Enclosing Water.
Nature, Revolution and the Making of Industrial Capitalism in a European Periphery
(the Liri Valley, 1796-1861)

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We need different ideas because we need different relationships
R. Williams, ‘Ideas of Nature’

The historical method is supposed to prove that economic changes have been the inevitable outcome of natural laws.
It just as often proves them to have been brought about by the self-seeking action of dominant classes.
A. Toynbee, The Industrial Revolution

Although its historiography dates back more than a century, there is still something hidden within (and more often by) the narrative of the ‘industrial revolution’. One of the most powerful, cross-field narratives concerning the ‘rise of the western world’ and its techno-economic supremacy, the story of the industrial revolution is the core of a broader progressive narrative about the relations between energy patterns and ‘modern growth’, including a number of implications about population and natural resources. This view identifies modernity with an unprecedented increase in energy consumption, considered an undisputable accomplishment of European culture on behalf of humanity. Originating at the very ‘energy mystique’ that Watt’s steam engine produced among contemporary observers, this idea informed a series of studies in economic history produced in the post-war and pre-energy crisis period, which educated generations of students, shaping common perceptions of society/nature relations in the industrial era.

Working from a more specialized perspective, that of entrepreneurs and managers, business historians in the last decades have ‘discovered’ many different things about industry, but they still seem unwilling to go beyond the factory gates (or, rather, out of the company archives) to look at the environment where the factory lies. That environment, I will try to show, tells many things not only about what industry has produced in the past two centuries of human history, but also how industrial capitalism has dwelled upon inherent, natural forces laying in the material world, erecting upon

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I owe my perspective on waterpower to my encountering with Donald Worster, and in particular with his Rivers of Empire. Water, Aridity and the Growth of the American West, Oxford: Oxford U.P. 1985, which taught me to look for social domination within the domination of nature, changing forever my way of seeing the Liri valley, and the world.
them an entirely new system of ecological relations. By its ability to transform labor into ‘human capital’ and nature into ‘natural capital’\(^4\), the capitalist firm has been, in fact, the most relevant subject mediating nature-society metabolic exchanges in the last two centuries, being responsible of major changes in socio-ecological relations\(^5\).

According to I. Wallerstein, the historiography of the ‘European miracle’\(^6\) can be identified as the first component of euro-centrism, ‘probably fundamental to the other explanations’, but also ‘the most obviously naïve variant and the one whose validity is most easily put in question’\(^7\). My argument here is that the ‘paradigmatic shift’, invoked by Wallerstein and others, to a new global history narrative, has not yet challenged what is probably the core of the old narrative, namely the ‘industrial revolution’ and its energy dimension\(^8\). The mainstream narrative of economic growth has a counterpart, of course, in a global ecological narrative of energy transitions, emphasizing the ecological contradictions of unlimited growth and especially critiquing the disregard of mainstream economics for natural limits\(^9\). The two have mostly proceeded in parallel, the ‘entropic’ story being less influential in academic and political terms than the ‘progressive’; nevertheless, they seem to have a common undisputed ground in their reluctance to include social power and relations as essential dimensions of ecological change\(^10\). Even environmental history, which has produced the most convincing stories about the social costs of industrialization (especially in the city\(^11\)), has left the topic of business and the industrial revolution almost unaccounted for\(^12\). According to Timothy Mitchell, even the post-structuralist narrative has showed a diffuse reluctance to question the crucial role that modern growth has played in economic ideas and storytelling\(^13\).

In what follows, I will critique the mainstream energy/modern growth narrative and present an alternative pattern of investigation focused on the socio-ecological dimension of industrial capitalism.

Between the end of the 18\(^{th}\) century and the early 19\(^{th}\), capital began to extensively experiment with the appropriation of nature within a new production system based on industry. In parts of Europe and North America, this major historical process coincided with what historian Eric Hobsbawm labelled ‘the age of revolution’, which began with the first factory system in history (centred around Arkwright’s hydraulic spinning mule) and with the Bastille uprising\(^14\). Both revolutions, of course, soon became myths, and have a long history of alternative interpretations responding to shifting political visions\(^15\). More relevant to this paper, though, is that the time span of both revolutions also coincided with the golden age of waterpower. It was the age in which the vertical water wheel knew its maximum geographical and technological expansion, while the hydraulic turbine was invented in France (and re-invented in New England). Although not intrinsically revolutionary, both technologies allowed huge increases in energy availability and
efficiency for industrial purposes, rendering hydraulic engines extremely effective and actually preferred for more than a century after Boulton and Watt’s steam engine had been successfully experimented\textsuperscript{16}.

In looking for industrial capitalism’s early relations to nature, I will thus consider the former as a geo-historical entity that was born and raised as a hydraulic energy system, and whose natural environment were mostly river basins\textsuperscript{17}. In fact, 19\textsuperscript{th} century industrial capital was not a metaphysical entity stemming from the immaterial world of economic laws; rather, it was itself shaped by the material conditions of life and production in particular social systems, and by active, inherent forces working within the natural environment. I thus consider waterpower as a historical subject, interacting with social forces (capital and labor) and with various forms of discourse (the scientific, the political economic, the literary) in giving birth to industrialization processes and in shaping the ‘ecological consciousness’ typical of early industrial capitalism\textsuperscript{18} (or hydro-capitalism). As Neil Smith put it, in fact, ‘more than any other identifiable experience, the emergence of industrial capitalism is responsible for setting contemporary views and visions of nature’\textsuperscript{19}. It is thus essential to look at how, when and in what conditions industrial capitalism itself developed its own ecological ideas; that is, not only from what philosophical ideas of earlier historical phases, but also from what material conditions of production and reproduction, from the acting of what forces inherent in the natural world, and in what landscapes. By creating a new production system, industrialists re-shaped and re-interpreted the dialectical relation of labor to nature and in so doing they were also changed by it in their own nature. I argue that the process of enclosing water in individual properties, in order to incorporate it as waterpower within the capitalist firm, and water’s reaction to this transformation, need to be investigated as the crucial moment in which a capitalist ecological consciousness was formed.

In the first part of the paper, I will present a critique of the energy/modern growth narrative. My emphasis on waterpower as the relevant energy system for industrialization questions the perception of ‘modern’ economic growth as the increase in productivity enabled by coal and fossil fuels. In fact, both at the core (England and New England’s valleys) and at the periphery (the Liri valley), industrialization was produced by an unprecedented intensification in the use of rivers as sources of mechanical energy. This path of investigation also includes an examination of economic ideas about the benefits of appropriating water ‘in the servitude of power’\textsuperscript{20}.

Following this line of argumentation, in the second part of the paper I will look at the industrial revolution in a particular river valley located at the periphery of 19\textsuperscript{th} century Europe, in the Apennines between central and southern Italy, during the transition from feudalism to the capitalist state. I will thus focus on the production of an industrial landscape, and the invention of a pastoral-
industrial narrative, showing how hydro-capitalism was construed and represented as a ‘natural force’, so hiding its oppressive character on both human and non-human nature.  

1. Waterpower: The ecology of early industrial capitalism.

Plainly, the modern industrial revolution would have come into existence and gone on steadily had not a ton of coal been dug in England and had not a new iron mine been opened.

L. Mumford, *Technics and Civilization*  

The history of the industrial revolution is commonly associated with that of the steam engine, and with the coal/iron complex. To the contrary, many studies have demonstrated that it was waterpower that set in motion the process of mechanization and concentration of labor that formed the substance of the factory system. Even in Great Britain, waterpower remained the major source of industrial power up to the second half of the nineteenth century, while coal was used mainly for domestic purposes and in the railroads. Between 1780 and 1850-70, it was the technical advances introduced in hydraulic converters (engines, transmission systems and machines) that led the increase in productivity which characterized the first industrial revolution. Both in Europe and in North America, coal can hardly be seen as the ‘prime mover’ of the revolution.  

Despite the abundant specialized literature to the contrary, the relevance of waterpower in shaping early industrial capitalism has been seriously understated. Probably the power of the coal-steam paradigm as the dominant historical explanation of economic change derived from its ability to capture the imagination of contemporaries, and to generate what social historian Dolores Greenberg called a peculiar ‘energy mystique’, namely the vision of a new era of technical domination over natural forces never exploited before, forces capable of increasing humanity’s powers beyond the limits of the solar/biological energy system. The production of this discourse on energy, and implicitly on technical progress in its control over nature, was a characteristic feature of bourgeois culture in the age of industrialization. It can also be seen as the ideology that legitimised a production system (the factory system) capable of imposing a much greater burden on labor, and greater social costs, than previous systems. Thus, the coal-steam paradigm was produced as a prophecy of progress, a social vision, rather than as the proper interpretation of an already accomplished change in technology. What is even more interesting, for the purpose of this paper, is the fact that the same paradigm was translated into the historiography of the industrial revolution, finally producing a perception of modern economic growth as the increase in per-capita energy consumption.
The invention of the ‘industrial revolution’ as a subject of historical investigation is generally attributed to Arnold Toynbee who, writing at the end of the 19th century, based on two building blocks: classic political economy (the division of labor, in particular) and steam technology. The two have been conjugated in a variety of different narratives ever since, among which those produced in the 1960s have been particularly relevant to the formation of common perceptions about ‘modern growth’ as a western pattern of development based on technical superiority and the mastering of inanimate power. A landmark in the field, recently republished unchanged, D. Landes’ 1969 *The Unbound Prometheus. Technical Change and Industrial Development in Western Europe from 1750 to the Present*, for example, launched a definition of the industrial revolution as the final victory of humanity (represented by the male hero who stole fire from the gods) from the constraints of ‘natural’ conditions, thanks to new technologies and social values. Although a different version of the story has more recently argued against the identification of technical progress as the core of the revolution, the assumption that steam power constituted its energy pattern has been a very basic and rarely disputed one. Generally speaking, the narrative of industrialization has concentrated very little on the energy question, including ‘coal’ as one of its many and interrelated variables; in so doing, it has reflected mainstream economics’ reluctance to take nature and ecology into account. On the other hand, it has given the centrality of steam power more or less for granted. In other words, the transition to coal has been assumed to be the obvious background of the revolution, the technical response to a significant energy shortage in the economy of 18th century Britain, with no need for special investigation. To give a couple of significant examples: volume n. 3 of the Fontana Economic History of Europe, edited by C.M. Cipolla (1973), after having defined the industrial revolution as the process which ‘transformed Man from a farmer-shepherd into a manipulator of machines worked by inanimate energy’, did not include any specific chapter on the energy shift. The same can be said of ten volumes published in the early 1990s in the Blackwell series on ‘The industrial revolutions’, collecting several articles by leading economic and social historians.

The latter example is particularly striking because one of the two series editors was E.A. Wrigley, the author of probably the most implicitly accepted representation of the energy question in economic history after Cipolla. His seminal study of 1988 (*Continuity, Chance and Change. The Character of the Industrial Revolution in England*) distinguished between two industrial revolutions: the first, renamed ‘advanced organic economy’, was based on the spread of the division of labor within industry and the international market, and it was destined to end up in the stationary state foreseen by classic political economists. Only the second, i.e. the gradual but irreversible shift to coal and other mineral fuels/raw materials, could eventually overcome the limits of the organic (non-mineral) economy and launch humanity toward unlimited growth. By distinguishing
between the two industrial revolutions, Wrigley strongly reinforced the idea that modern growth was a matter of transition from wood to coal, and that some western countries had had the chance/merit of initiating this shift.

This interpretation of economic growth is of great ecological and political interest, and deserves a proper critique: I shall limit myself here to some basic considerations. The first is that the growth of per capita energy consumption and per capita income, which that narrative considers the key feature of modern economies, is of very little significance when applied to the first industrial revolution. On the contrary, whether based on waterpower or coke, the shift to the factory system was experienced by contemporaries as impoverishment and the deterioration of living conditions for the working population, a new kind of economic crisis and unemployment, a substantial worsening in exchange relations among centres and peripheries in the world system, a profound impact on environmental conditions, and the production of ecological contradictions typical of industrial capitalism.

Moreover, the emphasis on growth of per capita income due to the increase in mineral energy consumption leaves completely unaccounted for the numerous cases, such as Italy, in which industrialization was accomplished without coal. This is not to say that the interpretative paradigm outlined above is incoherent, quite the contrary. Though industrialization in Italy began in the early 19th century, per capita incomes stayed very low up to the ‘economic miracle’ of the 1960s, when the country could benefit from the importation of cheap oil. Based on waterpower, in its mechanical and then hydro-electric form, Italian industrial capitalism showed a very long trend in salary compression, emigration and persistently low life-standards. Obviously, the organic/inorganic paradigm does not account for geo-political factors that could also explain this Italian trend (Italy’s position as a European agrarian periphery, or the role of fascism, for example). Nevertheless, my point here is to show how this definition of ‘modern growth’ simply does not apply to the industrial revolution as such, which was a quite different affair. Industrialization was indeed a major change in social and ecological relations, but 1) it was not accomplished with the coal/steam technology, but with a flow of solar energy (waterpower); 2) it cannot be identified with a growth in per capita income. The latter can be related to, but not explained by, the increase in energy consumption in industrialized countries; it should be also related to the global geopolitics of capital, which, unfortunately, is completely absent from Wrigley’s account.

The key difference between mineral and non-mineral energy systems is in their relation to land and labor. Since coal was not produced from agriculture, Wrigley’s narrative goes, it did not compete with animal and human energy for what was a very scarce resource (i.e. land), nor did it actually replace wood and other biomasses, but was an addition to them. Hence, its introduction to
the economic sphere was as a net gain (neglecting of social and environmental costs). Unlike all other biological sources, coal was also available in ‘unlimited’ amounts, i.e. it did not depend on cycles of natural reproduction. Ultimately, the difference between the organic and inorganic systems could be summarized by the difference between flow and stock. The former is alive (solar), thus dependent on, and limited by, a permanent metabolic exchange with its environment, the second is dead (fossil), thus available at the rate dictated by capital accumulation, technology and market incentives.

Waterpower was an energy flow, not a stock. Although not a living entity *strictu sensu*, it could not be conceived outside of an ecosystem which allowed its re-production through complex bio-physical mechanisms. And yet, waterpower was the energy source of the revolution. In Italy, like in several other places, industry relied on waterpower for a very long time (see the next paragraph). Thus, it can be said that industrial capitalism was born within a solar energy flow, and raised in river basins, where it experimented with the appropriation of nature and the mechanization of labor. Only later on, it loosened its links to the environment, moved to cities and forgot its connections to the natural world, which meanwhile had been transformed in an abstract, reified source of income: namely, a natural capital.

Since it does not recognize the link between waterpower and the birth of industrial capitalism, the organic/inorganic narrative cannot take into account the revolutionary changes in ecological relations produced by the capitalistic exploitation of nature in any form, either organic or inorganic. Although seemingly more ‘natural’ and traditional than steam as a form of energy (see the following paragraph), waterpower did have its own ecological contradictions and social costs[^35]. Water, in fact, shared a crucial feature with biological energies: space. It was competitive with agriculture in land-use patterns, as demonstrated by the New England doctrine of ‘reasonable use’, which was created to guarantee the industrial appropriation of rivers against the rights of agriculture[^36]. It was also internally competitive; its use implied the occupation of physical space by mills and their hydraulic works, allowing only a certain amount of manufacturers along the same stretch of the river. The production of waterpower, moreover, affected the land in several ways: by modifying the watercourse, obstructing the riverbed with deposits, impeding the proper passage and reproduction of fish. The decrease of irrigated crops, floods recurring over farms and towns, the loss of free calories available to the poor from fishing and aquatic fauna, and the general loss of access to the river as a space for the production of use-value and enjoyment of nature: these were the main social costs of waterpower, resulting from the enclosing of water within the industrial way of production. Although largely neglected in the mainstream narrative of economic history, the private
appropriation of nature, its transformation into natural capital, and its social costs are interrelated aspects of an historic process, coinciding with the rise of industrial capitalism\textsuperscript{37}.

To sum up, the crucial flaw in the ‘modern growth’ narrative of energy transition is its absent consideration of social and ecological relations. In one of the most widely read histories of technology (\textit{The Lever of Riches. Technological Creativity and Economic Progress}\textsuperscript{38}) economic historian Joel Mokyr states that ‘techniques (…) are analogues of species’ so that ‘changes in them have an evolutionary character’; he even categorizes the idea of how to produce a commodity as the genotype and the actual technique utilized by the firm in producing it as the phenotype\textsuperscript{39}. The resort to biology comes after about 300 pages in which the book seeks to explain ‘the difference between rich nations and poor nations’, proudly establishing that the ability of rich nations ‘to control and manipulate nature and people for productive ends is superior’\textsuperscript{40}. No consideration is given to the relationships between individuals and social groups, to geographic areas and 'nations', nor between any of them and the pieces of nature that they are manipulating (or are failing to manipulate) for superior ends. Borrowing from the style of Economics, this kind of study postulates a hypothetical world of equals who only eat and work, and whose difference in wealth is due to the predisposition to creativity. Progress, the book says, is the equivalent of a free lunch gained by exceptionally smart people. The possibility that free lunches might be stolen from someone else’s table is not considered in the book.

The idea that energy systems are like biological entities, responding to internal dynamics of organization and adaptation, and that their study has little if nothing to do with that of social power, might probably be ascribed to C.M. Cipolla’s \textit{Economic History of World Population} (1962), a seminal study in which human history was examined with a few tracts of calculation depicting shifts in energy-use patterns. Cipolla’s view of the industrial revolution as ‘the process by which a society acquired control over vast sources of inanimate energy’ was enormously influential on more than a generation of scholars. Although he was not an economist of a ‘reductionist’ type, nevertheless his writings about energy history encouraged the idea, very popular among economic historians, that everything worth saying can be expressed in numbers, having to do with two basilar kind of quantities: calories and money\textsuperscript{41}. The contrary idea, that change in energy systems has to do with social power, as expressed by social historian Marc Bloch in a major piece of history-writing on the spread of the water-mill in medieval Europe\textsuperscript{42}, has been largely ignored in mainstream narratives of energy and industrialization.

The historiography of the industrial revolution is huge and has been widely and seriously debated. It is not the intent of this paper to reduce those debates to the singular issue of energy: rather, my point is that the energy issue has been probably the \textit{least} debated among historians. A
general consensus has been reached that the essence of the industrial revolution consists in the fact that ‘no previous society had been able to escape the barriers which pre-industrial technology and culture placed on production’\(^{43}\) (emphasis added). Like the French Revolution, the industrial revolution was a process of liberation: it was followed by dramatic change and suffering, but it was nonetheless necessary and positive, since it allowed the freeing of human potential from constraints both ‘natural’ (the solar energy flow) and ‘un-natural’ (the moral economy), finally allowing unlimited growth. By emphasizing this liberation of humanity by the means of a new energy system, the narrative of the IR necessarily comes to consider capitalism as its hero (Prometheus).

Modern growth, the mainstream economic story goes, could not be achieved only by technological improvement; it also required new social values and institutions, probably the most important of which was private property. Instead of summarizing the concept of private property as delineated in the writings of early political economists, and especially in the Smithian ontological identity between private and public interest\(^{44}\), I will consider here some moments in the historiographical use of the concept, and its transposition within the narrative of the industrial revolution.

According to the modernization narrative, the foundational moment of a development process, such as the industrial revolution, is the individual appropriation of land, and/or other natural resources (water, oil, etc.), and their ‘freeing’ from a previous state of uncertainty of property rights, implying their over- or under-exploitation; the reference is generally to the experience of the English enclosures between the 17\(^{th}\) and 18\(^{th}\) century, celebrated in a consolidated historiography as the necessary prelude to economic growth\(^{45}\). Probably the most influential use of the concept of property in economic history in the last decades has been that elaborated by Nobel prize winner (in Economics) Douglass North and Robert Thomas in their *The Rise of the Western World. A New Economic History* (1973). Building on economist’s Harold Demsetz’s theorization of the relations between property and economic development\(^{46}\), the authors defined modern growth as the ‘break of the Malthusian trap’, and ascribed it to institutional changes ‘which by incentive direct man’s efforts towards technological change and sustained productivity growth’\(^{47}\). I have purposely emphasized the use of the present tense above, which shows how the intent of the authors was not to give a historical explanation for the English industrial revolution, but rather to build a universal model of economic development capable of explaining how the latter ‘occurs’ in abstract terms. This is perfectly explicable given the tendency of ‘new economic history’ to consider itself as a branch of Economics, so gaining a more ‘scientific’ stature. The institutional changes the authors refer to were centered around the emergence and reinforcement of private property, which was considered crucial to giving ‘men’ the incentive to increase labor productivity. This vision was then internalized in the
mainstream economic history narrative, and was fully acknowledged in Wrigley’s account of the two industrial revolutions, in which the shift from wood to coal was made possible by the existence of a capitalism-oriented society. Far from being alternative, the two causal explanations of modern growth, the emergence of private property and the energy shift, have mutually reinforced each other, producing a unified and powerful narrative of the ‘rise of the western world’. Both were perfectly consonant with the classic ‘commercialization model’ explanation of the emergence of capitalism, informed by Smith’s ideas of the market as naturally conducive to economic growth, implicitly assumed even in some Marxist accounts. This vision was significantly challenged in the so called Brenner debate of the late seventies, which located more firmly the origins of capitalism within the rural countryside and in the struggle among classes for the appropriation of land. Within this new Marxist approach, social historian E.P. Thompson was the one who more acutely described capitalism as an entirely new kind of society, created out of the transformation of property relations that, in turn, was supported by a new ideology, that of classical political economy, whose vision of class relations was enforced by courts’ decisions and state repression.

According to Ellen Meiskins Wood, capitalism was born as agrarian capitalism, and it entailed a new conception of the ‘improvement’ of nature, essential to the movement for enclosures as laid out by John Locke’s idea that ‘unimproved land is waste, so that any man who takes it out of commons ownership and encloses it in order to improve it has given something to humanity, not taken it away’

This tale of the origin and social benefit of private property, one of the foundations of law and the economic theories of property, obviously had no correspondence to historical reality. Not only was there no identity between labor and property, being work more and more accomplished by others than the landowners, but the increase in productivity gained by appropriation resulted in impoverishment for the large mass of the population. The latter, in turn, was forced to sell its labor to industrial capitalists, enabling the emergence of the factory system. Even more relevant for the purpose of this paper is the fact that Meiskins Wood fundamentally criticizes the post-structuralist identification of modernity with enlightenment values, and proposes to replace that with the concept of ‘improvement’. A more definite set of ideas and socio-ecological practices, ‘improvement’ meant ‘the subordination of all human values to productivity and profit’. In this way, capitalism comes to be seen in its essentially contradictory nature, as a system which destroys at the same time as it creates.

Law historian Joshua Getzler develops a different perspective on the issue of property in economic history focused on the concrete historical evolution of property rights in 19th century Europe. For example, the English law system had remained essentially customary and precedent-based, not adopting the more ‘rational’ Romanist concept of absolute property, and yet well suited
for the definition and enforcement of private property. This was possible, as Max Weber pointed out, because judges shared with entrepreneurs and the state a ‘development ideology’, which created a social environment ‘supporting certainty of business calculation’\textsuperscript{51}. Still more interesting is the fact that the new conception of private property was developed in England, as well as in other parts of the Western world, in connection with the practice of appropriating waterpower and through the juridical debate over water law. The high level of litigation and social conflict arising from the process of appropriation of water, both at the inter-class (landowners vs. millowners, competing industrialists) and at the infra-class level (‘developers’ vs. commoners) was a huge phenomenon spreading all over industrializing areas in the same period, as is very well documented in the Liri valley case\textsuperscript{52}. Water conflicts were the main object of Norman Horwitz’s influential study \textit{The Transformation of American Law, 1780-1860}, and they form a very relevant part of both Pigou’s and Coase’s theorems of externalities and social costs. The latter, Getzler argues, was particularly well suited to ‘excite the imagination of modern economic historians (…), notably North, who analyzes the historical rise of the western economies in terms of the development of definite property rights permitting low cost transactions’\textsuperscript{53}. Getzler’s point was that property rights theory had become too abstract and rigid, and needed an infusion of historical investigation into the complex relationship between legal institutions and economic change.

A similar argument also was made by law historian Carol Rose, who wrote on the discursive dimension of the theory of property, questioning the dogmatic story of transition from common to private property with the historical example of New England waterpower. It has been more recently restated by Spanish historian Rosa Congost, who has contested North’s attempt to equate theory of property with theory of state (political and legal institutions), to which she prefers a theory of property as social relations. This perspective would allow us to see how, for example, the enclosures were not an unquestioned way to economic efficiency, but rather produced social breakdown and even encouraged litigation, increasing transaction costs. Congost points to the ‘predetermined, idealistic view of property’ that still persists in economic history studies, especially those adopting a neo-institutionalist perspective. The studies above share a critique of the way in which economic history has internalized an abstract and reified conception of property. It seems to me, though, that the implications of this mainstream economic story for the perception of socio-ecological change have not been systematically addressed so far. In the next paragraph, I will attempt to fill this gap.

\textit{2. The machine in the river. A journey into the landscape of hydro-capitalism.}
With its over 6000 km of streams running down from nearly 350,000 kmq of hill and mountain land, Italy is probably the European country with the largest endowment of waterfalls per square/mile. This physical characteristic of the Italian territory counterbalances its significant lack of minerals. Due to the comparatively high cost of imported coal and the possibility of developing huge quantities of power from surface waters, Italian industry remained within the solar energy paradigm until a very late date, namely the second half of the 20th century. This long transition from a solar to a fossil energy system is probably the main ecological feature of Italian industrialization; yet, its implications in social, environmental, or even economic terms have not been fully explored so far.

The first statistical survey of Italian industry, dating 1911, gives us a clear idea of the importance that waterpower still played at that time: among energy sources, water occupied 59% of the power potential installed in factories, and 11% of this waterpower still came from hydro-mechanical engines (wheels and turbines), the rest coming from hydro-electricity. While lacking reliable data concerning the 19th century, we can easily argue that, before hydroelectric power became available in the 1880s, virtually all of the waterpower used in industry was developed directly along rivers. The origins of Italian industrial capitalism can be thus traced back to the internal valleys, where textiles, paper and other products were manufactured in water mills, often located in riverbeds, or along water works, which substantially altered the rivers’ flow. An industrial revolution took shape when the machines located in the rivers running through the Apennines became the core of a new system of production, entailing a new labor discipline and new ecological relations.

Looking for data on the increase of energy consumption and national income, and having found them only at the end of the 19th century, Italian economic historians have not considered the waterpower era as a stage of the industrial revolution. They have not been interested in social or ecological aspects of production, regarding both as ‘externalities’ to the very practice of being economic historians. The reason might also lay in a more basic characteristic of waterpower, having to do with its aesthetic and landscape more than with its economy: the image of the water wheel immediately recalls the idea of a rural traditional world, where mills appear as a semi-natural feature of the landscape. They are hardly associated with the ‘satanic mills’ that formed the imagery of the English industrial revolution, and with the landscape that ‘carboniferous’ capitalism had produced there. A narrative of the industrial revolution un-problematically linked to that of the steam technology is obviously ill equipped to account for the waterpower story, which is generally liquidated in one paragraph or two, and represented as a limited energy system which technological
innovation overcame. In the waterpower era, the word ‘technology’ had not even been invented yet; its place was occupied by the ‘mechanic arts’, indicating the ability to manipulate matter and a practical knowledge of physical laws. In common perceptions and philosophical ideas, the waterwheel generally represented the mechanical world, even if, as Leo Marx observed, this had not been yet reified in the abstract concept of technology as a leading force of human history. But it was the latter conception of technology that informed the way economic historians have narrated the industrial revolution. It is also for this reason that to associate the waterwheel with long hours of labor, with the bodies of women and children working to the rhythm of the incessant beating of machines moved by waterpower, with the loss of direct relationship to nature as a means of life and the loss of control over one’s own physical work, in sum with the social ecology of the 19th century factory system, is a particularly hard and unusual mental exercise. To do that, in my opinion, requires that we first deconstruct the cultural and the aesthetic categories which were built around waterpower in order to obscure the real nature of hydro-capitalism. During the long history of hydropower in Italy, the ‘scientific’ and the ‘political economic’ vision of rivers as flows of energy was accompanied by another vision, that of the landscape. River valleys, after all, were also the loci of poetry, archaeology, natural history investigations, travelling. Although these were seemingly separated by disciplinary boundaries, the landscape discourse actually developed in a complex relationship to the political economy discourse, contributing to shape a distinctive ecological consciousness of hydro-capitalism. To support this hypothesis, I will consider the emerging narrative of the industrial landscape in the Liri valley, one of the earliest locations of the Italian factory system, and I will show how that narrative produced a pastoral ideal of industrialization, suggesting a total compatibility between ‘nature’ and ‘progress’.

The industrial transformation of the Liri valley began in the early 19th century, under the influence of Napoleonic rule and of anti-feudal reformism, which had returned running waters to the ancient Roman law, classifying them as no-one’s property. Freed from the ‘fetters’ of feudalism, water resources became subject to those of private law, since they were individually appropriated by landowners and mill-owners all along the riverbanks. Like in other early industrial areas elsewhere, the private appropriation of the river soon revealed its ecological contradictions in three interrelated spheres: 1) rather than enhancing the overall efficiency of the economic system, as expected in North and Thomas’ model, private property produced a high level of litigation, increasing transaction costs; 2) it also produced inefficiency in energy use, because of overcrowding and the obstruction of riverflow; 3) it was responsible for the frequency and destructiveness of the floods experienced by the two factory towns, Sora and Isola Liri. I will briefly say something about this last aspect. During the first half of the 19th century the area was suffering intense deforestation, due
to both political and demographic factors. In the previous decades, capitalism in its agrarian form was spreading through the kingdom of Naples, leaving in its wake an intensification of environmental instability\(^65\). As a result, when it came to the factory towns of Sora and Isola Liri, the river already carried with it a huge quantity of deposits deriving from the increased soil erosion in the mountains and upper valleys. But in the valley the river found industrial capitalism, with its system of ‘water enclosures’: individual properties defined by weirs, stone walls and tree branches located within the riverbed, which created an environment particularly favourable to the obstruction of the watercourse and overflowing. Dozens of major inundations were recorded in the 19\(^{th}\) century, while ordinary floods occurred every year in the rainy seasons, so that the two towns, separated by a short 5 miles of river-course, came to live in a permanent state of near-disaster\(^66\). Far from being a universal, self-evident principle of natural law, the emergence of private property was a highly contested realm of social practice taking place in contested spaces/ecologies.

The story synthesized above, taking place over roughly a hundred years, entailed still another story, much less easily discernible: the shaping of a new ecological consciousness, dominated by the industrial capitalist vision of water. This new consciousness, which Carolyn Merchant has described in the New England case as the shift from the participatory to the analytical view of nature, was itself the dialectic product of changing social relations and of a particular landscape, that of the river. It is my argument here that, in the case of the Liri valley, the new ecological consciousness was mystified in important ways by the emergence of a narrative of the industrial landscape that obscured the very existence of floods, an indeed striking manifestation of ecological contradictions.

Located along the road between Naples and Rome, not far from the Montecassino abbey, and also Cicero’s birth place, the Liri valley was a popular stage for travellers, who left a series of descriptions, sometimes also accompanied by illustrations, or \textit{vedute}, of the Isola Liri waterfalls. These were a major attraction to visitors, and became the literary icon identifying the district of Sora. In the very year of the French revolution, for example, one traveller (the abbot De Salis) depicted the local landscape dominated by the feudal castle, erected on top of a rock standing between two waterfalls, one straight and the other inclined, and surrounded by well cultivated hills and deciduous woods (fig. 1). The Liri was said to ‘complete the very beautiful scenery with the sinuosity of its course’, while the countryside appeared as ‘delightful places’ whose beauty was rare ‘even in Italy’\(^67\). In regards to the local society, the traveller recorded its quiet and idyllic life, only complaining about the missed opportunity that the lack of a good road to Naples presented for the domestic wool industry.

A similar \textit{veduta} is that which the abbot D. Romanelli, travelling in 1819 from Naples to Montecassino, received from a local painter, and that he recorded on his journal as one of the most
graceful images of the kingdom (fig. 2). And yet, by the time that this other abbot reached the Liri valley, it had gone through the most important changes in its political, social and environmental history. First, the duchy of Sora had been de-feudalized through a Royal decree in 1796, with the expressed purpose of removing its waters from baronial control and developing an industrial district out of them. At the same time, and with the same purpose, the road to Naples had been put under construction. Waterpower had been given in concession to the Town Corporation, which had rented the fulling mills to the wool merchants. Within a few years, the French had entered the kingdom, the Neapolitan Jacobins had executed a revolution and issued a glorious as short-lived Republic (1799), the Bourbon monarchy had been restored (and the Jacobins hanged), then the French had come again and ruled over the country for ten years (1806-1815). In the meantime, being located at the northern border of the country, the district of Sora had gone through an incredible explosion of both revolutionary and counter-revolutionary violence and environmental devastation. Soon after, in 1809 the first mechanized paper mill had started working in Isola Liri, followed quickly by many other wool and paper factories.

Romanelli’s journey is in fact one of the earlier testimonies of the emerging industrial landscape in 19th century Italy. Once he reached the town of Sora, the abbot recorded an ‘active and industrious population, which makes an easy living from the manufacturing of wool and from agriculture’. Nevertheless, his attention is mainly focused on ‘the greatest and most impressive sight’ represented by the river, whose two branches mix just at the bottom of the ancient Ducale palace, after falling for about 20 meters from the rock where the palace itself stands. Initially, the abbot’s description resembles the usual iconography of 19th century Italian countryside: the two ‘marvellous’ falls concur to the beauty of the place, which looks like an enchanted isle, with plenty of gardens and citrus orchards, surrounded by a variegated landscape. He then heads towards the Fibreno river, in search for the ruins of Cicero’s birth place (he is mostly interested in the academic discussion around the site of those ruins), but, in walking along the road between Isola and Sora, along the eastern bank of the Liri, the author is forced to stop and contemplate an un-expected landscape. Side by side with the cultivated fields and orchards, he sees ‘many new houses built up for the wool-mills, canals and plugs, that one can head wherever he wishes, and many factories of useful and sought-after arts’. Once reached the site where the Liri and Fibreno merge, he records being surprised by a ‘novel sight’: before merging with the Liri, the Fibreno splits up in two branches, one of which splits again forming two small islands. On one of these stands the ancient monastery of San Domenico, which would have been the destination of his search for Cicero’s ruins (some said it had been built on them), but holds now a completely different attraction:
I stayed for a while contemplating some more, new wool-mills which have been built up there – the abbot writes - and then headed to the other small island, called Carnello, where I first stayed to examine the paper- and fulling-mills which have been erected there, and then the ancient ruins.

So, at the end of the second decade of the century, an industrial landscape was starting to take shape within and alongside the agrarian and the literary. The mills that the abbot saw in Carnello belonged to one of the earliest industrial complexes in the valley, a paper factory whose original location, in 1812, was inside a former convent (S. Maria delle Forme), endowed with proper water rights from the Fibreno river. A few years before, the original plant had been enlarged by adding some more constructions on the opposite bank, precisely on the small isle located in the middle of the river. The wool-mills that the abbot visited on the isle of San Domenico were once part of a monastery, too; the same can be said for another of the earlier factories in the valley, established in 1816 inside the former convent of S. Francesco near Isola Liri.

The peculiar location of some of the earliest factories in the Liri valley gives us a clue about something revolutionary which had in fact occurred in the area, something that the abbot did not feel necessary to remind his reader, but that was nevertheless at the very origin of that early industrialization: namely, the suppression of some of the monastic orders which formerly enjoyed the use of the waters to grind their own grain, whose buildings, water works and rights had been given to the entrepreneurs. A major shift in the asset of property rights over water was thus at the origin of the industrial revolution in the Liri-Fibreno basin. Formerly subject to the control of monastic orders and the town corporation, the waters running in the valley were now ‘freely’ accessible as the law insisted to the public. (viz., whoever could afford the investment necessary to their use as a source of power for industrial production.)

Despite Romanelli’s representation as a ‘natural’ feature of the landscape, industrial capitalism in the Liri valley had indeed stemmed from a violent and sudden change, involving war and a revolutionary shift in law and institutions. It had been preceded by the passage of soldiers, foreign and domestic, and of bandits; it followed fights, death, and the devastation of landscape. The local space had participated in the broader scenario of the Napoleonic wars, and the result was a new imperial domain, whose main consequence in the local social life was the introduction of economic liberties. Those liberties, however, entailing the liberalization of land and water, had broad and revolutionary environmental consequences.

The importance of this shift for the economy of the area, and potentially of the nation, was theorized and celebrated by the highest authorities in the kingdom of Naples, well after the end of the French rule, and perceived as a progressive change by other contemporary observers. One eloquent
testimony to this consciousness is a ‘pictorial’ description of Isola Liri published in 1830: written as a comment to one illustration of the town, clearly dominated by the waterfalls, the text starts with an emphatic call on the wealth that rivers offer to ‘civilized nations, who, running those waters to their own benefit, take advantage of them (...) as power source for one thousand kinds of machines’. Progress, the authors say, is the very ability of drawing from river-flows a great ‘increase of industry and wealth and prosperity’. The emerging mystique of energy, grounded in the peculiar Italian landscape, is well represented in the following paragraph, where the authors depict the Liri and Fibreno rivers as ‘spreading with their humours power and energy and prosperity’ so much that it has become impossible to say if their fame is linked to their history and ‘the natural beauties of which they form such a great part’ or to ‘the maximum utility they bring to the peoples that live along their banks’.

The text continues, describing the course of the Liri down to the isle of Carnello, where, ‘running among gentle falls, it then narrows in a little pond, from where, splitting in several canals, it gives shape to very graceful small isles, joined by country bridges’. The amenity of the place deserves a minute description, which is given in these terms:

All this place looks like a very precious garden, made from art less than from nature; and its main ornament is a long, twisty, delightful boulevard, offering one of those promenades that nowadays are called romantic. Thousands of variegated and pretty sights are enjoyed from it; but no one equals that of the so called Cascatelle [Little Falls]: before passing through the canal of Le Forme, like announcing its big fall, here the Liri playfully breaks among declivous rocks, laying with peculiar irregularity in the shape of five stairs, among trees and leaved bushes. The water, hit and re-hit, rumbling, foaming and spreading in white flakes, finally merges in a large, short and regular fall.

The authors are creating here an icon of the national path to industrialization, one in which art and nature, history and progress are completely merged and cannot be distinguished. They in fact conclude:

And, as if the beauty should never, in this lucky district, be separated from the useful, those falling waters have been already moving the wheels and the cylinders of the wool factory that currently honours the ancient palace of the Duchies of Sora, which sold it, along with all their possessions, to the Government, and the Government gave to the national industry.[71]

Here we finally have some reference to those power changes that gave birth to the process of industrialization in the valley. What the authors name the ‘national industry’ is in fact the factory of Gioacchino Manna, one of the first and more powerful industrialists in the valley. The narrative of
the industrial landscape is thus aware of the acting of social forces within the local environment. It contributes, in its own way, to legitimize the current assets of power by locating it within a natural order which has been restored by politics. Rescued from feudal possession, and after the government in its wisdom has given them to the best possible use, i.e. private industry, the Liri and Fibreno can show their maximum beauty and utility, contributing to the glory of the nation.

In this sense, the industrial landscape narrative is also one of political economy, since it appropriates the language of that discipline and translates it into a broader social discourse of economic and environmental change. In 1837, for example, the Poliorama Pittoresco (a popular journal of culture in the capital) published a description of Isola Liri which is also amanifesto of economic liberalism. Inserted within a section devoted to travel reports from the provinces of the kingdom, the article starts with the usual ecstatic account of the waterfall and the landscape, depicted as a ‘sunny valley of pleasant hills’; yet, this is just a prelude to the ‘hollow and humdrum sound, which [is] the roar of the falling water and the incessant beating of fulling mills, processing paper, cloths and other works in this district’. Maybe for the first time in the century, the beauty of the waterfall is linked not so much to its rural/natural character as to its industrial/artificial one. Quoting Byron to define it as a ‘water’s hell’, the author depicts the falls as the natural backdrop for a ‘very commendable town with its extremely industrious and active population’.

The article invokes quite contradictory images of memory and change, romantic ecstasies and industrialist emphasis: in the working of the paper- and wool-mills the author sees ‘the principles of political economy, this sublime science of the 18th century, accomplishing their sacred scope’. Testimony to this is the ‘ancient tower’ (the Ducale palace), ‘not a stage for oppression anymore, but a sacred, honourable workshop, where industry and the mechanical arts concur in the paper and cloth manufactures’. He then wanders through the ‘labyrinth of stairs and rooms, under the dark and subterranean vaults where the noisy splash of the water and the monotonous fulling of the machines echoes’, and then, to enjoy the contrast, heads to the footsteps of the second fall, where the water, ‘its fury and foam lost, flows through a bed of solitary and silent sand’. There, at the end of this literary tour, Isola Liri appears to him as ‘one of the most romantic lands of our Kingdom’.

The language of political economy and the romantic sublime are mixed up, in this text, to forge a new vision of the landscape, narrating a story of progress: from feudalism to industry, from the quiet idyllic rural landscape of the past to the industrious town where capitalism can be finally celebrated within the walls of the factory. And yet, no real contradiction can be seen within this vision, beyond the aesthetic contrasts so attractive to a romantic sensibility. The beauty of nature is in its incorporation within the factory system, not in an idealized past. The most striking feature of this account is its ability to ‘naturalize’ both social and environmental changes that have occurred in
the place, by dissimulating the oppressive character of industrialization towards nature and humans. The palace, which once hosted feudal power, is now a stage for a more modern form of oppression, the one of industrial labour discipline, forcing women, men and children to follow the rhythm of that same monotonous beating of machines under water that our author finds so exciting. Furthermore, water itself has been subject to a process of increasing domination, the Boncompagni palace being only one site among tens of mechanized factories which are concentrated in a short stretch of the river basin, taking advantage of the particular availability of power.

This translation of political economy through the quiet and reassuring language of the industrial landscape narrative is demonstrated in a number of other ‘secondary’ literary texts produced in the same period. In 1845, on the occasion of a conference of Italian scientists held in Naples, the economist Matteo De Augustinis eventually led the process of transliteration to its most emphatic epitome, defining Isola Liri as ‘the Manchester of the Kingdom of the two Siciles’. His description of the valley, to the benefit of the ‘foreigner’ scientists, is a celebration of the industrial landscape in its most artificial version, and a powerful exercise in environmental mystification: to him the valley is in fact ‘a huge and whole manufacture, so many are the buildings and workshops, and many the mechanized factories’.

Noise and the sprinkling of water (...), the creaking of machines and wheels, the sight of the exploited water, which has begun of thousands colours by the variety of dyes; the encountering with endless wools and cloths, with rags, with piled up papers; the encumbrance of carts and barrows in all the streets, in all directions; everything you see around shows that you are in the valley of labour and industry, that once was of leisure, ease and studying.

Here again we have an exercise, though quite more advanced than the preceding one, in the declension of a progressive narrative of environmental and social transformation. In two extremely powerful sentences the author manages to sublimate the polluting effects of the paper mills as a sign of the increased ability to dominate nature, impressing it with the colours of the new productive system; and to sanction the definitive closing of a past leisure time and its replacing with work.

In the course of this translation of political economy ideas into the narrative of the industrial landscape, water is also subject to an increasing process of de-materialization, one that progressively transforms it into an abstract, mechanistic and atomized commodity. The Liri and Fibreno rivers are now compared to gold mines in the New World, being ‘in the scientific terms of economics’ more valuable than the latter. In the words of the German historian Ferdinand Gregorovius, travelling through Italy in the late 1850s, the paper manufacturer Carlo Lefebvre arrived in town without means, ‘by carving pure gold from the force of water, transformed the Liri riverbanks in an
Eldorado’, gaining the entitlement of Count, and leaving his son Ernesto ‘factories and millions’. The language of the industrial sublime is then employed again to describe the ‘magnificent and gracious buildings’ of the two Lefebvre papermills and the garden of his villa along the Liri riverbank: enriched with canals and resembling ‘a little Tivoli and a paradise of nymphs’\textsuperscript{74}, the garden is in fact a celebration of the industrial mastering of water in its Edenic form\textsuperscript{75}.

Probably the epitome of the industrial landscape narrative in the Liri valley, Gregorovious’ depiction is still well into its logic. The river basin is, to his eyes, an enchanted site, and the Liri ‘developing its green water amongst high poplars’ is compared, ‘quiet and sleeping’ to one Germany’s river. Its banks are ‘enchanting, melodic, sunny and dreamful’; by contrast, the town of Sora, ‘quiet and idyllic, now so modern’, is described as ‘having a good road, an industrial life, an animated traffic’\textsuperscript{76}. On his way along the Liri toward Isola, the author then discovers the presence of an industrial elite, indicated by the ‘delightful villas and their industrial workshops looking from the trees’\textsuperscript{77}. Although the traveller is mostly attracted by the beauty of the aquatic landscape, the sound of the waterfalls, the sight of the uncountable canals speedily running into the river, and the ‘marvellous vegetation typical of southern countries’, he nevertheless notes how the plentiful water which runs around Isola gives power to many manufacturers, forming ‘a robust colony of factory workers’, and thus producing a beneficent effect throughout the district. ‘Blessed by Nature, Isola will always be the first industrial town of the area’, the author concludes.

What these industrial landscapes have in common is the ideological horizon: the need to build an acceptable social landscape in which history is not cancelled, nature is not mortified but put to its right use and industry does not represent a satanic agency but a virtuous path toward the public good. What they have in common is a pastoral ideal of industrialization which beautifully harmonizes itself with the Italian physical and social landscape. A landscape in which factories and agriculture are included in the same view of one river valley, where also ruins, poetry and literary memories are encompassed, and the observer can enjoy a full contemplation of history as the passing of time from one form of civilization to the following. A landscape where there is no place for the exploitation of either labor or nature, and where not even the alienation of people from nature seems to have occurred yet. A place, finally, where the appropriation of rivers by mill owners is a wise achievement of modernity, conducive to prosperity for all.

**Conclusions.**

Now Nature, having made Italy very poor in coal, made it very rich in water. When, according to Bergès’ lyric, it became possible to replace the black coal with the white, a new horizon disclosed itself to Italy.
While industrial capitalism worked by themechanization of both labor and nature, its narrative followed the opposite direction, attempting to closing the circle between nature and technology. Through both text and visual art, it produced the naturalization of the machine. The landscape narrative was the false consciousness of industrial capitalists in the Liri valley, since it produced the discursive unity between nature and progress, namely between ‘man’ and ‘nature’, at the very same time that industry produced the complete alienation of work from nature and other ecological contradictions.

Industrial capitalism used ‘nature’ as one justification for violent and potentially revolutionary social change while also presenting itself as a mechanical implementation of political economy’s ‘natural’ laws. And yet, this water-powered, ‘organic’ industrialization had its social costs. National archives are literally full of documentation and complaints about the perception of floods as a consequence of both deforestation and the private appropriation of the river. The ecological contradictions of early industrial capitalism, with its ferocious logic of externalities, was thus clearly apparent in the district at the same time that the narrative of the industrial landscape was being invented. It produced, of course, a narrative of its own, exposing the negative effects of economic change on both the social and the natural environment. Thus, the vision of the nature-society relationship became dichotomized in two completely distinct and non-communicating narratives: one, of harmony and wealth, was destined to legitimize a discourse of economic progress that would be also socially and politically acceptable; the other, of misery and destruction, was directed to solicit the intervention of public powers in the sphere of social protection and resource implementation.

To understand this myth of the origins of Italian industrialism, a key consideration must be the energy question. Compared to the early English industrial landscape, the Italian one similarly hosts water-powered mills, but it differs in many other respects. In so far as there was no real Manchester in Italy, that one became a myth. Unlike the American locomotive, the Italian machine in the river did not look like a counterforce, resembling the violence of industry ‘as a memento of reality’, but as a longstanding part of it, perfectly inserted within the landscape as a sign of how humans can live in harmony with nature while using it: in other words, how capitalism and nature could be harmonized in the pastoral (industrial) landscape. Moreover, the machine belonged to a mill that was often a remnant of the past (a feudal palace, a former monastery), symbolizing how that harmony between work and nature included history as well. Industrialization took place in riverscapes that did not resemble satanic places. Although this was initially true for England and other industrializing nations as well, the pastoral view of industrialization in Italy was a concrete
possibility for a much longer time. Eventually, the idyllic was broken by the electric plant, with its intrusive and highly disturbing technology of concrete dams and canals, its long, monotonous power lines, its dispossessing people from the land, submerging things, completely transforming the landscape, requiring huge amounts of labor carried out in hard conditions, dealing with risky materials. That was a completely new world, and required a new narrative and poetry: that of ‘white coal’.
1. Map of the Liri and Fibreno rivers merging near Isola, 1797.
(from: D. Pistilli, *Descrizione storico-filologica delle antiche e moderne città e castelli esistenti accostò de' fiumi Liri e Fibreno*, Napoli: Stamperia Francese 1824)
2. The Liri waterfall in Isola, 1819
(from: D. Romanelli, *Viaggio da Napoli a Montecassino e ritorno*, Napoli: Stamperia del Fibreno 1819)
5 A similar definition of the firm is that given by Christine Meisner Rosen: ‘an institution of human culture, at the nexus between the economy and the natural world’. See her ‘The business-environment connection’, Environmental History 1 (2005).
12 Early attempts at drawing the attention of scholars in EH to this field were done by T. Steinberg with an article published in Environmental Review 4 (1986), entitled ‘An Environmental Perspective on the Origins of Industrialization’, and some years later by Donald Worster in his edited volume The Ends of the Earth, which included a chapter on the Industrial Revolution by E. Wilkinson. A landmark on the topic remains Steinberg’s Nature incorporated. Industrialization and the waters of New England, Cambridge (MA): Cambridge U.P. 1991. More recently, the need to connect business and environmental history has been convincingly argued by C. Meisner Rosen and C. Sellers in ‘The Nature of the Firm: Towards an Ecocultural History of Business’, Business History Review, 73 (1999). In the last few years, several studies have begun to appear with this perspective. See for example C. Meisner Rosen (ed.), ‘Doing Business History in the Age of Global Climate Change’, Enterprise and Society 2007, 8.
I owe this perspective to my encountering with Donald Worster’s work, in particular with his *Rivers of Empire. Water, Aridity and the Growth of the American West*, Oxford: Oxford U.P. 1985, which taught me to look for social domination within the domination of nature, changing forever my way of seeing the Liri valley, and the world.


Debeir-Deleage-Emery, In the Servitude of Power.

On the naturalization of capitalism see I. Wallerstein, ‘From feudalism to capitalism: transition or transitions?’, in Id., *The Capitalist World-Economy*, p. 138 ss. On the human/non-human nature false dichotomy see also N. Smith, *Uneven Development*.


Greenberg, ‘Energy’.


See chapter Eleven, p. 275 ff.

Ibid., p. 3.

For a review of Cipolla’s and later studies on this topic see for ex. P. Mathias, ‘Energy and the Industrial Revolution’, Rivista di Storia Economica 1, 2003


Row 1980; see also D.S.L. Cardwell, Consumption in Italy is in P. Malanima, in Dilemma of Technological Determinism Milano: Jaca Book 2001; S. Neri Serneri, the Liri valley (South of Italy), 1806-1916', Environment and History 13, 2007.


Fibreno ASC IB, Ponti e strade (bonifiche), 44, 183; ASC, Prefettura Prima Serie, 188, 2105; ASC, Prefettura Prima Serie, cat.

also B. Trinder, The Industrial Revolution in Europe Napoli: Dalla stamperia e cartiera del Fibreno, 1832; E. Sereni, conceduto al regno delle due Sicilie

See D. Romanelli, See D. Pistilli, See Archivio di Stato di Caserta (ASC), Intendenza Borbonica (IB), Ponti e Strade (PS): 44, 81 (1807?).


For a more detailed account see S. Barca, ‘Enclosing the river: industrialization and the property rights discourse in the Liri valley (South of Italy), 1806-1916’, Environment and History 13, 2007.

See C. Afan de Rivera, Considerazioni su i mezzi da restituire il valore proprio a’ doni che ha la natura largamente conceduto al regno delle due Sicilie, Napoli: Dalla stamperia e cartiera del Fibreno, 1832; E. Sereni, Storia del paesaggio agrario, Bari: Laterza 1862; P. Bevilacqua and M. Rossi Doria, Il territorio come risorsa. Comunità, economie istituzioni nei boschi d'Abruzzo, Napoli: Liguori 1999.


See Archivio di Stato di Caserta (ASC), Intendenza Borbonica (IB), Ponti e Strade (PS): 44, 81 (1807?).

See D. Pistilli, Descrizione storico-filologica delle antiche e moderne città e castelli esistenti accosto de’ fiumi Liri e Fibreno, Napoli: Stamperia Francesca 1824; A. Lauri, Sora, Isola Liri e dintorni, Sora 1914.

See D. Romanelli, Viaggio da Napoli a Montecassino e ritorno, Napoli: Stamperia del Fibreno 1819 (my translation).


On ‘carboniferous capitalism’ see the classic depiction in Mumford, Technics and Civilizations.


See Bardini, Senza carbone.


On ‘carboniferous capitalism’ see the classic depiction in Mumford, Technics and Civilizations.


For a more detailed account see S. Barca, ‘Enclosing the river: industrialization and the property rights discourse in the Liri valley (South of Italy), 1806-1916’, Environment and History 13, 2007.


See ASN, MI, 2° Inv., 530 and ASC, IB, Affari comunali, 15; ASN, MI, Consigli Provinciali in Terra di Lavoro, 405; ASC IB, Ponti e strade (bonifiche), 44, 183; ASC, Prefettura Prima Serie, 188, 2105; ASC, Prefettura Prima Serie, cat. XXII, 253, 2547; ASC, Prefettura Prima Serie, cat. XXII, 188, 2463; ASC, Prefettura Prima Serie, cat. XXII, 253, 2547; ASC IB, Ponti e strade (bonifiche), 44, 183.


See Archivio di Stato di Caserta (ASC), Intendenza Borbonica (IB), Ponti e Strade (PS): 44, 81 (1807?).

See D. Pistilli, Descrizione storico-filologica delle antiche e moderne città e castelli esistenti accosto de’ fiumi Liri e Fibreno, Napoli: Stamperia Fracesc 1824; A. Lauri, Sora, Isola Liri e dintorni, Sora 1914.

See D. Romanelli, Viaggio da Napoli a Monte cassino e ritorno, Napoli: Stamperia del Fibreno 1819 (my translation).


Lauri, *Sora*, p. 11.

Ibid., p. 108.

Roux e Viareggio: Torino 1905 (my translation).

On this aspect see R. Williams, ‘Ideas of Nature’.


For a beautiful narrative on these aspects of dam construction see White, *The Organic Machine*.