potato soon lapsed into oblivion as far as urban dwellers were concerned.

Meanwhile, hard pressed peasants in Ireland, northeastern England and some of the well-watered parts of the European Continent continued to cultivate potatoes inconspicuously and on a relatively small scale as a safeguard against failure (or requisitioning) of the grain crop. But across most of northern Europe, where open fields prevailed, potatoes were strictly confined to small garden plots. Field agriculture was governed by age-old custom that prescribed seasonal rhythms for plowing, sowing, harvesting and grazing animals on fallow and stubble. This meant that potatoes were barred from large-scale cultivation because grain, and only grain, could be planted in the open fields so as not to disrupt established routines.

Yet in the course of the eighteenth century, potatoes broke through garden fences and became a field crop, supplementing and eventually also competing with grain. This permitted potatoes to exercise a new, important influence on European demography by enlarging the food supply, thus inaugurating a second era when the tubers began to affect world history in a significant way.

The enhanced importance of potatoes came about in two quite different ways. On the Continent government officials and noble landowners actively forwarded rapid conversion of fallow into potato fields after 1750, whereas in Ireland initiative in expanding potato cultivation rested entirely with landless laborers, renting tiny plots from landowners who were interested only in raising cattle or (after about 1750) in producing grain for market.

Ireland's unique path to dependence on potatoes derived from the failure of English plans to displace the Catholic Irish with a Protestant yeomanry by settling Cromwell's veterans on land confiscated from the defeated Irish. This policy was modeled on an earlier and smaller land transfer that had established Scots Presbyterian farmers in Ulster after 1611. Since natural conditions in Ulster were not very different from those of the Scottish lowlands, the Ulster settlement soon took root and prospered. But forty one years later Cromwell's veterans quickly discovered that the style of grain farming with which they were familiar in England was impractical in Ireland since in most years excessive moisture and

coolness prevented wheat and barley from ripening. (Scots by contrast relied on oats, a crop that usually ripened well enough, even in cool, moist Ireland.) Cattle grazing was the traditional alternative upon which the native Irish had long relied, and when English settlers' initial attempts at grain farming failed, a few land speculators bought out almost all of Cromwell's veterans, many of whom were not eager to farm for themselves anyway. The new landowners were solely interested in making money, and found they could best do so by becoming commercial graziers, sending cattle for slaughter to Dublin or Cork and so supplying the Royal Navy and the English merchant marine with cheap salt beef.

Commercial graziers needed a few laborers to work on their new estates. They quickly discovered that Englishmen, whose staple food was bread and cheese, required far higher wages than the native Irish, who were skilled herdsmen from time immemorial, and had recently learned to live on a far cheaper diet of potatoes and milk. That diet was new, for when Cromwell's soldiers herded the dispossessed Irish into Connaught in 1652, potato gardens and milking cattle were what allowed many (perhaps most) of them to survive even on comparatively very small patches of land.

In fact, a single acre of potatoes and the milk of a single cow turned out to be enough to feed a whole family; and such a diet, however monotonous, was nutritionally adequate to sustain what became an exceptionally healthy, vigorous (and desperately poor) rural population. It also became common for even the poorest Irish family to grow enough extra potatoes to feed a pig whose sale could supplement wages and help pay for rent, clothes and other essentials. Since potatoes and cows' milk were just as good a diet for pigs as for humans, subsistence on amazingly small potato patches sufficed to keep the Irish alive, first in Connaught and by 1780 or so, also allowed them to displace English settlers from nearly all the rest of the island. The Scots, however, remained firmly ensconced in Ulster, supplementing their oats with potatoes after crop failure in 1718-20 showed them how valuable the new food could be.

The Irish reoccupation of the southern part of the island took place because Protestant English landowners found a work force willing to live on so slender a base irresistible. Accordingly, Catholic Irish laborers soon seeped back into the provinces from which their ancestors had been forcibly removed, living as impoverished rent payers and wage earners. Then, in the latter decades of the eighteenth century, rising grain prices in England persuaded a good many landowners in the drier parts of the island to plow up pasture land and plant grain. This multiplied wage work; and the Catholic Irish population responded by growing very rapidly indeed. Early marriage prevailed. A couple needed only an acre and a cow to start a family; and landowners soon found themselves renting out more potato land than was needed to support the number of laborers they could usefully employ.

After 1815, grain prices collapsed and Irish landowners tried to go back to grazing. But there was no way for them to clear the land of surplus laborers, who found themselves desperately bidding against one another for the right to plant potatoes on a suitable patch of land. The unhappy result was that a bitterly impoverished and rapidly growing rural population confronted not very prosperous landowners across an inflamed religious barrier.

The Irish question that haunted British politics until our own time thus took form, reaching an especially acute and terrible climax in 1845-47 when the sudden outbreak of blight came near to destroying the entire potato crop. More than a million died of famine, typhus, and other diseases in those two years and by 1850 more than another million had emigrated (mostly to the United States). The Irish Diaspora affected all the lands of European settlement overseas, and continued into the twentieth century as rural Ireland was slowly transformed into a land of small mixed farms where grazing and dairying were more important than any crop—even, or especially, potatoes. In its own small way, therefore, the strange career of the potato in Ireland had worldwide impact, not least on the United States of America.

But what really dominated the global scene between 1750 and 1950 was the extraordinary ascendancy that a few states in north-

ern Europe exercised over all the earth on the strength of industrial, political and military transformations which could not have come about without an enormously expanded food supply from fields of potatoes.

England, where industrial transformation concentrated at first, was unusual since potatoes played only a modest part there. Exceptionally efficient commercial grain farming together with the early start of industrialization allowed bread to remain the staff of life for the English working classes. To be sure, potatoes had begun to supplement bread in northeastern England a few decades before 1700, but they never became the sole support of large numbers of people, as in Ireland. Beginning about 1730, however, the Scottish Highlands went over to potatoes as completely as Ireland had done so that, when I was young, my mother started supper by putting potatoes in the oven before thinking about what else there might be for us to eat. And the Scottish Diaspora that followed hard on the heels of the highlanders' defeat at the battle of Culloden in 1745, was a lesser version of the Irish Diaspora of the following century. It had a similarly widespread impact, though with interestingly divergent social and economic effects both in Scotland and abroad. But that is another story whose investigation would divert me from my proper theme.[3]

To return: the principal theater whence potatoes changed world history after 1750 was the vast European plain, extending from northern France through Germany, Poland and eastward into Russia. As I just explained, largely on the strength of its value in time of war, by 1715 peasant initiative had diffused the new crop inconspicuously through the much fought-over Low Countries, Rhinelands, eastern France and southwest Germany. Then during the War of the Austrian Succession, (1740-48) Fredrick the Great of Prussia recognized how valuable potatoes were for keeping peasants alive in time of war, and in 1744 ordered his government to propagate the tubers throughout his kingdom by distributing free seed potatoes with instructions on how to plant them. As a consequence, even when invading French, Austrian

and Russian armies ravaged Prussia repeatedly during the Seven Years war, (1756-63) Frederick's peasant subjects escaped disaster by eating potatoes, and the precarious survival of the Prussian state owed a great deal to that elemental fact. Not surprisingly, the invading armies became aware of the basis of Prussia's remarkable resiliency, and, in the aftermath, the Austrian, Russian and French governments all took steps to induce their own peasants to make room in their fields for the new crop.

The French took the lead, largely due to the initiative of an army doctor, Antoine Parmentier, who on the basis of what he saw in Prussia during the Seven Years' War devoted the rest of his life to investigating and propagating information about potatoes. His most important work, *Examen chymique des pommes de terres* (Paris, 1774) demonstrated the nutritional value of potatoes convincingly; and Louis XVI and his court were persuaded to lend themselves to a concerted effort to make the value of potatoes familiar to their subjects. Despite her subsequent "Let them eat cake" fame, Marie Antoinette even donned a headdress of potato flowers at a court ball to advertise the plant's virtues. And subsequently, in 1794, when the Committee of Public Safety was trying desperately to mobilize the country against its foreign foes, one way it chose to dramatize the effort was by planting potatoes instead of flowers in the royal gardens of the Tuileries.

Between 1770 and 1840, official encouragement and practical experience thus converged to bring potatoes into widespread cultivation across the northern parts of France where the climate was propitious. Government statistics registered the change, reckoning the annual potato crop of France as 21 million hectoliters in 1815; and 117 millions in 1840 (Langer, 1963, 1973).

In Austria and Russia official efforts to propagate potatoes also produced relatively rapid results, though peasant caution, the restraints of open field cultivation and climatic limitations (the steppes of the Ukraine, for example, and eastern parts of the Hapsburg monarchy were too dry for potatoes to flourish) set limits to the potato's advance. Thus, according to Langer, although potatoes had become widely familiar in Russia by 1800, they did

not escape the confines of garden plots until after crop failure in 1838–1839 persuaded peasants and landlords in central and northern Russia to devote their fallow fields to raising potatoes.

To understand the magnitude of the increase in food supply that potatoes brought to the entire breadth of north European plain after 1750, one must remember that traditional grain cultivation required leaving a third to a half of the cultivated ground fallow each year. Fallowing was designed to control weeds. By plowing fallow fields in summer, before weeds had time to go to seed, invading plants could be almost entirely eliminated, and in the following year, when the fallowed fields were sown again, a satisfactory and nearly weed-free harvest could be expected. But airborne weeds soon seeded themselves again so that fallowing had to be repeated in a two or three year rotation.

Before efficient horse drawn scufflers became common (sometime after the middle of the nineteenth century, I believe), hoeing by hand was the only way to remove weeds from potato ground. Usually this had to be done twice, once in late spring and again in early summer, before the potato tops bushed out sufficiently to shade out rival plants. Grain, being thickly sown, could not be cultivated during the growing season, and had to depend on its own rapid growth to compete with other plants. From a human point of view, therefore, potatoes meant a lot more work during the growing season. This, in turn, meant that before they could become a major field crop, enough labor had to be available to hoe the ground they occupied.

But since potatoes yielded from two to four times more calories per acre than grain did, the laborers needed to cultivate them could in fact be readily sustained. A feedback process thus set in: more potatoes meant more calories, more field work in summer and more workers to perform it. And by planting potatoes on the fallow, and using hoes to eliminate weeds, there was absolutely no need to decrease the grain supply! What a bonanza!

What was needed was more labor in the fields; and after 1750, for reasons demographers still dispute, world-wide population growth set in. But the expansion of human numbers in northern

Europe far outstripped the rate of population growth in other anciently civilized lands simply because the intrusion of potatoes onto fallow fields was such an easy way to increase supplies of food. Only in the Americas did population growth equal or exceed what was occurring in northern Europe. Both in North and South America, the existence of frontier lands that had been emptied of their human inhabitants by the ravages of Old World diseases, lifted all ordinary limits on subsistence agriculture. Northern Europe's exploitation of formerly fallow fields paled by comparison. But for many decades easy migration into the remote interior slowed the pace of urban growth in the Americas, whereas European agricultural expansion in situ had the immediate effect of multiplying urban as well as rural productivity. This permitted the wealth and power of European nations to outstrip American achievements until after about 1890.

Advantages of growing potatoes on fallow fields were especially great east of the Elbe where rye was the dominant grain crop. Rye required a shorter growing season than wheat or barley; but also yielded less; and in wet seasons, it was liable to a poisonous infestation, known as ergot, that when consumed by humans reduced birth rates and induced delusions, fits, and in some cases resulted in death (Matossian, 1989). Eating potatoes instead of ergot-infested rye therefore improved health and increased birth rates, providing enough and more than enough German, Polish and Russian labor to hoe larger and larger fields of potatoes and spill over into cities as well, both nearby and overseas.

To be sure, bread never disappeared from the diet of north European populations, but in course of the nineteenth century, potatoes displaced it as the principal food for the poorer classes everywhere from Belgium to Russia. Boiled or baked potatoes were cheaper than bread, and just as nutritious. They also required far less preparation—no grinding into flour, then kneading and raising the dough before it could be baked. And acre for acre, the calorie yield from potatoes was from twice to four times what grain could supply. Advantages were such that during the nineteenth century potatoes (as well as sugar beets)

began to encroach on east European rye fields. But these crops never displaced grain agriculture from its traditional primacy simply because grain was much easier to ship and store. Landlords, wanting income in cash, therefore usually preferred grain to potatoes.

Nonetheless, the practical effect of turning potatoes into a field crop was enormous. Many times more people could count on having enough to eat, even when population growth exceeded any need for extra labor in the fields. Consequently, the industrial transformation of northern Europe could and did proceed at a very rapid rate. In particular, new industries dependent on the exploitation of fossil fuels had no trouble recruiting the necessary labor without resort to physical compulsion like that upon which the Incas and Spaniards had once relied. Merely by offering subsistence wages, or something very close to subsistence, a suitable number of migrants from the countryside showed up to man the new machines and perform all the other nasty tasks of urban society. Rapidly growing European populations also filled the ranks of imperial armies and navies, and their victories in far parts of the globe allowed additional millions of Europeans to migrate overseas and eastward into Siberia as well.

All this is so familiar that it somehow seems natural that European empires should have extended round the globe and that the Americas should have been repopulated from Europe (and from Africa, where of course, the physical compulsion of slavery prevailed instead of personal response to the dictates of market prices.) Yet on reflection Europe's world dominance between 1750 and 1950 ought to amaze us. In those centuries European initiatives and example transformed the entire world more rapidly and radically than ever before. Global population growth prevailed, the Americas were repopulated, and fossil fuels provided unprecedented quantities of energy to activate industrial machines, mechanical transport and an ever more capacious and rapid network of communications. Then, after 1947 European empires collapsed almost as suddenly as the Inca empire had crumbled after 1532, and a new era began.

I hope my remarks convince you that an essential—but by no means the only—factor explaining the surprising rise of the west, to which I once devoted a book of more than 800 pages, was the extra food that potato fields made available to the peoples of northern Europe. It is certain that without potatoes, Germany could not have become the leading industrial and military power of Europe after 1848, and no less certain that Russia could not have loomed so threateningly on Germany's eastern border after 1891. In short, the European scramble for empire overseas, immigration to the United States and elsewhere, and all the other leading characteristics of the two centuries between 1750 and 1950 were fundamentally affected by the way potatoes expanded northern Europe's food supply. This, then, was the second time *Solanum tuberosum* played an important role in transforming human societies all round the world.

Quite a career for a plant we often treat with derision! And since I began my professional career by writing a doctoral thesis on *The Influence of the Potato on Irish History* (McNeill, 1947), and initially intended to write at length about its influence on European history, but never got round to doing so, I take particular pleasure on this occasion in summarizing the argument of the book I never wrote without doing any of the detailed research needed to support my hasty, but, I think, indisputable conclusions.

## Notes

[1]In western Europe, the Gulf Stream is so warm that the ground seldom freezes in winter and potatoes survive unaffected by frost until the warmth of spring starts them growing. Further east in Europe, potatoes freeze if left in the ground, thus turning into chuño. Digging them from hard-frozen ground is difficult but not impossible; and, though freezing alters both taste and texture, nutrition remains undiminished.

[2]The article "American Foods and Europe's Population Growth, 1750-1850," by William L. Langer is still the best account of how potatoes spread across continental Europe and my dates and anecdotes about their diffusion from Italy are all derived from Langer's researches. He did not, however, recognize the connection between acceptance of potatoes and military foraging that dictated the route of the potato's geographic migration.

[3]Among the Maoris of New Zealand, potatoes played as important a role as in the Scottish Highlands. Potatoes arrived with whalers soon after Captain Cook circumnavigated the islands in 1769-70, and gave the Maoris a much more productive crop than any they had known before. They took to it at once. As a result, population grew and tribal struggles intensified, until diseases introduced from Europe and armed collision with European settlers after 1840 depopulated Maori villages and disrupted traditional society more drastically than anything that happened to the Scottish clans after 1745. But, in New Zealand, as in Scotland, subsequent reconciliation between conquerors and conquered was unusually real and rapid.

## References

Langer, William L., "American Foods and Europe's Population Growth, 1750-1850," *Journal of Social History* 8(Winter 1975): 52.

Langer, William L., "Europe's Initial Population Explosion," *American Historical Review* 69(1963): 15–16.

Matossian, Mary K., *Poisons of the Past: Molds, Epidemics and History* (New Haven: Yale University Press, 1989).

McNeill, William H., "The Influence of the Potato on Irish History," Diss. Cornell University, 1947.

McNeill, William H., "The Introduction of the Potato into Ireland," *Journal of Modern History* 21(1948): 218–21.

Parker, Geoffrey, *Army of Flanders and the Spanish Road 1567-1659: Logistics of Spanish Victory and Defeat in the Low Countries' Wars* (Cambridge: Cambridge University Press, 1972).