

## Chapter 2

# The Commodification of Nature and Its Consequences

**Keywords** Free market premises • Free market efficiency • Commodification of nature • Resources scarcity • Environmental impacts

The defence of the free market is based on the premise that it is the most efficient economic instrument and, therefore, the one that delivers the most economic growth. In addition, it is said that it carries out a fair distribution of the wealth produced, as it does so depending on each person's contribution, and that nature is an unlimited resource that the market uses with efficiency. But geology shows us the process of resource depletion. In this chapter we will analyse the efficiency of the free market, the historical process through which the capitalist market emerged, the commodification of nature, its repercussions on the natural environment and the theories on the supply of natural resources.

### 1 The Efficiency of a Free Market

Adam Smith arrived at the paradoxical conclusion whereby, when each individual pursues the maximisation of their usefulness, the maximum social satisfaction possible is achieved. So a private vice (selfishness) becomes (through “an invisible hand”) a collective virtue (social well-being). Today the orthodox economy explains this paradox according to a series of virtues that it attributes to the free market:

- It determines, due to the free action of supply and demand, the real costs (prices), which are essential information for efficient economic action.
- It distributes resources efficiently.
- It satisfies people's desires, as businesses are always ready to satisfy demand, which expresses these desires.
- It avoids the need for complex planning, as it works automatically.
- It adapts to changes quickly and flexibly.

However, in order to express these virtues it has to meet the following premises:

- The existence of institutions capable of establishing property rights and guaranteeing the usufruct of the same.
- The existence of a clear and precise structure of property rights.
- Freedom and equality for all the members that intervene in the market. This means, among other things, that both parties have the same information and that there is freedom to enter and exit the market.
- This is achieved through the action of a high number of buyers and sellers.
- The existence of a balance between supply and demand.
- Divisibility of the production factors and of the products.
- Absence of public assets.
- Absence of environmental impacts.
- Absence of absolute lacks of resources.

The requirement that the economic agents be free and equal is systematically unmet, because the system is characterised by the private appropriation of the means of production and the tendency to concentrate them in a few hands. This creates a relationship of domination, of the owners over the dispossessed. The consumer's right to choose freely presupposes that their choice does not affect other members of society and of the world. As long as goods are reproducible and do not affect other goods and other consumers, the proposal makes sense, provided the consumer is perfectly informed. But when we factor in the social and environmental repercussions of the actions of economic agents, we realise that the supposed sovereignty of the economic agents often hides very strong impacts on other people, on societies and, above all, on future generations. For example, the ownership of a car, according to the sovereignty mentioned, contributes to the depletion of resources (particularly oil) and produces environmental impacts that generate a loss of well-being in cities and climate change.

The existence of oligopolies, their symbiotic relationships with political power, agreements to limit competition, pressure groups, multiple obstacles to enter a growing number of sectors (due, mainly, to the strong investments that are necessary to enter very monopolised sectors), show how far the market's behaviour is from that determined by the requirements indicated above. For E. Altvater (1993: 67), "markets are necessarily sources of inequality (...) if the market actors are unequally endowed with physical and economic or political power (...) then the procedures will not be neutral but will tend to reinforce the power disparity".

If these requirements were met, there is no doubt that the market would be a much more efficient instrument than what it is today, but even then it would still be inadequate to sustainably satisfy the vital needs of all the population. The market only services solvent demand. It does not distinguish between vital and non-vital needs. Thus, the OECD market usually offers countless manufactured products at low prices, while many people cannot afford decent housing or a quality health system. They are also denied the right to clean air and water, to be in contact with a non-degraded natural environment, etc. And these deficiencies become more evident

the more the market is deregulated. Thus, in the United States (USA), where public regulatory action is minimum, they have the worst health and education indicators of the OECD.

Last of all, to propose the market (a micro-economic instrument) as the adequate option to solve general problems (economic, social and environmental) means being oblivious to the hierarchical order of complex systems. In the biosphere, the biggest ecosystems are at the summit of the hierarchical system. As a result, instead of solving problems, it magnifies them: degrading nature, polarising the distribution of incomes and encouraging social disintegration. So “markets are only tools. They make a good servant but a bad master and a worse religion” (Hawken et al. 1999: 261).

## **2 The Emergence of a Capitalist Market and the Consequences**

We have seen in the previous chapter that the defence of the free market, that is, one entirely guided by its internal forces, without the mediation of States, leads to the affirmation that the economic liberalisation process is a natural process; so those who oppose it should be treated as dangerous people, people who conspire to subvert the natural order of things. So such a premise culminates in totalitarianism. But economic history does not back the theory of the natural evolution of the market. Many authors [such as Polanyi (1989), Mumford (1971), Thompson (1995), Altvater (1993), etc.] firmly maintain that there is no such natural evolution, but that there was a qualitative rupture in the capitalist market and that it was the result of the strong interventionism of the bourgeois governments that emerged after the success of the revolutions against the Ancien Régime.

The pre-capitalist market had two features of its own. First of all, it was limited in volume and in the type of goods, in space and in time. It was limited in volume because only a fraction of the goods produced were sold, as an immense majority of the population practiced an agriculture that was basically of subsistence. Polanyi considers that until the second half of the eighteenth century “so-called nations were merely political units, and very loose ones at that, consisting economically of innumerable smaller and bigger self-sufficing households and insignificant local markets in the villages. Trade was limited to organized townships which carried it on either locally as neighbourhood trade or as long-distance trade – the two were strictly separated, and neither was allowed to infiltrate the countryside indiscriminately” (1989: 39). Even in the Europe of the late eighteenth century there was hardly any trade between regions within the same State (Sachs 1992: 7). The types of goods being bought and sold were also limited. Land and labour were not considered goods, meaning they could not be exchanged on the market. In some societies not even food was sold, as it was considered of such importance that it was not considered a commercial asset. The primitive market only took place

in a location with well-defined physical and temporal boundaries, “and clearly differentiated from ordinary life, very often the market lies at a distance from the inhabited area, and functions as a neutral meeting place” (Berthoud 1993: 75). The temporal limitation means that it exclusively operated on certain days of the year. Secondly, the pre-capitalist market was heavily regulated. The authorities not only established order in the markets, but they also controlled the various aspects involved in the transaction, in particular the price and weight, as shown by historians Braudel and Thompson. In Great Britain, emergency measures were prepared for the periods of food scarcity between 1580 and 1630 that were codified in the Book of Orders. This “granted magistrates the power (with the aid of local courts) to inspect the stocks of cereals in chambers and granaries; to order the dispatch of certain amounts to the market; and to impose with severity all the regulatory rules on licences and hoarding. Cereals could not be sold outside the public market” (Thompson 1995: 256).

Medieval guilds, as is known, regulated the quality and price of the products, the number and the way workers were promoted, and many other aspects of life within the guilds, some of which were not strictly economic, such as in the case of certain services that are currently included under the term of social security. At least until the late eighteenth century intermediaries were considered as suspicious in the eyes of the law and their activities were very limited. On the other hand, millers and bakers were seen as servants of the community who did not work to make a profit but to earn a reasonable income.

Therefore, there was no “free price formation”. The authorities sought price stability as a means of guaranteeing social peace. For precisely this reason, the pre-capitalist economy was focused on satisfying needs. R. H. Tawney considered that “the economy of the medieval borough, was one in which consumption held somewhat the same primacy in the public mind, as the undisputed arbiter of economic effort, as the nineteenth century attached to profits” (Thompson 1995: 286). Despite this, pre-capitalist economies grew and became inter-related with the growth of the economy. But these factors “did not, however, transform markets into a market economic system, since the commodity form was not yet the universal ordering principle of social regulation, and private property in the means of production had not yet been firmly established” (Altvater 1993: 58).

### 3 The Commodification of Nature

The existence of nature is taken for granted and its appropriation is the result of a legal act, which historically has been frequently preceded by a violent conquest, because this appropriation means a loss for the rest of society or for other communities. In primitive societies land was not normally considered a good, because it was their territory, a shared asset that provided the food and materials necessary for their survival and which was the burial ground of their ancestors. Its commodification means an assertion of human control over nature

and the de facto negation of the systemic character of nature (it ceases to be considered an ecosystemic entity and becomes a succession of privatised plots of land), which opens the path to its destruction, because the land becomes a private means of production and therefore, subject to the mercantile logic of profit maximisation.

Economics handbooks state that a good is an asset produced for being sold, something that does not happen with natural resources; therefore, nature is not a good. Each authentic good is an individualised unit, perfectly separate from the others, meaning that the destruction of one does not affect the rest; for example, the destruction of one car does not affect the rest of the cars in circulation. The Earth formed 4 billion years ago; life appeared 500 million years later. And the human species is the latest product of the evolution of life on the planet. Evidently, we did not produce the Earth, but rather it produced us, so therefore we have no right to take over and commodify it. Its consideration as a good requires a valuation (mercantile) and a use that is incompatible with the vastly complex network of life. Natural systems have a holistic, indivisible character that rebels against mercantilist reductionism. So, for example, as Leipert says, "a tree or a species is part of a local ecosystem, which is part of a regional ecosystem, and this in turn is part of a network of ecosystems in the whole country, continent, the world. And all of these ecosystems interact with each other in such a complex way that they constitute together a single, indivisible, collective, public good, which belongs to the human race" (Ravaioli and Ekins 1995: 38). A couple of examples will be enough to illustrate the consequences of ignoring the systemic character of nature. The Chinese authorities banned cutting down trees anywhere in the Yangtze river basin, in addition to implementing a broad reforestation plan, due to the fact that the catastrophic floods in the summer of 1998 were worsened by the deforestation carried out during previous decades. From a more general perspective, the serious global ecological problems we face (climate change, ozone layer depletion, ocean degradation, etc.) are a consequence of the accumulation of many alterations produced at a local level. For this reason, Aldo Leopold (a naturalist considered to be the father of conservationism) states that the conservation of nature is an act of harmony between man and the land and that the commodification of nature destroys it: "We abuse the land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect" (Meeker-Lowry 1995: 158).

Despite what has been said until now, nature provides us with goods and services that cannot be appropriated or mercantiled but are meant to be public or free assets. They are assets whose enjoyment by one person does not prevent others from benefiting from them. In addition they cannot, in general, be privatised. Many natural assets are public assets (rivers, oceans, the atmosphere, wildlife, etc.), and even those that have been privatised (land, aquifers, etc.) are public in nature, because their use affects the rest of the biosphere and, therefore, humanity. But nature represents much more than a public economic asset. It is a totality of many aspects: it is our habitat, which means that respect for it is a guarantee for survival; and it provides us with many vital services, apart from being a source of resources

necessary for sustaining life. De Groot (1992: 263) considers that nature provides functions for regulation, support, production and information, which include 36 sub-functions.

Capitalist society tends to value the things that the market values and dismisses and does not respect whatever has no value for the market. This is what happens with public environmental goods and services, even if they are vital not only for the economy, but also for the survival of humanity. But as the deregulated market is the organising and valorising principle, it tends to dismiss everything that does not have a market value, which translates into a growing process of environmental deterioration and destruction: “Valorisation’ – or, in other words, extension of the market’s formal rationality and scarcity principle to previously free resources – always entails a largely hidden definition of the ‘non-valorisable’ or ‘valueless’ objects whose destruction is permitted” (Altvater 1993: 69).

The process of collision with nature is produced because the market is not the appropriate instrument to achieve harmony with it. Nature tends to shorten the life cycle of materials, minimising the transport and energy consumption they entail, meaning that it recycles most of them at a local level. As an ecosystem evolves towards maturity, it gradually reduces its need for external contributions of material. On the contrary, the market economy tends towards globalisation and, therefore, towards distancing the transportation of goods. This causes very important environmental damage and a considerable consumption of resources. Nature generates growing biodiversity, as it is a guarantee of stability and survival. The market tends towards the specialisation of countries and to the standardisation of products and production techniques. This is the case of industrial agriculture, where intensive specialisation is greatly reducing the genetic base and, therefore, the capacity to develop new varieties that can adapt to a changing reality. But this depletion (as Swanson declares) “is spoiling ‘a uniquely formulated insurance policy against shocks to the life system itself (...) because existing life forms encapsulated a history of successful adaptation within a changing physical environment’” (Gustafsson 1998: 266).

## **4 Free Market and Natural Resources**

### ***4.1 The Impact on Natural Resources by Establishment of a Capitalist Market***

For a political system to transform itself into a market economy system, land, work and money need to become goods and, therefore, separate property. The market goes from being a mere instrument for exchanging objects, as it had been in pre-capitalist societies, to becoming the universal regulating medium of society, determining social relations and classes. Money goes from being an instrument that facilitates exchanges to becoming the measure of all things. And the increase of its amount,

based on the appropriation of the surplus value generated by labour, becomes the aim that gives meaning to economic activity. As Hume says, “it is an infallible consequence of all industrious professions, to (...) make the love of gain prevail over the love of pleasure” (Altwater 1993: 60). So, if the world had been governed by the laws of the free market, it would have prevailed through the force of events, in a process of natural evolution.

These ideas became widespread from the 1820s and were defended by the bourgeoisie with religious fervour: “Born as a mere penchant for non-bureaucratic methods, it evolved into a veritable faith in man’s secular salvation through a self-regulating market” (Polanyi 1989: 78). But the discovery “of the laws that governed the world of men” did not lead to an acceleration of the “natural evolution”, because society presented fierce resistance: far from dismantling the strongly interventionist State of the absolute monarchies to give way to a market that regulates itself, while also regulating economic life and determining social organisation, the public administration was strengthened, to establish the market “by fire and sword, resorting to the full force of the State apparatus” (Naredo 1990).

Apart from the systematic use of force, destruction of the old order required suppression of its legal framework. In western Europe, between 1830 and 1850 many laws were passed that abolished the regulations of primitive society. In addition, it was necessary to create a legal and institutional framework that outlawed any defensive reaction. Thus, the appropriation by the bourgeoisie of common land was carried out according to new laws. Railways were developed under protectionist laws that, for example, eliminated the right to demand payment for damages arising from fires caused by steam engines. After the civil war, the American government donated to the railway companies a land surface greater than the states of California and Florida (Gorelick 1998: 15). A French decree in 1810 established the automatic authorisation of hazardous, unhealthy or unpleasant installations, with the aim of keeping them legally immune to the claims of those affected, who were receiving favourable rulings from magistrates. According to the French Institute, this “arbitrariness of the magistrates [...] disrupts the environment in which the manufacturer can operate freely and safely” (Naredo 1987: 272–273).

But the deregulation of early capitalism and the reduction of work and natural resources to mere goods soon showed their life-threatening nature, endangering even the survival of the system itself: “The idea of a self-adjusting market implied a stark utopia. Such an institution could not exist for any length of time without annihilating the human and natural substance of society; it would have physically destroyed man and transformed his surroundings into a wilderness” (Polanyi 1989: 7).

#### 4.1.1 Repercussions on Labour and on Nature

The market economy brought private appropriation of the means of production, turning most of the active population into wage-earners and their labour into a good. In the orthodox economy, labour power appeared as just another good whose

price (wage) was determined by the laws of supply and demand, and that, once incorporated into the production process, behaved as such a good. However, labour is but one of the manifestations of human life, meaning that it cannot be a good. Mothers have children and do not look after them with the intention of supplying productive resources to society. Unlike goods, the sale of labour does not entail a change of property; the business owner can only appropriate the value produced by the labour, which is one of human beings' expressions, inseparable from the rest of its expressions. The commodification of labour, therefore, degrades people.

Once labour became a good, it had to find its price in the market. Any labour price that had not been established in this way was considered anti-economic. But converting labour into a good means wiping out the organic relationships that existed in the pre-capitalist world, based on kinship, proximity, trade, etc., that linked labour with the other dimensions of life. In addition, it involved limiting the freedom of individuals to organise themselves. Chatelier's law in Napoleon's France banned worker's associations because they threatened the freedom of the employers. As people did not want to abandon the countryside and its community relations, they had to be forced, and the method usually consisted of undermining their livelihood base. In Europe this was usually achieved by taking land away from the peasants. In the colonies many methods were used to break the resistance of the natives: the best land was taken away from them, they were forbidden to manufacture goods of particular importance, they were heavily taxed, etc. And when these practices failed, they were turned into slaves. The French Minister of Commerce stated in 1901: "The black does not like work and is totally unaccustomed to the idea of saving; he does not realise that idleness keeps him in an state of absolute economic inferiority. It is therefore necessary to use ( . . . ) slavery to improve his circumstances and afterwards lead him into an apprenticeship of freedom". (*The Ecologist*, July–August 1992)

Treating labour as a good means turning it into something that is perfectly exchangeable, like parts of a clock. It is therefore necessary to divide it and trivialise it so that any worker can take the place of another. The commodification of labour entails, therefore, the structural need to eliminate any knowledge that could give workers the capacity to work autonomously. Thus, the implantation of capitalism brought about a process of elimination of knowledge among workers. American engineer Taylor was the one who systematised the techniques to achieve it and Ford completed the process with development of the assembly line. Adam Smith, despite defending the division of labour, acknowledged its degrading nature, although he only lived at the start of the British industrial revolution: "The man whose whole life is spent in performing a few simple operations ( . . . ) has no occasion to exert his understanding ( . . . ) He naturally loses, therefore, the habit of such exertion and generally becomes as stupid and ignorant as it is possible for a human creature to become" (Schumacher 1980: 60–61). Apart from the loss of control over the production process, the commodification of labour caused other known effects: a reduction of wages, longer work shifts, worsened occupational health, child labour, etc. Equally known are its side-effects of moral degradation: alcoholism, prostitution and delinquency.



On the other hand, the result of the commodification of nature is the start of a process of degradation that is still ongoing, because it is intrinsic to the system and only slows down when the market is heavily regulated, that is, when its supposed mercantile nature is questioned. At the beginning, capitalist deregulation did not cause ecological problems comparable to today's (population, economic activity and technological development levels were much lower than today's), although its effects are far from insignificant. One of the most serious is widespread deforestation. In England many communal forests disappeared through Parliament laws and the same happened in Italy and Spain with the expropriation processes. In the USA, colonisation ended in the late nineteenth century and, once the forests in the east were destroyed, the country strived to cut down what was left in the rest of the territory (Ramos Gorostiza 2009).

Another anti-ecological process was the gradual substitution of sustainable primitive agriculture with another that was industrial in nature. These effects were soon made evident. Liebig is known because of his development of chemical fertilisers, but he also criticised productivist agriculture because it breaks the cycle of matter of traditional agriculture, as the food waste from cities does not return to the countryside. Marx stated that capitalistic agriculture exhausted the land: "Moreover, all progress in capitalistic agriculture is a progress in the art, not only of robbing the labourer, but robbing the soil; all progress in increasing the fertility of the soil for a given time, is a progress towards ruining the lasting resources of that fertility (. . .) Capitalistic production, therefore, develops technology, and the combining together of various processes into a social whole, only by sapping the original sources of all wealth – the soil and the labourer" (Marx 1990: 463).

Meanwhile there was a two-sided process that had serious repercussions on the countryside, and which did not cause an ecological disaster because it was interrupted. On the one hand, introduction of the land market, which was established in Europe between 1830 and 1860, brought the elimination of traditional renting rights, causing a widespread exodus of landless peasants to cities, which became overcrowded, similar to what is currently happening in non-OECD countries. On the other hand, there was a sharp drop of agricultural prices as a result of the massive introduction into Europe of American cereals at very low prices, brought about by development of the railway and the steam boat. Both processes threatened the survival of most peasant farms and the abandonment of fields was an ecological disaster.

Last of all, the establishment of capitalism caused a demographic explosion in all societies, in particular due to the disappearance of the birth controls that primitive societies had gradually designed. Malthus developed his population theory by observing the exponential growth of the British population during his time. Europe soon became an overpopulated continent and looked for a safety valve in emigration. Between the early nineteenth and twentieth centuries 50 million Europeans emigrated (Crosby 1988: 16).

#### 4.1.2 The Regulating Reaction

The story of the free market is, at the same time, the story of the State's aggression on the community bases of pre-capitalist societies and the spontaneous reaction of the latter. This reaction was aimed during a first phase against the inclusion of land and labour in the market, and during a subsequent phase, against the most degrading effects this inclusion had. Wage flexibility and the mobility of labour had to be reduced, minimum wages guaranteed, regulation of the urban environment to prevent it from becoming totally unhealthy, regulation of natural resource management and limits on the activities that were most destructive for the environment. But regulation went beyond the strict framework of the problems dealt with here. The USA, industrialised European countries, and in particular Japan, protected their emerging industries from international competition by establishing strong customs barriers. It is curious that, in the name of economic liberalism, this right and need is denied to non-OECD countries.

While the destruction of the pre-capitalist economic and social structures was the result of a conscious and systematic action by the States, the reaction against the terrible side effects of this intervention was spontaneous in nature. This is proven by the fact that regulation came about through the adoption at the same time of very similar formulas in countries with very different political regimes, with not only central governments but also local governments working in the same direction. The process was simultaneous in Victorian England, in the Germany of Bismarck, in the French Third Republic and in the Habsburg empire. In addition, its promoters were people from across the ideological spectrum: "In Protestant England, Conservative and Liberal cabinets laboured intermittently at the completion of factory legislation. In Germany, Roman Catholics and Social Democrats took part in its achievement; In Austria, the Church and its most militant supporters; in France, enemies of the Church and ardent anti-clericals were responsible for the enactment of almost identical laws" (Polanyi 1989: 85).

Laws on work accidents were approved in 1880 and 1897 in England, in 1879 in Germany, in 1887 in Austria and in 1899 in France. Factory inspections were established in England in 1883, in Prussia in 1853, in Austria in 1883 and in France in 1874 and 1883. Laws were approved to limit the age for children to start working and to regulate hygienic conditions in factories; workday hours were limited, social security systems were established, etc. Meanwhile, and under pressure due to epidemics and unhealthy living conditions, cities established sewage, waste collection and food inspection systems, measures were taken to improve housing for workers and public parks were built. In the USA, in the late nineteenth century, Congress successively approved the Pure Food and Drug Act, the Federal Meat Inspection Act and the Historic Sites Act. By around 1880 most cities had built wastewater systems. In Europe, a powerful farmer's movement opposed to agricultural deregulation managed to push for protectionist measures from the 1870s, which allowed a stabilisation of the peasant population. Import duties were established for imported cereals, the transferability of land and direct and indirect economic aid for farmers was limited (Fabe and O'Connors 1990).

In addition, it was necessary to protect nature from the rapid expansion of capitalism and important conservationist movements emerged, whose action has led to the creation of many protected areas. In the United Kingdom a powerful movement against forest clearing saved many of them. In the USA, after the civil war, a strong conservationist movement emerged, a result of concerns about the rapid process of destruction of nature. The movement was very heterogeneous and was led by very different people. This lack of clear and common goals and the anti-environmentalist policy of president Taft (1909–1913) led to their decline in the early twentieth century, but their legacy is evident in many fields: the creation of protected areas, territorial planning, public water management, the nationalisation of large extensions of forests. The Forest Service was founded to manage them sustainably (Fabe and O’Connors 1990; Ramos Gorostiza 2009). This environmentalist movement saw a powerful resurgence during the recession of the 1930s with Roosevelt’s New Deal policy and meant that millions of young people were hired for the conservation of protected areas. In Spain, 8 years after the second expropriation law was published (Madoz Law of 1855), which like the first law was disastrous for its forests, published the Forest Act of 1863, “which responds to a desire to restrict the expropriation policy undertaken years earlier” (Aunos 1991). From 1917 natural parks began to be created.

Thus, the regulations for the protection of nature during capitalism’s first phase referred mainly to the agricultural use of land (and was very determined by social problems), and in some cases to the protection of high-value ecosystems, with the promulgation of laws on protected spaces. But there was not much progress in what would later be known as environmental policies: the limitation of emissions and discharges. It would be necessary to suffer the strong degradation caused by the shockwave of the postwar period for these policies to begin their development.

## ***4.2 The Scarcity of Resources in Classical and Neoclassical Thought***

Despite the destructive process of natural resources during the historical period analysed here, there was no general concern about their possible exhaustion. In Europe, the defence of forests was due to the fact that they were a key resource for the economy of small peasants. In the USA there was a conservationist motivation in very active minorities, without there being (at least directly) an interest in preserving a resource of high economic value. This concern is logical, because in the nineteenth century most of the Earth’s natural resources were still available, as the industrialised economic activity and the population were much smaller than today’s. The world’s population reached one billion in the mid-nineteenth century.

An exception to the general panorama described is the problem of Great Britain’s natural resources. The fact that the industrial revolution started in the late eighteenth century led to serious shortages of resources as the nineteenth century progressed.

The systematic clearing of forests decided by the British parliament led to a severe shortage of wood. Coal was another reason for concern. Although Jevons was one of the fathers of the neoclassical revolution, he was concerned about the exhaustion of coal in Great Britain (Bradley 2007). It is also very possible that the Spanish Forest Act was motivated by the scarcity of wood after most forests were cut down, due to the demand caused by the development of the railway and mining. But, except for the cases described, it is only in the late twentieth century when the scarcity of natural resources became manifestly clear.

The classical authors, (mainly economic thinkers from the first half of the nineteenth century) were influenced by the process of destruction of natural resources that took place during their time and they had, in general, a clear vision of the existence of natural limits to unlimited growth. They were therefore concerned about population explosion. Malthus believed that human beings tended to reproduce explosively, and therefore, to exhaust resources. In reality, what was happening was a phenomenon inherent to the establishment of the first capitalism: a population explosion motivated, among other factors, by the disappearance of the birth control culture of previous cultures. These used individual abortive mechanisms (abortifacient products, use of natural preservatives, etc.) and social mechanisms (delaying the age of marriage, sending many children to live a celibate religious life, such as in the case of Buddhism and Catholicism). With the industrial revolution in Great Britain, the age of marriage among young women dropped from 28 to 22. Based on this vision of population dynamics, some economists considered the problem that could arise regarding food. Malthus argued that food scarcity would lead to a competition that only the fittest would survive. The same concern led David Ricardo to develop a theory that proposed an innate tendency of deregulated capitalism towards stagnation. Population pressure would lead to an increasingly marginal use of land, which would cause the price of food to rise, and with them salaries, but the latter would see their purchasing power reduced to covering the bare survival of the worker and their family, the moment at which the population would stabilise because families would only have the children that they could afford to feed. On the other hand, rising salaries would reduce company profits, investment would fall and the economic system would stagnate. And to avoid this structural tendency, States should systematically intervene to encourage economic growth. This theory was refined by Keynes in the nineteenth century and is known as the neo-Ricardian or Keynesian school (Roll 1966). Keynes was concerned about the population problem. In his “General Theory” he states that one of the causes of war is “the population pressure” (Keynes 1964: 382).

For J. S. Mill and K. Marx the problems of the capitalist system’s unsustainability lead to the need to replace it. J. S. Mill understood during his mature stage the impossibility of limitless growth and argued in favour of a stationary state economy with a more equitable distribution of resources. In his *Principles of Political Economy* he wrote: “No man made the land. It is the original inheritance of the whole species. Its appropriation is wholly a question of general expediency. When private property in land is not expedient, it is unjust. But, it is some hardship to be born into the world and to find all nature’s gifts previously engrossed”

(Mill 1996: 233). K. Marx was convinced that there is a contradiction between capitalism and the conservation of nature, that the search for profit in the shortest term possible brings the destruction of farmland, due to overexploitation, and a lack of nutrient recycling. But the solution to this contradiction, as well as to others, should wait for the proletariat to overcome the main contradiction (between work and capital) by means of the proletarian revolution (Marx and Engels 1975).

On the contrary, with the so-called neoclassical revolution, any concerns about physical limits disappeared. They focused on the micro-economy (company economy) and lost any general perspective. And the fact that at a company level there are no problems of resource exhaustion or environmental impacts implicitly means that the Earth is an inexhaustible source of resources and a sinkhole for waste with limitless capacity. The orthodox economy maintained this vision for 100 years: "Between 1870 and 1970, mainstream economists (with some notable exceptions) appeared to believe that economic growth remained feasible (a growing economy need not run out of natural resources)" (Pearce and Turner 1990: 13). And up until now this has been the widely dominant opinion regarding the economy, to the extent that no economy manual takes this problem into account. However, the enormous environmental impacts that were produced during the period after World War II, due to the intensive growth of the economy and, in particular, the chemical industry, led to the birth and development of environmental policies from the 1970s onwards. But they continued to ignore that there could be an exhaustion of resources. The historical trend of falling prices of raw materials seemed to support this approach, but in reality it was mistaken. We will see later that the market only sends out signals (in the shape of rapid price rise processes) during the final phase of resource exhaustion. This is the scenario that emerges in the late twentieth century and during the following decade there were steep rises in fossil fuel prices and in most strategic metals, in addition to monopolisation phenomena.

Despite the fact that the dominant thought in the orthodox economy does not acknowledge the scarcity of natural resources, there has been an academic discussion about the "Economics of Natural Resources" where there are opposing points of view. And it is convenient to analyse the academic discussion because there are beginning to be swift changes of opinion faced with the evident growing lack of resources. There are, at least, four types of position: denial of the existence of scarcity; the scarcity of a resource raises prices and leads to a more efficient use of it, postponing the problem when not solving it; acknowledgement that resources, though finite, are abundant due to technological development or human ingenuity, which could mean that, although some resources may be exhausted, they will be replaced by others; and, there is a scarcity of resources. So the first three defend the capacity of the markets to face situational scarcities.

Among the pure deniers we have Adelman, Seaborg, Brooks and Andrews. Adelman states that the idea of "finite limited resources . . . is an empty slogan" [ . . . ] "but inventories of 'proved reserves', constantly renewed by investment in finding and development" (Bradley 2007). For Seaborg the abundance of energy allows us to "recycle any waste [ . . . ] to extract, transport and return to nature, whenever

necessary, all materials in an acceptable way". Brooks and Andrews state that the idea of "running out of minerals is ridiculous because the entire planet is composed of minerals" (Carpintero 2006: 147).

The positions of Samuelson, Friedman or Frances Cairncross (managing editor of *The Economist*) fit in with the second group. Samuelson states that "when resources start to be scarce [...] prices rise" and their use becomes more efficient (Carpintero 2006: 181). For Cairncross (1996: 7) "the environmental resources least in danger of exhaustion are those that are privately owned and traded. As they start to become scarce, their price will rise. This is likely to encourage their owners to conserve the supply". For Friedman there are no limited resources, because "when resources are really limited prices go up, but the prices have gone down and down. Suppose oil became scarce: the price would go up, and people would start using other energy sources. In a proper price system the market can take care of the problem" (Ravaioli and Ekins 1995: 33). DeGregori affirms that "the central role of knowledge as the ultimate resource and creator of minerals is -or should be- a fundamental principle of economics" (Bradley 2007).

The third group is the most widespread. Schumpeter declares that "there is not a law of diminishing returns in relation to technological progress". Zimmermann affirms that "the problem of resource adequacy for the ages to come will involve wisdom more than limits set by nature". Also adding: "Human wisdom is the principal resource". Simon rejects Malthusian ideas of scarcity and states that "a theory of endogenous invention is more persuasive in my view". Hotelling became the focus of the academic debate about natural resources since publication, in 1931, of the article "The economics of exhaustible resources". It is based on the assumption that natural resources are exhaustible, as the title indicates, but also replaceable, and reflects on what exploitation rate can maximise profit, which depends on the following premises: perfect knowledge of reserves, extraction technologies, prices, interest rates, alternative resources, etc. (Bradley 2007).

The fourth type states that resources are exhaustible, meaning they should be adequately managed. Authors who defend this approach coincide with many others who have spoken out about the exhaustion of resources and who are today associated with ecological or sustainable economy. Paradoxically, Jevons (one of the three people responsible for the neoclassical revolution, which determined the development of the economy of nature) expressed his concern about the exhaustion of coal in Great Britain in his book *The Coal Question*, of 1865. He was worried that England extracted 50 % of the world's coal, both for domestic consumption and for exports, while the country had 0.04 % of the world's surface area and 2.5 % of the population. Based on the definition of the principle of thermodynamics: the law of entropy (the energy used cannot be recycled because it degrades over time, the temperature is reduced so much that the energy cannot be used: entropy increases), many scientists have insisted on the unsustainable nature of the exponential growth in non-renewable energy resource consumption, such as Carnot, Clausius, Cournot, Podolinsky, etc. At an economic level, for Georgescu-Roegen the law of entropy is irrefutable proof that non-renewable energy runs out. He also defined what he called the fourth law of thermodynamics, with which he sought to express the impossibility

of totally recycling materials, because the dissipation of many of them makes it impossible to recycle them from an economic point of view. However, the fourth law has been rejected, even by his followers. And the science of thermodynamics never accepted it (Bradley 2007).

Positions such as those held by Adelman tend to disappear when faced with the growing evidence of the scarcity of many resources. But the approaches that combine market and technological development still prevail among orthodox economists, with authors differing greatly in their emphasis on one factor or another. So orthodox economists live, once more, with their back turned to other sciences and, in this case, to the Earth sciences. But we will later see that geologists are showing us clear processes of exhaustion.

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