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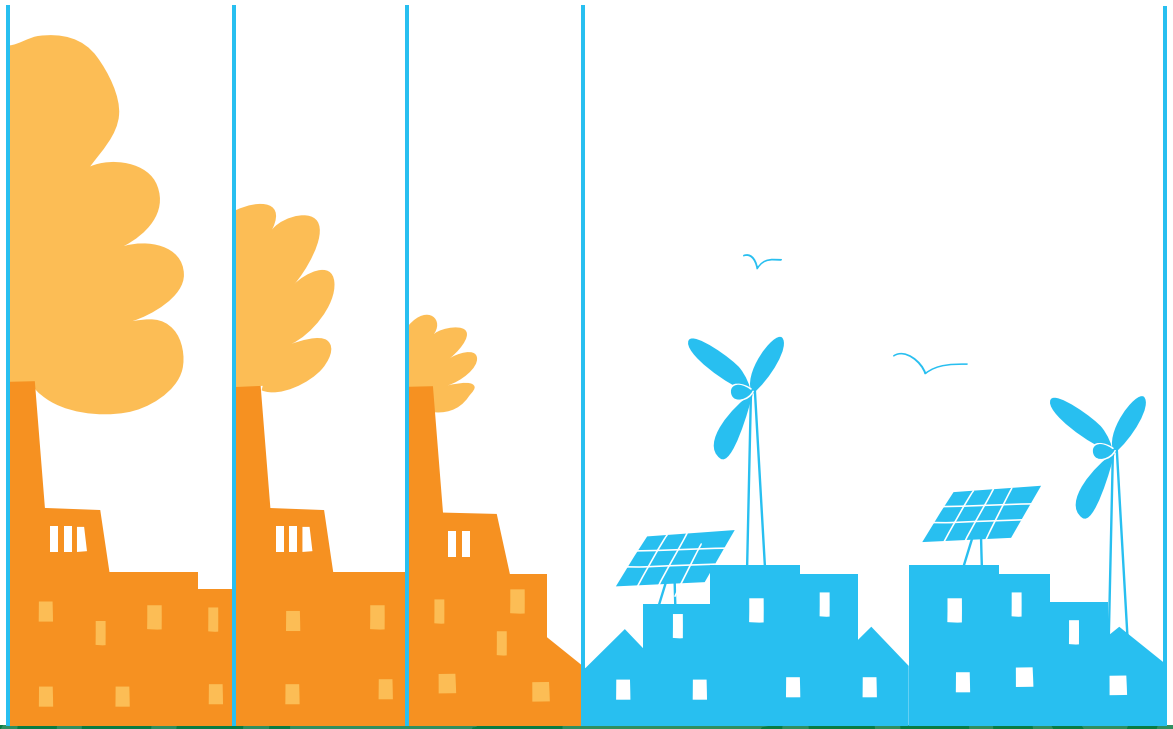


# CLIMATE CHANGE AND HEALTH

**United Nations Development Programme**

## Climate change: what do we know about the trend of temperature increase?

In the course of the period of 1960-2012, temperature increase with an average trend of 0.3°C per decade on annual level was observed in Serbia.

On the average, the most marked temperature increase was in summer months and it was 0.57 °C per decade. In other words, in the course of the past 15 years, mean summer temperatures were, on an average, higher by 1.4°C compared to the values from the middle of the twentieth century. Taking into consideration the global temperature increase rate, studies reveal that Serbia is facing a faster temperature increase compared to the increase in mean global values. It is also significant that eight to ten hottest years have been observed after the year 2000. The year 2000 was the hottest, with a positive anomaly with respect to the long time average of 1.86 °C, and then 2008, 2007, 1994, and then 2012.

The conclusion of the analysis of those trends is that the entire territory of Serbia has been facing a considerable average temperature increase as of the middle of the past century.

## Extreme weather events

Climate change also has impact on the incidence of the so-called extreme weather events, which may be either temperature or precipitation events. In the context of public health, temperature extremes of tropical nights and summer days are especially important.

A tropical night is defined as the night during which temperature does not drop below 20 °C, and a summer day as the day during which maximum daily temperature exceeds 25 °C. Studies show that, in the past 50 years, there was a significant trend of increase in the number of both tropical nights and summer days in Serbia. The positive trend of increase in the number of summer days is five days per decade and, of tropical nights, one day per decade.

Related to the above, also noticeable is a higher incidence of warm spell periods, yet another type of extreme weather events. A warm spell period is defined as a period of minimum six days with daily maximum temperatures in excess of the 90th percentile of daily maximum temperatures. An average value of the trend of increase in warm spell periods is 4 days per decade.

In addition, increase in precipitation at the majority of the stations has been recorded, but it is significant only at a few, in heavy and extreme precipitation indices. In the context of public health, this has significance in the fight against floods and consequences of floods.

## Future climate in the Republic of Serbia: what do the scenarios tell us?

Climate change scenarios forecast temperature increase over the entire territory of Serbia and changes in the precipitation regime. Such temperature increase may potentially be 1 °C up to 2040, or 2 °C up to 2070.

By the end of the century, depending on the scenario, temperature increase of up to 4 °C is possible, whereby warming is the most prominent in the course of the summer and autumn seasons and will exceed 4 °C up to the year 2100.

An increase in the number of summer days and tropical nights as extreme weather events is also possible. Such changes will

be the most prominent above the regions having lower altitudes above sea level, such as, for example, in Vojvodina, and parts of the central Serbia. The number of summer days and tropical nights will be potentially higher by around 30 by the end of the century.

Changes in the precipitation regime imply drier climate by the end of the century, with longer duration of dry periods.

## Climate change and health: direct consequences of changes in temperature and the precipitation regime

In the course of the past decades, Serbia faced new risks to the human health, which are related to climate change either directly or indirectly. Direct effects may appear due to temperature increase, climate variability, increased intensity of precipitation, longer duration of droughts, which all together may have a negative impact on the human health.

During the heat wave in July 2007, increased mortality rate was recorded in Belgrade. It has been established that, if mean daily temperature increases above the 90th, the 95th, and the 99th percentiles, an average number of the deceased will increase by 15.3 %, 22.4 %, and 32.0 %.

Between 16 and 24 July 2007, the total number of the deceased was 167. Out of the total number of the deceased, 151 persons (90%) were in the group of people above the age of 75, which is an increase of 76% percent compared to the reference mortality rate. In persons who had suffered from cardiovascular diseases and malignant neoplasms, the highest mortality rate was recorded (77 and 49 cases), but the highest relative increase in the mortality rate is related to diabetes (286%), chronic kidney diseases (200%), respiratory system diseases (73%), and nervous system diseases (67%). The mortality rate among women was over twice higher than the mortality rate among men.

During the floods in May 2014, 51 casualties were recorded. Floods and landslides had direct impact on the human health. Out of the total number, in 23 persons the cause of death was asphyxia due to drowning. An indirect threat during floods is potential contamination of surface and ground waters and the surrounding land by hazardous substances and waste waters (sewerage). Toxic coal waste poured into the Korenita River in the municipality of Loznica, when the dam of the waste dump succumbed to the flood.

Also, water supply in the municipality of Mali Zvornik was aggravated due to the penetration of heavy metals from the mine excavations into the springs of potable water. Another indirect impact of floods on the healthcare sector was the damage on the healthcare institutions in 15 municipalities, some of which were even temporarily closed (the EC, 2014).

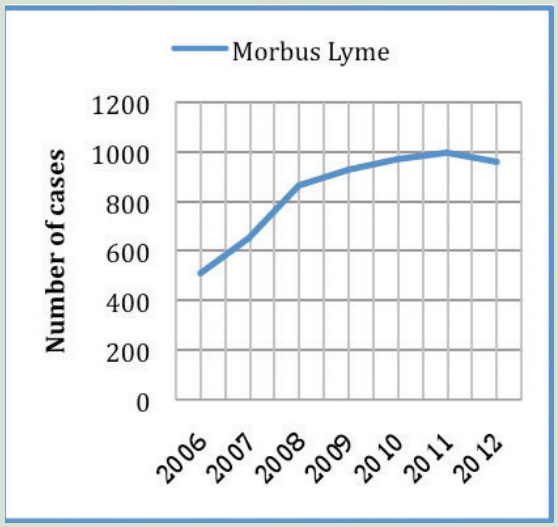
1 The report "Floods in Serbia in 2014", the Office for Assistance to and Reconstruction of Flooded Areas, link: http://www.obnova.gov.rs/uploads/useruploads/Documents/Izvestaj-o-proceni-potreba-za-oporavak-i-obnovu-posledica-poplava.pdf

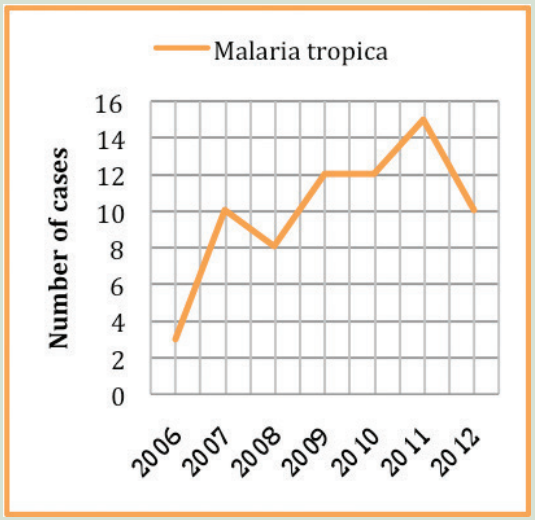
## Climate change and communicable diseases

Indirectly, climate change also brings along new challenges in the control of communicable diseases. Climate change will definitely give rise to a change of the spreading out and increased incidence of vector-borne communicable diseases (malaria, Dengue fever, the West Nile virus, etc.), as well as spreading of communicable diseases that are transmitted through water, such as cholera and diarrhoea.

In 2012, the Institute of Public Health of Serbia established the seasonal constant monitoring of the West Nile virus in the human population. In the course of the summer season of 2012, the total number of registered cases was 71 (probable/confirmed), including nine patients who potentially died from infection by the West Nile virus. In 2013, by the end of October, 302 cases of infection by the West Nile virus were recorded, as well as 35 death cases, which is around four times more than in 2012. Such a sharp increase indicates that the West Nile virus may pose a higher risk to the health of the people in Serbia in the future.

Figure 1. Number of whose who contracted Lyme disease (left) and malaria (right) in Serbia in the period from 2006 to 2012. (Source: Institute of Public Health of Serbia)



The summary of different potential impacts from climate change effects on the health of people in Serbia is given in Table 3.13.

Table 3.13. Climate change impact on the health of people

| Climate change | Health impact | Threatened population |
|---|---|---|
| Heat waves | - Early death<br>- Diseases related to temperature increase: sunstroke, heat stroke, kidney stones (renal colics)<br>- Heat stress<br>- Sudden death | The elderly, children, diabetics, the poor, city inhabitants, persons suffering from respiratory diseases, those who are active outdoors (workers, athletes, etc.) |
| Poor air quality (pollution) | - Increased occurrence of asthma<br>- Increase in chronic obstructive pulmonary diseases (COPD) and other respiratory diseases | Children, those who are active outdoors (workers, athletes, etc.), the elderly, people suffering from respiratory diseases, the poor |
| Extreme precipitation and floods | - Injuries<br>- Death due to drowning<br>- Increased incidence of communicable diseases that are transmitted through water contaminated by pathogens or contamination from waste waters<br>- Increased incidence of communicable diseases that are transmitted through food | Inhabitants of the flood- prone regions, the elderly, children, the poor, inhabitants of the regions that are at risk of torrents |
| Fires | - Death from burns and smoke inhalation<br>- Injuries<br>- Diseases of the eye and respiratory tract onset due to exposure to smoke | People suffering from respiratory diseases, people in the regions exposed to fires |
| Drought | - Inability to supply food<br>- Changes of crops, pests, and weeds<br>- Water shortages<br>- Malnutrition<br>- Communicable diseases that are transmitted through water and food<br>- Occurrence of new vector-borne communicable diseases and zoonoses | The poor, the elderly, children |
| Average temperature increase | - Increased rate of communicable diseases that are transmitted through food, such as Salmonella poisoning<br>- Increase in vector-borne communicable diseases, such as the West Nile virus, encephalitis, Lyme disease, etc.<br>- Increased pressure on regional reserves of potable water<br>- Increased vulnerability to fire and air pollution | Children,<br>those who are active outdoors (workers, athletes, etc.) |
| Temperature increase and CO2 level increase | - Increased allergies caused by pollen<br>- Increased number of cases having skin rash and allergic reactions to plants and trees | People suffering from respiratory diseases, people having acute allergies, children, those who are active outdoors (workers, athletes, etc.) |

In addition to the West Nile fever, onset of Lyme disease is also increasing as well as of malaria (Figure 1). In 2012, the two vector-borne communicable diseases, which are closely connected with the climate change, manifested their reduced incidence, but the growing trend in the previous six years is obvious. Also, in 2012, for the first time in the past few years, four cases of encephalitis caused by a virus that is transmitted by ticks were recorded.

## Monitoring and measures of adaptation to changed climate conditions in the health sector

As of the publishing of the First Report of the Republic of Serbia under the UN Framework Convention on Climate Change (in 2010), the monitoring of vector-borne diseases has been improved. Also, the improvement has been achieved owing to the development of the extreme air temperature early warning system.

According to the Law on Protection of the Population from Contagious Diseases and the Rulebook on Reporting on Contagious Diseases and Other Cases, the West Nile fever is not subject to mandatory reporting. However, taking into consideration the epidemiological situations concerning the diseases in the countries in the region, the presence of the mosquito (Culek pipiens), which is the main vector of communicable diseases in Serbia, the presence of reservoirs of infection (various bird species), and adequate climatic conditions in the summer period, in May 2012, the Institute of Public Health of Serbia forwarded the methodological instructions for establishing the control over the West Nile fever to the municipal institutions.

In 2013, the Institute of Public Health of Serbia, in cooperation with the World Health Organization, made preparations for launching of the pilot project on the assessment of the threat to the healthcare sector in Serbia from climate change. The Institute of Public Health of Serbia, together with the Republic Hydrometeorological Service of Serbia (the RHMSS), introduced the early warning system, in the situations when extreme climate conditions threaten to the health of the population. From 1 May to 30 September, the RHMSS issues warnings that periods of extreme temperatures may occur, which are also posted on its Web site (www.hidmet.gov.rs), but the warnings are also forwarded to the Institute of Public Health of Serbia (www.batut.org.rs) for the purpose of undertaking of preventive measures aimed to minimize the risk to the public health.

The Institute, through the network of local public health institutions, is going to instruct medical institutions how to give advice to patients on their protection in situations in which extreme climate change takes place.

For the purpose of raising awareness concerning the importance of the problem of climate change impact on the public health in the previous period, expert workshops and conferences were organized. To use an example, the expert workshop "Climate Change and Health Effects: Impact, Preparation, Recommendations and Examples" was organized in 2012, by the Ministry of Health and the Institute of Public Health of Serbia in cooperation with the Ministry in charge of environmental protection and the climate change policy, contributing to the raising of public awareness. Yet another important conference on the topic of health aspects of climate change, under the title: "Towards Improvement of the Environment and Health in Serbia, Air Quality Issue and Climate Change" was held in Belgrade, on 12 October 2015, organized by the Ministry of Health, the Ministry in charge of the environment,

and the World Health Organization. Also, on 5 October 2015, the Ministry of Agriculture and Environmental Protection, in cooperation with the UN Development Programme and the Embassy of the Republic of France in Serbia, organized the conference „Time for Action" on the eve of the 21st Session of the UN Framework Convention on Climate Change, which was held in Paris, in December 2015. This conference made a synchronized contribution by the interested parties in the R. of Serbia to the adoption of the new Paris Climate Agreement. The conference pointed to the close correlation between climate change and the health of the population, and the prospects of and possibilities for action on the national level (more information available at: www.klimatskepromene.rs).

## Conclusion

According to the findings of experts, the temperature in Serbia increased by about 1.5°C in the past 50 years. According to estimates, this trend may result in an additional temperature increase of 1°C up to 2040, or 2 °C up to 2070, and 4 °C by the end of the century. In parallel with the temperature increase, a higher incidence of extreme weather events and changes in the precipitation regime are expected.

Unless timely adaptation measures are applied, such climate conditions will have impact on the public health both indirectly and directly. Directly, through the impact of higher temperatures and extreme weather events on the rate of disease contraction among the risk groups and indirectly, through the spreading of the so-called vector-borne communicable diseases.

Therefore, in this area, the Republic of Serbia has undertaken a series of measures focused on the monitoring and early warning. Such measures are coordinated and implemented, inter alia, by the Republic Hydrometeorological Service and the Institute of Public Health of Serbia, in cooperation with the network of local public health institutions.

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