

IV. MODULE

Impacts on health, food and farm size

Module 4. Impacts on health, food and farm size

Climate has always changed due to natural influences. But it is indisputable that human activities, especially the use of fossil fuels, are the main causes of the increase in global temperatures and precipitation. The method of heating, that is, the use of firewood as a source of thermal energy, is one of the activities by which man disturbs the natural balance.

Of particular concern is the increasingly common unplanned cutting of trees, which reduces the forest stock and makes the process of carbon dioxide absorption and air purification impossible.

The soil becomes porous and susceptible to erosion from rainfall. At the same time, the use of firewood as a way of heating homes in households pollutes the ambient air that we all breathe during the combustion process.

Climate represents the meteorological conditions that prevail in a particular area during a long period of time. In fact, the climate is defined through a statistical analysis of the weather conditions, where the average values of the climate parameters (temperature, precipitation, humidity, atmospheric pressure, wind, etc.) and their variations over a longer period of time, usually the last 30 years, are considered.

Recently, more and more emphasis has been placed on the anthropogenic influence on the climate, that is, the influence that man has on it.

Human with his/hers activities, especially starting from the industrial period of development, begins to release large amounts of various gases into the atmosphere, and some of them (gases causing the greenhouse effect) cause global warming and climate change.

The planet is warming and will continue to warm.

According to global climate scenarios, warming will continue with increasing intensity. Even if the continuous increase in the content of greenhouse gases in the atmosphere stops, the planet will warm by 0.6oC by the end of this century.

Depending on the scenarios for the increase in the concentration of greenhouse gases, the temperature will rise between 2 and 6oC globally by the end of the century. So, how much the planet will warm up in the next period depends exclusively on man and his activity.

Air pollution produces cumulative negative effects on climate change, primarily due to the process of urbanization and extensive energy consumption.

All citizens of the planet earth are affected by the climate changes that are related to the use of energy.

Climate change has an impact on:

- ❖ Mortality and serious illness in humans
- ❖ Heat stress in cattle
- ❖ The yield of cereal crops
- ❖ The demand for cooling fluids
- ❖ Security of energy supply
- ❖ Range and Activities of Disease Transmitting Vectors
- ❖ Soil erosion
- ❖ The occurrence of floods;
- ❖ The occurrence of fires;

- ❖ The quality and quantity of water resources;
- ❖ The risk of infections and epidemics;
- ❖ Coastal erosion and damage to coastal infrastructure;
- ❖ Possibilities for moving;
- ❖ Conflict risks for safe drinking water.

Impact of climate change on health

Man is directly and indirectly exposed to the impacts of climate change. Climate change will cause consequences for human health worldwide, but the severity of these consequences will depend on the region and the ability of the population to prepare, cope with and recover from direct impacts, such as higher temperatures and heat waves, waves, droughts, floods and fires, and from indirect impacts, such as changes in vector-borne infectious disease risks, declines in crop yields, water shortages and population displacement.

Assessing the population's vulnerability to the impacts of climate change on health is the first step towards improving resilience to those impacts. The assessment can serve to identify the most vulnerable groups/individuals of the local population, to identify the biggest weaknesses in the health infrastructure - the differences in access to health services - and the shortcomings in the preparedness to deal with disasters in the region. Vulnerability assessment can help authorities determine the best strategies to improve population adaptation.

What diseases in the region may be affected by projected climate changes in the region, such as changes in temperature and precipitation?

Which population is most exposed to diseases influenced by the climate?

What are the risk factors/circumstances that influence those diseases?

What are the policies, strategies and programs aimed at reducing the impact of climate change on human health?

Data on health in the region were analyzed and linked to data on time variables over a certain period of time. Various statistical methods were used to determine relationships with exposure to weather or climate, taking into account factors that modify the condition and/or in some way influence it, such as current climate conditions, water supplies, food and nutrient production, as well as the socio-economic and health condition of the population.

The impact of climate change on human health will become more pronounced. Extremely high air temperatures, especially among the elderly, are directly related to the number of deaths caused by cardiovascular or respiratory diseases. Extreme weather events can destroy homes, medical facilities, and other essential assets needed for health care.

A large proportion of the population in vulnerable areas may have to relocate, which further increases the risk of infectious disease transmission and may cause additional health consequences. The change in rainfall patterns is expected to affect drinking water supplies, increase the number of floods and droughts, and threaten food supplies. There may be changes in the way water-borne and insect-borne infections spread.

In addition to the rise in temperature, due to the huge amount of energy accumulated on land and in water bodies, primarily the oceans, the atmosphere becomes more dynamic. This changes the variability of the weather conditions, that is, there is a possibility of greater deviations from the average values. Greater variability also brings with it extreme weather conditions (periods of drought, ice, floods...). Extreme phenomena will be even more frequent, more pronounced, stronger and more devastating, above all for highly vulnerable sectors such as agriculture, which are directly connected and conditioned by the climatic conditions themselves. A period awaits us in which the unexpected will

become expected. After all, what we knew about 40 years ago as "eternal ice" is now melting, the sea level has risen by more than 20 centimeters, there are periods of drought in Northern Europe, heat shocks in Western Europe, followed by floods and fires everywhere. around us. And here. In recent years we have seen very late spring frosts, extremely intense rainfall that has caused heavy downpours and floods, more frequent occurrence of sunburn in crops, especially those with western exposure, wet summers, dry summers, emergence of new pests and new diseases in agriculture .

Mental health a target of climate change

A new report from the World Health Organization, presented at the Stockholm+50 conference, states that climate change poses a serious risk to people's mental health, which also coincides with a report from the Intergovernmental Panel on Climate Change, in which rapidly growing climate change is identified as a threat towards mental health and psychosocial well-being.

The World Health Organization defines mental health as "a state of well-being in which an individual realizes his potential, can cope with life's stresses, works productively and contributes to his community".

The consequences of climate change on mental health are expressed through stress and clinical disorders, such as anxiety, depression, post-traumatic stress, and suicide.

Other consequences include effects on everyday life, such as the perception and experiences of individuals and communities in trying to understand and respond to the implications of climate change. The interdependence of climate, biodiversity and human societies, as well as the close relationship between temperature rise, ecosystem health, community well-being and sustainable development, are essential factors in understanding the overall consequences that climate change has on human health. Instead of the planned reduction of harmful emissions and limitation of warming, which international agreements strive for, the level of carbon dioxide has increased, so they are 149 percent higher compared to pre-industrial levels, while July 3 of the current year has been declared the hottest day in history, taking global average temperature into account.

Harmful air particles cause damage to inflammatory cells in the nervous system, increase the risk of autism, reduce cognitive abilities and cause ADHD, increase the risk of dementia and Parkinson's disease. High temperatures, on the other hand, can cause irritability, as illustrated by a series of laboratory studies in which participants under controlled conditions reacted aggressively to uncomfortably high temperatures. Numerous cross-sectional studies using real-world heat and violence data provide the same evidence. More violent crimes occur in cities and regions with warmer temperatures than in cold regions, even after controlling for other sociocultural factors that drive violence, such as age, race, poverty, and honor culture. Researchers estimated that an increase of 1 degree Celsius in the average annual temperature leads to over 7.5 attacks and murders per 100 thousand citizens. Although prolonged heat waves, especially in populations ill-prepared to manage them, can also cause a large number of deaths, patients with psychiatric disorders are at increased risk due to the intake of drugs that prevent an optimal response to physiological heat stress .

The increase in global temperatures affects the population both in the form of localized disasters, but also through the long-term effects of recurring disasters and their consequences for the well-being, economic stability and infrastructure of the affected region. Extreme weather conditions destroy homes and workplaces and require significant recovery costs, lead to increased disparity in income among the population, and fuel resentment and conflicts that manifest through robberies and revenge, which further contributes to the recruitment of the population and encourages terrorism. In response to physical, economic or political instability caused by an environmental disaster, eco-migrations also occur, which can equally cause hostilities and conflicts due to sharply increased competition for resources in an area and newly created resentment.

Certain groups of people are at greater risk of adverse mental health consequences due to exposure to climate or weather hazards, and they include children, the elderly, women, people with pre-existing mental illnesses, the economically disadvantaged, and the homeless.

Children are more affected than adults and are more likely to have trauma-related symptoms long after the disaster. Disruptions in routines, separation from a caregiver as a result of evacuation or displacement, and parental stress following a disaster put children at risk for mental health consequences, including phobias, sleep disorders, attachment disorders, and lead to problems with emotion regulation, cognition, learning, behavior, language development, and academic performance. Together, this creates predispositions for adverse mental health outcomes in adults.

Children also show a high level of concern about climate change. Extreme heat is associated with an increase in aggressive behavior and domestic violence, and exposure to extreme heat can lead to increased alcohol use to cope with stress.

Approximately half of the world's population currently faces water scarcity due to a combination of climatic and non-climatic factors, droughts, floods and habitat change due to climate change lead to a net reduction in global food supply of approximately 1 percent per 1 degree Celsius of increased medium temperature.

Although starvation related to lack of food is a problem in itself, it creates additional harm because it contributes to aggression on an individual level. Studies have shown that malnutrition precedes antisocial behavior, aggression and violence in adulthood.

Despite the current state of affairs suggesting that the world is on the brink of climate catastrophe, and that current actions and crisis resolution plans are insufficient to prevent intense heat waves, droughts, floods, wildfires, sea-level rise and famine, an analysis of 100 national policies found that almost half did not mention climate change.

A World Health Organization survey conducted in 95 countries in 2021 found that only 9 countries included mental health and psychosocial support in their national health and climate change plans.

A new World Health Organization policy report provides guidance for countries to manage the impact of climate change on mental health, including integrating climate policies with mental health programs and developing community-based approaches to reduce their vulnerability.

In the future, interdisciplinary collaboration between psychologists, climatologists, political scientists and economists could lead to more examples of positive change, such as the improved provision of mental health services in the Philippines after Typhoon Haiyan, or the national project in India, which resulted was the readiness of cities to respond to climate risks and to address mental health and psychosocial needs.

Impact of climate change on food

Unfortunately, food production also releases large amounts of carbon dioxide, methane and other greenhouse gases in a variety of ways, including through deforestation and clearing land for fields and pastures, and then through the digestive processes of livestock. This may sound comical to you, but actually the explanation is very simple.

The beef industry is one of the major contributors to methane emissions. Methane accounts for about half of the total greenhouse gases emitted by this sector. Cows create methane in two main ways: through their digestion and through their waste. They are part of the group of animals called ruminants – exclusively herbivores. They obtain nutrients from plant food by fermenting the grass in their stomach before digesting it, mainly through microbial processes.

All the nutrients that these herbivores whose meat we eat come from plants. After all, all food comes from plants, even animals depend on plants. Hence, we also get our food from plants. Either directly (fruits, vegetables, nuts, legumes, etc.) or indirectly (through animal products).

Plants, which in photosynthesis use energy from sunlight to produce oxygen (O₂) and chemical energy stored in glucose (sugar). They are the first link in transforming solar energy into chemical energy. And the human body runs on only one type of energy: chemical energy.

The process called "enteric fermentation" takes place in the rumen - part of the stomach of the herbivores that we consume. The rumen is home to a complex ecosystem of microorganisms. These include bacteria, fungi and protozoa. Some bacteria and protozoa break down sugar and starch from plants. Others break down the cellulose that makes up plant cell walls. Enteric fermentation occurs when bacteria break down complex carbohydrates into simple sugars. The end products of enteric fermentation by bacteria include volatile fatty acids (VFAs) as well as gases: carbon dioxide and methane.

Although carbon dioxide is much more abundant in the atmosphere than methane, methane traps approximately 30 times more heat than carbon dioxide.

Today on Earth there are more than 1.5 billion cattle - a number that would not even be close to today if man had not mixed his hands in natural selection. That is, if we humans would not put meat (and the other products we get from them) in a priority place in our diet, and hence we reproduce and grow these types of animals in enormous numbers.

In the food industry, the causes of climate change include the production and use of manure and manure (cattle manure) for the cultivation of cereals, as well as the use of energy for farm machinery or fuel for fishing boats, which is mostly fossil .

All of this makes food production a major contributor to climate change, even if we didn't include food packaging and delivery. Cheers to companies and food delivery people who choose to use bicycles as a means of transportation or electric vehicles!

Agricultural production takes place mainly outdoors and is very susceptible to weather conditions. At first glance, climate changes bring better conditions for agricultural production, a higher concentration of carbon dioxide should intensify photosynthesis, extend the vegetation season, increased active temperatures should bring opportunities for the cultivation of new, heat-loving crops, etc.

Yields are limited by the factor of production that is at a minimum. So, Macedonian crop production is limited by the lack of water. Due to rising temperatures, evaporation will be more intense in the coming period and crops will require more water for their growth. On the other hand, precipitation will decrease and have an even less favorable schedule. So the current low yields will further decrease. Even with the application of measures for adaptation to climate change, the reduction of yields is certain, primarily due to the low adaptive capacity in the country. Irrigation seems to be the optimal solution, but existing irrigation systems are sized based on an average dry year or a probability rate of 20%. These systems were built according to the climatic conditions of the past, when they could provide enough water in 8 out of 10 years without any problem. With climate change, this probability decreases even more and the systems will be able to meet the needs less and less. Drought is a regular occurrence in our country and producers have experience in dealing with it. As long as they can provide irrigation water.

However, the main expectations are that the amount of water in Macedonia will decrease, and the water needs in all production sectors will grow. Most likely, agriculture will not be able to continue using as much water as it currently consumes (over 70% of water is used in agriculture). All this will lead to water shortages and water conflicts, and agricultural production does not have the economic power to maintain the position of the largest water consumer in the future.

The problem of climate change in agriculture is not only related to water. In Macedonia, in addition to the lack of water, farmers also face:

Extreme weather conditions such as floods, drought, very high temperatures, late spring frosts, excessive insolation;

New diseases and pests characteristic of warmer regions are expanding their range and are already starting to appear in our country, and farmers do not know them and do not know how to deal with them;

The occurrence of heat stress in agricultural crops and the occurrence of sunburn after the fruits are becoming more frequent, which leads to a decrease in yields and their quality;

Cattle farmers are faced with new diseases that seriously affect their farms (blue tongue, nodular skin), which originate from warmer regions and are not characteristic of this region, which is why knowledge about them is limited. A loss in productivity is also suffered due to heat stress in domestic animals, reduced production of forage crops and an increase in the cost of animal nutrition.

Agriculture is the branch of the economy that is most sensitive to climate change. Agricultural production is directly related to climatic conditions, so small variations in temperature or humidity can lead to a drastic reduction in yields. As climate change affects agriculture, today's modern industrial agriculture contributes significantly to global warming, releasing large amounts of greenhouse gases.

Animal husbandry, and beef production in particular, is a major emitter of these gases. Also, the burning and cutting of forests, the conversion of meadows into arable land, the use of artificial fertilizers and pesticides, the burning of field residues, as well as the use of agricultural machinery have a large share in the emission of gases with a greenhouse effect. Industrial farms are particularly large emitters.

Unlike humans and animals, which have the possibility of faster adaptation and migrations due to climate change, such a reaction in plants is very slow. Plants are slow to adapt to changes in climate and when these changes occur at the rate they are happening today, plants are left at the mercy of the forces of nature. Although they have the ability to migrate, such migration is so slow that it is almost invisible to humans. An additional problem arises when climate change introduces new invasive species that, without natural enemies in the environment, are able to destroy large fields of monoculture crops that stretch from Canada to Australia.



Figure 15: Genetically modified food

Source: <https://pixabay.com/>

Human population growth seemingly requires a steady increase in agricultural production to feed a growing global population. Until now, the need for new arable land was solved by cutting down forests, especially the forests in the tropics, whose biodiversity is the richest. This further contributed to climate change, as vast areas of forests were burned and cut down, and they serve as natural regulators of the amount of carbon dioxide in the atmosphere. When it comes to climate change, the rule applies that everything that is taken is charged many times more expensive. The effects of climate

change can be seen in reduced rainfall and every year thousands of hectares of arable land are turned into ever-expanding deserts. Because of climate change, there have been major changes in the rainfall regime, and while the amount of total rain water remains the same, long dry periods or strong flood waves appear more and more often. Such changes in the rainfall regime have already affected the reduction of yields per hectare in certain parts of the world.

Like capitalism itself, climate change does not affect everyone equally: the weak and poor suffer the most, while the rich may even profit initially. The most exposed to the effects of climate change are the countries of the Global South, which due to their geographical position are already bearing the consequences, and even more so due to the lack of money for climate change adaptation measures. In Europe, agriculture is under attack in the southern and eastern countries, which have been further weakened by the imposed austerity measures. Greek agriculture has seen a decrease in yields in the last few years, and agriculture in Spain, Portugal, Italy and other Mediterranean Eastern European countries is also under attack. On the other hand, Finnish agriculture has seen significant gains due to warming, and the situation is similar in other rich countries of the Global North.

Natural calamities, and in fact social disasters, have nothing to do with any higher forces, but can be predicted and can at least be influenced to mitigate them.

Genetically modified seeds are often offered as a solution to changing climate conditions and increasingly vulnerable agriculture. These seeds should be able to survive significantly harsher climates and produce quality fruit. With the use of licensed GMO seeds, farmers lose sovereignty over the seeds and are forced to buy GMO seeds every year from a few large corporations that have a monopoly on GMO products. The use of such seeds leads to a decrease in biodiversity and creates fields with monocultures, which we mentioned are highly vulnerable to invasive species. In addition, the safety of GMO products has not yet been fully proven and in some countries their production and distribution are still prohibited.

In the context of the climate changes that are happening, instead of relying on controversial genetically modified crops and corporations, apart from irrigation subsidies and the like, an urgent update of planning in agriculture is needed, because even today many farmers notice that the species that have succeeded in certain areas now they are looking for relocation to a higher altitude, more northern exposure, fresher land. These are some of the possible ways to at least slightly improve the quality of life of the rural population and save food sovereignty and oppose the GMO industry.

Regardless of the advances and technological innovations introduced in agricultural production, weather remains the most significant factor in food production. The fact is that global warming is affecting agricultural yields and those effects are already visible. In countries that base a large part of their economy on agricultural products, climate change is a reality and its impact on agricultural production is seen in food losses amid droughts, floods and other extreme weather conditions. That is why it is necessary to start as soon as possible with measures to reduce the emissions of gases with the greenhouse effect, but also with adaptation to climate change.

Lack of food

Climate change and extreme weather conditions are part of the reasons for the worldwide growth in the rate of hunger and malnutrition. Fish farms, crops and livestock may be destroyed or become less productive.

As the ocean becomes more acidic, the marine resources that feed billions of people are at risk. Changes in snow and ice cover in many regions of the Arctic have disrupted food supplies from livestock farming, hunting and fishing. The heat causes a decrease in water and therefore in the harvest of the agricultural land, but also in the pastures, which affects the livestock.

Impact of climate change on animal health and welfare

Climate change is a serious problem that can have long-term consequences in almost all spheres of human existence, and especially for the survival of the living world. If earlier it was thought that the European continent would cope with climate change more easily than the rest of the planet, this year 2022 showed that the entire planet is in danger. Namely, we have witnessed that this summer the level of the largest rivers in Europe is at its lowest level in the last 500 years. This will undoubtedly have a major negative impact on the economies of countries that use large rivers to transport their products. However, what is even more important, the satisfaction of water and food needs at the global level is seriously questioned, because the biggest negative effect of climate change is on agriculture.

It is predicted that by the year 2100 the global temperature of the Earth's surface will increase by 1.8-4.0°C. It is expected that this increase in temperature will contribute to a decrease in the number of livestock by more than 20-30%, as well as to the disappearance of some species of animals on the planet, which will undoubtedly have a huge impact on the biodiversity of the planet.

High temperatures and air humidity have a direct and indirect negative impact on the body of animals. The direct impact, first of all, is reflected by the appearance of heat stress. The appearance of heat stress in animals leads to a disturbance of the general state of health and has a negative impact on the secretion of hormones, production, reproduction, the immune system and the biological rhythm of animals. In general, high-producing cows are more sensitive to heat stress than low-producing cows. The negative impact of heat stress on the biological rhythm of animals can be controlled through the level of melatonin in the body. Melatonin treatment is an effective and safe manipulation method in breeding some photoperiod-sensitive animal species, such as sheep, goats and deer. In that way, it is possible to influence the time of food consumption during the day and night, that is, animals eat in the cooler periods of the day.

In addition, animals exposed to heat stress change their behavior in order to reduce the heat load on the body. So, for example, animals look for shade, reduce the amount of food consumed, spend more time standing, especially near drinking fountains or in general to a source of water, increase the respiratory rate, and more.

The indirect impact of high temperatures and air humidity on animals refers to the increase in the occurrence and spread of many infectious diseases, primarily due to the creation of favorable conditions for the development of various vectors - carriers of diseases in animals and humans.

