INTRODUCTION

Jon Lovett-Doust

God Almightie *first Planted a* Garden*. And indeed, it is the Purest of Humane pleasures*.

Francis Bacon[1]

There is no ancient gentlemen but gard'ners.

William Shakespeare[2]

According to Mark Laird, historians have generally presumed that the principles of landscaping were no more complex than the famous dictum associated with the early English garden designer, William Kent (1685-1748)—"Nature abhors a straight line"[3]—thereby dismissing in a nutshell every single previous garden. As a plant ecologist and sometime gardener, I identify with Kent's dictum nearly as much as with Spinoza's earlier statement: "Nature abhors a vacuum."[4] The principles of garden design I shall leave to others more qualified, including the authors of the papers in this volume. What I do know is that gardening has played a pivotal role in the emergence and development of human culture. Today we are all gardeners. Gardening is pleasant, desultory, not very challenging work; it allows a lot of opportunity to contemplate other things while doing it. Our gardens range from arable crop farms, vineyards, and orchards to plantations of rice or coffee grown in a rainforest clearing. Some of us grow struggling, solitary houseplants, or tend tomatoes on apartment balconies; others grow them hydroponically inside large, intensively managed expanses of plastic greenhouse. We may cultivate herbs and spices, marijuana, opium, or fruit trees. Some of us tend tallgrass prairie or upland deciduous forest. We garden on many scales, from landscapes and shrubberies to more intimate rockeries, water gardens, herbaceous borders,

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[1] In "Of Gardens," *The Essayes or Counsels, Civill and Morall*, ed Michael Kiernan, Oxford Francis Bacon, vol 15 (Oxford: Clarendon Press, 1985), 139.

[2] In "Hamlet," *The Riverside Shakespeare,* ed G Blakemore Evans et al, 2nd ed (New York: Houghton Mifflin, 1997), 5.1.29-30.

[3] Laird, *The Flowering of the Landscape Garden: English Pleasure Grounds, 1720-1800* (Philadelphia: University of Pennsylvania Press, 1999), xiv.

[4] Baruch Spinoza, *Spinoza's Ethics and "De Intellectus Emendatime*," trans Andrew Boyle (London: J M Dent, Everyman, 1910), pt 1, prop 15, p 14.

and bulb beds.

By one account, we began in a garden. In reality, in the time before we were gardeners, people lived by hunting, fishing, and gathering what they could find from the wild. For more than a hundred thousand years prior to the emergence of gardening, human beings much like ourselves ate mostly fruits and seeds, leaves, roots and tubers, plus birds, snakes and lizards, frogs, snails, maggots, and insects. As annual seasons passed, our small tribal bands consumed well over a hundred different kinds of plants and animals.[5] Our diets differed from place to place and from season to season as we followed the food supply. We migrated from one region to another, camping for weeks or months in one place until moving on when food supplies got low. Like the wildebeest today, we probably cycled through the best sites every year or two, allowing a sustainable balance because the resource could recover during our absence.

We were food gatherers for far longer than we have been gardeners and farmers. People first began to cultivate plants and to domesticate animals only seven to ten thousand years ago, in the Neolithic Age.[6] With agriculture came the capacity to store grains and enjoy surplus food

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[5] Otto T Solbrig and Dorothy J Solbrig, *So Shall You Reap: Farming and Crops in Human Affairs* (Washington, D C: Island Press, 1994).

[6] For all our modernity, our genes are, as the evolutionary psychologists put it, Pleistocene genes. We have been here, a product of the highly cultured, settled, and civilized environment of the past ten thousand years, for just five hundred generations—far less than 1percent of the more than four million years that we have been present as a human lineage. So our genes, metaphorically, and to some extent deterministically, "look out at an ancient landscape," to use Daniel Janzen's striking phrase ("Gardenification of Wildland Nature and How to Absorb the Human Footprint," Kyoto Prize in Basic Science: Commemorative Lecture, 17/07/02 <http://www.aaas.org/international/pri/kyotoprize.htm>). They are the product of millions of years of human evolution in Africa, and have not had the time or the conditions of population genetics to respond significantly to the fairly recent frenzy of human cultural development over the past ten millennia. In any event, with high human mobility there has been ever-decreasing opportunity for local genetic specialization to occur. Thus the most recent few hundred human generations have likely seen little genetic change, and continue to reflect the parameters favouring our small, local human tribes, where we were all quite closely related to each other and lived off the land, and where there were enemies in the grass. Life was highly uncertain.

Our genes are still Pleistocene genes. But even so, the civilizing effects of those ten Holocene millennia of cultural development are like the difference between the magnificent Garden of Versailles and an untended patch of bare desert, or between space travel and walking. What makes us distinctively human is our capacity for communication and our civilization, and most of that has happened in the past ten thousand years. Our genetic nature represents a deep Pleistocene underpinning to the far greater force of human cultural evolution.

supplies. This released us from the immediate demands of food production for basic sustenance, and allowed people the luxury of living and contributing to society in other ways. Only after the emergence of agriculture, with its settled lifestyle, could new social classes of specialists arise—artisans, clerks, defenders, priests, even kings.[7] Living standards and cultural progress of a people increased following advances in agriculture and gardening technology.

Gardening and Non-Zero-Sum Games

Robert Wright recently surveyed human history through the lens of the game theoretician's "non-zero-sum" game.[8] Non-zero-sum games are those in which one player's gain is not necessarily bad news for the other players, since it allows for "win-win" situations. Indeed, in highly non-zero-sum games the players' interests overlap entirely. By contrast, in a zero-sum game, the fortunes of the players are inversely related. In a hockey game, for instance, one team's win is the other's loss. Political scientists and economists sometimes break down human interactions into zero-sum and non-zero-sum components. Occasionally, evolutionary biologists do the same in looking at the way various living systems work.[9] Non-zero-sum models underpin social cooperation, providing potential synergy.

Gardening too may be seen as a non-zero-sum game.[10] The development of crafts (metallurgy, smithing, brewing, baking, etc) and of art,

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[7] According to Jared Diamond, in *Guns, Germs, and Steel: The Fates of Human Societies* (New York: W W Norton, 1997), 265-80, hunter-gatherer societies tend to be relatively egalitarian, lack full-time bureaucrats and hereditary chiefs, and have small-scale political organization at the level of the band or tribe. That is because all able-bodied hunter-gatherers need to devote much of their time to acquiring food. In contrast, once food can be stockpiled, a political elite can gain control of food produced by others, assert the right of taxation, escape the need to feed itself, and engage in full-time political activities. See also Lesley Lovett-Doust and Jon Lovett-Doust, "Gender Chauvinism and the Division of Labour in Humans," *Perspectives in Biology and Medicine* 28 (1985): 526-42.

[8] Wright, *Nonzero: The Logic of Human Destiny* (New York: Pantheon Books, 2000).

[9] The 1994 Nobel Prize for Economics, awarded to the mathematician John Forbes Nash, was for his early work underpinning game theory. See Sylvia Nasar's *A Beautiful Mind* (New York: Simon & Schuster, 1998) for a discussion of its applications.

[10] See Wright's chapter "The Inevitability of Agriculture," in which he examines a number of hunter-gatherer societies and their practices regarding food and surpluses.

religion, science, architecture—indeed, the richness and com-plexity of all human activities that are hallmarks of civilization—could not have happened without the emergence of the garden culture, the garden "meme."[11] Cities first arose in those regions of the world where people adopted gardening and agriculture, and cities grew out of successful agricultural villages. The change from farming for subsistence to producing a surplus for sale, barter, or tribute represented a change in the social organization of farming communities that is almost as profound as the adoption of farming itself. Along with our capacity to store and horde food came a need to protect that resource, with city walls and an emergent military class.

The Gifts of Gardening

Hunter-gatherers take and consume what their environment offers. By contrast, farmers—gardeners and horticulturists alike—actively seek to influence a piece of the environment, to manipulate it in ways that increase the amount of product—food, flower, fibre, pharmaceutical, etc—that is available and consumable. More recently, they have created gardens that make social statements.

The origins and meaning of the garden and of gardening seem to me to be tightly linked to the history of land's transition from commons to private property, and to general changing tides of civilization. The cultivation of the garden (a Middle English word derived from the Old Northern French word *gardin*, "an enclosed piece of ground"[12]) suggests that the transition from common to personal space parallels the demarcation of fields in agriculture. The term *horticulture*, which is of relatively recent origin, first appeared in written language in the seventeenth century.[13] The word is derived from the Latin *hortus*, garden, and *colere*, to cultivate.[14]

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[11] "Meme" is Richard Dawkins's term for the unit of cultural inheritance parallel to the unit of organic inheritance, the gene. For more discussion of this concept, see Dawkins's *The Selfish Gene* (Oxford: Oxford University Press, 1976).

[12] *Oxford English Dictionary*, 2nd ed, sv "garden."

[13] According to J Janick in *Horticultural Science* (San Francisco: W H Freeman, 1979), 9, the first known use of the word *horticultura* is in Peter Lauremberg's treatise of that name, written in 1631. The word *horticulture,* says Janick (9), is first mentioned in English by Edward Phillips in *The New World of English Words* (London, 1678).

[14] *Oxford English Dictionary*, 2nd ed, sv "horticulture." The influence of the Roman Empire is notable in the spread of Latin, and in the powerful and rapid spreading of the garden meme across the globe—with pomology, viticulture, and oenology becoming particularly well developed by the Romans. As R N Clapham, T G Tutin, and E F Warburg demonstrate in *The Excursion Flora of the British Isles*

The theory goes that the advantages of farming and the settled lifestyle that accompanies it led rapidly to the so-called Neolithic Revolution. With the rise of farming came the first traces of cities, great leaps in the variety and subtlety of stone tools, and the slow eclipse of the hunter-gatherer lifestyle.[15]

The evolutionary ecologist Jared Diamond, in his analysis of the forces underpinning broad patterns of human history, suggests that the process of adoption of agriculture was evolutionary rather than revolutionary.[16] The emergence of a gardening culture did not happen overnight, but it does seem to have crystallized about ten thousand years ago in five or more different regions of the world.[17] For Diamond, four fundamental factors help us to understand why the transition to food production began around 10,500 B P,[18] and not, say, at 20,500 or even 30,500 B P. At the latter two dates hunting-gathering was still much more rewarding than incipient food

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(London: Cambridge University Press, 1981), a great many British weeds were introduced by the Romans as pot herbs.

[15] Indeed, it looks as if it will be in our own time, within the next ten years, that the last few remaining hunter-gatherer societies on Earth will cease to exist.

For most of the time since the ancestors of modern humans diverged from the ancestors of the great apes, all humans fed themselves exclusively by hunting and scavenging. Today most people on Earth consume food that they produced themselves, or that someone else produced for them. Diamond estimates that, at the current rates of change, within the next decade the few remaining bands of hunter-gatherers will abandon their ways, disintegrate, or die out, thereby ending our millions of years of commitment to the hunter-gatherer lifestyle; see Diamond, *Guns, Germs, and Steel: The Fates of Human Societies (New York: WW Norton, 1997)* 113.

[16] Ibid*,* 106.

[17] According to Diamond (*Guns, Germs, and Steel*), five areas for which the evidence is at present detailed and compelling are: Southwest Asia, also known as the Near East or Fertile Crescent; southeastern China; Mesoamerica (the term applied to central and southern Mexico and adjacent areas of Central America); the Andes of South America and possibly the adjacent Amazon Basin as well; and the eastern United States. Provocatively, Colin Tudge, in *Neanderthals, Bandits, and Farmers: How Agriculture Really Began* (New Haven, CT: Yale University Press, 1998) has extended the thesis that agriculture in some form existed in the repertoire of our ancestors thousands of years before the Neolithic farming revolution. The revolution was not as much the beginning of agriculture as it was the beginning of agriculture on a large scale in one place, with refined tools. Tudge takes this line of thinking much further back in time, to at least forty thousand years ago into the late Paleolithic, and argues that people were already managing their environments to such an extent that they might properly be called proto-farmers.

[18] B P: Before the present.

production, because large wild mammals that could be eaten were still abundant and wild cereals were not yet abundant; furthermore, people had not developed the inventions necessary for collecting, processing, and storing cereals efficiently; and human population densities were not yet high enough for a large premium to be placed on extracting more calories per acre.

Of course we do not have any accurate account of precisely how primitive people first began the domestication of plants and animals, but we do know that quite sophisticated pleasure-gardens existed—in Egypt and Mesopotamia[19] for example—long before the Christian era. Indeed, our word *paradise* derives from a Persian term meaning garden.[20]

Gardening, Domestication, and Selection

Gardening challenges are, at root, botanical in nature. The plant, the basis of all horticultural activities, is first of all a living entity, growing in populations. As a graduate student in the early 1970s at the School of Plant Biology in Bangor, Wales,[21] I attended a seminar given by my supervisor, John Harper, called "Obsessions with Sex and Death," a title that, suggestive as it is of Victorian-era metaphors of nature being at war and "red in tooth and claw,"[22] emphasized competition and conquest.

In his seminar, Harper argued for the primacy of (and hence the worthiness of his obsession with) both sex and death—at least from the perspective of evolution. Both factors relate to demographic urgencies: sex, as the process of reproduction and multiplication,[23] and death, as the

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[19] If Eden is the most famous garden of ancient times, the Babylonian "Hanging Gardens" of Nebuchadnezzar are surely next. Indeed, they were one of the Seven Wonders of the Ancient World. They are largely legend; however, the city of Babylon, which dates to some three thousand years ago, included a terraced hill adjacent to the royal palace, planted with numerous horticultural specimens and rare plants. These terraced gardens, when observed from a distance, could have appeared to be floating.

[20] As D F Ruggles notes in her paper in this volume.

[21] "School of Plant Biology" is *Pryfysgol ysgilliog* in Welsh—literally the School of Vegetables.

[22] Alfred Tennyson, "In Memoriam," *Tennyson's Poetry*, ed Robert W Hill, Jr, A Norton Critical Edition (New York: W W Norton, 1971), sect 56, st 4, line 15.

[23] Erasmus Darwin (1731-1802, grandfather of Charles Darwin), in his epic *Loves of the Plants* (New York: T & J Swords, 1798), called sex "the masterpiece of Nature." Quoted in Michael T Ghiselin, *The Economy of Nature and the Evolution of Sex* (Berkeley: University of California Press, 1974), 49.

inevitable end of all existence. The selection process, what Charles Darwin saw as the engine driving evolutionary change (including "natural," "artificial," and "sexual" selection) comes, finally, via the differential reproductive success of individuals in a population—through sex and death.

Sex and death are what life is all about even in the lives of buttercups and poppies, duking it out, so to speak, in the great game of life. And so it is for all living things. Each of us plays the existential game of life because, and only because, our ancestors did not lose. The millions and millions of species of insects (mostly beetles), bacteria, worms, corals, snails, fishes, salamanders, snakes, birds, and mammals exist simply because their ancestors were more successful than their neighbours. Births and deaths—along with emigration of individuals out of and immigration into a population—constitute the vital components of population biology and, hence, of evolution.[24]

Harper's training was in agricultural botany, and he drew his inspiration from Darwin (he called his presidential address to the British Ecological Association in 1967, "A Darwinian Approach to Plant Ecology"). Darwin, of course, famously took his inspiration from the world of animal and plant husbandry—from domesticated species and the everyday products of human gardening.

Darwin opens *The Origin of Species*[25] with a long chapter on a special case of natural selection, which he called "artificial selection" —his term for the process by which domesticated species and varieties come into being. Darwin uses the word *artificial* not as in *fake* but as in *artefact*—a product of human will. In the *Origin,* Darwin begins by discussing how farmers develop varieties of gooseberries; but he writes also about hybrid roses and cultivated pears, as well as about varieties of cattle, goats, and pigeons, among many others—and demonstrates how in each case the domesticated species contain great reservoirs of genetic variation from which humans select the particular variants or traits that they wish to see passed down to the next generation. In Darwin's words:

> I have seen great surprise expressed in horticultural works at the wonderful skill of gardeners, in having produced such splendid

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[24] Those interested in the obsession should note Graham Bell's *Sex and Death in Protozoa: The History of an Obsession* (Cambridge: Cambridge University Press, 1988). Bell brings the matter down from the world of plants and animals to that of single-celled forms of life. Whether or not these organisms also age and die, and what relation sex may have to the process of senescence, is dealt with illuminatingly.

[25] Charles Darwin, *The Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life* (London: John Murray, 1859).

> results from such poor materials; but the art has been simple, and as far as the final result is concerned, has been followed almost unconsciously. It has consisted in always cultivating the best-known variety, sowing its seeds, and, when a slightly better variety chanced to appear, selecting it, and so onwards.[26]

Darwin explains how in the special case of domestication, human preferences play the same role that blind nature does everywhere else, determining over time what constitutes suitability or “fitness,” and thereby leading to the emergence of new forms of life. The evolutionary "rules" (that is, “descent with modification”), remain the same, but Darwin knew that his readers would be more likely to empathise with examples drawn from the world around them, and so selected traits in the pigeon or the pear rather than the iguana; he drew his examples, in other word, from the farm and garden rather than the distant islands of the Galapagos.

From his early days, Darwin wrote articles for the *Gardeners' Chronicle and Agricultural Gazette*, a scientific yet practical horticultural journal read by leading professional gardeners and nurserymen as well as Victorian gardening aficionados. Thus, as Mea Allen reports, in 1843 he contributed "Double Flowers—their Origin," in 1844 "Manures, and Steeping Seeds," and "Variegated Leaves."[27] But even before then, in the first volume of the *Gardeners' Chronicle*, published in 1841, eighteen years before *The Origin of Species*, he was writing on "Humble Bees" and their habit of cutting holes at the base of petals to obtain nectar without expending time and energy crawling down the tube of the flower, something he witnessed hundreds of times in his garden.

Darwin’s great work, *The Origin of Species* was in fact written as a highly abbreviated version of the "big book" that he intended to write.[28] Darwin published it hurriedly: his long work on evolution through natural selection[29] had been interrupted when Alfred Wallace wrote to him about his own very similar idea, and Darwin was obliged to hurry into print a summary

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[26] Darwin, *The Origin of Species.* Quoted in Diamond, *Guns, Germs, and Steel*, 130.

[27] Mea Allen, *Darwin and His Flowers: The Key to Natural Selection* (London: Faber & Faber, 1977), 9.

[28] See S J Gould, “Darwin’s ‘Big Book,’” *Science* 188 (1975): 824-26, and Robert C Stauffer, *Charles Darwin’s Natural Selection: Being the Second Part of His Big Species Book Written 1856-1858* (Cambridge: Cambridge University Press, 1975).

[29] The word *evolution* did not actually appear in the *Origin* until a later edition. The issue was couched in such terms as *transmutation*, *the conversion* (of varieties into species), and *hybridisation*.

of the ideas that he had been nurturing for over twenty years but had never published. He subsequently published the richly detailed *Variation of Animals and Plants under Domestication*,[30] in which he explored more fully the parallel phenomenon of artificial selection.

Michael Pollan's recent book, *The Botany of Desire: A Plant's Eye View of the World,* has engagingly discussed the process of domestication from the perspective of the plant.[31] As Pollan points out, we tend to think of

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[30] Darwin, *The Variation of Animals and Plants under Domestication* (London: John Murray, 1868).

[31] Pollan, *The Botany of Desire: A Plant's Eye View of the World* (New York: Random House, 2001). Pollan's phrase "plant's-eye view" was used earlier in research papers by plant ecologists such as Harper (*Population Biology of Plants* [New York: Academic Press, 1977]), L Aarssen ("Competitive Ability and Species Coexistence: A 'Plant's-Eye' View," *Oikos* 56 [1985]: 386-401), and R Turkington ("Rapid Change in a Patchy Environment: The 'World' from a Plant's-Eye-View," *Evolution in a Rapidly Changing Environment: Global Warming*, ed R Buddemeir, Proceedings of ICSEB 90 [1991]: 194-200). The phrase appropriately connotes a sense of the evolutionary player. Every living organism defines the scale of its own environment. The "plant's-eye view" is what is relevant to explain the distribution, adaptation, and processes of change within species and within communities; see John Harper, *Population Biology of Plants*: (New York: Academic Press, 1977) 706. It is here that the analogy with players on a stage breaks down, since each player in a population of organisms defines the size of its own stage. A plant exerts an influence as far as its products are dispersed. A plant community, which may appear diverse to the human observer of a sampled area of vegetation, may be quite monotonous to an organism within it. Just as, say, an antelope samples the diversity of a savannah quite differently than does a lizard, so a clonal plant with long rhizome internodes samples (or "experiences") the surrounding vegetation in a very different way than does a tufted, tussock-type of plant. Lesley Lovett-Doust, in "Population Dynamics and Local Specialization in a Clonal Perennial (*Ranunculus repens),* (1) The Dynamics of Ramets in Contrasting Habitats," *Journal of Ecology* 69 (1981): 743-55, has represented these alternative evolutionary "strategies" of plant clonal morphology as guerrilla and phalanx strategies, and has described the consequences in terms of plant competition. Inter-specific competition is significantly more likely with the guerrilla form of clonal growth (as in, for example, the creeping buttercup, the wild strawberry, or the eastern cottonwood tree), while intra-specific and even intra-genotypic competition is more likely with the phalanx strategy (as in buffalo grass or cattails).

Furthermore, as far as plants are concerned (in their *Weltanschauung*, so to speak), we are simply one of thousands of animal species that more or less unconsciously domesticate plants. In this co-evolution (and in common with all animal species, including humans), plants must spread their offspring to areas where they can thrive and so pass on their genes. In the game of crop and garden ornamental plant evolution, humans have selected and bred plants for their size, sweetness, colour, perfume, fleshiness, oiliness, fibre content, drug concentration, and other beneficial qualities. Beginning in pre-history, by harvesting those

domestication as something *we* do to other species; but it is entertaining to turn this idea on its head and look at domestication as something certain plants and animals have done to *us*—a beneficial evolutionary strategy for advancing their own interests, so to speak. The species that have spent the last ten thousand years or so "figuring out" how best to feed, heal, clothe, intoxicate, and otherwise delight us have made themselves some of nature's greatest success stories. Pollan uses four domesticated species as illustrations: the apple, tulip, potato, and marijuana plants. All four play important roles in our everyday life. Pollan articulates the obvious point that, precisely because domesticated species have satisfied our most basic desires, they have thrived. We use genetic modification and other scientific means to get what we want out of plants—potatoes that will fry well, tulips that flower out of season, or pot plants with 20 percent tetra-hydro-cannabinol levels. But, Pollan asks, who is using whom here? These plants, in "helping" humans, have us at their service to help them multiply. What if, in other words, they are "using" us just as we are using them? A satellite image of our planet shows that the area of land covered by the seven or eight species of arable grains is vast; and, similarly, the numbers of dogs, horses, cows, sheep, pigs, and other domesticated species is in each case vastly greater than that of their former wild relatives.

In another book, Pollan nicely recasts Spinoza by stating that "nature abhors a garden,"[32] and develops the notion of gardening as a sort of portal towards, and point of tension between, nature and culture. As Pollan puts it: "The forest is 'normal'; everything else—the fields and meadows, the lawns and pavements and, most spectacularly, the gardens—is a disturbance, a kind of ecological vacuum which nature will not abide for long."[33] Indeed, "nature" proceeds to fill the vacuum: with annual weeds, perennial weeds, groundhogs, and the many spineless creatures such as cutworms, slugs, and beetles. Pollan argues that

> gardens . . . teach the necessary, if un-American, lesson that nature and culture can be compromised, that there might be some middle ground between the lawn and the forest —between

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individual wild plants possessing these desirable qualities to an exceptional degree, ancient peoples unconsciously dispersed the plants and set them on the road to domestication. At the same time, we often bred out of the plant secondary chemicals that protected them from herbivores, with the result that today we have to deal with pests that, like us, find the vulnerable crop very attractive. In that sense, we have also revised the role of opportunist organisms, which now undergo population booms that we call pest/disease outbreaks.

[32] Pollan, *Second Nature: A Gardener's Education* (New York: Dell Publishers, 1994), 45.

[33] Ibid, 56.

> those who would complete the conquest of the planet in the name of progress, and those who believe it's time we abdicated our rule and left the Earth in the care of its more innocent species. The *idea* of a garden—as a place, both real and metaphorical, where nature and culture can be wedded in a way that can benefit both—may be as useful to us today as the idea of wilderness has been in the past.[34]

Few gardeners have contemplated the idea of nature as both garden and wilderness as presciently as Henry David Thoreau, and there is little that reveals more of his philosophy than that section of *Walden*[35] in which he plants his "pleasure garden"[36] with beans ("making the earth say beans" as he puts it).[37] Thoreau details the effort of cultivating the beans ("the length of whose rows, added together, was seven miles"[38]) as he seeks "the meaning . . . of this small Herculean labour."[39] Thoreau saw an essential unity of nature, and concluded that

> we are wont to forget that the sun looks on our cultivated fields and on the prairies and forests without distinction. They all reflect and absorb his rays alike. . . . In his view the earth is all equally cultivated like a garden. . . . These beans have results which are not harvested by me. Do they not grow for woodchucks partly?. . . Shall I not rejoice also at the abundance of the weeds whose seeds are the granary of the birds?[40]

This seems to me entirely apposite. Of course, a garden is not a self-sustaining equilibrium: the entropy of chaotic nature must be constantly pushed back by our will and labour. Spinoza's vacuum, again, means that the spaces of black earth between plantings will be colonized by unwanted weeds, and that aphids will find pristine roses.

"Proximate" and "Ultimate" Factors

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[34]Pollan, *Second Nature*, 76.

[35] Thoreau, *Walden, or Life in the Woods* (Boston: Ticknor & Fields, 1854).

[36] Quoted in Joseph Wood Krutch, ed, *The Gardener's World* (New York: G P Putnam's Sons, 1959), 58.

[37] Ibid.

[38] Ibid.

[39] Ibid, 63.

[40] Ibid.

In *Guns, Germs, and Steel*, Diamond emphasizes the overriding influence of domestication as a factor underlying the broad patterns of human history. He argues that certain *proximate* factors (such as guns, horses, and diseases) enabled some peoples to conquer others, while larger, *ultimate* factors (such as the orientation of Earth's continental axes[41]) play even more fundamental roles—and that both sorts of forces interact with domestication. Thus, for example, diverse epidemic diseases of humans evolved in those areas of the world where there were abundant wild plant and animal species suitable for domestication. This occurred partly because the rich harvest helped support dense human populations (in which epidemics could arise and spread and maintain themselves by residing in reservoirs of individuals, ready for a new generation of susceptible victims), and partly because many of the human diseases that have plagued us, including bubonic plague, influenza, and (quite recently) bovine spongiform encephalo-pathy (BSE, or "Mad Cow Disease") evolved from germs of the domesticated animals themselves. Interestingly, some of our other zoonoses (diseases human beings caught from animals) came from wild animals whose habitats we have invaded (for example, HIV and Ebola-Marburg viruses, which were picked up by humans from chimpanzees and other closely related primates).

Diamond's ultimate factor of the orientation of continents also accounts for the extraordinary richness of the woody floras of eastern North America and East Asia in contrast to the comparatively depauperate European and British tree flora. From the fossil and pollen record it seems clear that the diverse Tertiary[42] floras of Europe suffered much greater extinction through

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[41] The predominantly west-east orientation for Eurasia, unlike the north-south orientation of the Americas and Africa, means that migrating domesticated species in Eurasia have had little need for evolutionary changes in fundamental biological features (involving, for example, a response to the environmental photo-period, the minimum winter temperature, and other climatic components) in order to spread. Evolutionary change would be needed if migration were occurring *across* the latitudes, in a north-south continent. According to Diamond, Eurasia's west-east axis allowed crops from the Fertile Crescent to launch agriculture over the band of temperate latitudes from Ireland to the Indus Valley, and to enrich the agriculture that had arisen, independently, in eastern Asia. In contrast, the movement of corn in America from tropical to temperate latitudes took thousands of years, with the need to evolve adaptations to shorter growing seasons.

[42] See Table 1. John McPhee engagingly points out in *Basins and Range* (New York: Farrar, Straus and Giroux, 1981) and *Annals of the Former World* (New York: Farrar, Straus and Giroux, 1998), how, by establishing our bearings across the temporal history of Earth, we owe an incalculable debt to vanished and endangered species.

The Cenozoic (literally "recent life") era begins immediately after the Cretaceous Extinction, and extends to the most recent moment of time; it is

the successive ice ages than did the floras of North America or East Asia. Why should this be? An elegant explanation, summarized by Max Walters,[43] draws attention to the difference between the main mountain ranges of Europe, which run in an almost unbroken chain from the Pyrenees in the west to the Balkans in the east, and the Rocky Mountains of North America, which run north to south like a backbone to the continent. The hypothesis is that in Europe the east-west chain of mountains blocked the gradual retreat of the Tertiary floras as the ice came down from the north, and that they were unable, except in a fragmentary form, to retreat south of the ice and "wait" for warmer times. In eastern North America, on the other hand, there was a wide north-south lowland corridor along which the Tertiary floras could retreat and retrench as ice ages came and went.

Fifteen thousand years ago, towards the end of the most recent ice age, much of North America and Europe were covered by vast sheets of ice that made our climate much like that of Greenland and Spitsbergen today. The time since the most recent melting and retreat of the glacial ice can be thought of as being like the most recent minute of time compared with the inconceivably long time scale of geological and biological evolution (eleven thousand years versus four thousand million years; see Table 1). Every human artefact now on Earth—our roads, cities, and industries, our pollution,

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sometimes nicknamed the age of mammals (though this is not to say that mammals had not existed prior to the Cenozoic). The Cretaceous Extinction was caused by an asteroid some 10 km in diameter hitting the earth just off the coast of Mexico (and closing out the earlier, Mesozoic era, 65 million years ago [give or take 120,000 years]). This event extinguished the ammonite mollusks, the great marine reptiles, and the dinosaurs, while severely diminishing the diversity of animal groups ranging from minute *foraminifera* to mammals. Plants were greatly affected too, particularly in North America and eastern Asia, where the shock and firestorms of the impact were most intense. It is speculated that, subsequently, "nuclear winter"-like conditions occurred, caused by particulate matter blocking the sun's energy from getting to the earth. Plants can endure such horrific conditions as root, seed, or spore in ways animals cannot. Those interested in the earliest days of the "story" about life in North America should see Tim Flannery's *The Eternal Frontier: An Ecological History of North America and its Peoples* (New York: Atlantic Monthly Press, 2001).

The *Primitive* and *Secondary* eras of eighteenth-century geology have long since gone from the vocabulary, but oddly enough the *Tertiary* remains. The term embraces nearly all of the Cenozoic era, from the Cretaceous Extinction to the end of the Pliocene, while the relatively short time that follows—the Pleistocene plus the Holocene epochs—has come to be called the Quaternary period (from 1.8 million years ago to today). The Tertiary Period includes the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs. Fossil evidence of the first apes occurs in the Oligocene; the earliest hominids appear in the Pliocene. The Quaternary Period is characterised by successive glaciations.

[43] Walters, *Wild and Garden Plants* (London: Harper Collins, 1993).

our problems of human population crowding, and our gardens—is very new. It is possible to analyse the presence of plant species in particular places over time by studying the profile of their pollen in the soil. Pollen atlases give detailed chronologies over past millennia, showing the spread of our modern temperate vegetation over what was formerly ice-covered terrain. It is important to note how very recent everything is—our human artefacts and the rest of nature too.

Earlier, when I suggested that sex and death are, for nearly all species, the main engines driving organic evolution, I deliberately left humankind out of the list of species. It is not entirely anthropocentric conceit to say that we are special, and (at least for the purposes of this paper) arguably because of the garden. Gardens and gardening gave us the conditions, time, and resources to develop rich cultures that reach far beyond the crude parameters of reproduction and mortality (perhaps to the cruder ones of death and taxes, with taxes being the outcome of garden surplus).

Historically, the greatest changes brought about by farming and gardening were social changes. The invention of agricultural tools and the development of agriculture transformed the human species from small nomadic bands whose activities had little ecological impact into highly complex and interrelated societies engaged in industrial activities affecting all life on the planet. Consider just one example: ploughing technology and the very slow incorporation of the horse, followed by their rapid replacement by the combustion engines and electric motors of today.

Until quite recently, horses were responsible for nearly all the hauling, lifting, pulling, and heavy work in the garden.[44] We still measure the power of our cars and tractors in terms of horse-power. As Vaclav Smil points out, horses are biomechanically superior to cattle and oxen, which preceded them as draft animals.[45] A little more than a thousand years ago, medieval Europe adopted fitted and padded collar harnesses, and iron horseshoes. Older throat and girth harnesses had choked the animals, and breastband harnesses were far less efficient.[46]

By 1000 B P horses were mechanically ready to play a bigger role in medieval society, yet it took them several centuries to displace oxen as the

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[44] William Cobbett, writing in the1820s, noted that a man with a spade could dig twelve rods in a day, while a one-horse plough might dig half an acre in a day, or eighty rods (see J and S Seymour, *Self-Sufficiency* [London: Faber & Faber, 1973], 34).

[45] Smil, “Horse Power,” *Nature* 405 (2000): 125. Unlike cattle, horses’ front ends are heavier than their rear ends, giving them an advantage in inertial motion. Furthermore, they can stand without engaging muscles, by locking their legs. Horses grow larger and live longer than cattle, and they have greater physical endurance.

[46] Smil, "Horse Power,"125.

principal draft animals.[47] As Smil observes, the size of the animals, their nutrition, and the ploughs they pulled explain why. The body weight (and hence power) of draft horses began to rise only after several centuries of selective breeding for the heavy war animals needed to carry armoured knights. But even larger, well-fed horses had a tough time with wooden ploughs. The plough's heavy soles, wheels, and mould-boards generated enormous friction, particularly in wet soils. Without a smooth, curved fitting between the share and the flat mould-board, they were constantly becoming clogged with soil and weeds. Iron mould-boards crossed from China to Europe only in the seventeenth century, and it was not until the rise of the modern steel industry in the mid-nineteenth century that smooth, curved, steel ploughshares replaced cast-iron shares.[48]

Heavier draft horses made it possible to cultivate the existing fields more frequently and to convert forests and grasslands to new fields more easily, freeing human labour for other activities. The post-1850 ploughing up of North America's enormous mid-western grasslands could not have happened so quickly with oxen. The heaviest nineteenth-century horse breeds—French Percherons, English Shires, German Rhinelanders—worked in teams of more than thirty animals, and pulled the first grain combines. But such large numbers of animals needed abundant farmland to provide their food.[49]

Gardens and the act of gardening were surely the greatest catalysts to the development of human culture, being at least on a par with our capture of fire and the benefits of a moving axle. Gardening moved us from the itinerant state of hunting and gathering to the settled state, and brought with it the opportunity for social development and specialization. Whereas it took us a very long time to begin to till, fertilize, plant, water, and weed a garden for food, at some point gardening grew into more than just food production: it became an aesthetic endeavour and personal expression of the gardener.

Terroir, and the Influence of Place upon Plants in a Landscape

Gardens consist of plants and animals—soil invertebrates and insect pollinators in all gardens, plus herds of deer and cattle in larger, landscape

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[47] According to Smil (ibid), the Domesday count of 1086 shows that a mere 5 percent of all draft animals, and about a third of the total on English peasant holdings, were horses. By 1300 they made up nearly half of all draft animals owned by peasants. But it was more than two hundred years before they became dominant.

[48] Ibid.

gardens. And of course there are pests too. Cultivators of both large and small gardens usually include in this category all those animals that attack plants, including insects, mites, slugs, snails, and birds.[50] Weeds are plants growing in the wrong place.[51] Plants have unique, evolved biologies that allow them to adapt for life in a particular place; and every place a garden is planted comes with biota or living things already there. As Pollan puts it: gardens instruct us in the particularities of place.[52] They reflect and accommodate regional geology, hydrology, and topography, and adjust to climatic and social realities. A gardener's talent may be measured by his or her ability to coax unexpected things to grow, and to defy the dictates of history and geography.

The topography of France, for example, is very different from that of Italy—to select, haphazardly, two countries that stand out in the history of landscape design. In France, much of the land is flat, with low-lying flood plains and flat marshes. Its climate is influenced by the Atlantic Ocean, whereas Italy has a Mediterranean climate that brings warm, wet, westerly winds in winter. However, because the planning and design of towns and estates was heavily influenced by classical Italian design, many ideas were taken and adapted for use in France despite the climatic and botanical differences. Whatever the social history, the celebrated Baroque style of

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[49] According to the Smil, when the number of farm horses in the United States peaked at twenty-one million animals in 1919, at least 20 percent of the country's farmland was needed to cultivate their feed. By that time, internal combustion engines and electric motors had almost totally displaced draft animals in the cities of industrial countries. Their eventual replacement in Western farming was inevitable, as even the small engines mounted on the first tractors could replace at least ten horses—and needed no oats or pasture.

[50] Of course, some of these are beneficial and should be preserved. Ladybirds, lacewings, hoverflies, centipedes, and some ground beetles live off herbivorous insects and provide natural pest control. Some animals fall in between. Consider the mole. These blind, insect-eating animals move about just under the surface, pushing aside the soil and eating the larva of many garden pests—but in the process disturbing the grass, creating characteristic tunnels in the lawn. In southwestern Ontario, the Eastern mole *Scalopus aquaticus,* identified as "vulnerable" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the federal conservation authority, is nevertheless regarded as a pest by most people, and subjected to lethal trapping via subterranean, sprung spikes. Others kill the insect grubs with insecticide, forcing the mole to go elsewhere.

[51] Most gardeners will agree that wild flowers and even weeds have their place—just not in a garden.

[52] Pollan, *Second Nature*, 274.

French gardens emerged from the physical environment of central Europe, and was adapted to fit the environmental context of cold snowy winters, warm sunny summers, and rich agricultural productivity. As all gardeners learn, any particular garden is always captive to the climatic zone in which it grows. Of all the common horticultural concepts, that of hardiness is perhaps *primus inter pares*. The relation between climate and plant distribution is profound and powerful.[53]

Gardens reflect political and aesthetic realities too, as we see in the gardens of the era of Louis XIV. The so-called Sun King, who came to the throne of France as a boy in 1643, was an absolute ruler. Not surprisingly, royal palaces and gardens reflect the political power arrangements of the era. Baroque art and architecture were powerful metaphors for human dominance over nature, and for the king's primacy over the citizenry. Heavy with decoration and ornamentation, Baroque art celebrates opulent wealth and power. Louis XIV had Andre Le Notre (1613-1700), and later the designers Charles Le Brun (1619-90) and Louis Le Vau (1612-70), design and build a grand garden around a relatively small chateau that had been his father's old hunting lodge at Versailles. The plan of Versailles was a deliberate, geometric expression of the power and supremacy of the monarch. It is only from the elevated vantage point of the palace windows that one can view the entire garden landscape[54]—a living tapestry where coloured stones enhance the delicate horticultural mosaic of parterres,[55] long canals, waterworks, statuary, and paths that convey a magnificent geometry. At ground level, the garden awes visitors by its grand scale. Throughout, nature is constantly held back, bent, clipped, and sheared into angular shapes; only within the strict constraints of paths, parterres, canals, and pools are elements of vegetation and water allowed to express themselves.

To create this garden masterpiece, a sandy marshland was transformed into a garden literally fit for a king. More than twenty-two thousand men and six thousand horses were employed in the construction

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[53] Unfortunately the science behind *hardiness* is not so straightforward. Individual site characteristics are also important. Thus, for example, a "hard winter" can be defined in terms of temperature (the January or February minimum), but whether a particular tender plant dies or survives is, as every gardener knows, a very complicated matter in which other variables, such as soil and shelter and physiological acclimation must be considered.

[54] D F Ruggles discusses in some detail the positioning of the ruler/patron within the space of the garden, in her book *Gardens, Landscape, and Vision in the Palaces of Islamic Spain* (University Park, PA: Pennsylvania State University Press, 2001).

[55] A parterre is a garden surrounded by paths. In seventeenth- and eighteenth-century France, the parterre would be planted with enormous numbers of tulips, lilies, narcissi, and other flowers.

of the garden of Versailles. Swamps were drained, terraces created, and waterways excavated. From the palace to the canal there is a drop of more than thirty metres; this provided the opportunity to form a series of terraces, vegetated slopes with woods, and an amphitheatre embedded in the topography. The cost of Versailles seems never to have been a consideration. Millions of dollars were spent on materials, and there was no limit to labour, as the army often helped civilian workers to build the garden. Some ninety sculptors were employed there; thousands of fountains were installed; three thousand orange trees were imported from Italy; twenty-two acres of walled kitchen garden were created where exotics like pineapple, coffee trees, and asparagus were raised. It seems that when we live in "flatland" we crave topography; when on mountain slopes we terrace to create some flat. If it is sandy, we seek to garden a rockscape; if stony we make smooth.

"In an English Country Garden"

Like Italy and France, England too is a country of gardens. The environment of Great Britain includes subtle landscape variations and a huge range of geological substrates, from rocky granitic coasts to undulating chalk-lands. Rich agricultural lands are abundant, and the predominant character is rolling terrain and a moist climate. In Britain, there was a great increase in rural estate development following the Reformation. Early on, gardens were formal and ornate, with axial plans imposing a symmetry and linear geometry onto the landscape very much in the vein of French gardens. Topiary and severely clipped plant materials were prevalent. Stylish estates often featured a knot garden, bowling green, maze, parterre with allée, kitchen garden, fountains to water plants, profuse flowers, and orchards—all maintained by a small army of cheap, abundant labour.

As Graham S Thomas has made clear in his book *Trees in the Landscape*,[56] the way we in the West look at the countryside has been shaped by the pioneers in landscape design, who used trees consciously to create pleasing views. In much of Britain what looks like unspoiled countryside to a viewer today is not in any sense natural vegetation, but is, rather, the product of a range of influences, not the least of which was the power of rich country landowners, who could afford to employ a succession of gifted landscape designers.

The English Romantic style (and, later, the *natural* style) had a great impact on landscape architecture and gardening. A Romantic garden allowed the inherent landscape to be expressed through the garden—although using mostly non-native plants. Design components commonly employed included *picturesque* rolling pastoral landscapes,

[56] Thomas, *Trees in the Landscape* (London: Jonathan Cape, 1983).

"follies" and obelisks, and the imitation of natural elements and forms (using clump and gap plantings, for example). In order to enhance the picturesque quality, representations of classical Greek ruins or other allegorical artefacts were often included in both the created landscapes and the paintings that the gardens were designed to mirror. Other design elements included meadows, ponds, trees, pagodas, grazing cattle and deer herds, hermit dwellings, dead trees, and "ha-ha walls" (hidden ditches that kept cattle—and their flies and "country pancakes"—away from the house, but within the picturesque view). Garden designers purposefully manipulated nature's undulating contours and the effects of light and shade to create surprise, variety, and concealment.

According to Laird,[57] the English landscape garden is generally visualized as a composition of undulating lawns, serpentine lakes, clumps of trees, and scattered follies. It is conventionally regarded as the antithesis of the highly geometric styles that preceded it. A small number of people bear principal responsibility for changing the English concept of gardens: William Kent, Lancelot ("Capability") Brown (1716-1783), and Humphry Repton (1752-1818), all of whom developed, promoted, and specialized in creating picturesque pastoral landscapes. Many grand, formal geometric gardens from an earlier era were re-built to create sinuous hills and valleys, curving paths, and lakes with undulating shorelines. Trees were encouraged to achieve their towering natural shapes, planted singly or in clusters (what Laird calls "painterly plantings"[58]). Later, Gertrude Jekyll (1843-1932), an English garden designer who also wrote numerous gardening books, and who was famous for her espousal of the herbaceous border and her love of cottage gardens, made gardening more widely popular among the merchant and middle classes.

Laird has challenged the standard view that the park of "[s]erpentine shrubberies and sinuous lakes, paths, and woods" is the enduring achievement of eighteenth-century English landscape art.[59] He argues that this conventional view of the picturesque style ignores the colourful flowers and flowering shrubs that graced the landscape garden of the Georgian era. In his work as a landscape consultant, Laird has carefully reconstructed the formal and horticultural characteristics of *theatrical* shrubberies and flowerbeds, showing how the unwritten lore of planting design was passed down through generations of gardeners. He emphasizes too the importance of the ongoing interaction of the landscape designer, client, nurseryman, land agent, and gardener in modifying and transforming the geometric

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[57] Laird, *The Flowering*.

[58] Ibid, 36.

[59] Ibid, xiv.

layouts of previous generations.[60] He traces the development of planting design theory and practice, and demonstrates how an English mania[61] for flowering trees and shrubs helped create the distinctive planting forms of the Georgian pleasure ground. As it happened, a great many species of flowering trees and shrubs were imported from eastern North America, including various species of *Magnolia,*[62] the Tulip-tree *Liriodendron tulipifera,* Redbud *Cercis canadensis*, Honey locust *Gleditsia triacanthos*, *Kalmia* spp*,* and *Carya* spp (hickories), as well as many conifers.[63] Laird invokes a wealth of visual and literary materials—from contemporary paintings, engravings, poetry, essays, and letters, to more prosaic household accounts and nursery bills—to focus our understanding of the English landscape garden as a powerful cultural expression. Ha-has and follies, flower beds and bowers, grottos, pools, pleasure grounds and the flowering auricula "theatres," all come delightfully alive in blazing New England colour.[64]

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[60] See Laird's essay in this volume.

[61] The allusion here is of course to the tulip. The tulip was first cultivated in Turkey and adjacent countries, and was brought to the West in the sixteenth century (where at first it was thought to be an edible bulb). Its decorative qualities and the ease with which new varieties could be bred soon brought it into such great popularity that it gave rise in the seventeenth century to a craze in Holland, afterwards named "tulipomania" (1634-37), in which fantastic prices were paid for individual bulbs. Large fortunes were made and lost in this horticultural madness, which collapsed suddenly, in 1637. It has a strong similarity to the "dotcom mania" of the 1990s.

[62] One of these was *M. acuminata*, which in Canada is now rare. *Magnolia* consists of about 125 temperate and tropical trees and shrubs. There is not a single European *Magnolia*. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists the status of *Magnolia acuminata*, the Cucumber tree, as endangered in Canada; see <http://www.cosewic.gc.ca/index.htm>.

[63] As Laird documents in *The Flowering of the Landscape Garden*, the exotic flowering trees and shrubs from North America came to Britain in large part via John and William Bartram (in Philadelphia) and Peter Collinson (in London), arising for their patron, Lord Petre. Collinson has been credited with having introduced the greatest number of tree species into England in the first half of the eighteenth century. Before the 1730s most North American shrubs and trees were coveted, but rare, curiosities in Britain, whereas by the middle of the eighteenth century—the era of Laird's American shrubomania (see his essay in this volume)—they had become much more available.

[64] The colour is not simply the green chlorophylls bleaching in winter, but a diverse cocktail of accessory pigments, red-purple anthocyanins, orange carotenes, and yellow xanthophylls that are much richer in North American flora than in European.

Laird closes his fine book with the following lines supporting his initial impression about planting principles:

> Restrained by the rules of graduation and mixing, uniting straight, circular, and serpentine motifs, Georgian planting was in fact as elegantly simple as the lines of the Chippendale chair. From 1720 to 1800, the art of composing a plantation, a shrubbery clump, or a floriferous "nosegay" followed one unifying ideal . . . a perfect slope of beautiful flowers.[65]

English Exotica, Plant Introductions, and Trouble for the Natives

Plants had been coming to Europe from North America since the sixteenth century, but during the eighteenth century the volume increased substantially, mainly the result of efforts by a small number of enthusiasts. For example, on our side of the Atlantic it was due largely to the efforts of John Bartram, the American-born explorer who, beginning in the 1730s, travelled and collected seeds and plants for Peter Collinson and others in Britain. Philip Miller of the Chelsea Physic Garden in London (and author of the influential *Gardener's and Florist's Dictionary*[66]) built up what was probably the finest medicinal plant collection in Europe. Private collectors such as Lord Petre of Thorndon in Essex played an important role, as did the interest of King George III. He inherited the Kew estate from his mother, Princess Augusta. Augusta had set aside nine acres of the garden at her house at Kew to grow exotic plants, founding what was later called the Royal Botanic Gardens, Kew. George III's enlightened patronage and, most importantly, money provided the basis on which the plant collection at Kew was subsequently built up (in particular, by the botanist and explorer Sir Joseph Banks[67]) to surpass all others in the world. Royal interest in gardening and botany (Queen Charlotte, George III's wife, studied botany) stimulated similar enthusiasm among those who followed royal fashion.

The expanding market in Britain for the rare, sensational, and bizarre—in plants as in all things—was stimulated by the exploration of hitherto little-known parts of the world, as the British Empire grew alongside the Industrial Revolution's ever-expanding need for markets. This exploration of the natural world fostered an artistic appreciation of plants

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[65] Laird, *The Flowering*, 385. Laird quotes Nathaniel Swinden (*The Beauties of Flora Display'd* [London, 1778]) as noting that the graduation of plants in a flower bed (from shortest to tallest) resembled "plants placed in a green-house, or seats in a Theatre," *The Flowering,* 210.

[66] Miller, *The Gardener's and Florist's Dictionary* (London, 1724).

[67] As a young man Banks had accompanied, as naturalist, Captain James Cook on his first voyage of discovery (1768-71).

and animals that resulted in a great array of beautiful books about plants and natural history.

The distinction between native and alien (introduced) species is important, for both horticultural and ecological reasons, and warrants some development here. Over the past ten millennia, Britain grew from a collection of regional peoples—Picts, Jutes, Celts, Angles, Saxons, and others—to a small northern outpost of the Roman Empire two thousand years ago, to become a world empire in its own right. All this human migration has created a flora of great diversity. Indeed, nearly one half of the British flora is alien: 46 percent of all the plants in Britain have been introduced from elsewhere.[68] By way of comparison, in southern Ontario only about a quarter (26 percent) of plant species are exotic.[69] These statistics presumably reflect several differences: the short time that settlers from distant places have been here; the fact that the British countryside has been more intensively gardened than has ours; and the relatively smaller amount of economic wealth here than in Britain at the height of its empire. The great British gardens collectively comprise many tens of thousands of hectares. Peers of the realm built gardens. Subsequently, the merchant class of wealthy gentlemen followed suit. All of these individuals—to say nothing of the rest of the population—have gardened for generations. Yet side by side with the love of gardens is the traditional British love of "wild nature" outside the enclosed garden.[70] How far are these two passions linked and how far are they contradictory? Where does a nature reserve end and a garden begin?

To stay with the British flora—for it is a particularly well-documented reflection of my themes here—I would argue that the largely alien flora that constitutes garden vegetation there is closely tied up with the history of field botany, and with the search for new and exotic plants in the eighteenth and

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[68] M J Crawley, P H Harvey, and A Purvis, "Comparative Ecology of the Native and Alien Floras of the British Isles," *Philosophical Transactions of the Royal Society* 351 (1996): 1251-59.

[69] Marc Cadotte and Jon Lovett-Doust, "Ecological and Taxonomic Differences between Native and Introduced Plants of Southwestern Ontario," *Ecoscience* 8 (2001): 230-38.

Whether or not a species is in fact native (i e, indigenous to that place) can raise serious passions. In his fascinating book about scientific fraud *A Rum Affair: a True Story of Botanical Fraud* (New York: Da Capo Press, 1999), Karl Sabbagh assembles the evidence that an eminent British botanist, John Heslop Harrison, in the 1940s actually "planted" particular plants on the Hebridean Isle of Rum, in aid of his idiosyncratic hypothesis concerning plant survival in Britain after the last ice age. Sabbagh's light touch seems quite appropriate to the occasional absurdity of this otherwise tragic story.

[70] See Walters, *Wild and Garden Plants*.

nineteenth centuries. Throughout the history of civilization, a knowledge of plants and their properties has been a necessary part of our development. One particular area of our plant knowledge—the medicinal use of plants—has necessitated that plant cultivation go hand in hand with their collection from the wild. From classical times until quite recently, the training of medical students involved the recognition and, increasingly since late medieval times, cultivation of European wild plants in "physic gardens."[71] As David Elliston Allen explains:

> The study of plants had obvious practical application for the infant science of medicine and, as a result of this, alone among the various branches of natural history, could count at this time on organized support from a professional quarter.[72]

Thus the needs of medicine brought about the cultivation of a great many physic gardens and other collections.

Nearly all the early movement of ornamental plants was between institutions such as the earliest botanical gardens (Pisa c 1543, and Padua c 1545). Today there are more than six hundred botanical gardens around the world, and they have an important job to do in plant conservation, rescuing threatened endemics, and maintaining seed banks. It became standard for government scientific expeditions to carry a botanist, and for sea captains to bring back plant treasures from the countries they visited. Many Indian camellias and azaleas came to England via the East Indiamen.

The distinction between native and introduced species is not one associated with gardening. In the Preface to his Victorian-era textbook *British and Garden Botany*, Leo Grindon stated that “those who love plants are seldom found asking whether a given flower be indigenous or exotic; they wish to know what they have got, and care little for its birth place.”[73] Consider the native British tree flora. For geological reasons involving ice ages, species extinctions, and re-invasions, the tree flora of Britain is very limited indeed. The gardens, parks, and woodlands in Britain today have been much enriched by centuries of largely planned introduction of exotic species. The gardener in us, to whom the range and variety of plants has always been intrinsically interesting, surely still feels, as the eighteenth-century

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[71] In Ontario, an increasing number of students today are following undergraduate science degrees with specialized three or four year programs in herbal medicine, alternative medicine, homeopathy, etc, in which the role of exotic plants and other botanicals is front and centre.

[72] Allen, *The Naturalist in Britain* (London: Allen Lane, 1976), quoted by Walters, *Wild and Garden Plants*, 155.

[73] Grindon, *British and Garden Botany* (London: Routledge, 1864), quoted by Walters, *Wild and Garden Plants*, 164-65.

landowners presumably did, that success in growing exotic trees is a wholly desirable achievement. As the British gardener and botanist Max Walters asked: What is wrong with an English countryside where the village on the skyline shows a group of wellingtonias[74] towering above the other trees?[75] Or, more locally, what is wrong with naturalized *Ailanthus*, or tree-of-heaven, in southern Ontario?[76] Are we not forced to the conclusion that at least some of our judgmental concern about aliens is illogical? Perhaps, as with architectural styles or clothing fashions, all that is needed to change public perception of the new and exotic is the passage of time.

There is, however, another side to the question, revealed with great clarity by Oliver Rackham in his writings on English woodland and the nature of the countryside.[77] As Walters puts it:

> It is possible for ecologists to distinguish with considerable conviction between ancient woodland, whose direct continuity with the original "wild-wood" is certain, and secondary woodland of all kinds, including, in the extreme case, commercial forests of exotic conifers. No one needs persuading that ancient woods need protection, not only from felling and clearing, but also from replanting with exotic species.[78]

Conservationists have expressed great concern about the deleterious effects of non-native species. Since they come from elsewhere, these species arrive lacking the array of pests and pathogens with which they evolved, and so can grow and spread more easily than the native species, which intimately co-exist with an array of other organisms. The loss of native species from natural ecosystems appears to be due in large part to the

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[74] *Sequoiadendron giganteum* was introduced into Britain in 1853, according to Walters, *Wild and Garden Plants*, 68. This extraordinary giant tree, confined as a native to isolated stands between fifteen hundred and twenty-five hundred metres on the western slopes of the Sierra Nevada in California, has made a great impact in the English countryside.

[75] Walters, *Wild and Garden Plants,*78.

[76] In Britain, there are relatively few species of native tree. By contrast, in southern Ontario there are more than a hundred native tree species, part of the comparatively rich Carolinian flora of the region. See Gary M Allen, Paul F J Eagles, and Steven D Price, eds, *Conserving Carolinian Canada: Conservation Biology in the Deciduous Forest Region* (Waterloo: University of Waterloo Press, 1990).

[77] Rackham, *Trees and Woodland in the British Countryside* (London: Dent, 1976).

[78] Walters, *Wild and Garden Plants*, 186.

presence of introduced species out-competing them for niche space, or otherwise interfering with them.[79] Botanists in the United States—for example, at the Massachusetts Natural Heritage and Endangered Species Program—have only just begun to alert the nursery trade to this problem.[80]

In the history of gardening, great importance is given to the changes in fashion affecting garden and landscape design during the seventeenth and eighteenth centuries. In Britain, as suggested above, this involved the initial acceptance of the formal French geometric tradition, and its eventual replacement by informal or so-called natural English styles. To subsequent Victorian gardeners, both formal and informal traditions were available, and could be incorporated into their designs. The big change during the Victorian era was in scale. Although some wealthy manufacturers could and did buy large country estates well away from the noise and muck of the cities where they made their money, the growth of gardening was mainly in the new suburban communities that followed the expansion of the railway systems. Inevitably, protagonists of the regimented, formal style of gardening came into conflict with the advocates of natural styles. In this controversy one figure stands out: William Robinson, author of *The Wild Garden*[81] and *The English Flower Garden.*[82] In his *History of British Gardening*, Miles Hadfield devotes one whole section to what he calls "the Robinsonian world."[83] According to Hadfield, by 1883 there were already in England gardens that

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[79] H A Mooney and E E Cleland, in their review of the impact of invasive species, "The Evolutionary Impact of Invasive Species" *Proceedings of the National Academy of Sciences* 98 (2001): 5446-51, give many examples of invasive species altering the evolutionary pathway of native species by, for example, competitive exclusion, niche displacement, hybridization, introgression, predation, and, ultimately, extinction. Many countries have 20 per cent or more alien species in their floras. For example, in New Zealand there are now as many alien established plant species as there are native species. Biotic homogenization within continents is now striking. As one example, Frank J Rahel, in "Homogenization of Fish Faunas Across the United States" (*Science* 288 [2000]: 854-56), notes that, in the US, pairs of states on average now share fifteen more species than they did before European settlement. Overall, invasive species are considered the second greatest threat to imperiled species in the United States (D S Wilcove et al, "Quantifying Threats to Imperiled Species," *BioScience* 47 [1998]: 607-615).

[80] See Yvonne Baskin, *The Work of Nature: How the Diversity of Life Sustains Us* (Washington, D C: Island Press, 1997).

[81] Robinson, *The Wild Garden* (London: John Murray, 1870).

[82] Robinson, *The English Flower Garden* (London: John Murray, 1883).

[83] Hadfield, *A History of British Gardening* (London: Hutchinson, 1960; reprint, Harmondsworth: Penguin, 1985), quoted in Walters, *Wild and Garden Plants*, 170.

exemplified

> the triumph of the "natural" style of gardening evolved by Robinson and his school, which is in general the style that has been maintained—perhaps only under the force of economic circumstances—ever since.[84]

Robinson championed the idea that the plants are what matter in gardens, not the statuary or the formal design.

It should be emphasized, however, that the English natural garden is in another sense quite unnatural, since it is full of non-native, alien species. The "apartheid" between wild and garden trees is based upon a real tension between natural conservation and human social history.

The Concept of Naturalness

According to George Frederick Peterken, when vegetation is described as *natural*, any one of several different meanings may be intended.[85] For example, we may mean to connote a *wilderness* sense, wherein the vegetation owes its features strictly to natural factors alone, and not to the actions of people.[86] Alternatively, we may have a *rural* definition, whereby natural broadly contrasts with urban, in which case even a cultural landscape can be described as natural. At yet another level, natural may be defined in an *urban* sense, where, for example, a city park of planted trees, sown lawns and rose beds is natural beside the surrounding roads and buildings.

Natural can thus be both absolute and relative. Of course, natural does not just describe vegetation, landscape, and environmental processes. In common parlance, according to the *Oxford English Dictionary*, the word *natural* connotes “objects, attributes, relationships and behaviour which are native or indigenous, unaltered, unimproved, unsophisticated, simple; an inherent condition, not artificial, genuine.”[87] The word *nature* derives from the Latin *nascere* "to be born," which refers to both origins and the potential for development. A question immediately arises: are people part of nature? Peterken’s considered intuition is to regard us as separate from nature. Ironically, strict usage would make this a fairly useless distinction since human

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[84] Hadfield, *A History of British Gardening* (London: Hutchinson, 1960; reprint, Harmondsworth: Penguin, 1985), quoted in Walters, *Wild and Garden Plants*, 170.

[85] Peterken, *Natural Woodland: Ecology and Conservation in Northern Temperate Regions* (Cambridge: Cambridge University Press, 1996), 10-17.

[86] We may consider vegetation as "virgin" if that state has prevailed at all times in the past.

[87] *Oxford English Dictionary*, 2nd ed, sv “natural.”

influence is today all-pervasive. In most parts of the world, original states free from human influence are difficult to recognise. In applying this kind of definition to woodlands, Peterken avoids the *question of nature's utility* by retaining the idea of *natural* as separate from people, while regarding *naturalness* as a kind of continuous variable, thereby allowing him to recognize some forests, or particular attributes of forests, as more or less natural.[88] The human cultural landscape can only really be understood by knowing its antithesis—untouched nature. This dualism underpins our appreciation of either one.

Our concept of what is *natural* today is based on personal experience at the expense of historical perspective. Thus, *natural* means the way things were when we first saw them, or exploited them, and *unnatural* means all subsequent change.[89] We see the world through a model of our own creation, which organizes and filters understanding.[90] Here that filter is the garden.

Efforts to preserve and manage wilderness raise numerous issues that are rooted in conflicting values about what is natural. According to D Bennett,[91] in America the Wilderness Act of 1964 defined *wilderness* in terms of tangible criteria, thus: (1) the earth and its community of life are untrammelled by humans, with the imprint of human work substantially unnoticeable; (2) people are visitors to the place, and do not remain; (3) primeval character and influence are retained and appear to have been affected primarily by the forces of nature; and (4) outstanding opportunities for solitude or a primitive and unconfined recreation are present. Once wilderness as a state of nature becomes differentiated from wilderness as a mental evocation of that state of nature, then it is clear universal agreement is unlikely. One person's wilderness may not be another's. Here again is the continuum in which primeval, untouched wilderness is at one end, and a garden at the other. Like Peterken's continuum of naturalness in *Natural Woodland*, Bennett's concept allows distinctions to be made between, for example, a vast, undisturbed natural area and a smaller, more human-influenced urban park, both of which might be visited for a wilderness experience by different people with different perceptions and expectations.[92]

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[88] Peterken, *Natural Woodland,* 12-15.

[89] J B C Jackson, "What Was Natural in the Coastal Oceans?" *Proceedings of the National Academy of Sciences* 98 (2001): 5411-18.

[90] Simon Schama, *Landscape and Memory* (New York: Knopf, 1995).

[91] Bennett, "The Unique Contribution of Wilderness to Values of Nature," *Natural Areas Journal* 14 (1994): 203-08.

[92] The idea of a continuum for naturalness is the basis for a wildlife management tool known as the Recreational Opportunity Spectrum, or ROS, which R N Clark and G H Stankey, in "The Recreation Opportunity Spectrum: A

In *Second Nature*, Pollan looks at the issue in another way, as we see in his comments on a particularly fine old variety of rose, “Maiden’s Blush” (from the alba family, dating from the fifteenth century), which, in France, is called “Virginale,” “La Seduisante,” and “Cuisse de Nymphe Emue” ("the thigh of the aroused nymph"!).[93] Pollan, who sees the continuity contained within the nature-culture dualism, asks: “Are we, finally, speaking of nature or culture when we speak of a rose (nature) that has been bred (culture) so that its blossoms (nature) make men imagine (culture) the sex of women (nature)?”[94]

Girding Nature: “Gardenification”

Thus far in the history of life there have been five so-called mass extinction events. These events took place, very approximately, 450, 350, 250, 200, and 65 million years ago. Their causes include extra-terrestrial impacts, giant geotectonic events, oceanic circulation shifts, and global climate changes. Many experts, pointing to the wave of extinctions we are witnessing in the world today, feel that *Homo sapiens* has put the world on the brink of a sixth mass extinction event.

Both humans and the species we domesticate rely upon their environment—sun, air, soil, and water—for existence. And the environment, reciprocally, depends on organisms for its health. Natural phenomena do not exist *in vacuo*; and the closer we look, the further and deeper the web of interdependence seems to stretch. Farming has taken its toll on the natural world. To feed the six billion of us now on the planet (plus the hundred million more we add each year), we have completely transformed natural landscapes, providing room for the large-scale cultivation of the very small number of plant species and even smaller array of domesticated animals that sustain us. Agriculture has altered the Earth’s biosphere and changed its geosphere: its biodiversity has become imperiled, forests have been felled and not replanted, the soil has been degraded, nutrient cycles have been forever changed, swamps drained, and rivers dammed. But that is what we do, and that is what gardening is all about—manipulating our environment to further our own wants and needs. Today, a relatively few, ever-more-isolated and ever-diminishing number of natural ecosystems remain in the world, mostly parks or fragmented tracts of "wilderness," which we must somehow protect.

The University of Pennsylvania plant ecologist Daniel Janzen has taken

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Framework for Planning, Management, and Research” (Portland, OR: US Department of Agriculture, Forest Service, 1979), suggest as a way to classify, inventory, and map levels of naturalness.

[93] Pollan, *Second Nature*, 112-15.

[94] Ibid, 115.

to another, more practical level Thoreau's philosophy of our mutual interdependence on nature. Janzen argues for what he calls the "gardenification" of wildland nature. The wildland garden has two functions: ecosystem services, where the garden as a whole provides a service—such as providing a place for ecotourism, removing excess carbon dioxide from the air, or providing habitat for some sustainable product (such as fish, fruit, or timber); and biodiversity services, in which a particular species provides a useful product, such as in pharmaceutical prospecting.[95]

Recognizing that a certain amount of the problem associated with the conservation of biodiversity is simply one of spin and semantics, Janzen[96] argues that, in order to get the message of conservation across to the public, we should stop

> naming the wild as the wild. Instead let's just say that there are many varieties of gardens. . . . Begin with any honest description of a well-conserved wildland, or even one to be conserved. Replace a few nouns with their analogs from the more familiar agroscape. We will then have in our hands the description of a garden. . . . If we label conservable wildlands with what feels good and normal to our genes, maybe they can have some chance of survival.[97]

He goes on to say that, rather than

> talking about national parks, wildlife refuges, . . . conserved wildlands, biological reserves, protected areas, . . . royal hunting preserves, . . . national monuments, and all the other obfuscating labels . . . . [l]et's call them all what they are, wildland gardens.[98]

Gardens give great pleasure, and it is the glory of the garden that has been extolled from the dawn of garden writing until now by garden writers—including the authors of the essays in this volume. The chapters that follow capture some of the enchantment of gardens as well as something of the alchemy of gardening. The present volume contains four essays that deal mostly with gardening at the larger scale of recreational spaces, namely landscape gardening: Brigitte Weltman-Aron considers postmodern nature in

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[95] See G C Daily, ed, *Nature's Services: Societal Dependence on Natural Ecosystems* (Washington, D C: Island Press, 1997).

[96] Janzen puts his money where his mouth is. With his wife, Winnie Hallwachs, he has raised more than $32 million to purchase and conserve an entire tropical forest ecosystem in Costa Rica, where he lives, to add to the Costa Rican park system (see <http://www.wcu.edu/pubinfo/news/garden.html>).

[97] Janzen, "Gardenification."

[98] Ibid.

the André Citroën Park in Paris; D Fairchild Ruggles looks at the "framed landscape" in Islamic Spain and Mughal India; Edwinna von Baeyer considers aspects of Canadian landscape history through the pioneering work of W T Macoun, Dominion Horticulturalist at the Central Experimental Farm in Ottawa from the late 1890s up to his death in 1933; Mark Laird discusses his involvement with two very different restoration projects, at Chiefswood in Ontario and Painshill Park in England.

Joseph Wood Krutch, the great gardening anthologist, asked: "Why garden?"[99] In examining the interplay between utilitarian and non-utilitarian answers, he enquired why it was that the gardener for pleasure raised tulips and roses when he or she might more usefully be raising turnips? Is it (as Thorstein Veblen would have it) mere "conspicuous consumption"[100]—and a demonstration that one is not obliged necessarily to be useful? Doubtless some gardens have been created for just that reason. But not all and surely not most. No: according to Krutch, people garden for pleasure because those whose business neither is, nor need be, the production of food can both produce beauty and at the same time participate symbolically in one of the most fundamental of human activities—helping green things to grow and flower.[101] But does the gardener really need any excuse at all? Is the beautiful good simply because it supports that which is utilitarian, or is the utilitarian good only because it makes possible the cultivation of the beautiful?

Jon Lovett-Doust
Department of Biology
University of Windsor

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[99] Krutch, "General Introduction," *The Gardener's World*, 28.

[100] See Veblen, *The Theory of the Leisure Class: An Economic Study of Institutions* (New York: MacMillan, 1899).

[101] Krutch, "General Introduction," *The Gardener's World,* 21.

Table 1

Deep Time (see www.ucmp.berkeley.edu/help/timeform.html)

[mya = million years ago]

CENOZOIC ERA (65 million years ago to today)	Quaternary (1.8 mya to today) Holocene (11,000 mya to today) Pleistocene (1.8 mya to 11,000 years ago) Tertiary (65 to 1.8 mya) Pliocene (5 to 1.8 mya) Miocene (23 to 5 mya) Oligocene (38 to 23 mya) Eocene (54 to 38 mya) Paleocene (65 to 54 mya)
MESOZOIC ERA (245 to 65 million years ago)	Cretaceous (146 to 65 mya) Jurassic (208 to 146 mya) Triassic (245 to 208 mya)
PALEOZOIC ERA (544 to 245 million years ago)	Permian (286 to 245 mya) Carboniferous (360 to 286 mya) Devonian (410 to 360 mya) Silurian (440 to 410 mya) Ordovician (505 to 440 mya) Cambrian (544 to 505 mya)
PRECAMBRIAN Time (4,500 to 544 million years ago)	