

## SOCIO-ECONOMIC FACTORS OF DESERTIFICATION

Florian Plit

---

*Department of Social-Economic Geography, Faculty of Geography and Regional  
Studies, University of Warsaw, Warsaw, Poland*

**Abstract:** Desertification processes are strongly influenced by the activity of man. For centuries, desertification has been caused by such factors as overgrazing and development of non-irrigated farming in the semi-arid areas. In recent decades, technogenic desertification, and predominantly motor traffic, has played a growing role. Marked local and regional differentiation of anthropogenic desertification factors can be observed, in parallel to general regularities. Desertification intensifies:

- a) in time of war and armed conflicts;
- b) in time of violent changes of ownership relations - privately owned areas are usually better protected from desertification;
- c) in countries witnessing a revival of Islamic traditions.

**Key words:** desertification, socio-economic factors

In recent years, we have been witnessing an outstanding interest of geographers in natural calamities; some will even claim that the "geography of natural disasters" is being distinguished as an independent branch of geographic studies (cf. Plit, 1989). The reasons for this are threefold:

- a) we are living in a time which, apparently, is characterised by an increasing number of climatic anomalies, which results in a greater threat of natural calamities;
- b) we are living in a time when, in expectation of the new millennium, popular interest in the imminent end of the world, natural calamities and such phenomena is growing, and people of various professions, including geographers themselves, are inclined to succumb to such emotions and frames of mind;
- c) in trying to restore the unity of their discipline, geographers direct their interest to issues bordering on natural and social phenomena, and natural disasters are a perfect example.

All this makes the problem of desertification, which became popular with geographers over twenty-five years ago, following the frightful Sahelian drought, both a current and popular issue. An outcome of this interest is thousands of detailed analyses, papers, hundreds of scientific and para-scientific conferences. We know a great deal about desertification indeed. The problem is that - despite some local successes - we cannot counteract it on a global scale.

Desertification, understood as a process of the impoverishing primarily of the vegetation cover and water resources in addition to other components of the natural environment, leading to the emergence of soil substratum (barc rock) on large areas, is a universal phenomenon, occurring almost ubiquitously in the semi-arid zone. Most signals testifying to desertification come from Africa: predominantly from the northern and southern boundaries of the Sahara and the Horn of Africa, and from Asia: from the Near East, through Iran and Afghanistan, and further on through the post-Soviet Central Asia to western China, and through Pakistan to north-western India. However, information of desertification is also being reported from other areas: the boundaries of the Kalahari, many places in Latin America, Australia, and even from the Russian tundra, where, among wet depressions, sandy dunes will emerge.

The estimations of the pace of desertification vary, which is primarily due to the fact that the process occurs at a different pace in different areas, which varies from year to year, and to the diverse measuring methods and adopting dissimilar definitions of desertification. Depending on the source, even the area of deserts on the Earth is calculated exact to approximately ten per cent, to amount to from less than 45 to over 50 million square kilometres (cf. Dresch, 1982). For this reason, some journalists and ecological organisations, often in good faith, disseminate quite incredible and absurd information on the pace of desertification. However, even if we reject the extreme opinions, there is little doubt that desertification is occurring very fast and poses a serious global danger to the coming generations, and a much closer one than, for instance, the threats related to the possible climate warming due to the greenhouse effect. In the geological past, the area of deserts underwent numerous changes; and the desertification we are witnessing nowadays may be partly caused by climatic processes. Nonetheless, even though it has been long observed that desertification processes are accelerated in years of dry weather, merely referring to climatic factors and their likely astronomical origins will not suffice. This is neither the not crucial factor. The drought period frequently occurred in the past, and brought about rapid expansion of desert conditions to vast areas. However, the situation would slowly be restored - by and large - to the original state. Contemporarily, desertification is occurring faster than ever was the case in the geological, and even the historical past. Wet years bring only partial redressing of the damage caused during dry years. Worse still, reports from many arid and semi-arid areas, such as the Sahel, Afghanistan, post-Soviet Central Asia, indicate that the state of vegetation and water resources is deteriorating even during wet years. At such times, desertification processes are occurring more slowly, but do not disappear altogether. Therefore, the crucial reasons for desertification must be sought in the activity of man.

Literature of the subject is genuinely ample, and the explanations that are offered, generally speaking, follow two directions. The first one assumes that the present rapid desertification, occurring mainly in the semi-arid zone, may be caused by negative effects of human activity in the area of other climatic and vegetation zones, predominantly of rain forest deforestation. The disappearance of rain forest leads to the lessening of the volume of water vapour escaping there to the atmosphere, to be subsequently transported to higher latitudes. As a result, precipitation in the savannah zone and in semi-deserts decreases, dry spells are more frequent and the vegetation deteriorated during one drought period cannot regenerate before the next arid spell comes. Naturally, this is a gross simplification. Nonetheless, numerous researches, primarily research conducted as part of the "Global change" programme corroborates the thesis that the deterioration of rain forest may be one of the factors causing desertification. Similar views were propounded much earlier. For instance, P. Boudy (1948) claimed that desertification in the northern margins of the Sahara was largely caused by deforestation in the Atlas mountains.

The second direction, seeking the causes of desertification in anthropogenic factors, perceives them primarily in the results of human activity in areas directly affected by desertification, especially in the semi-arid zone. We shall examine those matters more closely. However, it should be expressly stated that the negative effects of activities in the equatorial zone and in semi-arid areas do not cancel each other; conversely, they are mutually reinforced.

As early as in the 19<sup>th</sup> century many historians and geographers regarded nomadic shepherding and an unrestrained drive of shepherds to increase their stock to be the main factor of desertification (e.g. cf. Baraban, 1887). The animals eat up the grass, crumble the soil with their hooves, facilitating soil deflation and water erosion; the shepherds destroy forests and shrubs by burning with a view to increase the grazing area and speeding up grass growth, and by collecting firewood, and timber for the construction of tents and cattle pens. Until today, excessive grazing is considered to be one of the main factors of desertification. Statistics regarding the changes in the number of stock can be frightening. In Africa, the highest increase took place in the Sudan, where, according to FAO data, in 1950 about four million cattle were grazed; in 1970 - about 14 million, and currently - about 22 million. Those are approximate data, based on the official, biased statistics. However, regardless of the fact whether over those several decades the cattle population has grown six-fold, or merely four-fold, such an increase means a huge burden for pastures, since their area has not increased, nor their quality has been improved. Over the past thirty years the classic model "more animals - more deserts" was considerably modified. Firstly, it was pointed out that with a small population of animals nomadic shepherding, thanks to a high mobility of herds, and the possibility to divide and scatter them, only slightly adds to the deterioration of vegetation and - consequently - starting the desertification processes. It allows to make use of the scanty natural resources in a permanent manner (e.g. cf. Reckers, 1997). That is why one of the papers of C.G. Widstrand (1975) was expressly entitled "The Rationale of Nomad Economy". Secondly, it was indicated that the desertification processes occurred most intensively around most productive wells, which attracted huge numbers of animals.

This phenomenon is best known from the Sahelian zone of the 1970s, although similar processes also occurred in other parts of the world, e.g. earlier in Australia and the United States.

Another factor adding to the deterioration of the natural environment and intensification of desertification processes has been the development of farming in the semi-arid zone. For a long time, the scientists perceived negative effects solely in the case of non-irrigated farming. Ploughing causes the crumbling and exposure of the soil, thus depriving it of any protective vegetation cover. Violent rain may cause washing away of the soil, to the point of exposing the bedrock. Gusty winds are even more dangerous; although the layer that is blown away is normally thinner, winds can affect areas of several hundred thousand square kilometres. Particularly threatening is deep downslope ploughing conducted in huge areas, and sowing of species with a long germination period, which makes the soil lie bare for a long time. Negative effects of large-area cereal farming in the Dust Bowl (USA) in the 1930, and in Kazakhstan and the neighbouring areas of southern Siberia in the 1960s, are commonly known. In both cases, the drought that came led to local desertification, although those were areas of a relatively high rainfall. The destruction was made worse owing to the fact that ploughing was conducted in huge areas, while some fields would be prepared in the autumn, and sowing would not be done until spring (with spring crops).

The literature on the influence of farming on soil degradation, started by Plato, is abundant. Since Plato's time, examples have been compiled from all historical periods, beginning with the Neolithic, and from all continents excluding Antarctica. A somewhat pointless dispute erupted among geographers, administrators etc.: which manner of land use leads faster to desertification: farming or nomadic shepherding. Both concepts had their ardent followers. For instance, M. Cote (1979) is of the opinion that long periods of peace, which saw flourishing farming, were conducive to the expansion of the Sahara. Supposedly, this was what happened in the times of the Pax Romana and in the times when Algeria remained under French rule.

Farming using artificial irrigation is regarded to be much safer, particularly in its "oasis" version, i.e. a number of species in one field, several levels of cultivation (crop and vegetable growing in the shadow of date palms or fruit trees), two - three cereal and vegetable crops annually. Although it is commonly acknowledged that such type of farming may also lead to desertification, especially as a result of soil salinification, this is not an inevitable effect of irrigation, but a result of badly conducted drainage. There are areas where irrigated farming has been conducted for millennia, invariably ensuring high crops. That is why, according to some experts, irrigation seems to be a panacea both for the threat of desertification and shortage of food. This belief has not even been shaken by the ecological disaster in the region of the Aral Sea.

Excessive grazing and farming, coupled with obtaining fuel timber, can be regarded as classical factors of anthropogenic desertification. They are obviously related to the demographic explosion: the more people the more cultivated fields, and the more human activity in areas with sensitive natural ecosystems, easy to destroy. A description of such phenomena represents a classical motif in human geography. On the one hand, Ratzel (1889 - 1891) writes about it, and Makowski, a hundred years later (1999), points out

that the desertification mechanisms in Africa and Asia and deforestation of rain forest in Latin America are surprisingly similar, and can be explained using the same models. Without containing the demographic explosion, the elimination of those desertification factors seems to be extremely difficult in the least.

During the past twenty-five years, a new motif has appeared in the literature on desertification - that of technogenic desertification. Although it was Le Houreou (1968) who discussed desertification caused by the caterpillars of Rommel's tanks in Northern Africa, thorough studies on technogenic desertification and its dimensions were started much later in the Soviet Union (cf. for example Babayev, Freykin 1977; Kharin, Kirilceva 1988). This is related to the fact that the area of land in Central Asia degraded as a result of natural resources exploitation, mass-scale cross-country motor traffic (including the steppe and the semi-desert areas), military manoeuvres, experiments with various types of weapons is huge, in the case of Uzbekistan, Kazakhstan and Kirgizstan assessed at 6.5 per cent of the total area of those countries. However, technogenic desertification is not confined to the former Soviet Union. Its occurrence was signalled in many countries, for instance in Egypt (connected with the mining industry, desert safari and "across the desert" car rallies), Algeria and Morocco (the deterioration of vegetation accompanying the Paris-Dakar rally gave rise to disputes), California. It can be assumed that this type of desertification occurs almost ubiquitously outside protected areas, only on varying scales.

The longer research on desertification is conducted, the more it transpires that we know very little about the process. Even though it is closely connected with the demographic explosion and technological progress, desertification cannot be regarded as a simple derivative of those processes. In every part of the world desertification progresses differently, which is partly due to the specificity of the natural environment, and partly - to the local social, cultural and political conditions. These differences are easily visible in the few existing regional comparative studies (cf. e.g. Mabbutt, Floret 1980; Plit 1995). In some cases, changes in the pace of desertification may be related to the operation of an unexpected social or political factor of a strictly local nature. For instance, in the post-Soviet Central Asia, the end of the unlimited power of security service (KGB and others) meant that trees and shrubs aimed to hide them from the onlookers no longer were planted around the forbidden areas. This can be regarded as a paradoxical example of how the collapse of communism contributed locally to the increased degradation of the natural environment. In the Sudan zone in Africa, confining deforestation is fostered by the existence of "holy groves", which are now disappearing, partially due to the progressing Islamisation and decline of pagan traditions. In Algeria, pastures in the vicinity of roads were subject to considerable degradation since the young shepherds would leave their animals to be tended by a colleague, and they would hitch-hike to town.

Despite a great variety of situations, certain regularities can also be observed. For instance, it has been observed that desertification processes are accelerated:

- ♦ in times of wars and other conflicts. All activities for the sake of protecting or enhancing the status of natural environment are then either limited or entirely forgone. Military action leads to technogenic desertification. Large-scale relocations of

population are taking place, huge population centres are emerging locally (e.g. camps for refugees), in the vicinity of which the pillaging of resources (e.g. overgrazing, tree felling) leads to such changes in the natural environment that restoring the original conditions may veritably take ages. Such a situation is encountered, among other areas, in 1980's on the Pakistani-Afghan border.

- ♦ In the period of rapid changes in the ownership relations. Generally speaking, in areas privately owned desertification is occurring at a slower pace than in state owned areas, that is - in common understanding - the ownerless land. For instance, such a situation occurred following the nationalisation of pastures in the Algerian steppe in the 1960, and at the same time in the Sahel, where deep wells abounding in water and pastures located in their vicinity were regarded as public domain. Similarly, according to most experts, the desertification around the Aral Sea shall not be contained until realistic prices of water and mechanisms enforcing payment for water are not instituted throughout the region. However, accelerated desertification is not always associated with departing from private ownership; in the Sahel, desertification was witnessed during the transition from the traditional, self-sufficient tribal economy to the market economy, which was frequently accompanied by the emergence of individual ownership in lieu of tribal one.
- ♦ in the times of Islamic revival. In Islam, there are many references to shepherding traditions, and their close observance requires a sizeable number of animals (e.g. eating the ram). At the same time, it should be borne in mind that many countries lying on the border of the desert had theirs' own shepherding traditions, which were curtailed in the period of foreign occupation. It was not by chance that Algeria, after regaining independence, saw a return to Islamic tradition which had been hardly observed before, a rapid increase of the stock of sheep, and accelerated desertification. Contemporarily, in the post-Soviet Central Asia a comeback to Islam is also observed, in addition to a revival of shepherding traditions, e.g. in Kazakhstan. Its consequences, though, may prove catastrophic for the natural environment. An example contrary to Islamic impact of the religion factor may be the state of Utah, with a prevailing Mormon population, which can serve as a model of sustainable development and use of the natural assets, permitting to use them in a long time period.

Finally, we should address the question why research on desertification is also conducted in Central Europe, including Warsaw University, if there are no deserts in the region. Desertification has to be considered as one of the most serious global threats. Research on the phenomenon is not only extremely important in terms of practical benefits (on the global level), but also of theoretical ones, since they help to integrate many branches of science (e.g. geography, biology, history, archaeology, sociology), and geographic studies themselves. Investigating the role of man in desertification processes significantly brings us closer to the explanation of the role of man in transforming the natural world and in apprehending general rules governing the relationship between man and nature, and therefore contributes to the understanding of our attitude towards nature. In the era of globalisation, we cannot keep away from this research; we should at least be watchful observers.

## References

- Babayev A.G. - Freykin Z.G. (1977):** Pustyni SSSR vcera, segodna, zavtra. Mysl, Moskva.
- Baraban L. (1887):** A travers par la Tunisie. Etudes sur les oasis, les dunes, les forets, la flore et la geologie, Rotschild, Paris.
- Boudy P. (1948):** L'Economie forestiere Nord-Africaine, vol. 1, Larose, Paris.
- Cote M. (1979):** Mutations rurales en Algerie. Le cas de hautes plaines de l'est, Centre de Recherches et d'Etudes sur les Societes, Paris.
- Dresch J. (1982):** Geographie des regions arides, P.U.F., Paris.
- Kharin N.G. - Kirilceva A.A.:** Novye danye o ploscadakh opustynennykh zemel v aridnoy zone SSSR, Problemy osvoenia pustyn, 4, 3-8, Ashgabad.
- Le Houerou H.N. (1968):** La desertisation du Sahara septentrional et des steppes limitrophes (Libye, Algerie, Tunisie), Annales Algeriennes de Geographie, 3, 6, 2-27, Alger.
- Makowski J. (1999):** Oral communication in: Convencion Tropico 99, Geografia, Meteorologia y Agricultura Tropica, 29 de Marzo el 2 de Abril, La Habana, Cuba.
- Plit. F. (1989):** "Geografia klęsk żywiołowych" - nowa gałąź geografii, Przegląd Geograficzny, LXI, z. 1-2, 115-120, Warszawa.
- Plit F. (1995):** Pustynnienie antropogeniczne na obszarze Sahary i w Azji Środkowej. Studium porównawcze, Uniwersytet Warszawski, Warszawa.
- Ratzel F. (1889-1891):** Anthropo-Geographie. T. 1 Grunzuegeder Anwendung der Erdkunde auf die Geschichte, T.2 Anthropogeographie. Die geographische Verbreitung des Menschen, J. Engrlhorn, Stuttgart.
- Reckers U. (1997):** Survival Strategies of Nomadic Herdsman - the East Pokot in Kenya, Applied Geography and Development, 49, 32-42, Tubingen.
- Widstrand C.G. (1975):** The Rationale of Nomad Economy, Ambio, 4, 146-153, Oslo.

## Resume

### Spoleczno - ekonomiczne czynniki pustynnienia

Procesy pustynnienia przebiegają obecnie tak szybko, że nie jest możliwe ich wyjaśnienie odwołując się wyłącznie do astronomicznie uwarunkowanych zmian klimatycznych. Istotne, zapewne dominujące, znaczenie ma działalność ludzka, zarówno na szczególnie zagrożonych pustynnieniem terenach półsuchych, jak też w innych strefach klimatyczno-roślinnych (pustynnienie jako pośredni efekt degradacji lasów równikowych). Pustynnienie jest wprawdzie procesem przyrodniczym, ale na jego przebieg istotnie wpływają czynniki demograficzne, gospodarcze, społeczne i polityczne. Niektóre z nich mają charakter globalny, inne tylko lokalny.

Od dawna rozpoznanymi czynnikami degradacji środowiska w strefie półsuchej są: nadmierny wypas zwierząt (wciąż trwa dyskusja, czy bardziej degradującym jest chów stacjonarny, czy też koczowniczy), rozszerzanie powierzchni upraw nienawadnianych, rabunkowa eksploatacja drzew (gł. na opał). Wpływ tych czynników najpełniej widoczny jest w najuboższych krajach Afryki i Azji, nasila się on w wyniku eksplozji demograficznej i ulega przyspieszeniu w czasie posuch. W ostatnich dekadach zwrócono uwagę także na pustynnienie spowodowane nadmiernym rozwojem rolnictwa

nawadnianego i błędami popełnionymi przy irygacji (np. w Azji Środkowej) oraz na pustynnienie technogeniczne, towarzyszące rozwojowi górnictwa, ale też i imprez turystycznych oraz sportowych organizowanych na pustyniach.

Obserwacja tempa pustynnienia w różnych regionach świata wskazuje, że nasila się ono w okresie wojen i innych konfliktów, w czasie szybkich przemian stosunków własnościowych (na ziemiach mających prywatnych właścicieli na ogół przebiega wolniej niż na państwowych - prawidłowość potwierdziła się w Azji Środkowej, Algierii i w strefie Sahelu) oraz w czasie renesansu tradycji islamskich.

Badania pustynnienia ukazują bardzo złożony system relacji między człowiekiem i środowiskiem przyrodniczym, przez co dobrze nadają się do opracowywania ogólnych modeli degradacji środowiska przyrodniczego.