

Summary

People and Environmental Change Over Time

Reports by the Intergovernmental Panel on Climate Change (IPCC) have for a long time comprehensively presented and documented the human impact on climate change, which is intensifying and occurring all over the world (IPCC, 2007; 2014; 2022). Human presence, or rather all the activities we carry out, has led to such (irreversible) changes in the environment that even scientists have started to refer to this human-dominated period as the Anthropocene. It began in 1950 with the rapid increase in the impact of greenhouse gases on climate and biodiversity, and marks a period in which the cumulative effect of the numerous human activities has overwhelmed the Earth's own natural functioning.

Climate change adaptation (CCA) and disaster risk reduction (DRR) due to rising global temperatures require new approaches that could contribute to the development of a resilient society. However, the summary of the latest IPCC report (2023) has already issued a warning that "the adaptation options that are feasible and effective today will become constrained and less effective with increasing global warming. Losses and damages will increase, and additional human and natural systems will reach adaptation limits. Maladaptation can be avoided by flexible, multi-sectoral, long-term planning and implementation of adaptation actions, with co-benefits to many sectors and systems" (IPCC, 2023).

We have access to large global databases that show the magnitude of climate change. Furthermore, data exists on the estimation of damages resulting from climate change, and responses to climate change are better defined due to the rising costs of action and adaptation (Climate change adaptation ..., 2017). This approach has been followed in Slovenia with the adoption of the national Strategic Framework for Climate Change Adaptation, whose main objective is that of "reducing Slovenia's exposure, sensitivity and vulnerability to climate change impacts and increasing its climate resilience and adaptive capacity" (Strateški okvir prilagajanja ..., 2016).

The scientific monograph **People and Environmental Change over Time** was written by members of three departments of the Faculty of Arts, University of Ljubljana: Department of Geography, Department of History, and Department of Psychology. We address environmental change and the role of people in a changing environment from different perspectives, with a focus on the Slovenian landscape. We have brought our findings together in a single scientific work, with each author remaining methodologically faithful to their primary area of research.

The individual parts of the chapters were conceived during the completion of the interdisciplinary research project "The adaptation patterns of human activities to the environmental changes after Last Glacial Maximum in Slovenia" (J6-4016), which was conducted under the leadership of Dušan Plut (Department of Geography, Faculty of Arts, University of Ljubljana) and completed in 2014. The data were later updated and complemented, and the results of the survey on Slovenian farmers' attitudes toward climate change and adaptation were upgraded by an additional survey.

The monograph consists of two parts. The chapters in the first analytical part detail past environmental changes (and responses to them) and, in particular, explain the extent of changes by interpreting a variety of data sources. The second part focuses on humans in terms of how we perceive environmental change and respond to it. In addition to a concise presentation of the theoretical background for understanding human reactions and responses, this part focuses on the results of surveys of Slovenian residents and farmers.

The introductory chapter, *Global environmental change*, by geographers **Dušan Plut and Darko Ogrin** first outlines the causes and consequences of climate and related environmental change in the past, more specifically, in the Holocene period. It examines climate dynamics in this otherwise warm period of the Earth's history, during which humanity often felt the effects of climate and related environmental change, such as the great droughts in Southwest Asia, the progressive aridity of the Sahara, and the effects of the Medieval Warm Period on Europe and the Americas (Fagan, 2005). The authors place particular emphasis on anthropogenic drivers of global warming over the last 150 years. With the increase in world population, permanent settlements, accelerated urbanisation, and the Industrial Revolution, humanity has become increasingly vulnerable to long-term and short-term climate change and, above all, to natural disasters. In just over 100 years, our planet has warmed by 1 degree Celsius, with the land and northern latitudes warming up more than the oceans. Global sea levels are rising, the world's seas are becoming more acidic, glaciers are melting, and floods and droughts are becoming more frequent (Kajfež Bogataj, 2014). In the Alps, the average temperature has increased by about 2 degrees Celsius over the last 150 years, which is significantly higher than the global average temperature (Methods and Tools ..., 2014). In the second part, the authors summarise some of the key implications of contemporary climate change around the world and Slovenia in particular, concluding with climate projections for the 21st century. Projections of future climate change are highly uncertain in the geographically and climatically diverse Slovenia. It should be noted that local influences (particularly due to the varied topography) often prevail over the wider weather patterns, especially in cases of precipitation. Simulation results for the future predict a significant increase in mean annual air temperature by the end of the 21st century across the entire Slovenia and in all seasons. By the end of the century, the rise in winter temperatures will be more pronounced than the annual average, most notably in the high mountains and lowlands of central and eastern Slovenia. The temperature rise will significantly increase the heat stress in the summer. By the end of the 21st century, an increase in winter precipitation is most certainly expected. However, this does not mean an increased chance of snowfall, as air temperatures will also rise. Instead, the intensity and frequency of extreme precipitation events will increase, especially in the colder half of the year. The authors summarise that, despite the midlatitude location and abundant water resources, some Slovenian regions are classified as moderate to highly vulnerable to climate change. This makes a common national strategy and sectoral and regional climate change adaptation strategies that much more necessary.

Traditional knowledge and attitudes need to be taken into account when developing strategies for adapting to climate and wider environmental change. Traditional knowledge regarding people's past responses to climate change, when identified and

appropriately interpreted for the modern context, can help shape more appropriate adaptation pathways in the present. The various aspects of social adaptive capacity are also addressed in the comprehensive second chapter, *Historical adaptations to extreme environmental events in Slovenia with a focus on the 16th and 17th Centuries – lessons for the future*, by environmental historian **Žiga Zwitter**. The analyses of archival materials provide a more detailed insight into the multifaceted nature of the cause-and-effect relationship between humans and the environment, which, given sufficient data, avoids deterministic assumptions (Pfister, 2014). Among the different types of extreme environmental conditions and events to which people have adapted, the author focuses on extreme weather and climate events, as these were the most frequent causes of societal challenges during the period in question. Since real, landscape responses are the most important for identifying learning opportunities from past extreme events that could benefit us in the future, the author focuses on responses related to floods, droughts, water erosion, landslides, and other events. Territorially, the study is limited to Kranjska, Koroška and Štajerska. In terms of response to extreme environmental events, the author identified and systematically examined institutional forms of action (and assistance), and assistance from the local community, neighbours, and relatives. The presentation of the so-called systemic assistance during extreme events, involving the response of landed nobility, various authorities at the regional level, and individual natural and legal persons, is very interesting. The author presents a careful selection of the actions taken and describes specific forms of assistance, for example the possibility of providing additional agricultural land to the affected holding or adjusting the serf's obligations in the light of the damage caused.

The third chapter by **Darko Ogrin**, *Certain aspects of climate change in Slovenia in the instrumental period*, presents long-term trends in air temperature and precipitation changes over the last 150 years. In order to determine the climate variability in Slovenia during the instrumental period, the author used data from various meteorological stations which are currently in operation or used to operate in Slovenia and neighbouring regions (Ljubljana, Trieste, Maribor, Zagreb and Dobrač). A comparison of the centennial temperature trends in Ljubljana, Dobrač, Zagreb, and Trieste showed that the warming trend is least pronounced in Trieste and most pronounced in Ljubljana and Dobrač. The results for Trieste are expected, as the warming trend is generally less pronounced in areas with a maritime climate than in areas with a continental climate. The data also show that the warming trend for Ljubljana, especially since 1950, is more pronounced than that for Zagreb, even though Zagreb has a more continental climate than Ljubljana. In the second part of the chapter, the author analyses climate change data and trends in Slovenia after the Second World War according to climate type. He concludes that the climate is getting warmer in all climate types, with particularly intense, warmer summers in the lower-lying areas. The warming is less intense in parts of Slovenia that are more influenced by the sea and the high mountains. Analysis of the data shows that the change in precipitation patterns is less pronounced. The most striking finding is the intensification of autumn precipitation at the expense of precipitation in the warmer half of the year, resulting in the strengthening and expansion of precipitation in autumn toward the eastern and north-eastern part of the country.

For society to actually change its habits, we all need to recognise the changes taking place, and seriously consider the consequences of our actions (we need to tap into

our emotions as well). Only then we might change our behaviour. The ability and the means to adapt are not only important for the development of appropriate strategies and policies but are important also from an economic point of view in terms of direct and indirect costs of climate change or wider environmental change. The ability to understand environmental change and adapt to it must be addressed in a holistic way, without overlooking the psychological aspect of adaptation. This is explored in more detail in the fourth chapter, *Dilemmas of climate change*, by psychologist **Marko Polič**. To better understand human behaviour related to climate change, the author first explains the factors that influence public awareness and action. He presents the theoretical basis for understanding human response, which facilitated the interpretation of the survey responses of the Slovenian population. The author interprets people's attitudes and beliefs about climate change and presents individual and social barriers to engaging with climate change. He also establishes the link between awareness of climate change and actual action.

The most obvious response to climate change so far has been to reduce greenhouse gas emissions. Since 1980, the EU has played a key role in this area, particularly through research and a rather ambitious policy to reduce greenhouse gas emissions, especially by the leading EU countries. Clear, visible evidence of events such as melting glaciers and shrinking permafrost, measured temperature records, prolonged periods of heat waves, flooding, and other extreme weather events have contributed greatly to the awareness of climate change. The perception of environmental change among the Slovenian population in the middle of the previous decade is explained in greater detail in the fifth chapter, *Perception and response of the Slovenian population to changes in the environment*. The authors **Barbara Lampič and Marko Krevs** analytically present the results of a large-scale survey (N=1311). The attitudes of Slovenians towards environmental change are provided in detail. The survey confirmed that Slovenians are well aware of the reality of climate change. Increased attention is paid to the perception of the different aspects of climate change impacts, concerns about and responses to change, and in the final part, to the review of actual measures. Regarding the latter, the results of the survey show that Slovenians are already very active in some areas (e.g. being mindful of water consumption, consciously buying locally produced food, and changing their heating systems). Unfortunately, this diminishes when faced with the reality that is confirmed in our society again and again, namely that we are willing to make declarations, but in practice, change happens very slowly. This is particularly true when the measures interfere with our routines or our "comfort zone". One of the most important findings is that, while our society has a higher-than-average level of awareness and recognition of climate change compared to other EU countries, the level of perception at a personal level and the sense of personal jeopardy are notably lower. This has certainly changed significantly following the extreme events of 2023, in particular the massive floods in August which affected a large number of the population. It is important to note that the people of Slovenia already consider their own adaptation to changing conditions to be a part of the solution to climate change.

The final, sixth chapter focuses on agriculture and farmers. Agriculture is one of the most vulnerable sectors to climate change impacts due to its direct dependence on weather conditions. At least a quarter of European farmers lose more than 30% of

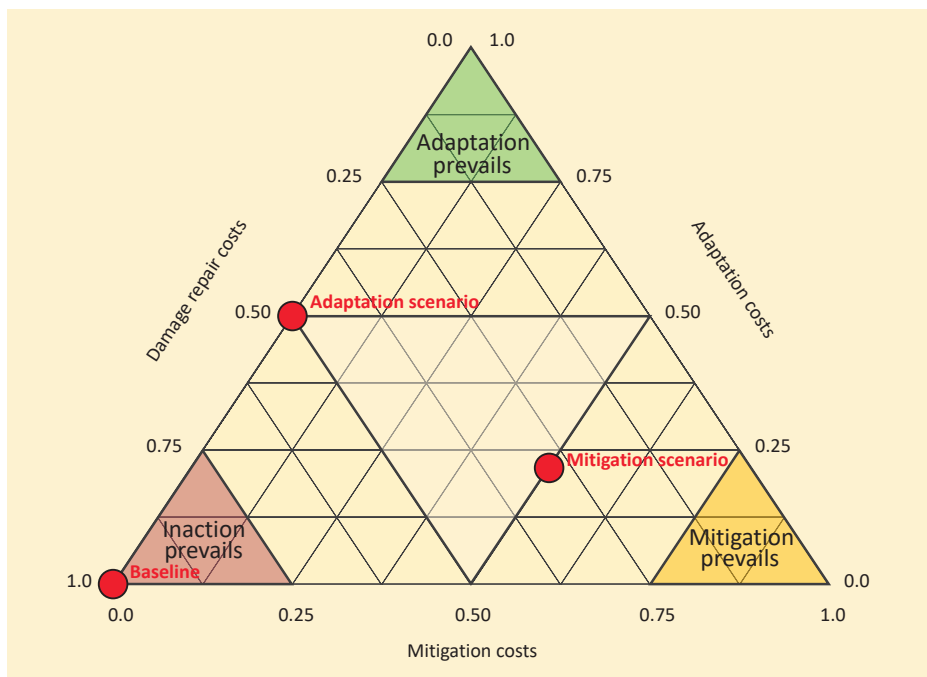
their income annually due to various extreme weather events (Communication from the Commission ..., 2017). In the chapter *Climate change and agriculture – uncertainty of the Slovenian farmer, response and search for solutions*, **Sara Mikolič and Barbara Lampič** identify the differences in Slovenian farmers' perception of climate change in the different climate types in Slovenia, as well as the dominant forms of adaptation to climate change. The survey involved 362 farmers. The chapter also includes a breakdown by statistical region, of the damage caused by natural disasters over the last ten years. The authors found that the vast majority of farmers (much like the general population) agree that climate change is having an impact on agriculture. Climate variability was thoroughly examined among farmers using the following variables: inadequate distribution of rainfall throughout the year, increased frequency or intensity of droughts, hailstorms, frosts and floods, diseases and pests, and longer growing seasons. Inadequate distribution of rainfall and drought are the most perceived consequences of climate change in Slovenian agriculture, followed by increased pests, more frequent frosts and longer growing seasons. Farmers are least likely to perceive the negative impact of more frequent or intense flooding on agriculture. In terms of climate types in Slovenia, the impact of climate change is felt more by farmers in the temperate continental climates of north-eastern, eastern, and south-eastern Slovenia. The survey also included the adaptation aspect, which showed that farmers are most likely to adapt their crop selection, while other forms are established more gradually. Farmers in eastern Slovenia are adapting more actively. Farmers in the temperate continental climate of north-eastern Slovenia are the most likely to adapt their crops, with around half of them already doing so.

Slovenia is already facing the consequences of a number of climate change issues, but come the end of 2023, we still do not have an overarching document to deal with them, i.e., a climate change adaptation strategy. The example of addressing the needs of agriculture as one of the most vulnerable sectors illustrates the intricacies and complexity of establishing and financing appropriate measures.

For some time now, Slovenia as a country and its society as a whole has been faced with a decision: which approach to take, which measures to implement to respond and adapt to the many changes in the environment, and in which direction to develop them. The question is whether the measures, together with financial investment, will be primarily directed towards adaptation and the search for new systems of working for human activities, or whether policies will prevail that (continue to) support measures to reduce exposure and recover the costs of the widespread and ever-increasing damage caused.

The extreme weather experienced in the summer of 2023 and the resulting major damage has left its mark and reinforced the realisation that the damage caused by various natural disasters must be accepted and understood as a constant that is ever-present for humanity and one that poses a constant threat to individuals and society. This fact will have to be taken into account and integrated into both strategic planning and the functioning of society. Managing the impacts of environmental change, and therefore climate change, involves large financial inputs, including adaptation costs (for society and individual sectors), mitigation costs and financial investments related to repairing the damage (Van Vuuren et al., 2011).

Figure 7.1: Different approaches to managing the consequences of environmental change in relation to financial investments.



But countries, regions and societies are implementing different measures. Adaptation policies may be at the forefront when efforts and resources are channelled towards adaptation measures. However, approaches may prevail where, due to years of inactivity and the absence of clear strategies, states devote large amounts of financial resources primarily to repairing any damage caused.

The increased passivity in politics and society generally leads to higher costs in terms of largescale restoration, cost recovery, etc. due to the damage caused. Society supports such behaviour until it is able to see and identify all the direct (and indirect) investments made in remediation, or until the costs of the damage incurred deviate significantly from the usual costs. Subsequently, the costs are transferred to the category of costs associated with the implementation of the various mitigation measures. We begin to react to change and its consequences in a systemic way, and the cost of taking action rises. But as society gains awareness and starts to look for new solutions or to put into practice different adaptation models, proactive social behaviour gradually takes over. This is when the cost of actual adaptation gradually begins to take precedence.

In recent years, we have been “flooded” with studies, data, scenarios, projects, strategy and implementation documents, financial mechanisms, media coverage, etc., all addressing the challenge of climate change for humanity. What seems to be missing from all these approaches is the awareness that as a society we will have to find and accept a series of compromises that will affect our daily lives as individuals, as well as

many sectors of the economy. Above all, there is a notable absence of understanding and application of the concept of restraint and maturity, something comprehensively argued by Dušan Plut in his extensive work. The authors of the present work have attempted to put together a mosaic of approaches and views regarding this wide-ranging issue. We have extended the prevailing analytical and scientific approaches with sociohistorical methodological approaches, leaving the burden of responsibility and the search for new solutions in the hands of the people.

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