

## **THE IMPACTS OF CLIMATE CHANGE ON TOURISM AND POTENTIAL ADAPTATION RESPONSES IN COASTAL AND ALPINE REGIONS**

Tanja Cegnar

Environmental Agency of the Republic of Slovenia, Ljubljana, Slovenia

tanja.cegnar@gov.si

**ABSTRACT** As in many other countries Slovenian tourism is an important and fast developing economic sector. It is highly climate and weather dependent, and in recent years, it has benefited from improved weather and climate information. Since the tourism industry is quite fragmented, climate change represents a significant threat to tourism. It forces the industry to adapt already. Future adaptation to climate change is a major challenge for tourism.

**KEYWORDS:** *Climate change, tourism, adaptation, natural resources, climatic diversity*

### **INTRODUCTION**

The main tourist attraction in Slovenia is the well-preserved nature with beautiful landscapes and rich cultural heritage. Snowy alpine peaks and the Triglav National Park with many glacial valleys, gorges, waterfalls, lakes and crystal-clear wild waters attract visitors looking for peace in the mountains, as well as sports climbers, skiers, rafters, canoeists, gliders and others in search of relaxation and excitement in everyday life. The landscape and also the opportunities for sports, recreation and leisure are highly dependent on local climate. Climatic conditions in Slovenia vary. There are a continental climate in the northeast, a severe alpine climate in the high mountain regions, and a sub-Mediterranean climate in the coastal region. Yet, there is a strong interaction between these three climatic systems across most of the country. This spatial variety is also reflected in climatic variability over time and is an important factor in the determination of the impact of global climate change.

### **NATURAL RESOURCES**

As nature-based tourism prevails in Slovenia, climatic change could endanger some of the touristic resorts and activities. Already now, it is evident that winter tourism based on sports and recreation on ice and snow is highly vulnerable. Immediate efforts for adaptation are

needed. For example, snowmaking is already one of the most widely spread adaptation measures. Climate change will shorten the tourist season in some parts of the country, but on the other hand, there are locations, which will benefit from the more favourable climatic conditions for selected sports, recreation and leisure activities like hiking. It is also expected that more tourists will concentrate in selected zones, thus increasing environmental stress in these regions. There are some natural phenomena (like caves with underground rivers in the karst terrain, wetlands, lakes and waterfalls), which are very sensitive to changes in the precipitation regime. Some of those natural beauties could even disappear if climate changes significantly. Ecosystems including some rare and protected species will be highly endangered in unstable climatic conditions. Already now, tourism represents a significant environmental burden for some fragile ecosystems, which may be unable to stand any additional stress caused by climate change.

### **CLIMATE SENSITIVE NATURAL FEATURES**

The coastal region is under stress if high tides occur in combination with special weather conditions (low air pressure and jugo wind in combination with high tide). Expected sea level rise will increase the problems in that region. The first to suffer is the salina landscape, a precious area protected for its cultural and environmental value.

Snežna jama cave with its frozen stalactites in alpine Mount Raduha is a special sight, and the caves in the shallow karst of Dolenjska are unique. The karst springs of rivers are a surprising feature in the Julian Alps; waterfalls and white-water rapids are found on many rivers and streams that flow here through narrow gorges. Charms of a special kind are shown by karst lakes, among which the disappearing Cerknica Lake is the largest and the most picturesque. This is an intermittent lake, which starts to disappear in spring and lives behind a field (Cerkniško polje). When the largest lake in Slovenia is full, the surface can reach up to 38 km<sup>2</sup>. In case of Cerknica Lake, the precipitation regime is crucial. The Škocjan caves are a unique natural feature and cultural heritage; they have been on the UNESCO world heritage list since 1986, and in 1999 were put on the Ramsar List of Wetlands of International Importance as the world's largest underground wetlands. However, these ecosystems are also very sensitive to changes in environment and consequently to climate change. Changes in precipitation regimes will have significant impact on all above-mentioned features.

Especially in costal regions and karst water supply is limited during the summer, which means that different sectors have to compete for water. If there is a low water level, the water

quality is also compromised. Due to warm weather, the temperature of surface water increases and the level of ground water decreases in summer.

### **CLIMATIC DIVERSITY**

Slovenia is a heterogeneous country not only in its climate and topography, but also in its vegetation. This diversity in vegetation is affected by varying temperature conditions and precipitation regimes, which directly define the length of the yearly vegetation period. Forests cover more than one-half of the national territory. Throughout Slovenia, there are forest reserves, and primeval forests are still found in some parts of Slovenia. Protected forests, trees, and the autochthonous flora and fauna are often part of the landscape parks that preserve the heritage of individual areas. We can also find about 850 endemic species in Slovenia, which can easily become endangered and extinct due to their vulnerability and restricted habitat; the most important are *Campanula zoysii* and *Proteus anguinus*, but there are also many others (hladnikovka, kranjski jeglič, kratkodlakava popkoresa, Savinjski deževnik, pajek Polenčev lijakar, primorski rjavček...). Many of Slovenia's natural sites are included in theme trails, forest education trails, and various local excursion programs. Droughts, flash floods, wild fires and severe storms can endanger them. Single weather events and slow changes in temperature and precipitation regimes could jeopardize them.

### **NATURAL HERITAGE**

The natural heritage of Slovenia is protected either as national park, regional park, nature park, Natura 2000 park or as a natural monument.

Triglav National Park (TNP) is the only Slovenian national park. It was named after Triglav, the highest mountain in the center of the park, which is also the highest mountain in Slovenia (2864 m) and a national symbol. The park covers 3% of the territory of Slovenia. It is among the first established European parks; the first protection dates back to 1924 when the Alpine Conservation Park was founded.

Škocjan caves, which are the most important underground phenomenon of the karst region, are strongly connected with Škocjan caves regional park. Škocjan caves are among the finest caves in the world. The largest of them is 123 m wide and 300 m long Martel's chamber that reaches, at its highest point, the stunning height of 146 m. This is one of the most famous sites in the world for the study of karstic (limestone) phenomena. In the village Cerknica is situated the Notranjska regional park, is extended on 222 km<sup>2</sup>. Kozjansko regional park was registered in 1999, it covers 196 km<sup>2</sup>.

The 42 nature parks of Slovenia cover more than 3 % of the territory of Slovenia. In 2004, Slovenia designated also the Natura 2000 sites, which cover approximately 35 % of the Slovenian territory. 26 sites for bird conservation and 260 sites for the conservation of habitat types and species were defined. However, protected areas are highly fragmented and endangered species will be faced with limited migration possibilities.

### **IMPACTS OF CLIMATE CHANGE ON TOURISM**

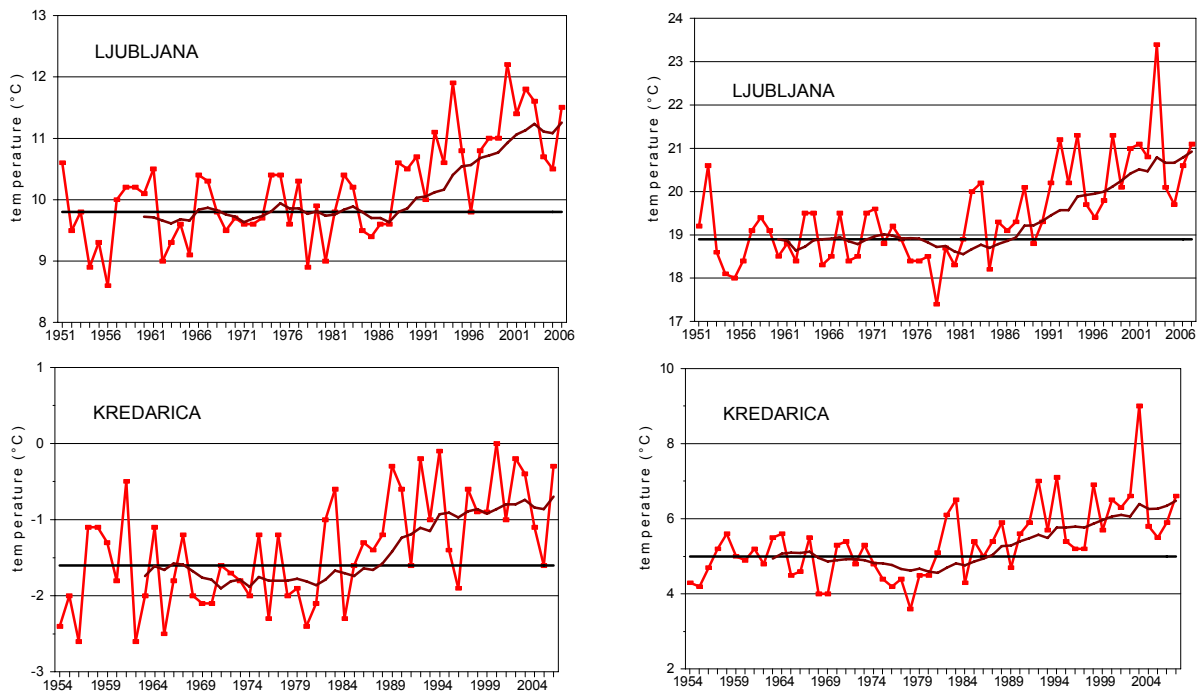
It can be expected that climate change will have some effect on the desire and necessity to travel to places with different climate, on mobility (concerning available transport means, transport safety and convenience) and safety. Weather extremes are expected to become more frequent and intense (they are likely to endanger tourists more than the local population). Climate change could have some effects on the appeal of tourist destinations. Some new destinations may develop, and some traditional destinations may lose their present appeal, or could even disappear (for example some low lying ski resorts) and, finally, on the frequency of particular weather conditions suitable for different sports at selected tourist destinations.

### **IMPORTANCE OF METEOROLOGICAL DATA**

Meteorological data are important in all economic sectors, and the tourism is no exception. Climate and weather are of great importance for sport activities and health resorts claiming healthy effects of their local climate.

Many sport activities are peculiar for specific climatic conditions. Need for meteorological data of some of them goes beyond information provided on a regular basis in the frame of weather forecasts. Extreme sports require even better meteorological support. Some tourists may expose themselves to risk (e.g. hanggliding) which makes them particularly vulnerable. No tourist season is complete without the sad news of accidents befalling tourists engaged in some particular form of sporting or mountaineering activity, who get surprised by a sudden adverse rapid change in weather conditions.

Due to climate change, the risk of vector borne diseases is expected to increase, particularly ticks spread to new territories and higher-elevated areas and the ratio of infected ticks is increasing, which also jeopardizes tourism. Changes can create situations and conditions that favour or support new or different disease patterns. Weather and climate have a considerable influence on asthma, hay fever and other respiratory disorders caused by various allergens, pollens and pollutants, so spending a holiday in places with healthy climate could result in enhance work efficiency and help to prevent illness. Climate is even more important for health resorts claiming to offer healthy climate or climatotherapy; more and more people are willing to spend at least parts of their vacation in health resorts.



**Figure 1: Annual air temperature (left), the mean air temperature in summer (right), the 1961-2006 normals (black line) and the 10-year moving average (dark red line)**

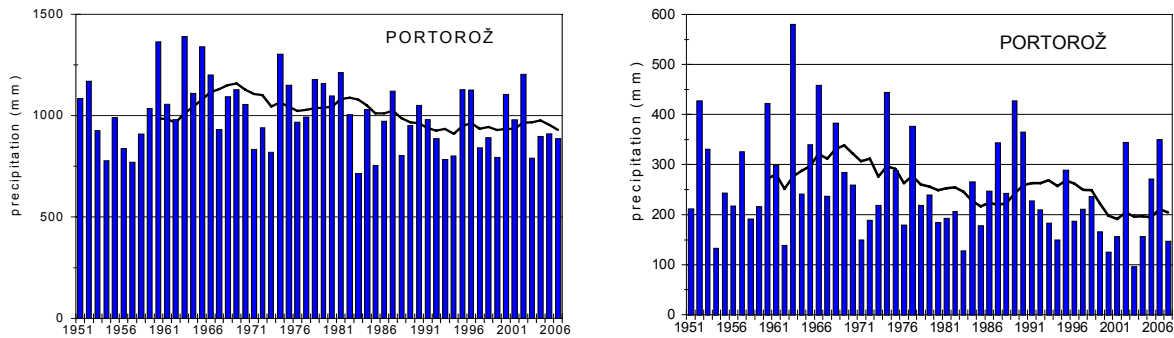
## NEED TO ADAPT

Slovenia is perceived as water rich, there is no perception that we should carefully deal with this resource. However, with progressive climate change over the next decades, this perception will have to change considerably. Extreme weather and climate events have always represented a threat to society and the environment, in such a varied climate as ours, extremes have various impacts and their consequences involve different aspects. During the last year, more attention was paid to extreme events and potential consequences of climate change, and a project focusing on assessing the impacts of potential climate change in Slovenia was established. The first step is to determine the vulnerability of our environment and society to climate change. In this respect tourism is an important economic sector, which occupies a visible place within the project. Only through the effective use and management of existing resources and adaptation to changing climatic and environmental conditions tourism revenues will increase, local small- and medium-sized enterprises will get a boost.

## CONCLUSIONS

Changes in global and regional climate are beyond the control of the tourism industry, which means negative consequences for many current tourist destinations. Tourist destinations will be forced to respond and adapt the infrastructure and programs, and the duty of experts is to improve the accessibility of climate information tailored to the specific needs of the tourism

sector. Diversification of tourism activities is inevitable. Some destinations are already adapting their own offer; ski resorts are forced to make the artificial snow, but also to develop alternative programs. Snow making is not among the sustainable adaptation measures, but it is widely taking place in spite of high energy and water consumption, and also higher prices in ski resorts.



**Figure 2: Precipitation in the period 1951-2006 (left), precipitation in summer (right) and the 10-year moving average**

Tourism is a continuously adapting industry, responding to changing demographic and economic conditions, as well as to new demands, technologies and fashion. Due to its fragmented structure, adaptation is likely to be gradual, with new investment in tune with other strategic decision. For tourism adaptation is vital; in costal regions and karst more efficient water use to prevent the deficit of water in summer seems to be inevitable in the future. Some measures will be necessary to enable migration of endangered species and carefully developed forestry policy to be implemented, especially for low land forests that now consist mostly of spruce not inclined to prosper in warmer climate. Sultriness is becoming more and more frequent in the lowlands; therefore, some health resorts will have to develop alternative programs during summer and cities will become less appealing during summer because of more frequent heat waves. But these are only some of the preliminary results within the national Climate Change Adaptation project running at the Environmental Agency.

## REFERENCES

National Climate Change Adaptation Project, in development at the Environmental Agency of the Republic of Slovenia