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Drought in Bulgaria

Ed. C. Gregory Knight, Ivan Raev, Marieta P. Staneva, *Drought in Bulgaria. A Contemporary Analog for Climate Change*, Ashgate Publishing Company, Burlington.

The connection between human life and water is well known. For instance, water makes up 71 per cent of the human body. Humans can live about one month without food but only one week without drinking water. Any human being needs on average 5 litres of water for drinking and cooking, and some 25 litres more for personal hygiene. 97.5 per cent of water is to a great extent of potable use. Therefore, only 0.007 per cent of water reserves of the planet are both potable and easily accessible. Such small water reserves when not refilled by rain water are insufficient to human needs. Several rainless days could cause serious water shortage, which could have a negative impact on the natural environment, agriculture, economy, and society. This natural phenomenon is known as drought, and occurs quite frequently in Africa, but it also takes place in Europe. In the years 1982–1994 severe drought occurred in Bulgaria, bringing negative consequences especially for the natural environment and socio-economic system.

A good attempt at describing the complicated connection between the climate phenomenon, drought, and natural environment and socio-economic system can be found in the book entitled *Drought in Bulgaria. A Contemporary Analog for Climate Change*. The book was published as a result of interdisciplinary research on effects of the drought. Scientists from the US National Foundation, The Centre for Integrated Regional Assessment of Pennsylvania State University, Bulgarian Academy of Science and American University in Bulgaria in Blagoevgrad were involved in the research. The severe drought with devastating effects which had been accumulating over a long period of increasing aridity, recently experienced by Bulgaria, was treated as a potential interdisciplinary case study related to global climate analogies, an area of increasing attention as society contemplates the eventualities of climate change. The authors of the articles compiled in

the book claimed that science aimed at sustainable development must integrate all disciplines; it must address the human-environment system as a whole. The book, the result of research conducted by a group of scholars directed by C. Gregory Knight, Ivan Raev and Marieta P. Staneva, brings all disciplines together and tries to show the physical, environmental and socio-economic processes and events contributing to the drought. The aim of this book was to gather data from the drought period of 1982–1994 and pass it on to future generations while noting the impacts on the natural system and on economic and social processes in Bulgaria. The authors say: "We use analyses of what occurred in the period 1982–1994 to make inferences about planning for future climate in the same country. We do so on the basis of reasonable evidence that future climate may be like, or even worse, than the drought Bulgaria experienced."

The book is deeply rooted within the "human dimensions of global change" paradigm, and in the use of analogy in exploring the consequences of global climate change from the human viewpoint. According to the authors, the human dimensions of global environmental change comprise the causes and consequences of people's individual and collective actions, including the changes which lead to the modification of the earth's physical and biological systems, and they affect the quality of human life as well as sustainable development in different parts of the world. It is mentioned that because of the complexity of this natural phenomenon, a uniform methodology for implementing drought studies has not been developed even though investigations of drought are carried out all over the world. They suggest using an analogy method, claiming that "Analogies provide an approach to understanding the potentialities of complex events that are difficult to fully capture in formal analyses or models. Given the uncertainties in projections of future climate and the changing human context in which climate change impacts will be experienced, thinking by analogy provides one useful way to explore the dimensions of such change."

The book consists of materials presenting results of an interdisciplinary research of the 1982–1994 period. The authors try to explain the effects of the drought from the following perspectives: climatology (Nicola Slavov, Ekaterina Koleva), hydrology (Strahil Gerassimov), water quality (Galia Bardarska and Hristo Dobrev), forest ecosystems (Ivan Raev and Boyan Rosnev), wild mammals and birds (Georgi Markov), agriculture (Vesselin Alexandrov), health and hygiene (Galina Golpina), water resources management (Todor Hristov), and social impacts (Georgi Fotev, Caedmon Staddon). Because the scope of the work is quite wide, I would like to direct the reader's attention to four issues. These are the following:

— history of the drought,

— negative impacts on natural environment (water reserves and forests),

— agriculture and drought,
— societal and economic dimensions of the drought.

First of all, the authors of the study claim that summer drought is a normal climatic phenomenon associated with the Bulgarian climate. Drought can occur in any month of the year. Weather conditions during drought are characterised by decreased precipitation, high air temperatures, low humidity, and warm strong winds. Long-term drought can negatively impact the water balance of plants, causing unstable physiological conditions of the crop, and low crop yields, as well as threaten natural ecosystems and water supplies. According to Bulgarian meteorological definition, drought is a rainless period of at least ten successive days and nights. The average annual number of droughts is five or six. They are most frequent in the second half of the summer and during the autumn, and once in every two or three years the rainless period may last for 40–50 days. During the period 1982–1995 Bulgaria experienced severe drought which was considered a natural disaster. Events during the 1982–1994 drought showed many negative impacts of unfavourable climate in Bulgaria, with environmental, economic and social dimensions. Many of these impacts multiplied in the most severe drought period of 1993–1994 continuing into early 1995.

The drought began to emerge in May 1982; September and October were the driest months. Decreasing precipitation and low soil humidity was observed. The drought continued throughout 1983 and 1984. Other negative effects of the drought were noticed. There was an increase of forest fires, and a drastic fall of reservoir water levels was observed. A considerable decrease in crop yield was noted as well. Water supply problems resulting from the drought forced the government to create a National Water Council. In the period 1985–1989 precipitation levels continued to decrease. Water supply shortages in many parts of the country caused that water began to be rationed in areas traditionally known from a good water supply. In 1989–1990 the negative ecological and economic impact of the droughts was connected with political changes (the communist regime in Bulgaria collapsed). The authors of the study noticed that ecological issues contributed to public protests that led to political change later in the year. In August 1990 some perennial rivers went dry and annual precipitation lowered even more. During that period many irrigation systems collapsed; researchers claim that it was caused mainly by impending land privatisation. In some parts of the country an epidemic upsurge of vital hepatitis A was observed. According to a report from the Bulgarian Academy of Science, the parliament passed a special decree prohibiting water diversion projects. Nevertheless, social and political changes overshadowed drought issues. 1993–1994 were the driest years of the drought; this was the peak of the rainless period. Apart from the negative effects mentioned above, some more im-

pacts were observed; e.g., many wild fires burned over large areas within and beyond forests. Water shortages in many settlements continued. Incidents of various diseases caused by water shortages occurred virtually throughout the country. The authorities prepared for medical emergencies and possible evacuations. It is worth adding that by the end of 1994, the last year of the drought, water prices doubled and regimes in Sofia limited water usage in many residential areas to as few as one day in four. In 1995 annual precipitation returned to levels above average and the severe drought in Bulgaria was over.

The objective of the next part of the book about the negative impact on the natural environment was to evaluate qualitative conditions of water resources in Bulgaria during the 1982–1994 drought, and to use this period as a model for future climate change. This research was based mainly on quantitative analysis. Data gathered by scientists correlates with global data from other countries and with the astronomical parameter such as solar activity and radiation. The authors claim that such correlations allow objective assessments to be made for a long historical period.

In the opinion of the authors in order to diminish the negative impacts of possible future droughts, wise use and management of available water in reservoirs, natural lakes and grant water reservoirs, even during wet periods, is obligatory. They recommend that legislative and economic policies and incentives must promote economical water use by all consumers. Furthermore, they suggest that a policy of restrictions towards different groups of water users must be developed as an extreme measure to avoid a water crisis. The authors claim that "When all alternatives for water conservation and other efficient management decisions have been exhausted, only then might the building of dams and inter basin transfers be considered after extensive hydrological, ecological and socio-economic impact analyses are done followed by broad public discussion."

The main message given to decision-makers is that with the use of appropriate technological schemes and chemical products, polluted reservoirs could provide a safe and sustainable source of water during drought periods.

The authors of the study try to analyse the effects of the drought on natural and managed forests in Bulgaria. The scientists used statistical data on forests in Bulgaria from the National Statistical Institute. In their research they show that during a long period of severe drought there were many forest fires. Because of the low precipitation and soil humidity, a decrease in timber growth was observed. The drought caused a lot of damage in natural ecosystems, which have been preserved in excellent conditions in Bulgarian forests. It is said that about two thirds of Bulgarian forests are natural, primary forest ecosystems which in the past covered

Southern Europe. Most of them have not been affected by afforestation activities.

The conclusion of that part of the book can be found in the following quotation: "The impact of drought on natural Bulgarian forest ecosystems is an indicator of the potential effect of further warming, resulting from global climate change during the next century. Our analysis points to measures that can be taken now which have the potential to alleviate the negative impact of global warming in Bulgaria."

Another important issue discussed by the authors are the negative effects of the drought on Bulgarian agriculture. Unfavourable meteorological conditions cause twice as many losses in agricultural production as they do in most other business sectors. The authors of the study claim that "The intensity, time occurrence, duration and area of impact are important dimensions of unfavourable meteorological events when they seriously decrease crop yield. Drought is usually the most important constraint limiting crop production in the rain-fed areas in the country. Drought may be considered a severe meteorological event, for example, when it covers more than 10% of the sowed arable land, when atmospheric humidity is less than 30%, or when less than ten millimetres of soil moisture is in the top soil layer for ten or more days."

The authors are especially interested in the effects of water shortage on cultivating maize. According to them, the soil and climate conditions in Bulgaria are suitable for the cultivation of maize. When drought occurs in a period of maize development (as well as during the development of other grain), crops are limited. Researchers using data gathered by State Crop Variety Commission (SCVS) made an attempt to develop statistical models for regional assessment of maize productivity. Taking into account the results of the research and future changes in climate during the 21st century the authors claim that agro-technological management should be changed significantly. According to them, stress should be put on: developing new types of agricultural production (e.g. maize and other types of grain which would be more "drought resistant"), and creating better water reserves management (e.g. irrigation technologies with decreased water charges and without losses to water transport and distribution, restoration and reconstruction of the previously constructed irrigation facilities, utilisation of river water and precipitation for storing irrigation water during the winter season, re-utilisation of waste water, and creating better water drainage systems).

The authors mention that changes in the types of agricultural production and irrigation system will require significant changes in farm layout and the types of equipment employed. In the parts of the country requiring irrigation systems, more new water reservoirs or boreholes may be needed. The

negative effects caused by the recent drought forced the government to make a decision to embark on the construction of a number of dams varying in size (from medium to large) throughout the country. Ending this part of the study, the authors claim that because of the large cost involved in infrastructural changes (at the farm level) only small incremental adjustments may occur without changes in government policy.

Fotev makes an attempt to look at drought from a sociological perspective. He claims that in both scientific debates and everyday language, drought can be defined as a significant water shortage for different periods of duration. He adds that "The root of the Bulgarian word 'susha' means earth, in contrast to water bodies (e.g., seas or rivers) or air. However 'susha' in Bulgarian also denotes climatic water shortages which may be the result of various causes but is usually due to lengthy periods with no rain. Because life without water is absolutely impossible, drought is seen as an intensive, fatal event and in more extreme cases as a catastrophe."

Fotev says that in a most general sense, water and droughts are "experienced" differently in different periods of history. The author describes the attitude of traditional society in pre-industrialised Bulgaria towards water as a part of the natural environment, and the change in the attitude which took place in the period of industrialisation. Fotev describes how traditional Bulgarian society witnessed drought and how such an experience can be re-discovered in Bulgarian folklore, folk songs, myths, legends, proverbs, sayings and tales. Droughts leave traces in people's lives and become part of their life experiences, which in turn become part of their artistic outlook on the world. As Bulgarian society moved towards modernisation, fundamental changes occurred in the world. Attitudes towards the changing world become secular and did not include magic, and the meaning of such elements of nature as water shortage also changed. The process of secularisation of Bulgarians' attitude towards water was strengthened during communist rule. According to Fotev, another kind of change began when the totalitarian communist system collapsed. The process of transition from a communist state to a democratic political system and a market economy changed that attitude towards water. Water began to be treated as one of the normal economic goods. The drought occurring in the new political circumstances in the early 1990s enabled people to demand better water management without being persecuted by the totalitarian state. The author says that such a protest, connected with the drought, was observed in 1994 and continued until the spring of 1995.

In the end it is recommended that monitoring of the social, cultural and ethical aspects of water problems of Bulgaria should be carried out systematically. With time, social sciences and the humanities will have gathered empirical data that can be analysed with the use of scientific methods.

Finally, the opening up of Bulgarian society in a regional, continental, and global contexts calls for international research cooperation.

The authors of the study try to analyse the long-term influence of climatic factors on the economy; they take into consideration the background of the whole socio-economic development of the country. They attempt to answer the question if it is "possible to achieve sustainable development in a country that is not only lacking in quality water resources, but is also ill-prepared for negative consequences of drought?" In their opinion, Bulgaria, in comparison to another European Countries (especially EU members), is poor in water resources. At first researchers concentrated on the biggest users of water in the country, and those include: agriculture, hydroelectric power stations, and chemical, food and machine-building industries. The authors show the influence of water deficits on the country's economy, especially on the branches mentioned above. The result of the study shows that:

— hydroelectric production decreased in the early 1980s (when the drought began) and started to increase in 1995, which was the year when the drought ended;

— average yields for a group of crops (maize, sugar beets, wheat) tended to decrease after 1982 and then increased at the end of the drought;

— average production index for a group of commodities from the food and fodder industry showed a similar tendency.

With the use of available statistical data (because the influence of water shortage has not been documented), the authors wanted to show the impact of climate change on the Bulgarian economy. They mention that the drought was one of the factors which had a negative influence on the Bulgarian economy, but it had such negative consequences because it occurred during the period in which the country was experiencing a deep economic crisis caused by the transition process of Bulgarian economic and political system from leaving the totalitarian regime and centrally planned economy to moving towards liberal democracy and a free market economy.

The economic aspects of the drought on different sectors of the economy were ignored in the past but cannot be ignored in conditions of a market economy. Economists should, in their studies, take into consideration the connection between changing climate (e.g. drought) and economy. Drought can cause negative effects in such branches of the economy as: recreation, tourism and agricultural industry; it can strike all the sectors of the country's economy. Moreover, from an economic viewpoint, expectations that use of water resources will be a growth factor are well grounded. Keeping in mind the importance of the cyclic natural phenomena like drought for the country's economy, especially in the agricultural sector, the authors of the study suggest to policy-makers that it might be necessary to allocate funds

designed for EU accession in the direction of establishing a system of solving water shortage problems. At the end of the study the authors make an optimistic statement: "Even in transitional economies, good management, forecasting, developments, creation of proper infrastructure, and planning can lead to positive changes."

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It is worth adding that according to the authors "The abnormally dry conditions of the early 1990s in Bulgaria could become the norm by the middle of this century and this bears consequences for the environment, economy end society." These warnings should be taken seriously by the decision-makers at local, regional and global levels. Therefore, at the end of the book the authors offer Bulgarian policy makers recommendations focused on helping society to plan for drought as a more common occurrence, and to adjust the Bulgarian economy and resource management to an expected warmer and drier future. Using the "human dimensions paradigm" and the innovative analog methodology in their research, the authors provide a strong basis for looking at human environment interactions. Attempts at ideas on how to solve the problems connected with the natural environment, agriculture, economy and society, which are caused by drought can be found in this monograph.