Chapter

Perspective Chapter: Water, Natural Disasters and Socio-Economic Development in the Early 21st Century

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Abstract

This chapter investigates the complex relationship between socio-economic development and environmental sustainability by focusing on one of the most vital natural phenomena: the water cycle. Considering the current public awareness of climate change and the growing number of natural disasters, focusing on this topic provides a better understanding of weaknesses and bottlenecks that 21st-century society faces daily. This work presents three case studies, different from each other but conceptually interconnected. The first case concerns the situation of lakes in the world, whose water in many cases is at risk of disappearing. In the second instance, we present the growing socio-economic risks generated by floods. Nowadays, floods play a fundamental role in influencing socio-economic development due to the dislocation of economic activities in Southeast Asian countries. Finally, we discuss desertification affecting large areas of the African continent. One aspect of great interest is the *Grande Muraille Verte* project promoted by numerous countries. Reforestation of large arid areas is the main issue; the attempt is to support local communities to implement agricultural and livestock activities. Socio-economic and environmental sustainability and resilience are the main challenges that countries, regions and local communities are facing.

Keywords: natural disasters, water, lakes, cities, industry, floods, Asia, desertification, Africa, reforestation, agence panafricaine de la grande muraille verte

1. Introduction

The seventies and eighties of the 20th century marked a turning point for the environment and environmentalism [1]. A chain of dramatic events brought the threats looming over the future of natural resources and, more generally, the planet's ability to absorb the negative consequences of industrial development to the public attention. The hundreds of deaths caused by the gas spill at a Union Carbide factory in the Indian state of Madhya Pradesh (1984), the fears triggered by the accident at the Chernobyl nuclear power plant (1986), or the coasts of Alaska covered by a dense one tar coat after the sinking of the oil tanker Exxon Valdez (1989) are just some of the tragic news that marked, at the end of the last century, the progressive materialization of the challenges connected to the fragile

medium-environmental balance that risked breaking forever. The images of the disasters were added to the constant references from the scientific world on the consequences deriving from the greenhouse effect and the lack of alternatives to the rapid depletion of energy sources of fossil origin [2]. As it is apparent from studies conducted on resilience and ecological footprint, 1970 appears like the time when economic growth became less sustainable. But the signs for the advanced economies to find themselves at a crossroads were many and came from a plurality of directions. In addition to a continuous succession of tragic events to be punctually placed in different places on the planet, the economic system born after the Second World War proved inadequate to deal convincingly with massive evolutionary processes, such as the demographic growth of developing countries, the formation of immense metropolitan areas or the global pressures resulting from the overrun of emerging economic powers. In the context of greater global sensitivity toward less invasive [3] forms of progress, international organizations and economically more developed countries, urged by an increasingly sensitive public opinion toward certain behaviors of exploitation of natural resources without limits and rules, were obliged to place ecological issues at the center of an articulated reflection on economic development models aimed at correcting the distortions deriving from pollution and land occupation, to recall only two points from a long list of issues [4]. In 1985, 28 countries signed the convention for the protection of the ozone layer and 2 years later, in 1987, an agreement was reached in Montreal on substances harmful to the ozone layer. Summits, these and others, which paved the way for the Kyoto Convention (1997) on climate change. At the same time and together with the succession of international discussions on apparently technical matters, at a more general level, in the last two decades of the last century, the concept of sustainable development [5] began to make its way. While the urgent need to limit the damage accumulated over half a century of unstoppable industrialization was evident, at the same time it was equally essential to arrive at the formulation of a different growth paradigm based, no longer on indiscriminate consumption but attentive to the quality of people's lives, energetic diversification, the use of advanced technologies, cooperation between countries [6–8]. Thus the conditions for the holding, in 1992, of the United Nations conference in Rio di Janeiro (Rio Earth Summit 1992) on the environment and development matured, hinged on the imperative to combat environmental degradation as a multiplier factor of poverty and social inequalities [9]. In the background was now placed the awareness that environmental issues had to be addressed in the broader and more intertwined framework of the escape from hunger and underdevelopment [10]. Despite the setbacks, the work program defined in Brazil was resumed 10 years later in Johannesburg to reach the conferences on climate change in Lima (2014) and Paris (2015) at the beginning of the 21st century. Moving from general to sectoral approaches, it is worth remembering that the first world conference on oceans will be held in New York between 5 and 9 June 2017, an event to be placed in the context of the 2030 Agenda for sustainable development. In fact, the oceans contain 97% of the planet's water which contributes 86% to rainwater, thanks to evaporation. On the subject of maritime waters, the irreplaceable role of oceanic masses in biodiversity and economic activities related to fishing (about three trillion dollars) should also be mentioned. The United Nations appointment was indeed preceded by a few days after the announcement by the President of the United States, Donald Trump, of the country's withdrawal from the Paris Convention. Undoubtedly, the American decision, justified in terms of defending employment levels and relaunching the national economy, not only constitutes a hard blow in the search for solutions that comply with climate needs but at the same time makes the thesis of growth deriving from traditional industrialization processes. Although it is premature to speak of

consequences and concrete effects, the decision of the republican administration has actually moved the hands of world environmental policies back by 20 years. Despite the presence of positions likely to undergo radical changes and although the branched environmental reality cannot be considered fully consolidated, subject to continuous formulations of compromise to smooth out the contrasting positions, the "rebirth of nature" [11] has followed other paths. From this point of view, this is the rather evident case of the rediscovery, always at the end of the 20th century, of the landscape to the point of making the environment and the landscape two terms that are sometimes interchangeable. It goes without saying that this is obviously an excessive schematization but at the same time that in post-industrial society the defense of the environment became a reason for political commitment, the landscape was assigned a precise qualifying value of socio-economic contexts [12]. In other words, the request made to politics and the economy to commit itself to avoid indiscriminate consumption of natural resources did not respond solely to the need to favor responsible production processes, this need also arose from considering nature a determining factor in the formation of a common cultural heritage. Through the UNESCO Convention of 1972 and subsequently the European Convention of 2000, the landscape came to occupy a "central, if not indispensable, position in philosophy and geography, without forgetting its increasingly marked place within sociological, anthropological and archaeological theories" [13] the presence of the landscape as an economic stimulus. In the decades that marked the transition from the 20th century to the new century, the landscape, in its dimension of abstraction of nature, became perceived in its immaterial dimension as an asset to be preserved and enhanced. Certainly, it would be illusory to carry out a detailed examination of all the aspects (positive as well as negative) of a story whose plot sees the dense intertwining of political, cultural, economic and social components to the point of making the environment-landscape combination one of the characterizing traits of the first steps of the 21st century. Changes that involved (it could not be differently) the social sciences called to confront a society that found in nature, whether it was declined in terms of environment, territory or landscape, anchor points capable of filling the void left by nature, disappeared from the myth of factory work. And so [14], have evolved from being the background on which to project human action to having a leading role by feeding on socio-historical study plan a multidisciplinary reflection on the forms and implications of the composite interdependence between man and the environment. In this regard, some initiatives help to better mark the path taken: the American Society for Environmental History was established in 1976, while in 1999 it was the occasion of the European Society for Environmental History, both associations with their own journals (Environmental History and Environment and History) [15]. Instead, J. Donald Hughes goes so far as to say that it is "a type of history that is interested in human beings to the extent that they have lived, worked and thought in relationship with the rest of nature, through the changes that have taken place over time". The human species is part of nature, but compared to most other species we have brought about far-reaching changes in the conditions of the earth, sea, air and the plants and other animals that share the planet with us [16]. In this specific field of scientific research with a strong social commitment, Italy has not been left behind, on the contrary, it has a large number of authors to its credit who have been able to intercept the stimuli coming from the environmental side. It is first of all worth remembering the far-sighted views of Alberto Caracciolo who, in 1988, wrote The Environment as History [17], an agile and concise notebook that represented the beginning of a fertile line of studies. In fact, over the course of 30 years, the studies conducted by Piero Bevilacqua, Roberta Morelli, Paolo Malanima, Guido Alfani, Luca Mocarelli, Renato Sansa, Ercole Sori, Simone Neri Serneri, Salvatore Adorno, Marco Armiero,

to make a quick and incomplete list of names, have allowed the formation of a rich and varied heritage of studies on forests, energy, common goods, waste, reclamation, landscape, mountains and, more generally, on the territory, the environment and, as far as we are concerned, on water [18–22]. Paying attention to the life cycle of water, offers the opportunity to grasp how much the society of the early 21st century is forced to deal with a context full of fragility and contradictions that raise numerous questions that are not easy and immediate to answer. In one case, the evolution of large lakes is briefly sketched given the fact that some of them are at risk of disappearance or radical downsizing as lake water has become too precious a commodity. The second focus aims to highlight the bottlenecks that can be generated worldwide following the dislocation of industries and production processes in areas of the planet at frequent risk of floods and natural disasters. From this point of view, it is emblematic of what happens in the countries of Southeast Asia. In this case, the challenge will be to reconcile the economic well-being deriving from industrial employment with the needs imposed by the government of potentially destructive environmental phenomena. The third case study focuses on the African regions most affected by desertification and the impoverishment of agricultural land due to lack of water. In this scenario, water is a scarce resource on which the future of thousands of people depends. In an attempt to stop the advance of the desert and to allow the recovery of soil fertility, the ambitious project of the Grande Muraille Verte was born, an initiative that involves a large number of countries and their main objective is to complete the reforestation of the territories threatened by the desert. An initiative that constitutes an eloquent synthesis of some of the major environmental challenges to be faced without too much delay.

2. Lakes: Fragile environmental ecosystems

Although Adam Smith used water to establish a concrete distinction between "use value" and "exchange value" [23], in actuality this disparity appears very blurred as water has been transformed into a good that has a precise and high economic value [24]. The issues related to the use of white gold are so complex and at the same time so symbolic [25] that we are now openly talking about a new sensitivity and culture of water [26]. For this reason, it does not go unnoticed that water occupies a prominent place among the many and very diversified approaches taken, now on the theoretical level of the programs, now on the operational level of the achievements. The reason is simple enough to understand. Water, among all the elements that contribute to defining a given ecosystem, is the one that contributes to the greatest extent to measure the health of the social conditions that regulate the interaction between man and the environmental context. Over time, different ways of using water have followed, which have shaped the water system to the new needs and requirements of an evolving society. Water must not only be placed at the base of any sustainable [27–31] development project but according to the latest works of the WWAP (United Nations World Water Assessment Program), the production of energy and the creation of conditions for guarantee access to income for the populations who live in the most disadvantaged areas of the planet [32, 33]. Today, when dealing with the issue of water and available water resources, we usually resort to large numbers: 12% of the planet's population has access to the world's water resources and wastes 85% [34]. The data available are many others even if they have in common the fact that they highlight that the distribution of the good water presents strong regional and social imbalances. Of the 1400 million cubic kilometers of water available, freshwater scarcely accounts for 2.5%, and of these, an even smaller amount (0.3%) is made up of the waters present in rivers, lakes and the

atmosphere. The remainder is found in glaciers and underground. If they now look at the dominant situation on the employment front, the distortions do not tend to disappear, on the contrary, they appear even more marked as agriculture grabs 70% of the world's water resources, leaving 20% for industry and 8% for the domestic consumption. For a correct understanding of such percentages, it must be said that irrigated agriculture guarantees 40% of world food. That is, compared to the water consumed, the contribution in terms of food is much lower. The data just mentioned clearly signal the inseparable link between water and food production. However, in recent times, precisely in the agricultural sector, we are witnessing processes that generate many critical issues. It is the case, for example, to encourage the use of biofuels whose manufactured from plants, such as sugar cane or corn, requires the availability of large water resources. In this way, an evident clash of interests is created between the enhancement of renewable fuels and the exploitation of a scarce and precious commodity such as water, above all in those regions of the world where the phenomenon of land grabbing is modifying traditional agro-pastoral systems, disruptive processes from which conflicts and mass migratory movements [35] then derive. If we add to all this that the impetuous growth of the urban population causes an increase in the demand for food, we understand the terms of a dangerous accumulation of clashes of interests that are played out by discharging the social and political tensions on access to natural resources, in first and foremost the water ones are the most fragile and vulnerable. Suffice it to say that in the course of the 20th century, withdrawals of freshwater have increased on a global scale by almost seven times [36]. But in terms of perception, not all water reserves are the same. In recent times, in the wake of the blue revolution [37, 38], the interest of the scientific community but also of international organizations has essentially turned to issues related to running waters [39]. The figure of the countries crossed by the major river courses in the world (the Nile, Tigris, Euphrates, Indo or Mekong), the immense volume of water resources available should be at the basis of basin economic development projects. Instead, and in the absence of mutual cooperation projects, the construction of artificial dams for reasons that are now hydroelectric and now irrigated often leads to political and military tensions between countries [40, 41], each committed to defending its specific national interests along the river [42]. Conversely, for lakes, except the literature on pollution, there is a lower volume of reflections, perhaps because the pools of water are more difficult to integrate into industrialization processes [43]. Hence many lakes, in the absence of specific environmental protection policies, can be transformed into simple deposits of industrial and urban residues, if not into useless spaces to be suppressed. In fact, and confirming how much the history of lakes has to deal with a very simple past, it should not be forgotten that they, as part of the broader category of stagnant and marshy waters, were even seen as a real danger for the people's health as a source of diseases and infections [44–46]. Better, as evidenced by the long history of Italian land reclamation but not only [47], proceeds to their suppression by transforming the soils of the freed lakes into new territories suitable for the practice of agriculture. But in recent years, attention to surface waters has become increasingly relevant, identified as one of the most important natural values of societies [48]. In this renewed interest, lakes become significant resources for territorial socio-economic development. They represent natural ecological places that allow the approach of nature in urban contexts, break the monotony of the landscape, diversifying it and becoming part of the identifying symbolism of resident citizens and therefore an identity resource. They are also a social resource for the recreational, tourist and aggregation possibilities made possible by the presence of a network of services that improve their use. The new possibilities of using water, which involve not only protection and conservation but also

enhancement and promotion, still represent a form of anthropic influence on the lake that must be sustainably managed and governed [49]. In the world, there are in total 253 large lakes distributed mainly between the American, African and Asian continents [50]. In general, the waters of the lakes do not know a good state of health, threatened by the disappearance and by suffering strong pollution processes [51]. In fact, and to start with the most emblematic case, the satellite images taken between 2000 and 2006 document the enormous natural disaster that took place with the disappearance of the Aral Sea, almost to the point of decreeing the complete drying up of what had been one of the largest deposits of freshwater of the world. Of the original 68,000 square km, just over 10% remain, the remainder is now a lifeless deserted sandy land. The reasons for what happened are widely documented: at the time of the Soviet Union and to allow the irrigation of the cotton fields of Uzbekistan, the two main rivers that fed the lake were diverted, for this reason, condemned to remain without emissaries. The consequences are there for all to see, immortalized by dozens of images of old rusty boats buried by the desert sands, in the places where until a few decades ago there was a fishing port at the center of a thriving regional economy. Another sensational case of how the distortion in the allocation of flowing waters [52]caused the loss of another important freshwater reserve is located in the Andean plateau between Peru and Bolivia. We are talking about Lake Poopò which has undergone an irremediable shrinking process [53]. Although, in this case, it is a natural phenomenon that repeats itself with a certain periodicity, experts observe the phenomenon with concern as the disappearance of water could depend not so much on natural causes as being the direct consequence of its systematic use of the waters of regional rivers in gold and silver mining operations. While waiting to understand if we are in the presence of a transitory situation or if all this represents a definitive environmental loss to be attributed even in this circumstance to a precise choice of economic policy, the fact is the end of the economic activities of indigenous communities, dependent on always from the practice of fishing. As in the case of the Aral Sea, the Poopò lake has ceased to be a reservoir of aquatic biodiversity. Without leaving the Andean area, not even the situation of the other large lake in the region, the Titicaca, can be said to be too encouraging. As is known, lakes tend to accumulate substances that prevent the reproduction of flora, which is essential for the life and reproduction of fish species. In the case of Titicaca, the problems derive from the increasing levels of water pollution. If, on the other hand, we move further north along the American continent, what about Lake Nicaragua through which the third channel between the Pacific and Atlantic oceans should pass. To realize the mammoth project behind which we can see the interests of China, eager to have its own trade route through the Central American isthmus, the Nicaraguan lake would in fact become not only the corridor through which giant container ships pass but also an immense reserve of water to be used in the construction of the impressive engineering work with evident negative repercussions on the fragile environmental balance of the region [54]. Changing geographic scenery, not even the biblical Lake of Galilee or Tiberias appears immune from suffering serious problems of environmental deterioration. If the Gospels hand down that Jesus performed the miracle of filling the nets of the apostles with an extraordinary quantity of fish, today the picture appears instead radically changed. Given the real risk of the Tiberias losing its fish fauna, the government of Israel has banned the practice of fishing by launching an urgent repopulation program. On the other hand, in the African continent, Lake Victoria presents just as many management complexities, especially as regards the practice of fishing, which has always been the main resource of the local population [55]. It must be said, however, that in recent times tourism has been growing and has begun to affect the creation of a different image of Lake Victoria, as is the case with the

Titicaca. In this way and responding to the precise needs of the international leisure industry, which always needs to have new destinations available to the general public, the traditional fishing economy could be replaced by other logic. The presence of water, the movement ensured by navigation, the possibility of fishing and other recreational activities are in fact facilitating an anthropization of the lake areas which is allowing the lakes to become a real tourist attraction. And it is precisely the increase in demand for tourist services in lake destinations and the rapid evolution of travel that have led to the exploitation of the lake environments. The lake attracts tourists who identify it as the main reason for their vacation, but also those who experience it as part of a tourist experience that finds the main motivation for moving in other interests. The lakes thus become not only an attraction in themselves but also an attractive setting for the enjoyment of free time. This is how the chapter measuring the positive and negative effects deriving from the transformation of lakes from spaces inserted in specific agricultural economies into places of leisure and entertainment is outlined.

3. Floods and industrial relocation to Asian cities

As emerges from this work, since the end of the last century environmental issues, in alternating phases, have occupied a prominent place in the contemporary public debate. If in the 1970s the risk of rapid depletion of fossil energy sources began to be pointed out, during the 1980s a series of terrible disasters accelerated awareness of the fragile balance between quality of life and economic development resulting from indiscriminate exploitation of natural resources. However, and despite the widespread sharing of positions over the course of almost half a century, the environmental question still remains an area of lively political discussion that has fueled divergent positions among those who interpret environmental issues in terms of opportunities for the qualitative growth of society and those who argue that environmental protection, to be subordinated to other priorities, must not be a brake on growth. We can see this divergence of positions still at the beginning of the 21st century when the European Union Commission launched the European Green Deal [56] while other important economic systems remain anchored to more traditional scenarios. If we were to borrow the theories of the American economist W.W. Rostow, to summarize the current situation, it could be said that we are witnessing the difficult harmonization between mature economies engaged in the search for new stimuli and emerging economies in full transition or imminent take-off. Faced with such a picture, dominated by extremely fluctuating international balances, the positions taken on the consequences of climate change often end up serving as a simple background to old disputes. If on the one hand, the environmental reasons continue to find many obstacles to become the reference point for a different approach to the concept of economic development, on the other, the geography of the dislocation of industrial plants, which took shape in the decades around the turn of the 21st century, has shifted the interest on the risks deriving from the transfer of entire production chains to areas of the planet liable to suffer the consequences of frequent and devastating natural disasters. The terms of an interesting intertwining of dynamics are defined almost contradictory because, if at the same time the delocalization of industrial work can prove to be a valid tool for improving the living conditions of the population of the poorest countries, at the same time, it is equally evident that this choice that has actually ended up favoring geographic areas that are particularly vulnerable from an environmental point of view. Within the context of the dynamics of the global economy, the terms of two apparently opposite phenomena are defined to be highlighted by following different research paths. As

is well known, natural disasters contribute decisively to increasing poverty and the precariousness of people's lives, especially in the poorest countries. Indeed, the correlation between poverty and natural disasters [57] appears undoubted. According to the World Bank's calculations, enhancing the resilience of the poorest communities would produce resource savings of about 100 billion dollars a year, reducing the impact of natural disasters on the well-being of citizens by 20%. Communities less endowed with resources and solid institutional systems have a noticeably less responsive capacity. Examples would be innumerable. In these cases, the responses are much less effective, with serious consequences also on the level of education and health of the affected communities. By fueling a negative circle, poverty deepens, even more, favoring social insecurity, mass immigration and in many circumstances, even armed conflicts. In the early 21st century alone, the cost of damage caused by "natural disasters" amounted to nearly $ 2500 billion, but UN calculations indicate an underestimate of the order of 50%. If we look at the statistics referring to over a century of natural disasters (1900–2015) the data collected are eloquent: 8 million deaths and damages for 7 trillion US dollars [58]. It is true that the most reliable estimates begin only after 1950. Also with regard to the trend of the victims, the evidence obtained demonstrates a plurality of aspects to be taken into consideration because, on the one hand, the natural disasters identified experience a growing trend starting from "last twenty years of the 1900s, the confirmed victims seem to have undergone a radical downsizing from 200,000 people who died in 1970 to less than 30,000 in 2011". Positive evolution, resulting from the application of increasingly effective safety and prevention systems as well as on the quality of buildings. It is no coincidence that the problems of "holding on to places" of communities affected by natural disasters are becoming one of the basic guidelines that guide national and international intervention strategies. That the issue is of considerable importance is shown by the attention paid to the issue by the main insurance companies, involved, not surprisingly, in monitoring and providing continuous feedback. To refer to the data provided by the Munich Re insurance company, between 1980 and 2018 there were 18,169 natural events of catastrophic significance worldwide, for a total of 1.7 million deaths. In 2017 alone, losses amounted to $ 250 billion. In consideration of the nature of the event, hydrological events (floods) are placed first, amounting to 7350 of which 3501 in Asia (47.6%). Then come the meteorological catastrophes (snow, typhoons) with 7125, also in this case there is a sad record of the Asian countries (2085, 30%). Third, drought and heat appear (2111) and lastly earthquakes (1584). Divided by geographic areas of the planet, the greatest criticalities tend to be concentrated above all in Asia (**Table 1**).

To make a quick reference to the last year, for which we have data, 850 natural events of catastrophic significance occurred in 2018 [59]. Geophysical events such as earthquakes [60], tsunamis and volcanic eruptions accounted for 5% of the total.

Disaster	North America	South America	Europe	Africa	Asia	Oceania	Total
Geophysics	198	135	148	108	908	92	1.584
Meteorological	2.256	263	1.443	546	2.089	545	7.125
Hydrological	875	738	890	1.059	3.501	298	7.350
Climatic	560	135	466	269	544	142	2.111
Total	3.888	1.271	2.944	1.982	7.041	1.077	18.169

Source: https://natcatservice.munichre.com/

Table 1.
Number of natural disasters (1980-2018).

Storms reached 42%, floods and landslides 46%, while the remaining 7% correspond to very heterogeneous categories such as desertification or fires. Divided by continents, the sad record of Asia (43%) is confirmed, followed by North America (20%), Europe (14%) and Africa (13%). According to the Food and Agriculture Organization (FAO), natural disasters caused a total of 96 billion dollars in losses to agriculture in developing countries between 2005 and 2015 [61]. This is a huge amount that is practically impossible to recover as, to a large extent, it affects economic systems that are too backward. Half of the losses are located in Asia due to the combination of long periods of drought and torrential rains. If we add to the damage that occurred in the Asian continent those that occurred in Africa and Latin America, the drought alone caused losses of about 30 billion. As can be seen from abundant statistical material, worldwide natural disasters are becoming less deadly but more expensive for the economy. This is what has been observed since the end of the 1980s in a country like Thailand where the growing dislocation of Japanese car factories (Honda, Toyota) [62, 63] and photographic material (Canon, Nikon, Sony) in the alluvial valleys around the capital Bangkok ended up causing the occupation of the spaces traditionally used for rice fields. The most evident negative consequences of this dynamic occurred in 2011 when due to the flooding of highly specialized industrial plants, the country suffered losses estimated at 40 billion dollars and the world car market experienced a significant slowdown. The case of Thailand, to be taken as an example, should be placed in a more general context since trends such as urban development and economic growth in developing countries increase the likelihood of natural disasters with a great economic impact. It is estimated that in 2070, seven of the 10 largest urban centers in the world exposed to the risk of flooding will be located in developing countries. In fact, the effects of the divergence between city growth and losses (human and material) in the event of natural disasters are captured. If on the one hand, the enlargement of the urbanized part reduces natural defenses against disasters, on the other hand, the cities themselves contribute to the socio-economic progress of the poorest social strata. Therefore, and as part of a very articulated debate, in certain areas of the planet [64], the challenge of the century is to make compatible the measures to contain the impact of disasters without losing the role of cities as a vehicle for improving the conditions of life of the population of the least developed countries.

4. Desertification in Africa: programs for the recovery of environmental balances

According to the United Nations, more than 25% of the planet's cultivated land is affected by the advance of the desert, "jeopardizing the livelihoods of more than a billion people" [65]. Every year about 10–12 million hectares of land are hit by degradation processes. The phenomenon is particularly serious in Africa, Asia, South America and the Caribbean, but it also affects the United States, Australia and Mediterranean Europe [66]. About 265 million people are affected by food shortages in sub-Saharan Africa alone. Due to desertification [67] Nigeria, the most populous nation on the African continent, with about 190 million inhabitants, loses every year over 350,000 hectares of pastures and arable land. The majority of migrations that move from these regions toward Europe are produced by the fertility crisis of arable or pasture land. The African continent's land, the fertile one able to generating life, has become a scarce resource, and therefore, highly attractive. Squeezed in the grip between demographic expansion, with the consequent increase in the demand for food, and a decrease in its actual availability, as a result of the processes of desertification and other forms of degradation or definitive

removal from agricultural use and therefore from the production of food and of numerous other commodities (from textile fibers to oilseeds, to timber), the land in the African continent, the fertile one capable of generating life, has become a scarce resource, and therefore highly palatable. And it is also from here that land grabbing originates, the impressive and disturbing race of states and multinationals to grab arable land, generally in poor or developing countries. A phenomenon, land grabbing, already known, that episodically accompanied the history of colonialism in the 19th and early 20th centuries, but that in the last 15 years has taken on completely new and absolutely extraordinary peculiarities and dimensions. Also becoming the same cause of expulsions of a large number of peasants and entire village communities and at the same time, due to the adoption of an intensive and monocultural agricultural use, of immense processes of degradation and often the definitive death of the land itself. According to some estimates, between 2006 and 2011 alone, as many as 200 million hectares of fertile land were acquired by private companies and foreign governments mainly concentrated in Africa but spread over a very large area, from Latin America to several Asian countries. But what are the causes of desertification, one of the most worrying phenomena of our time and fraught with catastrophic consequences?. It is perhaps worth noting that the term desertification does not refer only to the enlargement of the perimeter of the desert, of an existing ecological reality that expands, engulfing neighboring areas previously cultivated. This is also a real and worrying phenomenon, which is becoming evident almost everywhere, from the Sahara to the Gobi desert in China, generating other impressive theories or processions of refugees or environmental migrants. More specifically, it indicates the "progressive degradation" of the characteristics of arable soils in their various aspects - mechanical, physical, chemical and biological - as a result of the interactions between natural factors and human activities. As the definition adopted by the United Nations Convention to Combat Desertification [68, 69]-, signed in Paris on October 14, 1994 - states, "the term desertification designates the degradation of land in arid areas, semi-arid and dry sub-humid caused by various factors, including climatic variations and anthropic activities". Natural factors, such as climate and human activities, favored or not in their negative effects by the environmental peculiarities of individual territorial contexts, are therefore at the origin of the progressive degradation of soil fertility. Although climatic conditions are not independent of human life, since one of the causes of their change is, as is now known, precisely human activity. And it is in fact the latter, with its concrete forms of activation of the earth resource and their intertwining with local environmental specificities, the main origin of soil erosion processes. In many regions of the intertropical belt of the Earth, the area of the greatest concentration of desertification phenomena, alongside the immense deforestation that has radically changed the pre-existing environmental frameworks and the industrial and monoculture agricultural use that has accompanied and accompanies the land grabbing, one of the main causes of soil erosion lies in the increasing intensification of the levels of land exploitation, determined by the rapid and sustained demographic growth that has unfolded since the second half of the 20th century. In fact, as already mentioned, it took concrete form in the lengthening of the years of cultivation, until it was almost continuous, and in the consequent reduction, sometimes up to the almost complete abolition, of fallow, the practice of regeneration or reconstitution of the fertility of those soils, generally not very deep and in need of the continuous supply of organic matter. In Africa, and in particular in the central regions, with a rurality index that still at the end of the first decade of this century was around 60% of the total population, the demographic increase, estimated between 1950 and 2010 and beyond 364%, against a world average of about 174%, has resulted in a drastic reduction in the "amount of land that each

family can cultivate". Over 40 years, between 1970 and 2014, the availability of arable land in sub-Saharan Africa decreased, in relation to the rural population, from an average per capita extension of about 4 hectares to 1517. This has determined a twofold but convergent consequence: on the one hand, the decrease, in the individual conduits, of grazing areas, with the consequent decrease in livestock and the availability of manure for the reintegration of soil fertility; on the other hand, a strong intensification of the exploitation of the soils themselves through the extension of the cultivation period and the drastic limitation of the millennial and regenerative practice of fallow. "For a large part of African farmers - reports one of the world's leading experts in agricultural regeneration, Roland Bunch - the periods of rest of the earth have gone from 15 years in the seventies to about ten in the eighties and just 5 in the nineties. Today, most of them can keep their land fallow for 2 years at the most, and many cannot even afford to do so ". In a pedological context already marked by vulnerability, characterized by "une faible fertité [70] " the outcome, also supported by climate change which has massively altered the rainfall regimes and little or not at all mitigated by the very limited use of mineral fertilizers, is the drastic and rapid reduction, to the point of total exhaustion, of their weak fertility and their productive capacity. It is estimated that since 1970 the Sahel region has lost about 12 million hectares of land equivalent to about 20 million tons of cereals. If, in consideration of what has been said up to this point, in crowded Asian cities the containment of the economic and social damage deriving from natural disasters, earthquakes and floods, first of all, calls into question the progress made in the construction of buildings and in the planning of urban spaces, in the case of the countries along the vast sub-Saharan area, attention shifts to the measures to be taken to curb the progressive desertification that the region is experiencing. Considering what has been said previously on the semantic value that one wants to give to the word, it does not matter if the desertification of the sub-Saharan region is to be understood in terms of the advance of the desert sands or of increasingly less fertile soils due to the lack of adequate regeneration of the organic soil properties. Indeed in many countries, both phenomena go hand in hand, pushing indigenous communities that live off the practice of agriculture and pastoralism to abandon traditional economic occupations to swell the ranks of the massed suburbs of the cities of the continent or to undertake the route of emigration towards the "Europe". Already in 1952, the English botanist Richard St. [71, 72] Baker raised the dangers caused by the advance of the desert by promoting the idea of building an immense green barrier. The idea was revived in 2002 at the summit of N 'Djamena, the capital of Chad, with the creation of the Agence Panafricaine de la Grande Muraille [73] (APGMV) or Great Green Wall led by the African Union [74, 75]. As yet, the countries involved in the "great green wall" project (almost 8000 kilometers between Djibouti and Senegal) are more than 20. Notoriously, the Sahel is one of the poorest regions in the world where climate change contributes to creating a permanent state dominated by factors that favor drought and food shortages as well as the proliferation of conflicts and mass migration, a picture that has become even more dramatic since in recent years the precarious living conditions of the population have favored the consolidation of fundamentalist terrorist groups. Three billion US dollars have been allocated for the period 2016-2020 and one of the priority objectives to be achieved is to achieve land management that will "inverser le processus actuel de dégradation des terres en vue d'atteindre la neutralité en termes de dégradation des terres. La sensibilisation et l'encadrement des populations aux meilleures techniques et pratiques de gestion durable des ressources naturelles et des terres et des systèmes de production ruraux les plus adaptés au terroir" [76]. Naturally the "Great Green Wall" initiative raises many diplomatic, legal, institutional and, last but not least, social implications that in the coming

decades may have concrete reflections on the future of an important part of the African continent. In this case, however, what we want to emphasize is that this initiative is evidence of the actual capacity of contemporary society to know how to adopt strategies that can respond to the challenges imposed by climate and environmental issues. In an attempt to grasp the ecological impact that the cooperation program underlying the APGMV has, just think that in this vast sector of the African continent the fate of millions of people depends solely on the availability of land which, now for agriculture, now for breeding, it is the only source of sustenance available. In few other parts of the planet, people's survival is so closely linked to access to land and the presence of conditions that make it fertile, starting with the regular availability of water reserves. In the absence of other economic alternatives, 83% of the region's population appears to be subordinate to the land but almost 40% of the main and only available resource risks disappearing under the desert dunes. To make the situation even more dramatic, it must be added that the available water barely satisfies 3% of arable land. The program of the barrier or green wall, in an extremely weak human context, has set itself the goal of obtaining the lasting management of fertile land in the hope of enabling people to have a less precarious resource available. Even in the presence of common objectives, each country adopts specific strategies and measures from the moment in which the intervention promoted by the individual states cannot fail to establish a fruitful dialog with the traditional practices in force in the respective local agroforestry systems [77, 78] must become a support tool, knowing how to interact with a branched socio-cultural background . Until now, the most encouraging results come from countries such as Nigeria, Senegal and Ethiopia [79], which have become the scenario of restoration of millions of hectares of land through the planting of acacias as this tree, in addition to proving particularly resistant to climatic conditions in areas where rain constitutes an exceptional atmospheric event, offers the possibility of guaranteeing a series of raw materials such as leaves for grazing animals or construction timber. Faced with the obstacles to be overcome, it is no exaggeration to say that the great green wall establishes a precise division between two scenarios: on the one hand the impoverishment of soils, mass human movements toward the peripheries of continental or European cities, the spread of fundamentalist movements, on the other hand, the possibilities of economic growth, social cohesion, political stability. Two scenarios are to be placed against the background of environmental issues on which the future of the African continent depends but also on the nearby shore of the Mediterranean Sea.

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