Climate change could cause massive losses in Pyrenees ski resorts

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An increase in temperatures due to climate change could mean that the Andorran ski resorts have a shorter season in the future, especially in lower areas. A study undertaken by the Polytechnic University of Catalonia and the Andorran Sustainability Observatory has analysed the specific case of the Pyrenean country and predicted that financial losses could come close to 50 million euros.

One of the major challenges when studying climate change effects is to establish the relationship between physical impacts and environmental changes on the one hand, and between these factors and impact on humans on the other hand.

An international study enjoying the participation of the Polytechnic University of Catalonia has investigated the particular case of Andorra and has demonstrated a predicted increase in temperatures as a result of climate change will shorten the ski season in the resorts of the principality.

Furthermore, depending on the predicted climate change scene, a fall in income has been predicted along with lesser adaptation capacity provided by snow production machines.

Published in the Climate Research journal, the study estimates a reduction in the number of skiers, especially in lower altitude resorts.

The mountain regions are considered especially vulnerable to the effects

of climate change. "The rapid decrease in glacier mass, quantity and frequency changes of snowfall, level variations and biodiversity distribution are examples of how mountain ecosystems are highly sensitive," as explained to SINC by Marc Pons from the Sustainability Measuring and Modelling Laboratory of the Polytechnic University of Catalonia and the Andorran Sustainability Observatory and coauthor of the study.

Andorra is a small country in the middle of the Pyrenees between France and Spain with a population of approximately 80,000 inhabitants. It receives 10 million tourists each year according to data from Andorra Turisme 2010, especially during the winter season. Snow tourism is one of its main sources of income used for local development.

The study analysed three ski resorts in the principality: Grand Valira, Pal-Arinsal and Arcalís. And it is based on three possible scenarios as a consequence of climate change: the current situation and two possible future conditions.

Out of the last two, the first considers an increase of 2 ºC in the average winter temperature whereas the second is based on an increase of 4 ºC.

"We have employed these temperature increase figures based on two of the scenarios from the SRES report of the Intergovernmental Panel on Climate Change (IPCC), which are predicted as plausible for the Pyrenees at the end of the 21st century," states Pons.

The estimations have allowed them to analyse possible consequences, such as reduction of the ski season over time, the subsequent decrease in the number of skiers and thus what they would spend when visiting the region.

The importance of attitude

In the study, the altitude of skiable terrain is "one of the most determining factors in the vulnerability of the resorts," adds Pons. An assessment was made of the future snow cover of each one of the tourist resorts at various altitudes: 1500 metres, 2000 metres and 2500 metres.

Pons adds that studying different altitudes "is important to analyse the capacity of the resorts to compensate for climatic variability by using artificial snow production." He outlines that in recent decades, "resorts have invested significant amounts of money in artificial snow production."

In the case of Andorra, around 50% of the ski zones are covered by such snow production systems.

In addition, the researcher explains that there are "a great variety within the same region, which means that two resort groups now arise: those that are more vulnerable and those that are resilient, like Arcalís."

More specifically, if the temperature were to increase by 2 ºC in winter, only the lowest areas of Pal-Arinsal would be affected and the ski season would be shortened by 30%. This would mean a reduction in the number of skiers and investment in the region would be very small.

In contrast, in the case of a 4 ºC increase, the three tourist resorts would suffer from serious reductions in their lower altitude areas, where even the snow production machines could not even help to save the ski season. Nonetheless, the higher areas would remain stable throughout the season.

Delicate Pal-Arinsal and privileged Arcalís

The most critical of situations would be that of Pal-Arinsal, which could not even continue even with snow production machines. On the other

hand, Grand-Valira and Arcalís would carry on, although with a shorter ski period.

In this context, a 15% decrease would be recorded in visitors with losses of approximately 50 million euros each season. In this case the resorts receiving the most visitors (Pal Arinsal and Grand Valira) would be affected both at the very beginning and at the end of the season.

Nonetheless, "aside from the figures themselves, the most important factor is the capacity to relate to physical changes," adds Pons.

The researcher points out that despite the influence of altitude, "there are other determining factors, such as orography and orientation, which have a strong influence and therefore should be considered in future studies."

This type of study helps governments to acquire deep and detailed knowledge on areas or resorts that are more vulnerable to the effects of climate change, the range of possible impacts and what adaptation measures are more suitable for each specific area."

More information: Marc Pons-Pons, Peter A. Johnson, Martí Rosas-Casals, Bàrbara Sureda, Èric Jover. "Modeling climate change effects on winter ski tourism in Andorra". *Climate Research*.

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