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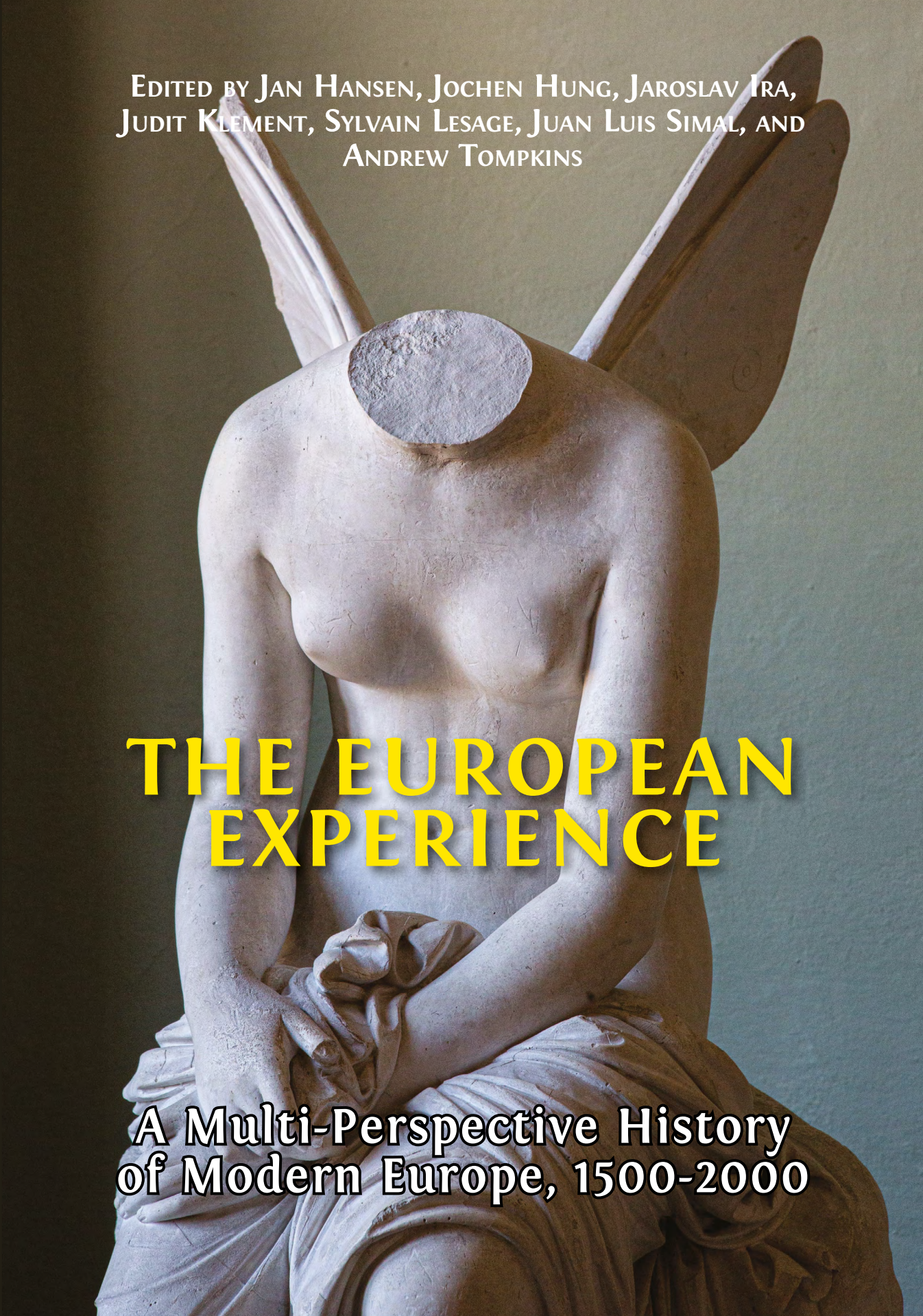

The European Experience

A Multi-Perspective History of Modern Europe, 1500-2000

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4.4.2 Understanding and Controlling the Environment in Modern History (ca. 1800–1900)

Hans Schouwenburg, Jiří Janáč, Sophie Lange, and Juan Pan-Montojo

Introduction

Confronted with resource scarcity, industrialisation and colonial exploitation, Europeans in the nineteenth century conceptualised and experienced the natural world in new ways. In scientific and political discourse, the notion emerged that man depended on a fragile and interconnected system, which needed to be used wisely and preserved in order to endure. Nineteenth-century ideas about ecological limits to growth, sustainable use of resources, and intrinsic links between the economy, society, and the natural environment provided the conceptual building blocks for the sustainability discourse which shaped environmental thinking in the twentieth century.

From the eighteenth century onwards, there emerged two distinct views of nature, which environmental historian Donald Worster has called 'imperial' and 'arcadian'. The imperial tradition, with intellectual roots in Francis Bacon's natural philosophy and underpinned by God's proclamation in Genesis 1:28 to "fill the earth and subdue it", gave mankind authority over all living creatures and scientific and technological means with which it could master, exploit, and control nature. This human-centred view, most strongly expressed in Carl Linnaeus' (1707–1778) *Systema Naturae* (1735), remained influential in the nineteenth century. It provided a rationale for ever-increasing state intervention in managing natural resources. Below the surface, however, a parallel arcadian tradition, imagined—in the words of Worster—"a simple, humble life for man with the aim of restoring him to a peaceful coexistence with other organisms".

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Embodied in Gilbert White's (1720–1793) *The Natural History and Antiquities of Selborne* (1789), the arcadian view assigned man a moral responsibility to take good care of God's creation. This strand of thought gained momentum in the wake of the industrial revolution and shaped the early conservation movement that emerged at the end of the nineteenth century.

Natural Resources and Political Power

Fundamental to the imperial view of nature was a conceptual division between the natural world and human society. Modern science and technology, understood in terms of applied science, played a crucial role in constructing and further deepening this dualism. Physical items such as rocks, soil, vegetation, climate, or plants and animals became subjected to thorough scrutiny by an emerging professional community of natural scientists who first described, mapped, and later modified and improved 'nature' to serve the needs of society.

The first stage of this process can be described as concerned with mapping the world and focused on the observation and classification of nature. Newly acquainted knowledge was presented and arranged in practical terms as a guidance or an instrument for improving living standards and the economic welfare of European societies (or at least their elites). Scientists and researchers throughout Europe engaged in a massive effort to classify, catalogue, and describe nature—living organisms, rocks or newly-discovered lands in the colonies. In the mid-eighteenth century, when Swedish naturalist Carl Linnaeus in his *Systema Naturae* captured the variability of plant species, he described them as stable, and in so doing, he created a system that ordered the natural world into discernible groups. Around the same time, the French chemist Antoine Lavoisier (1743–1794) discovered and named oxygen and carbon, overthrowing the traditional belief that fire was caused by a mysterious substance of phlogiston.

This first process of classification and observation developed into a second stage, in which scientists directly focused on the exploitation of nature. In the early nineteenth century, Charles Darwin's (1809–1882) theory of evolution, Charles Lyell's (1767–1849) idea of uniformitarianism, and Jean-Pierre Perraudin's (1767–1858) glacier theory all showed that nature was not immutable, but constantly evolving. Embracing the ethos of liberal capitalism, scientific understanding thus shifted towards seeing nature as a dynamic result of competition between various actors and elements, which needed to be dominated by humans and cultivated into a dependable economic resource. Nature, from now on, had to be conquered and tamed. Perhaps the most illustrative example of this view were Gregor Mendel's (1822–1884)

pea plant experiments conducted in Moravia in the 1850s, which provided a scientific basis for traditional forms of crossbreeding and enabled the development of more efficient agriculture. In practice, however, such efforts undermined the ideological divide between nature and society: the natural environment became more and more intertwined within emerging human-made technological systems.

The conceptual division between the natural world and human society provided monarchies throughout Europe with a rationale to intensify centralised efforts to regulate scarce natural resources, especially timber. In a context of ever-growing demand for trees, forestry manuals—starting with Hans Carl von Carlowitz's (1645–1714) *Sylvicultura oeconomica* (1713)—provided royal employees with a technocratic and quantifiable framework. Carlowitz identified man's greed, lack of knowledge, and mismanagement as causes of deforestation and called for "a continuous, resilient, and sustainable use" of forest resources. As a result, forestry services, first established to manage the domanial forests of ruling families in Central Europe, developed—between the 1760s and the 1800s—a science of forestry, which would be adapted in other countries and applied to the royal or newly-defined public lands almost everywhere in Europe. Wherever they had the means, forestry officers attempted to create homogeneous masses of trees in order to facilitate their commercial exploitation and increase fiscal revenues. These services and other state officers did not only undertake the transformation of domanial and public forests: the use of village woodlands was very often subject to strict regulation from above.

The results of these trends were manifold. From an environmental point of view, the application of scientific forestry brought about a simplification of species in forests with the aim of producing monocultural, even-age, and geometrically ordered landscapes. The 'rational' forests were very productive and their weaknesses, such as their tendency to decay, only became evident in the long run. On the other hand, public or publicly regulated monocrop and protected forests had often negative consequences for local peasants: traditional use of forest resources was criminalised, with peasants deprived of pastures, wood, and other raw materials at risk of fines or imprisonment.

The impact of forestry and wild lands regulations were larger, because customary systems of tenancy and property experienced a parallel change. Church lands were privatised in most Catholic countries between the French Revolution and 1848, whereas seigneurial rights were redefined as public and private rights in a long sequence of reforms that would culminate in Russia in 1861 with the emancipation of the serfs (peasants who had hitherto been tied to specific manorial estates and subject to diverse personal obligations and to the jurisdiction of their lords). These reforms very often went hand-in-hand

with the enclosure of land and the privatisation of the commons, a tendency against communal forms of land holding and work that became widespread throughout Europe. The case against communal tenancies and usages was based upon a mixture of liberal principles and fiscal objectives. Its success brought about the reduction of untilled surfaces. The ploughing of land and the destruction of spontaneous pastures had both social and environmental consequences: among the environmental consequences were a reduction of biodiversity, a transformation of landscapes, and, in the Mediterranean countries, a shorter supply of organic fertilisers which had a significant impact upon agriculture.

Land and forests were not the only resources that were regulated by national and imperial states. Water streams and springs increasingly became public resources or—in countries where they were not turned into public goods—at least subject to public regulation. Local management of water was very often subjected to national rules. Its use was further transformed by concessions to private and public companies for the building of canals (such as the Canal du Rhône au Rhin or the Ludwig-Donau-Main Kanal), supply systems for urban centres and factories (the Canal de l'Ourq in Paris and the Canal de Isabel II in Madrid), or large irrigation schemes (the Canale Villoresi in Lombardy or the Canal de Tamarite de Litera between Aragon and Catalonia). At the end of the nineteenth century, the first hydroelectric plants were constructed.

Fig. 1: Worksite of the dam Pontón de la Oliva for the Canal de Isabel II in Madrid in the 1850s taken by Welsh photographer Charles Clifford (ca. 1850s), Biblioteca Nacional de España, http://bdh-rd.bne.es/viewer.vm?id=bdh0000258154.

At the same time, views on natural catastrophes and their political prevention changed and new protective measures were carried out: floods were tempered by straightening rivers like the Rhine; canalisations were carried out in major cities like Hamburg, Vienna, and London; and there were efforts to reforest mountains to prevent avalanches in Switzerland. A growing amount of legislation tried to keep pace with the new needs of capitalism and new expectations placed by citizens on national authorities, and the ability of those authorities to protect citizens and give them new resources, developing complex schemes and redefining the exact rights of local communities.

Industrialisation and the Environment

The industrialisation process in the long nineteenth century had far-reaching impacts on the natural environment. The economic, technological, and societal change from an agrarian to an industrial society marked the transition from hand-made to machine-made production and led to growing populations, improving living standards and accelerating national productivity. Propelled by the invention of steam and combustion engines in the eighteenth century, as well as the commercial use of electricity at the end of the nineteenth century, the industrial revolution marked a fundamental turning point in the history of the relationship between humans and nature. The key element enabling this revolution was energy. Coal replaced water and wood as the prime energy source. The exploitation of coal, the need for faster transportation systems for goods, and rapid urbanisation—caused by the influx of rural populations into cities—profoundly transformed the natural environment.

British cotton factories and Manchester's bleaching industry, the iron, steel and coke industry in the Ruhr Area, and Borsig's *Maschinenbau-Anstalt zu Berlin* drained, polluted or even poisoned waters in nearby rivers and seas or emitted heavily polluted air due to the combustion of coal. These hazards caused health problems among people and animals living in close proximity to industrial areas. As a result, people started to complain about dirty and foul-smelling water and demanded better protection from the hazards of industrial waste. However, the most common response to such problems was to increase the heights of chimneys at factories, a solution that limited local contamination, but spread the toxic fumes to wider areas. Environmental problems like the so-called 'smoke pest' or 'smoke plague' (*Rauchplage*), sulphured air, and toxic water became vital issues in cities.

Closely related to industrialisation was urbanisation. Crowded cities in which people had been crammed together to work in factories provided fertile ground for pest, cholera, and other epidemics like typhus. Cholera outbreaks caused by contaminated water in London in 1854 and Hamburg

in 1892 stimulated scientific research. Such research helped contribute to a better understanding of infectious diseases and led to improvements in health and sanitation. Miasma theory—the belief that diseases spread because of bad smells—for example, was replaced by germ theory. An analysis of London's waste water in the mid-nineteenth century proved that cholera was caused by microbes, a discovery that ultimately led to the production of a cholera vaccine. In addition, the introduction of municipal sewer and canalisation systems and the further development and broader distribution of the flush toilet further improved sanitary conditions in cities by the end of the nineteenth century. These improvements thus motivated city councils to further centralise and regulate water supply and removal systems. In the 1860s, Britain—the first country to address at full scale the environmental effects of industrialisation—passed the so-called Alkali Acts to regulate emissions from the chemical industry. Gradually, other pieces of legislation were introduced, but most other industrial countries did not follow Britain's path before the interwar period (1918–1939).

Around 1850, agrochemical scientists and social reformers in Britain and Germany (such as Edwin Chadwick and Justus Liebig) started a transnational discussion about the recycling of human waste and other city garbage. However, attempts to establish a kind of circulatory process with the use of manure in a sewage farm in Berlin were not successful. One reason for this failure was the increase of industrial waste within urban waste which made the circuit useless. Nonetheless, the increase of non-degradable waste led to advanced garbage collection systems and the first waste incineration plants in Nottingham and Hamburg in 1874 and 1896, respectively.

In the late nineteenth and early twentieth centuries, in response to all the challenges that came with urban life, organisations and movements were founded which strived for the improvement of social and sanitary conditions in cities. Middle-class social reformers demanded that their municipal authorities provide better protection from air and water pollution. For example, Rudolf Virchow (1821–1902), an early social hygiene reformer in Prussia, was a medical practitioner who fought for the establishment of hospitals and children's playgrounds in poor districts as well as for medical education for nurses.

The sanitary, public health or nature preservation movement was also strongly connected to scientists from different fields. Academics from chemistry to political economy warned that the industrialisation process was reaching its limits. The British economist William Stanley Jevons (1835–1882), for example, argued that the United Kingdom was bound to lose its advantage over other nations because of an overconsumption of coal. He predicted that economic growth would abate and even decline, and—following Thomas Malthus (1766–1834)—imagined a gloomy future in which living conditions

would deteriorate rapidly. In 1852, Robert Angus Smith (1817–1884), a Scottish chemist living in Manchester, one of the world's first industrial cities, identified the role of the burning of sulphur-rich coal in the emergence of acid rain. By the end of the nineteenth century, Swedish chemist Svante Arrhenius (1859–1927) shifted discussion of the problem from a regional to a global scale, when he theorised the threat of global warming induced by growing levels of carbon dioxide in the atmosphere.

Rapid development from the nineteenth century onwards in industrialisation, urbanisation, population growth, and the exploitation of resources (especially the massive use of coal) launched the beginning of a new geological era called the 'Anthropocene'. Already in 1873, geologist Antonio Stoppani (1824–1891) introduced the idea of an "anthropozoic era" in which humankind started influencing the biosphere's biological, geological, and atmospheric processes. In 2000, following Stoppani's idea, chemists Paul Crutzen and Eugene Stoermer started an international discussion about the notion that humankind was effectively a geological factor which now altered the relatively stable environmental conditions of the Holocene.

Rise of the Conservation Movement

By the end of the nineteenth century, rapid environmental changes led to the idea that the natural world was a fragile and interconnected system that needed protection. It was in the European colonies overseas, before the environmental consequences of the industrial revolution became visible at home, that scientists from Britain, France and Germany for the first time experienced how human expansion and activities degraded a natural beauty that they equated with the biblical Eden. Tropical islands under colonial rule, such as Mauritius and Saint Helena, appealed to European fantasies about unspoiled and unadulterated nature, vividly depicted in romantic literature and art. Because of their surveyable size tropical islands provided sites ideally suited for botanical research, and it was here that ideas about ecological connections were first envisioned.

It was in the colonies, too, with the economic interests of the metropole and local hunting interests in mind, that enlightened administrators applied forest and soil conservation measures for the first time. As part of an imperial policy protecting timber, for example, the British colonial regime in India established forest reserves in the 1850s. At the end of the century, in some provinces more than thirty percent of forest land was formally protected. In a similar vein, the British colonial administration in the Cape Colony in present-day South Africa enacted legislation protecting forests (in 1859) and wildlife in hunting reserves (in 1886).

At the end of the nineteenth century, imperial ideas about the natural environment as an interconnected system were transported to the European core and converged with Gilbert White's arcadian view of nature, and concerns over the environmental effects of industrialisation. Two broader developments led to the foundation of the first nature conservation organisations in Britain and elsewhere. First, following the example of Gilbert White (and paradoxically facilitated by the invention of the steam locomotive that connected urban areas with the surrounding countryside), natural history became a popular pastime in Victorian Britain. The study and observation of nature by amateur field naturalists who escaped overcrowded and polluted cities in search of tranquillity and wonder, in turn, stimulated a desire to protect rare plant and animal species, and ultimately the landscape as a whole. Second, as part of a larger 'civilising' movement, middle-class reformers, including many women, started a campaign against cruelty to animals. Members of the bourgeois Society for the Prevention of Cruelty to Animals, founded in 1824, believed that cruelty to animals, like slavery and alcohol addiction, stemmed from savage impulses that needed to be restrained. They persuaded parliament to prohibit dog fights and to pass legislation protecting wildfowl and wild birds whose plumage was used for women's fashion.

Other European countries followed suit and after the foundation of the Society for the Protection of Birds in Britain (1889), the *Bund für Vogelschutz* was established in Germany in 1899. In contrast to Britain, however, the German nature conservation movement, inspired by romanticism and nationalism, combined concerns over birds and plants with a concern for the preservation of cultural heritage and regional identities, resulting in a nationally-oriented campaign to protect the German landscape (*Heimatschutz*). At the beginning of the twentieth century, after the International Congress for the Protection of Nature in Paris (1909), national organisations established the foundations of a transnational nature protection network. It was within this context that a sustainability discourse emerged.

Conclusion

The ways in which humankind controlled and understood the environment changed in the nineteenth century. On the one hand, the natural environment became an important scientific object which triggered new political, economic, and technological developments and opportunities. With a better understanding of the natural world as a fragile ecosystem, there emerged a need to take responsibility for the well-being of all species and habitats. The idea to utilise nature in a more sustainable, improved, and economic way found its expression in the political need to regulate common resources like

land, forests, and water more thoroughly. On the other hand, the developments and processes of industrialisation and urbanisation resulted in increased exploitation of resources, especially coal, and led to environmental pollution on an inconceivable scale. As early as the nineteenth century scientists discussed the idea of an 'Anthropocene', a new geological epoch in which humankind decisively shaped the environment. Today, geologists seem to agree that the Anthropocene is a reality, although they still debate the period's exact starting point: did humankind become a geological force in the sixteenth century with colonialism, in the nineteenth century with the industrial revolution, or only after 1945 with the beginning of the atomic era and the great acceleration of resource exploitation?

Discussion questions

1. How and why did the concept of 'nature' change in nineteenth-century Europe?
2. Describe the impact industrialisation had on the way Europeans thought about the environment.
3. Environmentalism was 'invented' in the European colonies. Discuss this statement.

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