



In collaboration with
UN Tourism



Fachhochschule Graubünden
University of Applied Sciences

Preliminary Findings of the UN Tourism Report

Climate Change and the Future of Snow-Based Mountain Tourism Destinations

Impacts, Adaptation Strategies & Recommendations

Presenters

Christian Baumgartner | Melanie Tamborini

13th World Congress on Snow, Mountain and Wellness Tourism | 24th March 2026



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Report

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Section Overview

Impacts & Challenges of Climate Change on Snow-Based Mountain Tourism

Ecological · Economic · Social



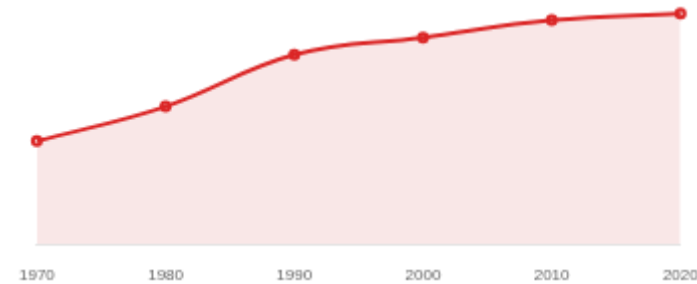
Duration: 2 min

The Mountains Are Changing Faster Than Anyone Expected

📍 Rapid Warming in the Alps

+2°C

Since late 19th Century
(3× Global Average)



❄️ Snow Cover Decline & Season Shortening

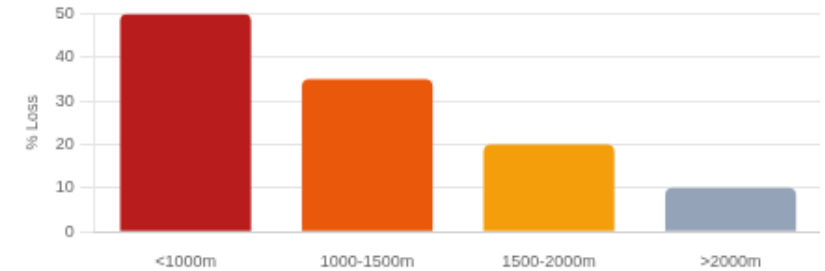
-8.4%

Snow cover decline per decade
(1971–2019)

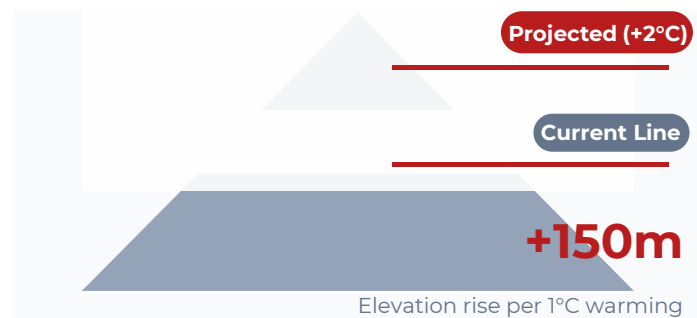
↓ **Season Length**

-36 Days

Shorter snow season on average



⚠️ Rising Reliable Snow Line



🏔️ Permafrost & 0°C Isotherm

0°C Isotherm Rise **600m → 850m**

Projected +200m by 2030

⚠️ Permafrost Warming

+0.36°C / decade

Destabilizing rock glaciers & infrastructure

☁️ Extreme Weather Events



+40%

Rain-on-Snow Events
(Last 50 years at mid-elevations)

Geographic Distribution of Climate Risk

↓ The Altitude Trap

< 1,500m

Resorts operating below this threshold face existential threat. 53% of European ski areas are in this "Red Zone".

🌐 Pyrenees & Apennines

89% Risk

Highest vulnerability due to southern latitude and lower average elevation compared to central Alps.

⚠️ Central Asia

Glacier Retreat

Tian Shan & Pamir: Rapid glacier mass loss (18-27%) threatening water supply and high-altitude tourism.

Regional Risk Levels

- **Very High:** Existential threat
- **High:** Heavy adaptation needed
- **Moderate:** Resilient >2000m

Vulnerability Across UN "Europe" Region (Atlantic to Ural)

📍 West & Southern Europe

⚠️ Pyrenees

Very High

89% Risk

Vast majority of resorts vulnerable at 2°C warming due to latitude.

⚠️ Apennines

Very High

Sporadic Snow

Southern exposure makes consistent snow cover increasingly rare.

🌲 Mittelgebirge

Very High

< 1,000m

German & Czech low ranges face near-total loss of natural snow season.

📍 Alps & Northern Europe

⚠️ Western Alps

High

Variable

High altitude resorts resilient; mid-mountain stations highly vulnerable.

❄️ Eastern Alps

High

Tech Dependent

Heavy reliance on artificial snowmaking to maintain season length.

🚶 Scandinavia

High

Fast Warming

Region warming 4x faster than global avg, affecting low-altitude Nordic skiing.

📍 East & Central Asia

⚠️ Carpathians

High

Unpredictable

Increasing variability in precipitation patterns threatens season stability.

⚠️ Caucasus

Moderate

Height Buffer

Higher average elevations (>2000m) provide temporary climate refuge.

🏔️ Tian Shan

High

-18% Ice

Rapid glacier retreat threatens water supply for snowmaking & tourism.

An Industry Worth €50 Billion at Risk

Current Threat Level

40%

of European ski resorts at risk
(operating below 1,500m)

@ 2°C Warming
>50% Risk

@ 4°C Warming
98% Risk



Austria Projection

€221 Million

Projected annual losses for the ski industry by the 2050s due to climate impacts.

Snowmaking Crisis

Suitable Days (2050) **-30-50%**

Operating Costs **+30-50%**

Energy Consumption **~18% of Total**

"Snowmaking is becoming physically impossible at low altitudes."

Asset Exposure

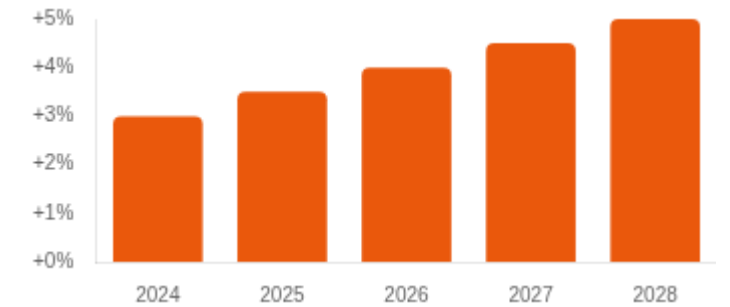
Total Infrastructure Replacement Value

> €50 Billion

Stranded Asset Risk

Lifts & facilities becoming unusable due to lack of snow.

Consumer Impact



Annual Ticket Price Increase Needed

More Than Snow: Communities, Culture & Livelihoods at Stake

“

"For many Alpine communities, skiing is not just a business – it's an identity."



Labor Market Vulnerability

20–35%

Of the labor force in Alpine municipalities are seasonal workers. Shorter seasons create income insecurity and a talent retention crisis.



Cultural Identity Loss

"Solastalgia"

Psychological distress caused by environmental change. Communities face the loss of a century-long winter sports culture and heritage.



Depopulation Risk

< 1,500m

Low-elevation areas are losing young residents as economic viability declines, threatening the collapse of public services like schools.



Consumer Shifts

40–60%

Of winter tourists now prioritize snow reliability when booking. 30–50% actively consider a destination's climate resilience.

02



Section Overview

Part 2: Adaptation Strategies

From Survey Insights to Real-World Case Studies



Duration: 5 min



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73% Report Significant Climate Impacts – Yet Adaptation Lags Behind

73%

Of respondents report significant or moderate climate impacts in the last 5 years

>60%

Observe Visitation Shifts

Changes in timing & patterns due to extreme weather

THE "ADAPTATION GAP"

Awareness is high, but implementation is slowed by costs & complexity.

The Adaptation Gap: Few Destinations Taking Comprehensive Action



Comprehensive Strategy

Snowmaking
Year-Round
Diversification

Partial Action

Single measure only (mostly technical snowmaking)

Minimal / No Action

Reactive response only; Lack of strategic planning

Major Barriers to Adaptation

Lack of Financial Resources

Top Barrier

High Infrastructure Costs

Limited Knowledge/Skills

Regulatory Hurdles

Short-term Planning

Technical Adaptation: A Bridge, Not a Destination



Advanced Snowmaking Efficiency Gains

AI-optimized systems reduce energy consumption by **30–50%**. Intelligent integration with meteorological data ensures production only during optimal windows.



Snow Farming

Storing snow over summer under thermal blankets to guarantee early-season base layers.
Example: Ejder 3200, Türkiye (pioneering technique).



Spatial Adjustments

Strategic phasing out of marginal low-elevation slopes. Investment focused exclusively on north-facing, high-altitude, and snow-secure terrain.

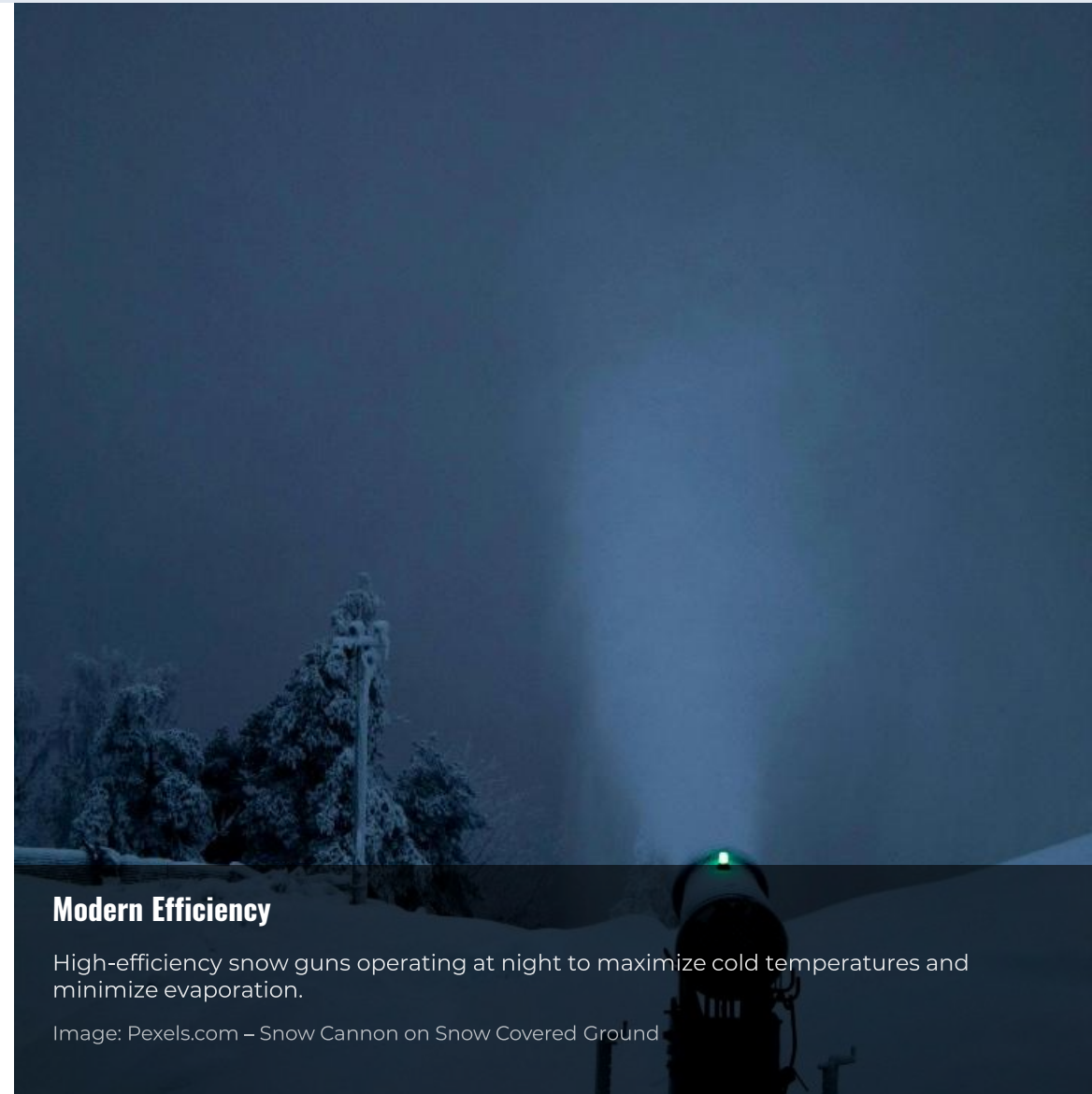


Water & Energy Security

Dual-use reservoirs (snowmaking + summer irrigation). Transition to 100% renewable energy sources (e.g., Crans-Montana, Andorra).

Snowmaking is essential – but it cannot save resorts below 1,200m. It buys time for transformation.

Technical solutions address the symptoms, not the root cause of warming.



Modern Efficiency

High-efficiency snow guns operating at night to maximize cold temperatures and minimize evaporation.

Image: Pexels.com – Snow Cannon on Snow Covered Ground

Six Destinations, Six Paths to Resilience



AT **St. Corona am Wechsel**

Radical Summer Pivot

2/3 Revenue

Generated from summer activities

Shifted entirely from winter-focus to family adventure park & trails.



FR **Métabief**

Managed Retreat

200k+ Visitors

Summer lift passes sold annually

Stopped all ski investment based on climate data; building "Mountain Station".



SI **Kope**

Infrastructure Inv.

€35 Million

Invested in year-round facilities

Developing Europe's largest bike park with EU/public funding leverage.



CH **Crans-Montana**

Energy Transition

929k Overnights

Balanced split: 55% Winter / 45% Summer

Premium repositioning coupled with aggressive renewable energy goals.



AD **Andorra**

Technical Excellence

9.6M Visitors

Record visitation numbers

66% snowmaking coverage + national tourism strategy integration.



TR **Ejder 3200**

Niche Premium

3,000+ Climbers

Attracted to Ice Park annually

High-altitude sports camps (football/athletics) + advanced snow farming.

Smart Governance: Act Before Crisis Hits



Collaborative Future

Participatory governance involving all stakeholders is essential for securing social license for major transitions.



Scientific Tools & Evidence-Based Planning

Moving beyond intuition to data-driven projections. Tools used for long-term viability assessment:

CLIM-SNOW

Snow Compass

NIVOPYR



Courageous Decisions (Métabief Example)

Using CLIM-SNOW data to halt new ski lift investments. Pivoted to "Mountain Station 2040" master plan to manage transition proactively.



Participatory Governance

Creating multi-actor frameworks involving operators, municipalities, NGOs, and local communities to ensure broad support.



International Integration

Joining multi-resort networks (e.g., Magic Pass, Epic Pass) to diversify visitor origins and reduce dependence on local weather.

Act while financially stable to fund transformation.

Destinations that wait for crisis lose the financial capacity to reinvent themselves.



Section Overview

Learnings & Preliminary Recommendations

For Destinations · Private Sector · National & International Policy

To be revised in the final report

What We Have Learned: Five Principles for Climate-Resilient Mountain Tourism



Accept Climate Reality

Decisions must be based on scientific evidence, not wishful thinking. Acknowledge limits.

01



Snowmaking is a Bridge

Technical adaptation buys time but is not a permanent solution for low-altitude destinations.

02



Timing is Everything

Act while financially viable. Use winter revenues to fund the transition before crisis hits.

03



Find Your Anchor Product

Generic diversification fails. Develop a flagship non-snow experience (e.g., world-class biking).

04



Collaboration Wins

Structural change requires deep alignment between private sector, public policy, and community.

05

For Destination Managers: From Winter Resort to Mountain Experience



Shift to 12-Month Operations

Move beyond the 3-4 month winter model. Stabilize revenue and retain staff year-round to build resilience against erratic seasons.



Commission Vulnerability Assessments NOW

Don't fly blind. Use scientific tools (e.g., CLIM-SNOW) to understand local climate risks before investing in new infrastructure.



Develop a Non-Snow "Anchor Product"

Create a compelling flagship experience (e.g., world-class bike park, wellness center) that draws visitors independently of snow conditions.



Use Dynamic Pricing (-30% to -50%)

Aggressively discount shoulder seasons to activate demand and habituate visitors to non-peak travel times.



Join International Networks

Integrate with multi-resort passes (Epic, Magic Pass) to diversify visitor origins and reduce exposure to local weather risks.



Engage Communities Early

Secure social license for transformation. Structural change requires community buy-in to succeed.



Image: Pexels.com - Scenic Swiss Village with Snow-Capped Alps

“The goal is not to save skiing at any cost, but to save the mountain economy by reinventing it.”

For the Private Sector: Invest Smart, Move Early



Invest in Dual-Use Infrastructure

Retrofit lifts for bikes and hikers. Ensure capital assets generate returns in both winter and summer seasons to maximize ROI.



Optimize Snowmaking with AI/IoT

Deploy smart systems to cut energy use by 30–50%. Produce snow only when conditions are optimal to reduce waste and costs.



Leverage Public Funding

Use EU grants and regional funds as a catalyst for structural transformation, leveraging public money for long-term resilience.



Diversify Products Proactively

Don't wait for snow-poor seasons to force your hand. Develop non-snow revenue streams while cash flow is still positive.



Build a Resilient Brand

Re-position from a "ski resort" to a "mountain experience" destination. Broaden appeal to reduce climate vulnerability.



Image: Vecteezy.com – Cable Cars Ascending Snowy Mountain Slope

“

"Business as usual is the riskiest strategy of all. Adaptation is the new competitive advantage."

For Governments: Create the Enabling Environment



Classify as "Climate-Sensitive Strategic Sector"

Formal recognition is key to triggering dedicated policy support, subsidies, and specialized funding streams.



Fund Vulnerability Assessments

Proactively finance destination-specific research to understand local risks before crisis conditions emerge.



Invest in Sustainable Access

Expand rail and public transport to mountain hubs to drastically reduce Scope 3 emissions from visitor travel.



Develop National Frameworks

Create standardized sustainability instruments (e.g., Switzerland's "Swisstainable") to guide the industry transition.



Enable Cross-Boundary Governance

Facilitate inter-municipal cooperation frameworks to align planning and regulation across administrative borders.



Support Cross-Border Research

Fund international initiatives (e.g., Interreg) as climate risks and tourism flows transcend national borders.



"The role of government is to de-risk the necessary transition to a climate-resilient economy through strategic policy."

Image: © Mountain Research Initiative MRI – Living Labs: Sustainable Ski Tourism in the Alps – mountainresearchinitiative.org – Open Research

For International Organizations: Coordinate, Fund, Lead



Recognize in Global Frameworks

Formally acknowledge mountain tourism as a "climate-sensitive strategic sector" in international climate policies and agreements.



Integrate into Adaptation Finance

Make the sector eligible for international climate funds (grants, blended finance) to support resilience and structural transition.



Create Global Monitoring Standards

Establish universal metrics to track snow-tourism vulnerability and adaptation progress across borders and mountain ranges.



Scale Knowledge Transfer

Facilitate North-South cooperation and peer learning networks to share best practices in adaptation between developed and developing regions.



Certify Resilient Destinations

Develop and support international certification schemes for destinations that successfully transition to climate-resilient models.



Fund Longitudinal Research

Support long-term studies on global visitor behavior shifts to inform data-driven adaptation strategies.



Image: UN Tourism Executive Council Meeting

“*Climate resilience knows no borders. International cooperation is the bedrock of sustainable mountain tourism.*”

The Mountains Are Calling – For Action

"Mountain tourism is culture, identity, and livelihoods in climate-vulnerable regions. Climate change is not waiting. Neither should we."



Step 1

Assess

Understand your vulnerability today. Don't rely on past data - commission localized climate risk assessments.



Step 2

Adapt

Invest in resilience while you can afford it. Use current financial buffers to fund the necessary transition.



Step 3

Transform

Build the mountain destination of the future. Shift from "ski resort" to "year-round mountain experience."



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