CHAPTER 2

BRIEF HISTORY OF LAND USE

There is broad evidence to suggest that direct human alteration of terrestrial ecosystems by hunting, foraging, land clearing, agriculture, and other activities started about 12,000 years ago. Sometimes referred to as the "Neolithic Revolution," agriculture slowly began to transform societies and the way in which people lived; traditional hunter-gatherer lifestyles were abandoned in favor of more permanent settlements and a reliable food supply. This transformation was particularly significant in some regions, which experienced long-term changes from forest clearing, increased frequency of fire, mega-faunal extinctions, species invasions, and soil erosion.

Beginning around 8,000 years ago, agricultural land use expanded in Mesopotamia and in the Fertile Crescent areas of southwest Asia; this was followed by growth in China, India, and Europe. Intensive land use patterns developed in India, especially on the Ganges plains; in China, along the lower Yellow and Yangtze rivers; in Africa, throughout the Sahel; and in South America, along the Andes. This agricultural expansion led to the development of more complex forms of societal organization. Fertile land and the domestication of wild food crop species allowed nomadic tribes to settle and form early towns and cities. The landscapes of the neo-tropical dry forests of South America, for instance, played a pivotal role in the emergence of pre-Colombian civilizations, such as the Incas.

By approximately 6,000 years ago, agricultural expansion had spread across most continents, leading to the clearing of native vegetation and to the culling, or domestication, of herbivores. Native flora and fauna were replaced with intensive crop and livestock management practices as human populations grew and became denser. Starting around 1750, the transformation of land started to accelerate, and rapid land use change continues to be a dominant influence today.

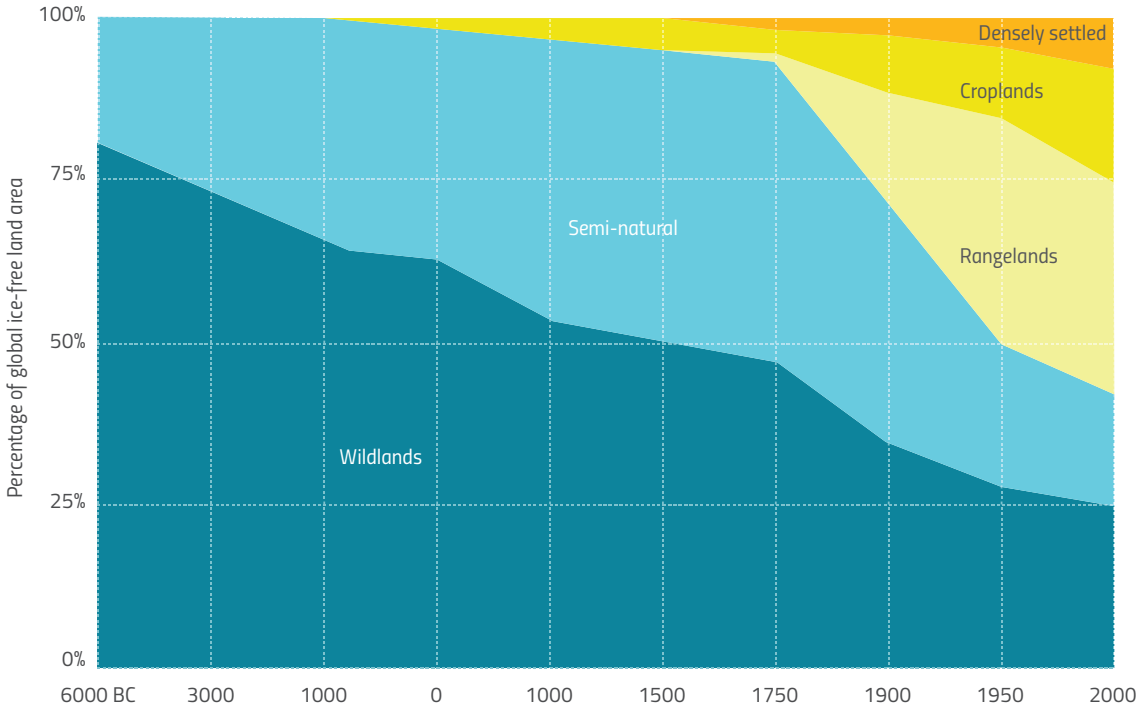

Figure 2.1: Transformation of the biosphere over 8000 years: Adapted from,[4] Based on[5]

THE COMMON ERA

By the start of the Common Era (CE), up to 60 per cent of the land in Europe was being used by humans, albeit with significant fluctuations as some areas were periodically abandoned due to war, famine, and other events that affected human populations. By the Middle Ages (14th and 15th centuries), land use intensity in both Europe and China increased greatly following the development of cities and towns. During the same period, nearly 90 per cent of the indigenous peoples of the Americas died as a result of European contact, through slaughter and, principally, disease.

This led to the massive regrowth of natural vegetation, especially of forests in the Amazon, Andes, Mesoamerica, and the western areas of North America.[1]

These pre-1700 land use changes were substantially smaller, more localized, and less intensive than those that came later but still transformed landscapes, e.g., from closed to open woodlands, altering soils, fire regimes, and regional patterns of biodiversity.[2] In some cases, relatively small human populations are thought to have made widespread and profound ecological changes over 3,000 years ago.[3]

Figure 2.2: Theatrum Orbis Terrarum: Reproduced with permission[7]

THE MAP THAT CHANGED THE WORLD

In 1564, Abraham Ortelius, a thirty-seven year old mapmaker from Antwerp, produced what is generally regarded as the first modern atlas, known as the *Theatrum Orbis Terrarum*. It provided, for the first time, a clearly discernible global map.[6] Not all of it was accurate: the Antarctic was too large, South America too narrow, and Australasia was yet to be discovered. Nevertheless, even to the casual observer it is quite obviously a map of the world. The next several decades witnessed a massive growth in mapmaking, mainly in Europe, and by the middle of the 17th century the accuracy of world maps had significantly improved. New maps encouraged new discoveries: a search for new lands, new experiences, and new products. The age of exploration had dawned, leading quickly to colonialism and to the large-scale exploitation of natural resources around the globe.

The history of global surveying and cartography had enormous influence on the development of humankind's self-image in relation to the natural world. Formerly, the two had been as one, but now nature existed as an object, separate from, and ascribed value only through its usefulness to, humankind.[8] This ultimately led to a profound reconfiguration of the relationship between land and society in some parts of the world.[9] In this regard, the 17th century scientific revolution included, most notably through Francis Bacon but also René Descartes, calls for the "conquest," "mastery," and "domination" of nature.[10] The belief that technological progress could overcome any limitations imposed by nature became central to global political and economic strategies.[11]

While the general contours of the world were becoming more familiar, less was known about what lay beyond the coastlines: most of the interiors of Africa, the Americas, and Australasia lay undiscovered. The population of the world at that time has been estimated at around 500 million,[12] a mere eight humans per square kilometer compared with an average of 57 today.[13] Farming and artisanal mining were small scale, and forests were untouched in large parts of the tropics. As long as new land frontiers continued to open, the social and environmental costs of exploitation were seen as diffuse and/or easily offset. More recently, we have come to understand that this new web of communication and relationships transformed the food system and landscapes in a relatively short period.[14]

A NEW ECONOMIC PARADIGM

The forces of science and economics came together to completely transform the idea of nature. The notion of a limitless, human-built world[15] was embraced and reinforced by the many voyages of exploration, primarily from Europe. Colonialists abruptly gained access to what seemed to be a limitless stock of natural resources,[16] and in the process externalized their ecological footprint.[17]

Meanwhile, economic thought underwent its own revolution, leading to a philosophy based on free trade and the maximization of self-interest.[18] Land,[19] as the principal source of wealth in classical economics, lost its central role in the transition to neo-classical economics, being replaced by notions of marginal utility and productivity. The distinction between wealth and value, or use value and exchange value, was abandoned; the broader environmental and social costs of capital accumulation[20] were largely ignored in the new economic paradigm.[21] Between 1700 and 2000 the terrestrial biosphere made the critical transition from mostly wild to mostly anthropogenic.[22]

From the standpoint of capitalist value calculation, land is seen as a free gift of nature[23] often referred to a "free goods" in modern economics. The inherent consequence of such capital accumulation was and is the unbridled exploitation of the commons[24,25] and accelerated environmental degradation.[26] The history of civilization is strewn with examples of unsustainable land management practices, leading to deforestation and soil degradation[27] and, eventually, societal collapse. Yet, it was the combination of new commodity relations, reconfigured wealth and value conceptions, and industrialized agriculture that cleared the way for rapid, systematic land use intensification.

LAND AS NATURAL CAPITAL

More recently, mass production has led to an economy based on mass consumption and built-in obsolescence, with economic growth as the single fundamental aim and marker of development success, as measured by gross domestic product (GDP). While its strongest supporters dismiss any limits to growth,[28] there has been vocal opposition to this paradigm, spearheaded by the Club of Rome in the 1970s,[29] and which continues today. It is only in the 20th century that mainstream economists have begun to talk about natural capital (including land) on an equal footing with human and built capital;[30] to understand the form and importance of natural capital to – and the effect of its depletion on – human welfare; and to explore the costs and impacts of land degradation on economic growth.[31,32]

While this development signals a step in the right direction, it also carries the profound risk of advancing the commodification of nature. The original motivation of this economic approach was to garner policy and business support for natural resource conservation and sustainable use by demonstrating both tangible and intangible values. This remains worthwhile and relevant. In some cases, the approach has been transformed into one which seeks payments for ecosystem services on the assumption that such remuneration will ensure their provision.[33,34]

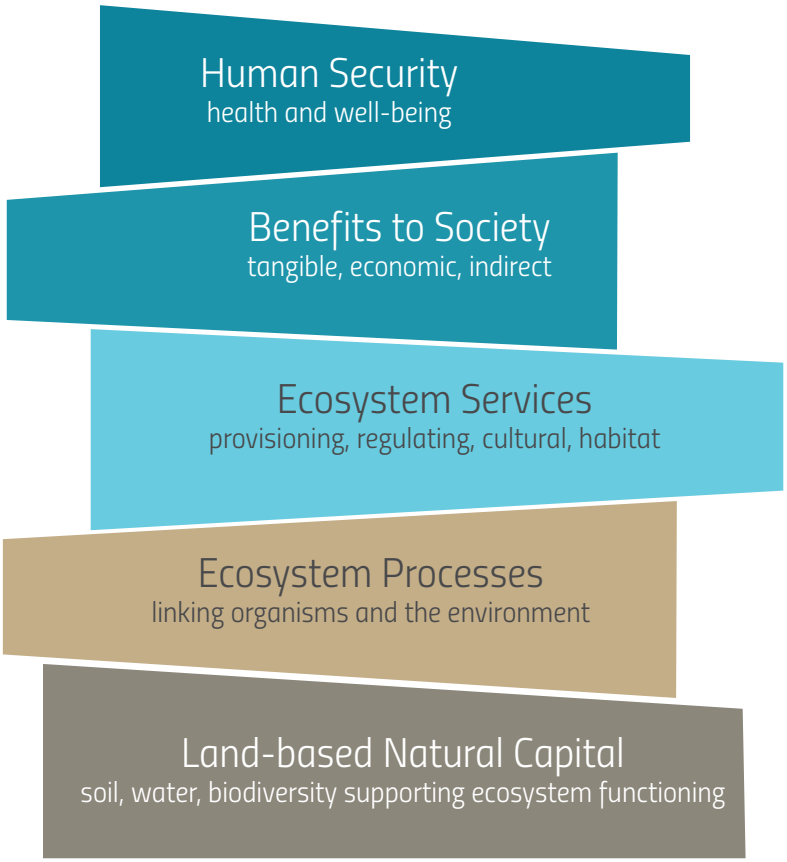

Figure 2.3: The relation between natural capital and human security: Adapted from[35]

Box 2.1: The Revenge of Nature

The power of human social systems to transform the Earth in a destructive way, thus provoking the "revenge" of nature, was already apparent and being observed in the late 18th and early 19th centuries. In 1848, the German botanist Matthias Schleiden, for example, stated *"that those countries which are now treeless and arid deserts, part of Egypt, Syria, Persia, and so forth, were formerly thickly wooded, traversed by streams,"* but were now *"dried up or shrunk within narrow bounds"* and exposed to the full force of the sun. He attributed these environmental changes primarily to the human destruction of forests, and concluded: *"Behind him, he [man] leaves the Desert, a deformed and ruined land and is guilty of the thoughtless squandering of vegetable treasures here again in selfish pursuit of profit, and, consciously or unconsciously, following the abominable principle of the great moral Vileness [sic] which one man has expressed, 'après nous le déluge,' he [man] begins anew the work of destruction."*[36]

EXPLOSIVES AND TRACTORS

The industrial processes of the past three centuries have been critical drivers of anthropogenic global change, including land use change and ecosystem conversion. By the beginning of the 19th century, world population had doubled in a mere hundred years,[37] and the demand for timber, energy, metals, and precious minerals was about to grow exponentially: the industrial revolution had begun. It would profoundly reshape the world. We confront its legacies today and will continue to do so well into the 21st century.

The demand for minerals, such as iron ore and coal, along with fuelwood for the industrial revolution, would give rise to new demands on land resources by a rapidly growing population seeking wealth and prosperity.

Although extracting precious minerals from the earth began as early as 3,000 BCE in Egypt,[38] it was small-scale and heavily dependent on labor. The rise in large-scale mining and quarrying can be traced to the early 17th century. In 1627, the use of explosives was introduced, which allowed the scale of mining to increase dramatically, while the adoption of the steam engine, some years later, propelled the demand for energy-based minerals. The demand for minerals, such as iron ore and coal, along with fuelwood for the industrial revolution, would give rise to new demands on land resources by a rapidly growing population seeking wealth and prosperity. Other minerals, such as gold and precious stones, would rise in importance and become de facto currencies while adding little to real wealth.[39]

While agricultural practices can be traced back some 10,000 years or more, it was the industrial sector, with its rising wages and demand for food along with a growing population, which shifted the focus and scale of agriculture. In the 17th and 18th centuries, as the need for cheap food and fuel grew, significant changes to agricultural systems were introduced, such as crop rotation, selective breeding of animals, enclosures, and mechanization: the advent of industrial agriculture.

The increasing demand for cheap food, energy, and water triggered the necessity to farm land differently. Subsequent technological advancements, such as mechanization, both made this shift possible and encouraged its intensification. In 1901, the first powered tractor was introduced, paving the way for draft animals to be replaced and an era of energy-intensive farming to begin. Over the past hundred years, the application of agricultural science grew dramatically in response to the demand for food. The "Green Revolution" of the early 1970s witnessed significant yield increases coupled with greater intensity of fertilizer and pesticide use. While yields did increase significantly overall, addressing imminent threats of food shortages, they were accompanied by unwelcome environmental impacts as well as by the significant expansion and consolidation of land used for crop and livestock production.

There is no question that modern agriculture has been successful in increasing food production. Contrary to Thomas Malthus's predictions,[40] food production has kept up with, and even outpaced, population growth. However, roughly half of the world's surface area has been converted to land grazed by domesticated animals, cultivated crops, or production forests resulting in the loss of more than half of the world's forests.[41] This expansion and intensification has led to devastating environmental impacts at local, national, and global levels.

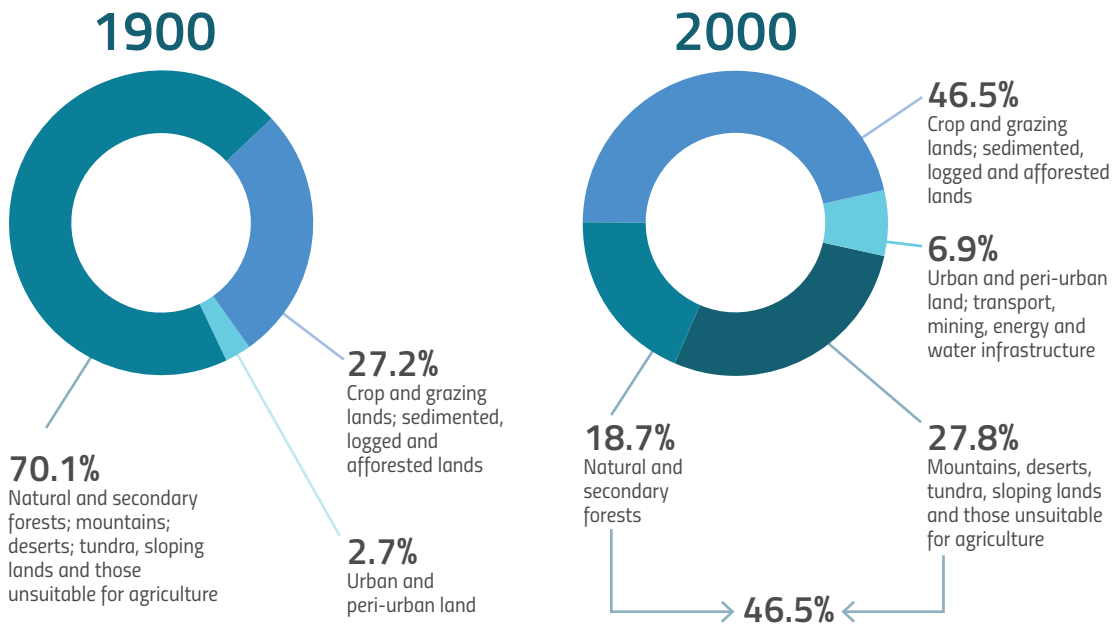

Figure 2.4: A century of land use change: Based on 1900[47] and 2000[48]

A CENTURY OF LAND USE CHANGE

Many factors have driven the growth of cities and the transition from rural to urban living. Cities exist for manifold reasons and the diversity of urban characteristics can be traced back to the wide variety of functions they perform: from transport to security, including, of course, market functions, initially for agricultural surpluses and then for other goods and services including banking and finance. Cities tended to be located in strategically important areas: hubs of trade, close to good agricultural land, presence of government and military complexes, etc.

The size, pace, and nature of urbanization has been a defining characteristic of the 20th and 21st centuries. While the rapid rates of urban population growth over the past century have occurred on less than 3 per cent of the world's terrestrial surface, its impacts have been global. Approximately, 78 per cent of carbon emissions, 60 per cent of residential water use, and 76 per cent of wood used for industrial purposes are attributed to urban areas.[42] It has been estimated that up until the middle of the 19th century, only between 4 and 7 per cent of the world's population lived in towns. The early expansion of cities tended to be horizontal: it has been estimated that as the population of cities such as London and Paris expanded twenty-fold, their corresponding land footprint expanded two hundred-fold.

Land use change to build cities and support the demands of growing urban populations drives other types of environmental change. In 2007, an important transition occurred when, for the first time in history, we moved from being primarily rural dwellers to becoming majority urban dwellers.[43] Urban populations depend on the productive capacities of ecosystems well beyond their city boundaries. Their so-called "ecological footprints," namely that which is required to produce the flows of goods and services (including waste absorption) that sustain human well-being and quality of life, are tens to hundreds of times bigger than the actual urban area they occupy.[44] The response to this conundrum has been a renewed focus on intensive agriculture, concentrated on the most productive lands, and operating according to an industrial agribusiness sector model, with increasing influence on trading systems and research.[45] Although city dwellers have always relied on agricultural surplus, the scale today is unprecedented.[46] The demand for agricultural products has been the single largest historical driver of land use change.

THE NON-MARKET VALUES OF LAND

Many peoples have defined their culture and values in terms of the lands they occupy. Indigenous peoples have historically had a close and intimate relationship with land.

Land offers more than just economic or financial rewards, whether from farming, forestry, or mining. Many peoples have defined their culture and values in terms of the lands they occupy. Indigenous peoples have historically had a close and intimate relationship with land.[49] Lands have been universally celebrated for their intrinsic and inestimable value in religious, spiritual, aesthetic, and recreational terms. People appreciate landscapes as having worth well beyond their exchange value.

At the national level, almost all countries have demarcated some of their territory as protected areas to be conserved in perpetuity. These protected lands and waters provide a legacy for future generations to enjoy. The earliest national parks in Africa, India, Australia, and the United States were created in the late 19th century. Today, approximately 15 per cent of the world's land surface and inland waters are designated as protected areas, a sign that we care deeply about preserving biodiversity and ecosystem services as well as the majesty and beauty of the landscape.

A growing number of protected areas are also internationally recognized. The United Nations has explicitly acknowledged that land embodies important values well beyond the financial. The United Nations Educational, Scientific and Cultural Organization's World Heritage sites, which include both cultural and natural sites, remain a powerful symbol that recognizes the cultural, social, and spiritual values of our lands. To date, over 1,000 sites have been recognized as having World Heritage status, of which over 200 are classified as natural or mixed use sites. The natural sites are deemed to represent "*superlative natural phenomena and significant natural habitats for in situ conservation of biological diversity.*"[50]

CONCLUSION

The understanding of the finite quantity of natural resources at our disposal, a recognition of their importance to our survival, and an increased awareness of the pace at which we are depleting and degrading them has shaped a whole new paradigm in the public discourse. The growth of ecological concerns based upon the sustainability of natural systems and their components has its roots in a wide range of academic disciplines. Climate change has become a major catalyzing force that affects – and is impacted by – the use and management of land resources, further linking land to all dimensions of human security.

Momentum continues to grow at the global and national levels. In the lead-up to Rio+20, two decades after the pivotal 1992 Earth Summit in Rio de Janeiro, the UNCCD set out an ambitious agenda of achieving land degradation neutrality by 2030.[52] The United Nations 2030 Agenda for Sustainable Development, adopted in 2015, set out a series of Sustainable Development Goals (SDGs) and targets that encourage more judicious land use, management, and planning. SDG 15, in particular, puts a strong emphasis on the need to scale up transformative management practices with the goal to "*Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.*"[53]

There is little doubt that the planet is reaching a critical juncture in terms of how we use and manage our land resources. The demand for these resources will only increase and a range of future scenarios is discussed in Part Two of this Outlook. Sustainable land use is as much about ensuring that land is protected and nurtured for successive generations as it is about providing social and economic opportunities today. Striking a balance will remain an enduring challenge for the 21st century.

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The View from Space

In December 1968, a seminal event occurred which transfixed humanity and transformed our view of Earth. As Apollo 8 left the Earth's orbit for the moon, it sent back a picture of our planet that had not been seen before. This photograph provided a unique perspective on its shape, its blue color, and, perhaps most importantly, its finite size. A series of other images were collected, including the famous "blue marble" image of the planet taken from the last moon mission, Apollo 17, in 1972. These images greatly influenced the research of scientists and scholars. Those responsible for producing the groundbreaking book, "Limits to Growth," that placed the Earth's finiteness into a context of economics and policy – a group of enlightened businessmen led by Aurelio Peccei and a team of scholars and systems planners from the Massachusetts Institute of Technology – have often spoken of the influence the early space photos had on their work. Indeed, by the late 20th century, a new ethic had emerged, underpinning and transforming our understanding of the importance of managing natural resources in a manner that can be sustained over time and with a respect for planetary boundaries.

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