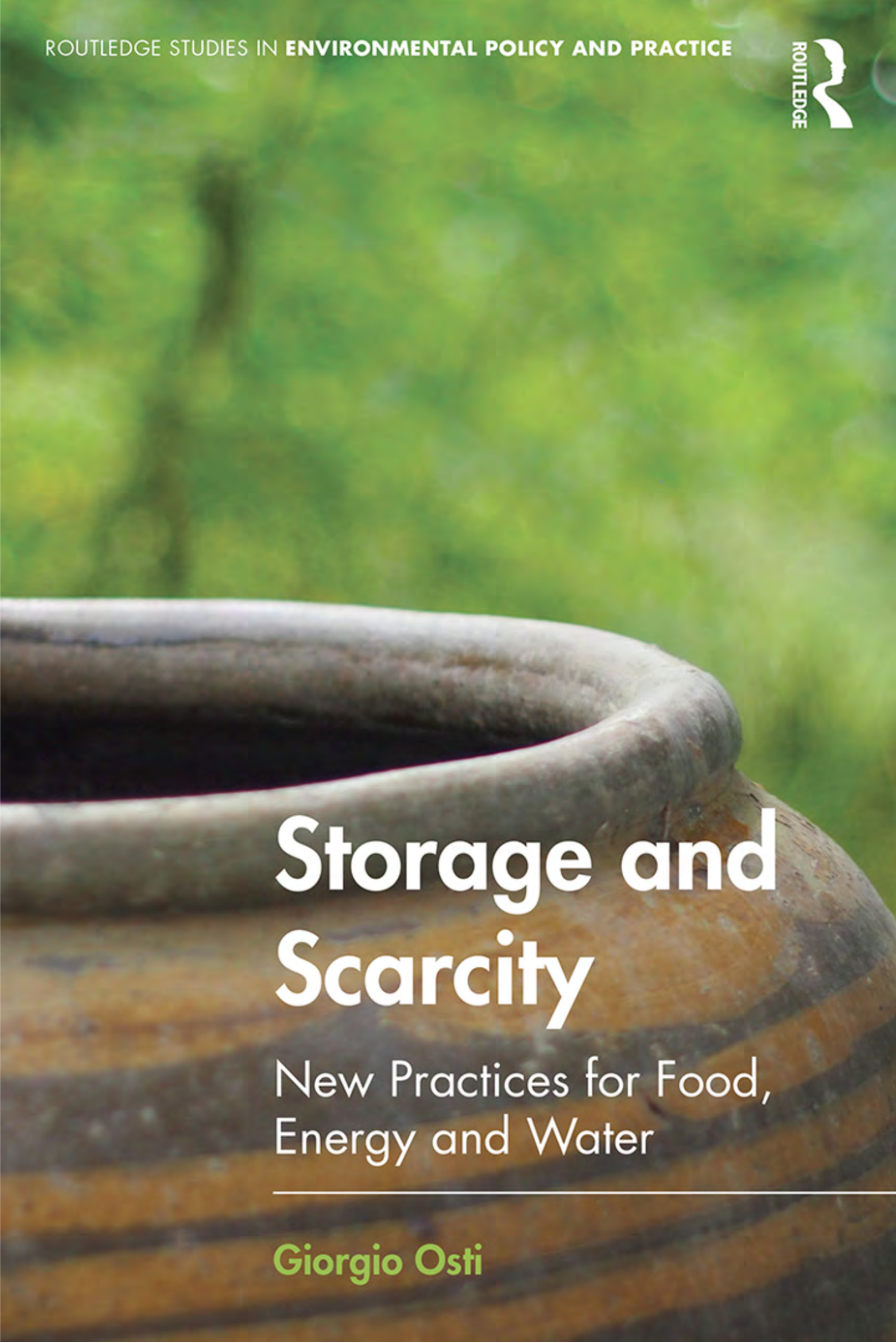

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ROUTLEDGE

Storage and Scarcity

New Practices for Food, Energy and Water

Giorgio Osti

Storage and Scarcity

In an era of abundance, at least part of humanity has stopped thinking about the future provision of basic vital resources such water, energy and food. Storage actions, with all their variants whether real or imagined, are sources of innovation in the provision and treatment of crucial resources.

This book explores the notion of water, food, energy and biodiversity storage as a response to a new era of scarcity. It analyses a variety of examples of multilevel storage policies, consumers' practices and local organisations, such as the industry and practices of food conservation, the need to stock agricultural produce, the role of artificial water basins in controlling floods and droughts and the development of batteries able to compensate for the intermittence of renewable energy sources. Storage and self-sufficiency can be achieved in many technical ways, at different territorial levels and according to different policies or philosophies. Being more a grasshopper or an ant – the two extreme positions – depends not only on the technologies available but also on different analyses of the environment and different attitudes to the future.

This book offers an environmentalist perspective that uncovers hidden or absent activities of ultramodern societies that will be useful to students of environmental sociology as well as those researching and studying at the interface of environmental studies and geography.

Giorgio Osti is a rural and environmental sociologist at the University of Trieste, Italy.

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Storage and Scarcity

New practices for food, energy and water

Giorgio Osti

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To Bruno, a friend forever

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Preface

In the era of abundance, at least part of humanity has stopped thinking about the future provision of basic vital resources: food is easily found in convenient and nearby stores; water and energy are delivered directly to the home through efficient and ramified grids. Distribution has progressed to such an extent that almost all goods can be delivered to the home through e-commerce and courier services. If anything, the problem is low income, and the consequent inability to afford the costs of such an abundant availability of goods on our own doorsteps. In developing countries and some remote areas of developed countries this abundant provision is still lacking. This is a problem not only of widespread poverty, but also of bad distribution. Energy or water grids need large initial public investment and a secure number of users. Distribution of packaged goods, such as food, has less need of a large preliminary investment, but it too requires a sufficient number of nearby customers.

Fresh meat and vegetables can be bought every morning at the market; drinkable water and calorific gas constantly arrive through pipelines. Very rarely is there a shortage or a break in provision. Energy companies usually provide good maintenance of services: a blackout may interrupt the electricity supply for some minutes, hours, or even days, but confidence that supply will resume is high, and confirmed by regular past provision. Again, in many parts of the world there is no such regular provision of vital resources. Water and electricity arrive for a few hours a day, and their quality is poor. A large proportion of humanity has no electricity connection at all. In both situations – stable and precarious provision – the objective is the same: to create a regular and ramified grid with abundant consumption, which is a political aim, or at least an aspiration. In any case, it is a model, a target, a benchmark with which to compare less fortunate situations.

But the era of abundance may be coming to an end (Barbier 2011; Brown 2012; Manders 2011). Basic resources are increasingly insufficient, for a number of reasons: intractable waste, population growth and the depletion of deposits. The problem is well known and sufficiently proven. What remains obscure is whether efficiency measures are enough, or whether a radical redistribution of goods among social classes and areas of the planet is necessary. Fiscal policies – like carbon taxes or progressive taxation – are insufficient because they negatively affect two crucial aspects of the new era of scarcity:

people's lifestyles and goods distribution systems. The former are linked to imponderable cultural variables, the latter are embedded in socio-technical networks that have arisen in the period of abundance and are resistant to any change that will reduce their provision capacity. Storage enters into both these issues: it concerns lifestyles, and it challenges the grid systems of distribution.

The extent to which authorities and communities are concerned about these two issues is not at all clear. Appeals to reduce consumption are very frequent (Humphery 2009), if nothing else because there are serious secondary effects (for example, obesity). There is less awareness of distribution methods, in particular as regards storage and provision. Before the era of abundance, storage and provision of water, food and energy were major problems that were addressed in many ways. The need for food conservation generated a wide range of techniques and habits (salted food, seasonal diets); water was collected and kept in rooftop tanks; energy was regularly provided thanks to animals and serfs maintained in passable conditions. Of course, some techniques – typically refrigeration and grid distribution – have reduced the problem of storage; but because they are energy-demanding, the problem of shortage arises again. It is better to process agriculture goods immediately, in order to avoid the costs of long-term conservation, but new risks ensue from the use of artificial preservatives. Electrical energy is probably the best example of the dilemma of modern technologies: once electricity has been produced, it is almost impossible to store, and must be consumed.

For various reasons, therefore, provision and storage systems should be placed at the centre of our attention. They require action at three levels: the household, the local community and the nation. The question is whether each level is organizing new forms of basic goods provision and storage that are able to reduce the depletion of resources and prevent shortage crises. The social analysis of these levels considers practices, policies and long-term structures like beliefs, cultures and institutions. In an uncertain scenario on the role of storage in preventing food, energy and water crises, an expressive divide is between *ants* and *grasshoppers* (in Romance languages, called *cicadas*). Some households, communities and countries are more zealous than others in organizing less costly systems for the provision and storage of vital resources. There is also a dualism in terms of stocks and flows: almost a philosophical dilemma between stubborn self-sufficiency and bonding relationships.

This philosophical dilemma has a political consequence as well. In periods of abundance, the free market allocates goods better: people are more confident in the invisible hand's ability to provide everyone with the best chances of finding a commodity, a job, a dwelling. In periods of scarcity, people are less confident in automatic mechanisms: they distrust each other, and start hoarding. External forces of regulation must intervene to calm people and distribute goods. Of course, in these situations the abuse of force is likely. In the context of penury or disasters, some communities concentrate more on prevention, storing living goods and training for civil protection.

To conclude: prevention, storage and self-sufficiency can be achieved in many technical ways, at different territorial levels, and according to different policies or philosophies. Being more a grasshopper or an ant – the two extreme positions – depends not only on the technologies available, but also on different analyses of the environment and different attitudes to the future. Hence, faith and religion are important factors linked to diverse cosmologies and eschatologies. Provision and storage systems are thus at the centre of a wide field of analysis to be explored in light of the end of the era of abundance. This is an environmentalist perspective that promises to uncover hidden or absent activities of ultramodern societies.

Most of the literature on vital resource storage varies from the scenarios analysis – with a range from complacency to catastrophism – and detailed suggestions on what to do easily drift into normative attitudes, plain advice and ingenuities. The bulk of this book lies somewhere in between: it analyses and reports many cases of family-, community- or regional-level responses to emergencies (preparedness) that already exist and are underestimated. These cases are more instructive than general analyses because they are practical, visible, easy to handle and offer a starting point for gradual improvements. In fact, it is preferable to move little by little toward a more sustainable society than to wait for an ecological re-foundation (see Foster 2010).

An example will illustrate the primacy of practices. Fresh water management will be studied at all scales of analysis, and a plurality of public and private actors considered (Norman, Cook and Cohen 2015). Those scales are interconnected by daily practices of administrators, technicians and water users' movements. It is fundamental to affirm that flood prevention has to be treated at the watershed level, but innovation occurs when a major detention basin is connected with the seasonal restoration of ditches made by land reclamation consortia and by each landowner, without forgetting the wastewater catchment basin cleaning of urban dwellers. The same goes for food, energy and biodiversity: multi-level policies have to be matched with grassroots practices.

The background literature for studying storage practices can be represented by Figure 0.1.

Increased pressures on ecosystems have provoked a depletion of vital resources, a decrease of biodiversity, and the introduction of dangerous substances in human

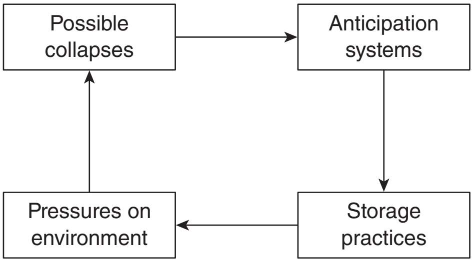

Figure 0.1 Inclusion of storage practices in a set of topics according to a circular causation model

and natural environments, with high production of intractable wastes. The *Driving Forces–Pressures–State–Impacts–Responses* (DPSIR) framework, despite its limitations (Maxim, Spangenberg and O'Connor, 2009; Carr et al. 2007; Svarstad et al. 2007), is a starting point frequently used by environmental analysts (Ness, Anderberg and Olsson 2010). The systemic nature of the DPSIR framework has been the basis for well-known predictions of the collapse of the world ecosystem since the celebrated Club of Rome study (Diamond 2005; Tainter 1990; Douthwaite and Fallon 2010; Perna 2011). The world is discovered to be more vulnerable, ecosystems less resilient, and climate events more bizarre (Waughray 2011). In this uncertain environment, some individuals (Paek et al. 2010) and some communities (Comfort 2005; Comfort et al. 2001) show the will and the capacity to pre-organize measures for dealing with possible adverse events. They develop anticipation (Poli 2010) or learning (Wenger 1998) systems that take the forms of public programmes, dedicated organizations, targeted devices, voluntary corps, daily habits: in a word, *practices* (Spaargaren 2011). Storage practices traverse all these social forms. Their novelty consists of using old forms of action typical of pre-industrial society rediscovered to face a new era of scarcity, new possible disasters, new environmental problems and – why not? – new ways to improve comfort and welfare. Often, storage is a *retro-innovation* (Stuiver 2006); but, like every human activity, it is a mix of rationality and rituals (Wynne 2013) with a gradient from the single individual attitude to the most complex organizations (Goffman 1983).

This book does not propose storage as the solution to the environmental crisis, but rather as a perspective, a point of view, that begins from that aspect of human activity which involves prevention, preparedness, accumulation, saving and subtraction from immediate consumption. This, hopefully, is the added value of this book: it highlights a new perspective on socio-environmental studies. Indeed, storage practices constitute an immense field of research. The majority of cases will come from Europe and North America. This is not to exclude emerging countries and relatively poor ones; it is a methodological choice. Western countries represent a homogenous domain of research: they face the same problems of mature overconsumption, and they have the most advanced grid systems for the delivery of items of every kind. Ideas and examples of change can and must come from these countries. With tangible changes, Western countries can negotiate reasonable world limits on natural resource extraction. Some sporadic references (especially with regard to energy storage) will be made to Asian countries. Ideal-type polarizations will not be easy, even if North America is more involved in grassroots preparedness than Europe, which seems internally diversified: the northern countries are more concerned with climate change and adaptation/mitigation measures, while the southern ones are less so. Many examples come from Italy, not only because it is the author's own country, but also because its long civilization, linked with a recent entry into the industrial era, puts storage practices in an intriguing position. In ancient but turbulent countries, such practices are very old and almost neglected, but are now urgently called on for an environmental renaissance.

The goal of the book is to answer three questions:

1 Is storage a category that is able to highlight new or neglected social phenomena?
2 Is storage an ideal type with heuristic capacities?
3 Is storage really middle-range – intermediate between the shallow and deep views of environmental issues?

Thus, the analysis will begin with storage as a purely cognitive stratagem, but the final ambition is to draw attention to useful new ways to meet the challenge of creating a more prosperous and equal society (Jackson 2009).

Chapters

Chapter 1 illustrates four points: (1) the anthropological background of storage, and the fact that it has been an archetype of human organization; (2) storage, especially food conservation, was an important source of social security for centuries until the industrial revolution; (3) the reasons why the importance of storage declined during the modernization period when societies substituted it with the instant delivery of goods through efficient networks; (4) the ways in which social sciences can foster renewed attention to the crucial nature of goods storage.

Chapter 2 focuses on food storage; it starts with a general overview of storage in terms of *food security*. The topic alternates between needs for social control and practices of self-sufficiency. A second theme is *food safety*, because of the great efforts made in every age to preserve food from diseases caused by forced periods of storage. The third theme is the rational fight against *food waste* conducted by intelligent organizations along the chain from food production to recycling. Finally, the plural world of *food symbols* is explored, in that storage is also a quasi-religious ritual.

Chapter 3 on water storage is introduced by a history of land reclamation. For centuries the diktat has been that water must drain away from land as soon as possible. Land reclamation and water flow acceleration increased usable surfaces, but created new insecurities. Slowing down the water's speed and creating detention basins are now seen as new ways to prevent floods. Water storage is also crucial for household uses (harvesting) and agricultural irrigation (farm ponds). In both cases, a mix of micro-storage structures connected to a network emerges as a good solution to the problem of scarce or too abundant water.

Chapter 4 views energy storage as a socio-technical *network*. There is a special link with the rise of renewable energy sources; their intermittence requires the complementary use of storage devices. Furthermore, energy storage entails more room for the final consumer and modifies the relationship with the grid energy supplier, usually prominent on the demand side. At first glance, energy storage is a way to sever the link with a network. However, the most intriguing situation is where there is a mix of energy self-provision, storage and exchange with a grid.

Chapter 5 explains that biodiversity conservation is the necessary complement to food, energy and water storage. It is a means to maintain entire *ecosystems* rather than single natural resources. After illustrating the main forms of biodiversity storage – natural parks, botanical gardens/animal sanctuaries and seed banks – the chapter shows the mutual advantages between human-aimed conservation and biodiversity. A mosaic or landscape ecology is finally presented as an attempt to arrive at a synthesis.

Chapter 6 summarizes the book's results in two analytical dimensions: temporal *continuity* of storage practices and *integration* of single modules. The four storage fields – food, water, energy and biodiversity – are inserted into this framework. Finally, possible storage policies are recommended.

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1 Accumulation versus networking

The terms of the storage issue

1.1 Storage, an eclipsed issue

Storage is a primordial activity. It is so ancient that it is a behaviour shared with those animal species that practise the collection of seasonal food. But storage is probably also a turning point in the history of humanity, because food and energy storage mark the capacity to create conditions of stability allowing child education and community intellectual activities beyond mere physical reproduction. The late Neolithic period was distinguished by a greater capacity to store water and food in artificial containers. Anthropologists, especially those involved in archaeology, highlight the importance of storage in the increase of societal complexity (Hendon 2000), even though they emphasize that, at the dawn of society, storage, for example of food, happened at the household level. Higher levels of storage were socially more problematic and uncertain (Bale 2012).

Thereafter, improved ability to store food, energy and water gave some communities an advantage over others: it created the conditions for a more stable and predictable environment and the development of devices useful for agriculture and for war. Good storage enabled communities protected by walls to resist enemy sieges. At the same time, it was a source of power not only between communities, but also within communities. The differential capacity to store vital resources generated asymmetries in exchanges, with some actors more able to ration the goods and then to keep sufficient reserves for long time (Halstead and O'Shea 1982). That gave rise to the phenomenon of *surplus*: in other words, the production of an amount of foodstuff that exceeded survival needs. That surplus was the basis for a differential accumulation of wealth and power within communities and among them. It is difficult to establish a distinct threshold between the satisfaction of survival needs and food surplus; however, that does not impede being able to see the extraordinary power generated by storage capacities.

Storage is a basic criterion for the analysis of human organization, an archetype of associated human beings. It has been less thematized because modernity, conceived as a centuries-old dominant culture, has sought some sort of emancipation from the urgency of storage. This has happened for three main reasons: the development of networks and exchanges, the discovery of freezing technology, and the abundance of underground resources like oil.

At a time when everything was made easily available by means of rapid transport, the storage of many items became obsolete and expensive. Markets, with their rapid and low-cost capacity to provide every kind of *article of trade*, were the antinomy mechanism of storage. There came a time in the history of industrial production when companies thought that they could work 'just in time', drastically reducing the need for warehouses (Cheng and Podolsky 1993). In ideal terms, the market and the network behind it can be seen as the opposite of storage. They can provide every good requested almost in real time; the rapidity and completeness of such provision are the features of a working market. Indeed, scholars of organized spaces tell us that it is impossible to eliminate the *friction of distance* in communication, especially for material goods (Ellegård and Vilhelmson 2004). It is impossible to provide the latter in real time. Moreover, rapid transport has a great impact on the environment, and high energy costs. Thus, the simultaneous capacity of the market is an ideal. Nevertheless, its opposition to planned and huge warehouses remains real.

A second reason for the disappearance of the storage issue was the extraordinary development of freezing machinery. Before the introduction of such technology, the provision of cold to conserve food and drugs during the warm season was very demanding. Large caves had to be dug underground in order to keep ice created and transported during the cold season. Application of the Carnot cycle – the theory at the basis of artificial refrigeration – was successful for a set of concomitant reasons: the development of artificial insulation materials and the availability of electric energy to supply compressors. Furthermore, it was useful for creating both cold and heat, even if the latter advantage was fully developed later. The capacity to create refrigerators of all sizes – from the cold store to the car fridge – and the modularity of machines which combined a freezer and a refrigerator led to ubiquitous application of this technology. Note that this was a technology that had minimal negative secondary effects (ozone-depleting gases, primarily) and was cost-effective. In conclusion, successful storage technology obscured the atavistic problem of storage. We know, moreover, that refrigerators wrought a revolution in the organization of households and consumption styles. The extreme capacity to store through cold did away with the need to cook every day and keep an entire room as a cellar.

The third reason for the eclipse of the storage issue was the great abundance of cheap energy, as has already emerged above: transport facilities and freezing technology took advantage of a great availability of energy. Coal, and later oil, brought about the miracle of providing a copious source without rivalry with other land uses. In the past, energy provided by wood and animals created competition with arable land designated for the nourishment of human beings. Underground energy resources changed this situation and created the basis of a great demographic increase, as actually happened. From our point of view, another feature of coal and oil was fruitful for the destiny of humanity: their capacity to be stored quite easily, either by modulating their extraction or keeping them in simple containers. For biomass, wind, falling water and animal-origin energy, such storage has traditionally been more problematic. The conservation of fossil energy sources, including natural gas, is easy – a feature which largely explains the success of automobiles powered by such fuels. Again, storage capacity became a reason for neglecting a key factor in the organization of human life. The taken-for-granted qualities and quantities of fossil fuels covered up the problems of their reserves and of keeping them available and their use efficient.

This brief historical reconstruction shows that storage as an *archetypical factor* of human organization has not disappeared. Rather, it has been clouded, because of the improved capacity of some societies to find temporary alternative solutions. Not by chance, less-developed societies are still contending with the age-old problem of food, energy and water storage. This observation highlights a sort of territorial divide: storage in the period of industrialization became a secondary problem for more developed countries, while it retained all its urgency in the less developed ones. But now – and this is the main point – it is becoming a problem for the entire world, facing a new era of scarcity. The use of the progressive present tense is revealing, both because the issue is not fully recognized, and because the balancing point between immediate consumption and storage is rather mobile. We must abandon the idea of a neat dichotomy between the two aspects: the direct use and the storage of water, energy and food are intertwined.

1.2 Between storage and security

Storage is the conservation of vital resources like food, energy and water in dedicated containers so that they can be consumed during periods when they are not easily available, 'an activity involving the placement of useful material resources in specific physical locations against future needs' (Hendon 2000: 42). Attention should be paid to the special spatial–temporal coordination performed by storage: *it consumes space in order to save time*. Effective storage action needs to maintain resources for basic features like performance capacity and safety over time. For example, a freezer is able to keep meat calories almost unchanged for a long period without hazards to the health and security of consumers, but it has its *ecological footprint*. Two corollaries ensue from this thinking. The first is the clear instrumental meaning of storage: it is a practical action aimed at making the provision of some goods easier and more stable over a period of time. The second corollary is that *security* comprises *safety* in the sense that storage enables access to a product over time without provoking harm for the final users. In other words, it is a regular provision of healthy or non-damaging goods.

A point not contained in Hendon's definition concerns *distribution*: who is entitled to access the stored goods? As stated above, storage is a material action with serious political consequences. The managers of storage facilities acquire a great deal of power. For this reason, storage is usually regulated by public authorities, or indeed directly managed by them (Barquín 2005: 260). The intense presence of the state since the *ancien régime* in storage activities is not only a matter of justice – to ensure that everybody has essential resources – but also a matter of social control. The assumption is thus negative: people left alone tend to overconsume or to hoard. The former activity creates waste; the latter a false state of penury. Because people are irrational, a central authority must intervene, especially in periods of turbulence (war, bad weather, riots and so on). It is now clearer why storage management is linked to security in terms not only of stable provision, but also of politics. Also clearer is its ideal-typical opposition to the market mechanism, which implies actors' freedom and rationality, and very limited government intervention (Ó Gráda and Chevet 2002). On the contrary, a central bonding political action proves to be necessary to keep the community alive and under control.

Not by chance, some storage activities are classified under *security policy*, a field more linked to the fight against social disorder and poverty. Storage in this sense has a *redistributive function*: it allows the forced collection of the good from all members of the community and its distribution to poorer ones. It works in a way very similar to the ideal-type 'redistribution' of Karl Polanyi (1944). In the case of food, the storage centre works more or less as a selective dispenser: the authorities maintain a reserve of food constantly ready for emergencies or peaks in demand. In the case of water, it typically takes the form of intervention with tankers when the grid is absent or contaminated. In fact, grids for water were built for security reasons: to allow the regular (and comfortable) delivery of drinkable water to a neighbourhood. Later, social security worries facilitated the service's access to more peripheral areas. It is interesting that the delivery of vital resources like water and energy through grids changed the intervention to ensure social security: it moved the problem to the efficient functioning of the grid and to the limited quota of people unable to pay the service pipe fee. Thus, by means of the grid, social help became more precise and at the same more bonding. As storage has been theoretically conceived as an alternative to the grid, it is noteworthy that the former assures more autonomy to poor people, while the latter centralizes social security actions and makes them more managerial.

Storage thus traverses many fields. From the simple meaning of assuring the regular provision of resources, it easily acquires political and social ones. But there is a further meaning. According to public goods theory, the provision of certain goods via the market produces sub-optimal results. Commons are a case in point. When individual rational actors can use a good without paying a price for it, because it is open-access, such actors tend to exploit it endlessly. They do not consider the reproduction time of the good. The water of a river provides an example. The landowner upstream is tempted to use as much water as possible to irrigate his field because water is free and nearby, disregarding farmers downstream. We know that solutions for this free rider problem are many and disputable (Ostrom and Ostrom 1977).

For our purposes here, it is important to show that storage is part of larger-scale solutions to problems concerning commons. A dam at the top of a river can store a great deal of water and offer security of provision for the summer. Of course, the dam needs many other matters to be agreed among downriver landowners and authorities. Stored water in any case has a greater economic value than the river water itself, because it can be used according to the desires of producers and consumers. In other words, the main economic actors find the storage system to be a