



REPORT ON THE UNDERSTANDING OF YOUNG RIDERS ABOUT THE IMPACT OF THEIR SNOWBOARD PRACTICES ON CLIMATE CHANGE

Deliverable 6

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Abstract

This study examines the environmental awareness of young snowboarders and its influence on their behavior and perceptions regarding climate change. Utilizing a questionnaire based on the Pressure-State-Response (PSR) model, the research assesses key dimensions of environmental impact, including 'Pressure' (human activities affecting the environment), 'State' (perceived environmental conditions), and 'Response' (proactive environmental behaviors).

The findings reveal a significant gap between awareness and action, with 73.8% of respondents identifying as environmentally conscious, but only 20% demonstrating consistent proactive behaviors. While snowboarders exhibit high sensitivity to ecological challenges and moderate concern about environmental conditions, their actions often lack behind due to barriers such as insufficient knowledge or convenience factors.

The study underscores the role of education in addressing this action gap, suggesting innovative strategies like interactive learning tools and targeted campaigns to promote sustainable practices in snowboarding. Recommendations for snowboard associations include implementing educational initiatives, incentivizing eco-friendly choices, and collaborating with resorts to adopt sustainable infrastructure.

By bridging the gap between attitudes and actions, the snowboarding community can contribute to preserving the natural landscapes vital to winter sports. This research highlights the importance of aligning environmental awareness with actionable behaviors to ensure the future sustainability of snowboarding.

1 Introduction and Problem Statement

Climate change represents one of the most pressing global challenges, with widespread implications across various sectors, including sports. Snowboarding, a sport that has gained significant popularity in recent decades, is particularly vulnerable to the effects of climate change. As sport relies heavily on natural snow and cold temperatures, changes in climate patterns pose a serious threat to its future viability. The younger generation, which constitutes a substantial portion of the snowboarding community, holds a critical role in addressing this issue. Their collective efforts and increased awareness of environmental sustainability could play a pivotal role in shaping the future of the sport and mitigating the impact of climate change on snowboarding and similar outdoor activities.

The EU-funded project "ZERO - Zero Emissions Rides Objectives" by the World Snowboard Federation aims to raise awareness about the environmental impacts of snowboarding and to develop innovative solutions to reduce the sport's carbon footprint. The COVID-19 pandemic has significantly influenced sports habits in Europe and highlighted the need to promote sustainable sports practices. While 6 out of 10 Europeans, according to Eurobarometer 2018, are inactive or exercise less than once a week, snowboarding offers an attractive way for the 14 to 25 age group to be outdoors. The ZERO project aims to increase young people's participation in snowboarding while empowering them to actively contribute to combating climate change.

The United Nations recognizes sport as an important driver for sustainable development. The 17 Sustainable Development Goals (SDGs) emphasize the role of sports in promoting tolerance, respect, and the achievement of development and peace objectives. The ZERO project aims to contribute to the UN SDGs goals by educating and raising awareness among the young snowboarding community. Together with partner organizations from eight countries, the project is working on developing educational and informational materials to direct young people's focus towards the relevance of sustainable development

This report critically examines awareness and understanding within the snowboarding community, particularly among younger generations, regarding their environmental impact. It explores the ways in which this demographic perceives and responds to the challenges posed by climate change, specifically within the context of snowboarding. The analysis also evaluates existing measures and initiatives aimed at fostering environmental responsibility within sport. The primary objective of this report is to develop evidence-based recommendations for empowering youth to take an active role in climate action, focusing on innovative strategies and sustainable practices that can be integrated into snowboarding culture. Through this approach, the report seeks to identify effective avenues for encouraging environmentally conscious behaviors and ensuring the long-term sustainability of sport amidst growing climate-related concerns.

How does the environmental awareness of young snowboarders affect their perception and behavior regarding climate change, and what role do they see for themselves in promoting sustainable practices in snowboarding? To evaluate the effectiveness of such initiatives, it is essential to measure the environmental awareness of young snowboarders. The German Environment Agency (2016) developed a measurement tool

based on the adapted "Pressure-State-Response" heuristic to assess the environmental awareness of this target group. This heuristic divides environmental awareness into three main components: Pressure (knowledge and perception of ecological risks), State (relevance and value of the environment to the individual), and Response (concrete environmentally conscious behavior). Applying this theory makes it possible to categorize young snowboarders into "environmentally aware" and "environmentally unaware" groups and analyze their perception of their role in fighting climate change. The theoretical part of this work will detail the foundations and methodology for developing this measurement tool.

2 Theory

The goal of this chapter is to introduce different definitions and concepts of "environmental awareness" to explain the working definition used in this study. Since there isn't a single agreed-upon definition, "environmental awareness" is often measured in studies by the questions and scales used (Matthies and Schahn, 2004). Different views exist on the concept: some authors, like Preisendörfer (1999), prefer a one-dimensional approach focused on attitudes and values, while others, such as de Haan and Kuckartz (1996), see it as multidimensional, including both attitudes and actual behaviors towards the environment.

This chapter draws a distinction between two key perspectives: the internal (attitudinal) perspective and the external (behavioral) perspective. The internal perspective, which encompasses an individual's attitudes, values, and cognitive awareness, is inherently subjective and not directly observable. In contrast, the external perspective refers to observable behaviors, actions, and practices, which can serve as indicators of a person's environmental awareness and commitment. According to Neugebauer (2004), while attitudes may not be immediately apparent, they can be inferred and assessed through the analysis of behavior. This distinction underscores the importance of considering both internal attitudes and external actions when evaluating environmental consciousness and sustainability practices within a given community or demographic.

The concept of "environmental awareness" was especially discussed around the year 2000 (Bogun, 2002). Since there is no unified definition, many different scientific approaches have emerged. The first definition comes from a report by the German Advisory Council on the Environment in 1987, describing "environmental awareness" as an "understanding of the danger to natural resources caused by humans" and a "willingness to take corrective action" (SRU, 1982). Preisendörfer (1999) criticizes this as incomplete, adding an emotional component that includes people's emotional reactions to environmental threats.

2.1 Definitions of Environmental Awareness

In contrast to Preisendörfer's (1999) one-dimensional view, de Haan and Kuckartz (1996) offer a multidimensional definition that includes both individual attitudes and observable environmentally relevant behavior. Research shows that "environmental awareness" lacks a universal definition due to the complexity of ecological issues (Bogun, 2002). In this study, the term is understood as a multidimensional concept, considering both environmental attitudes and concrete behaviors. This approach allows for a more detailed classification of participants and an analysis of their environmental profiles.

Switching from an internal to an external perspective is considered useful, as it enables a comparison between environmental attitudes and actual behavior. This is especially important for examining how general environmental awareness applies to specific contexts, such as winter sports.

2.2 Environmental Impacts of Snowboarding

This section describes the human impacts on the environment that are directly or indirectly caused by snowboarding, as well as possible solutions found in the literature. The ecological issues presented here serve as a basis for the study's questionnaire. Frequently mentioned problems in the literature are highlighted, though some aspects are difficult to separate due to interconnected ecological and climatic relationships. The goal of this section is to identify areas for action within the snowboarding sector without delving too deeply into the chain reactions of environmental damage associated with tourism-related snow sports.

2.2.1 Climate Change

Snowboarding is closely tied to natural and climatic conditions, and the impacts of climate change pose a serious threat. The number of snow days is steadily decreasing, which has significant effects on winter sports, high-altitude ecosystems, and flood patterns (Harrison et al., 2001). Studies by Moen and Fredman (2007) and Gilaberte-Búrdalo et al. (2014) highlight that the long-term economic sustainability of skiing and snowboarding is uncertain due to climate instability. A simulation by Wobus et al. (2017) predicts that the winter recreation season could shorten by up to 90 % by 2090. However, alternative emission scenarios suggest that these negative impacts could be lessened by limiting global greenhouse gas emissions.

2.2.2 Transportation

Transportation to and from ski resorts is the largest source of emissions in ski and snowboard tourism. In a study by Wicker (2018), the annual CO₂ footprint of snowboarders was assessed, showing that travel alone results in average emissions of about 431.6 kg CO₂ per person. This number is significant when compared to a proposed per capita budget of 2000–3000 kg per year to meet the 2-degree climate target by 2049. For more ambitious goals, like the 1.5-degree target, this budget would need to be even lower. High CO₂ emissions not only impact ski areas locally but also have global consequences (Apul, 2012), highlighting the need to reduce emissions.

2.2.3 Water Scarcity and Chemicals

Artificial snowmaking, as a response to climate changes, is a major environmental burden in skiing and snowboarding. The production of artificial snow and use of chemicals lead to soil pollution, water scarcity, and high energy consumption (Börner, 2016; Stott, 2019). Water for artificial snow is sometimes taken directly from drinking water supplies or natural sources, increasing the risk of local water shortages (Alpine Convention, 2011). The WWF (2013) criticizes the extreme water demand of 1 million liters per hectare, roughly equivalent to the annual water consumption of a large city like Hamburg, which contributes to drying out the Alps. Future warming would further increase water and energy needs, with around 300 gigawatt hours currently used for snowmaking each year, leading to significant CO₂ emissions (Staff, 2023). Chemical additives in artificial snow also harm soil quality and negatively impact local vegetation by altering soil composition, disrupting natural growth conditions (Stott, 2019).

2.2.4 Environmental and Natural Damage

The flora and fauna of the Alpine region are important CO₂ storage resources, and their preservation is essential for climate protection. However, environmental destruction can turn these areas into CO₂ emitters themselves (Dietz, 2021). The grooming of ski slopes changes the snow cover, causing ground frost and ice layers that harm vegetation and reduce biodiversity (Fahey et al., 1999; Wipf et al., 2005). The use of additives in artificial snow increases the risk of phytopathogenic effects on plants, which can hinder their growth (Lagriffoul et al., 2010). Soil quality is damaged by the impact on ski slopes, reducing water retention and nutrient availability (Stott, 2019). Stott emphasizes that mechanical grooming of ski slopes causes particularly severe, lasting damage that cannot be fully offset, even with replanting efforts (Stott, 2019).

2.2.5 Wildlife

The impact of ski slopes on vegetation and climate also affects wildlife. Treeless mountain regions are important habitats for animals but are threatened by ski slope operations (Rolando et al., 2007). Studies show that natural meadows have higher biodiversity compared to ski slopes. The destruction of vegetation reduces species richness, and full recovery of wildlife populations is only possible if the original plant landscape is restored (Caprio et al., 2016; Reimoser, 2016). It is especially important not to disturb animals in winter, as they need to conserve energy, for instance, through hibernation.

2.2.6 Waste and Litter

Winter tourism generates large amounts of human waste, which harms the environment if not properly disposed of. Apollo (2017) found that winter tourists leave significant amounts of feces and urine in the mountains each year. This waste alters the nutrient content of the soil and displaces native plant species. Additionally, litter attracts animals, which can become trapped in or eat plastic, further reducing biodiversity and polluting the environment (Stott, 2019; Watson & Moss, 2004).

In summary, the Environmental Impacts of Snowboarding present certain challenges for the future. This raises the question of how young snowboarders address these challenges and what role they see for themselves in promoting sustainable practices. Based on the described theory, the research question is defined as: *How does the environmental awareness of young snowboarders affect their perception and behavior regarding climate change, and what role do they see for themselves in promoting sustainable practices in snowboarding?* A questionnaire is used to collect data on their awareness, attitudes, and behavior. The goal is to identify patterns and potential ways to support sustainable practices in winter sports.

3 Development of the Questionnaire Design

Based on the adapted Pressure-State-Response model outlined in the German Environment Agency's 2016 study, the study will operationalize the three key components: 'Pressure,' 'State,' and 'Response.' This will be done using appropriate sub-areas (indicator systems) and sets of questions. The principles of ecological modernization and socio-ecological transformation, as presented, will guide the formulation and selection of specific items within these indicator systems. These principles will be adjusted to address the unique aspects of snowboarding. The Pressure-State-Response model is a framework used to analyze environmental issues.

In this context:

- 'Pressure' refers to human activities affecting the environment
- 'State' describes the current condition of the environment
- 'Response' represents societal actions taken to address environmental concerns

The components "Pressure," "State," and "Response," adapted from the German Environment Agency's 2016 model, have all been tailored specifically to snowboarding. The study aims to understand its environmental impact and identify potential solutions. The indicator systems will help quantify and assess various aspects of snowboarding's relationship with the environment, allowing for a comprehensive analysis of its sustainability.

3.1 "Pressure" Component

The "Pressure" aspect of environmental awareness in snowboarding has been broken down into three main areas:

1. Understanding of global environmental limits, threats to snowboarding's future, and unintended consequences of actions meant to help.
2. Recognition of how important these environmental limits are, measured by how threatening people perceive them to be.
3. Awareness of other sustainability challenges, measured by how significant people think these issues are.

These areas were chosen because snowboarding both contributes to and is affected by global environmental issues, especially climate change. However, the content has been adapted for snowboarding specifically. The first two areas focus on the most serious environmental problems related to snowboarding: climate change, water scarcity, and loss of biodiversity. To effectively survey young snowboarders, it's crucial to adjust scientific terms to ensure they're understood. This means avoiding complex words and providing relatable examples. This approach helps children and teenagers answer questions more accurately, leading to more representative results. The assumption is that if someone is very familiar with these issues and considers them highly relevant or threatening, they likely have strong environmental awareness. This high level of awareness is expected to correlate positively with overall environmental consciousness.

The "Pressure" component is divided into three sub-areas, each designed to measure different aspects of environmental awareness in the context of snowboarding.

1. Knowledge of Ecological Risks (Pressure I)

This sub-area assesses the understanding of environmental issues related to snowboarding. It measures how familiar individuals are with specific ecological problems. For example:

- One item highlights that a snow cannon uses as much water annually as a large city like Hamburg, but for an area only the size of a football field. This fact illustrates the potential for water shortages.

2. Subjective Threat from Environmental Risks (Pressure II)

This sub-area evaluates how threatening individuals perceive these environmental risks to be, both for nature and for snowboarding as a sport. Example items include:

- Climate change as a danger to nature and snowboarding
- Predictions that the winter recreational season could be halved in about 20 years and reduced to just a tenth of its current length in 70 years

3. Relevance of Sustainability Challenges (Pressure III)

This sub-area assesses the perceived importance of various sustainability initiatives. It measures how significant individuals consider different environmental actions to be, such as:

- Transitioning to renewable energy
- Improving public transportation
- Developing eco-friendly travel technologies
- ...

By breaking down the "Pressure" component into these three sub-areas, it is expected to gain a comprehensive understanding of environmental awareness among snowboarders. This approach allows for the assessment of knowledge, perceived threats, and the importance attributed to sustainability challenges, providing a multi-faceted view of how snowboarders relate to environmental issues connected to their sport.

3.2 "State" Component

The "State" component focuses on environmental attitudes and is divided into two sub-scales:

1. State I: Environmental Attitudes

This sub-scale measures general environmental attitudes using statements that respondents agree or disagree with. It incorporates:

- Established statements from long-term environmental awareness research (Preisendörfer, 1999; Haan & Kuckartz, 2013)
- New attitudes reflecting recent changes in environmental awareness

The statements cover three aspects of awareness:

1. Cognitive (knowledge-based)
2. Affective (emotion-based)
3. Conative (action-based)

These statements consider both ecological modernization and socio-ecological transformation. Examples include:

- Feeling reassured about environmental conditions for future generations
- Valuing a healthy natural environment as part of a good life
- Believing current lifestyles and snowboarding practices harm the sport long-term
- ...

2. State II: Social Innovations

This sub-scale assesses the acceptance of selected social innovations based on their individual attractiveness. Examples include:

- Repair stations for snowboards and equipment in ski areas
- Using rental or shared boards instead of owning one
- Forming or joining carpooling groups for travel to ski areas
- ...

The selection of social innovations aims to cover a broad spectrum, guided by the typology from the UBA guide "Soziale Innovationen im Aufwind" (Rückert-John, 2014)¹. The underlying assumption is that environmentally conscious individuals are more likely to be open to innovations supporting socio-ecological change (Scholl et al., 2016). By incorporating these two sub-scales, the "State" component provides a comprehensive view of environmental attitudes among snowboarders. It captures both general environmental consciousness and openness to specific innovations that could make snowboarding more sustainable. This approach allows to assess not only how snowboarders think about environmental issues but also their willingness to embrace new, more sustainable practices in their sport.

3.3 "Response" Component

The "Response" component measures actual environmental behaviors among snowboarders. It uses self-reported behaviors as indicators, derived from literature reviews. To minimize biases in self-assessment, the questions often refer to specific past periods or ask about willingness for future behavior. The component is divided into seven sub-areas:

1. Response I: Extending Product Lifespan

- Focuses on repairing, buying used, and selling used snowboarding equipment
- Example: "I repair or have my damaged snowboard equipment repaired."

2. Response II: Transportation

- Measures use of cars and planes for travel to ski areas (inversely scored)
- Assesses use of environmentally friendly transport options
- Example: "I have compensated for my CO₂ emissions from travel when booking flights, buses, or trains."

3. Response III: Sustainable Accommodations

¹ Social Innovations on the Rise" (Rückert-John, 2014)

- Evaluates awareness and influence of eco-certified accommodations on booking decisions
- Example: "Eco-certified accommodations played a decisive role in my choice of lodging."

4. Response IV: Use of Sustainable Offerings

- Includes renting snowboard equipment from shops or online
- Example: "I rent snowboard equipment for the period I'm riding."

5. Response V: Civic Engagement

- Covers participation in environmental groups, donations, signing petitions, and demonstrations
- Example: "I participate in climate or environmental protection group activities or projects."

6. Response VI: Environmentally Conscious Behavior in Ski Areas

- Includes staying on marked trails, proper waste disposal, and snowboarding only with natural snow
- Example: "I only snowboard on marked trails and designated routes."

7. Response VII: Sustainable Ski Areas

- Measures awareness and influence of eco-certified ski areas on booking decisions
- Example: "Environmental certifications were important in my decision for a ski area."

These sub-areas were chosen to adequately cover the three main areas of environmentally relevant behaviors for snowboarding:

1. Accommodation
2. Ski Area
3. Mobility

The behavioral indicators are operationalized and queried based on:

- Frequency of occurrence
- Willingness to engage in the behavior

This comprehensive approach allows to assess a wide range of environmentally conscious behaviors specific to snowboarding. By covering product use, transportation, accommodation choices, sustainable offerings, civic engagement, on-site behavior, and ski area selection, the "Response" component provides a holistic view of how snowboarders' environmental awareness translates into actual behaviors. This information can be valuable for understanding the current state of environmental consciousness in the snowboarding community and for identifying areas where further education or initiatives might be beneficial.

3.4 Validation Questions

Validation questions are crucial in questionnaire design to ensure data quality and reliability. For the environmental awareness indicator questions, several additional features are included:

1. Sociodemographic Characteristics

- Gender: Male, Female, Diverse
- Age: Open-ended question

2. Perception of Own Role in Climate Change Fight

- Open-ended question: "What can you do while snowboarding to help combat climate change?"

3. Role Perception through Environmental Type Characteristics

- Respondents choose which description best fits them in the context of climate and environmental debate:
 - Sustainability-oriented
 - Environmentally concerned
 - Environmentally passive
 - Growth-oriented

4. Self-assessment of Environmental Awareness

1. Yes/No/Don't know question: "Do you consider yourself environmentally conscious?"

These validation questions serve several important purposes:

1. They provide additional context to the main environmental awareness indicators.
2. They allow for cross-checking responses, enhancing the overall validity of the questionnaire.
3. They help identify potential inconsistencies or biases in responses.
4. They offer insights into the respondents' self-perception and motivations regarding environmental issues.

By including these validation questions, researchers can:

- Better understand the factors influencing respondents' environmental awareness
- Assess the consistency of responses across different question types
- Identify potential areas for further investigation or clarification
- Strengthen the overall reliability and validity of the study's findings

This approach to questionnaire design demonstrates a commitment to robust scientific methodology, ensuring that the data collected provides a comprehensive and accurate picture of environmental awareness among snowboarders.

4 Calculation Rules and Scale Determination

4.1 Determination of Environmental Awareness

Overall Calculation Process

1. Individual indicators are consolidated into subscales.
2. Subscales are combined to assess "Pressure", "State", and "Response" parameters.
3. Final goal: Categorize individuals as "environmentally conscious" or "environmentally unconscious".

Definition of "Environmentally Conscious"

An individual is considered "environmentally conscious" if they score above the calculated mean in all three parameters: Pressure, State, and Response.

Scoring Process

1. Individual indicators are combined into sum scores for subscales.
2. Subscale sum scores are consolidated into an "overall sum score" for each component of environmental awareness.

Coding and Calculation of Indicator Questions

Each component has its own scoring system:

1. Pressure I (Knowledge of ecological risks):
 - Yes, I was aware of that = 1
 - No, I was not aware of that = 0
2. Pressure II (Subjective threat from environmental risks):
 - Very threatening = 3
 - Rather threatening = 2
 - Rather not threatening = 1
 - Not at all threatening = 0
3. Pressure III (Relevance of sustainability challenges)
 - Very important = 3
 - Rather important = 2
 - Rather not important = 1
 - Not important at all = 0
4. State I (Environmental attitudes):
 - Strongly agree = 4
 - Rather agree = 3
 - Partly agree = 2
 - Rather disagree = 1
 - Strongly disagree = 0
5. State II (Social innovations)
 - Very attractive = 3
 - Rather attractive = 2
 - Rather not attractive = 1
 - Not attractive at all = 0
6. Response components
 - Always = 4

- Often = 3
- Sometimes = 2
- Rarely = 1
- Never = 0

General principles:

- More positive or aware responses receive higher scores.
- Some items are inversely coded (disagreement with a negative statement receives a higher score).
- Maximum scores are calculated for each component based on the number of items and the highest possible score per item.

Handling Missing Values

"Does not apply to me" is treated the same as "never" and gets the score 0.

Key Points

1. The system allows for a nuanced assessment across multiple dimensions.
2. Higher scores indicate greater environmental consciousness.
3. Calculated means serve as thresholds for classification as "environmentally conscious".
4. The approach combines quantitative scoring with qualitative categorization.

This scoring system provides a comprehensive method for evaluating environmental awareness among snowboarders. It considers knowledge (Pressure), attitudes (State), and behaviors (Response), offering a holistic view of an individual's environmental consciousness. The use of subscales and overall scores allows for detailed analysis at various levels, from specific aspects of awareness to overall environmental consciousness. This approach can help identify areas where snowboarders are particularly aware or where there might be room for improvement in environmental education and practices within the sport. By setting the threshold at the calculated mean for each parameter, the system creates a relative measure of environmental consciousness within the surveyed population. This can be particularly useful for understanding the distribution of environmental awareness among snowboarders and for tracking changes over time.

4.2 Item Analysis and Scale Development

Since the study focuses on individuals involved in snowboarding a total of 145 snowboarders took part in the survey, providing valuable insights into their perspectives and behaviors related to the sport and its environmental aspects.

The data from the field test was analyzed using the statistical software SPSS. After verifying the dataset, variables were recoded to ensure comparability. The highest level of environmental awareness was assigned the highest numerical value, while the lowest level was assigned a value of zero.

Key characteristics of the variables were then calculated, including mean, standard deviation, item discrimination, and item difficulty. Scale development was carried out by calculating a sum score, in which the test values of respondents were summed across

the items of the respective scale. Metrics were calculated for individual components as well as for an overall score.

To achieve this, all other subscales ("Pressure," "State," and "Response") were standardized so that the theoretically achievable values always ranged between 0 and 15. This standardization was necessary to ensure that, despite differing original scale ranges, comparable values were available for further calculations, and all individual scales were equally weighted in the higher aggregated scales during subsequent calculation steps (see Table 13).

5 Results

5.1 "Pressure" Components

5.1.1 Pressure I – Knowledge about Ecological Risks

The first aspect of "Pressure" includes knowledge about environmental risks. A total of 10 items were formulated, which could be answered with "Yes, I was aware of this" or "No, I was not aware of this."

Table 1 Awareness of Environmental Risks (N=145)

Items	"Yes, I was aware of this"
1. A snow cannon consumes as much per year for an area the size of a soccer field, as much water as a large city like Hamburg and can lead to water shortages.	28.3%
2. Climate change is endangering nature and the sport of snowboarding.	95.2%
3. Science assumes that the season will be half as long in just under 20 years will be half as long, in 70 years it will be a tenth.	55.9%
4. Traveling to and from the ski resorts by car alone causes around a quarter of the of the exhaust gases (CO ₂) that a person emits in a year a year if you want to save the climate.	45.5%
5. If you cause CO ₂ , this warms the climate and causes damage that cannot be reversed.	89.0%
6. The deforestation of trees for the construction of new ski slopes or their preservation accelerates climate change.	82.8%
7. Saving CO ₂ through new technology is offset in many areas by other influences are canceled out again.	61.4%
8. Wild animals and plant species that live in the ski resorts are threatened by new ski slopes and ski slopes and off-piste skiing displaced.	71.0%
9. The snow from the snow cannons changes the soil and the plants, so that some animal and plant species are slowly disappearing.	48.3%
10. Wild animals in alpine areas need peace and their peace and quiet in winter because they hibernate there.	76.6%
11. The progressive extinction of animal and plant species and plant species, nature is becoming increasingly more susceptible to damage that can no longer be later.	78.6%

The results show that participants' knowledge of ecological risks varies. Topics like the threat to wildlife and plant species caused by ski tourism and the progression of species extinction are particularly well-known, with 70.6% of respondents stating they were aware of these issues. Additionally, 67.4% of participants are aware of the destruction of natural areas for the construction of new ski slopes and infrastructure. However, less known is the information that the ski season could be reduced by half within the next 20 years due to climate change, with only 53.9% being aware of this. The least known issue is that some snow consumers support using a second ski slope as a water source, despite it contributing to water scarcity. Only 19.3% of respondents were aware of this

problem. Overall, the findings reveal a mixed level of awareness regarding ecological challenges.

5.1.2 Pressure II – Subjective Threat from Environmental Risks

The responses of the 145 snowboarders aimed to capture the subjective threat posed by various environmental risks. Respondents were asked to rate how threatening they perceived certain environmental issues. The evaluation was conducted on a scale from 0 (not threatening at all) to 3 (very threatening).

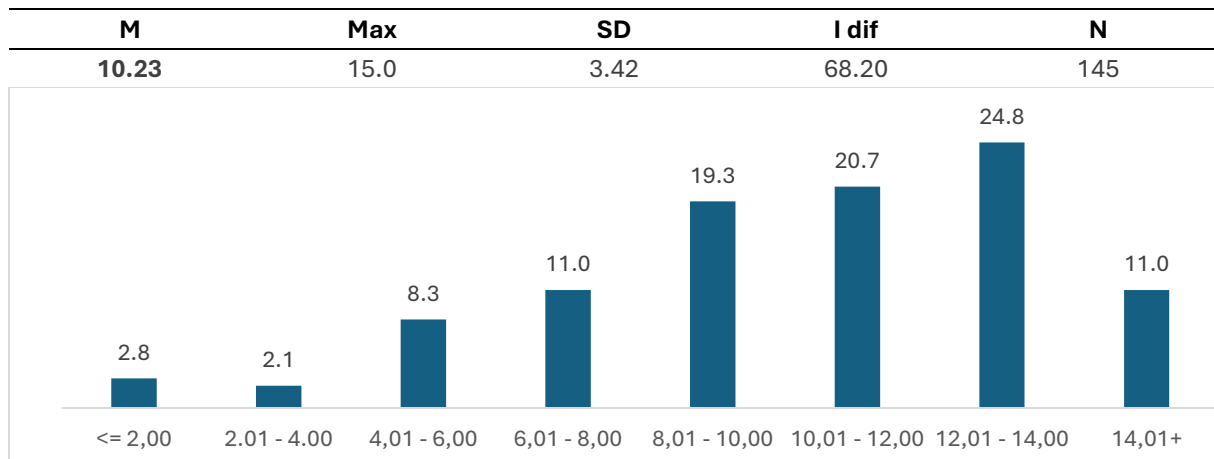
Table 2: Descriptive Statistics of Pressure II

Items	M	SD	I dif ²	I dis ³	N
1. A snow cannon consumes as much per year for an area the size of a soccer field, as much water as a large city like Hamburg and can lead to water shortages.	1.81	0.93	60.33	0.72	145
2. Climate change is endangering nature and the sport of snowboarding.	2.36	0.87	78.67	0.71	145
3. Science assumes that the season will be half as long in just under 20 years will be half as long, in 70 years it will be a tenth.	2.23	1.00	74.33	0.70	145
4. Traveling to and from the ski resorts by car alone causes around a quarter of the exhaust gases (CO ₂) that a person emits in a year if you want to save the climate.	2.09	0.86	69.67	0.69	145
5. If you cause CO ₂ , this warms the climate and causes damage that cannot be reversed.	2.29	0.91	76.33	0.72	145
6. The deforestation of trees for the construction of new ski slopes or their preservation accelerates climate change.	2.11	0.91	70.33	0.71	145
7. Saving CO ₂ through new technology is offset in many areas by other influences are canceled out again.	1.90	1.01	63.33	0.70	145
8. Wild animals and plant species that live in the ski resorts are threatened by new ski slopes and ski slopes and off-piste skiing displaced.	1.94	1.01	64.67	0.69	145
9. The snow from the snow cannons changes the soil and the plants, so that some animal and plant species are slowly disappearing.	1.97	0.95	65.67	0.68	145

² Item difficulty (I dif) indicates how challenging a specific item is compared to its maximum achievable value. It is calculated by relating the item's mean score to its maximum possible value. A high item difficulty suggests that an item is considered highly significant by many respondents.

³ Item discrimination (I dis) describes how strongly an item correlates with the overall scale, indicating the relationship between responses to the item and the overall test result. According to Moosbrugger and Kelava (2012), item discrimination reflects how well an item differentiates between individuals with high and low overall scores. A high discrimination index, with a maximum value of 1, means that individuals with high test scores typically agree with the item, while those with low scores tend to reject it. Discrimination values between 0.4 and 0.7 are considered good, and values above 0.7 are regarded as very good (Moosbrugger and Kelava, 2012).

10. Wild animals in alpine areas need peace and their peace and quiet in winter because they hibernate there.	1.89	0.96	63.00	0.70	145
11. The progressive extinction of animal and plant species and plant species, nature is becoming increasingly more susceptible to damage that can no longer be later.	2.19	0.97	73.00	0.72	145



Graph 1: Distribution of Scores for Pressure II

The results show how threatening snowboarders perceive various ecological risks. Item 2, which addresses climate change and its impact on nature and snowboarding, was rated as the most threatening ($M = 2.36$, item difficulty 78.67). Item 5, describing the release of CO_2 and the resulting irreversible damages, was also rated highly ($M = 2.29$, item difficulty 76.33). Item 6, which focuses on the destruction of natural areas for the construction of new ski slopes and infrastructure, is also perceived as significantly threatening ($M = 2.11$, item difficulty 70.33).

The distribution of overall scores shows an average of 10.23 with a standard deviation of 3.42. The most frequent score range is 12.01–14.00 points (24.8%), while only a few participants scored below 2.00 (2.8%) or above 14.01 (11.0%). This indicates a wide range of perceived threat levels, with a focus on moderately to highly threatening risks.

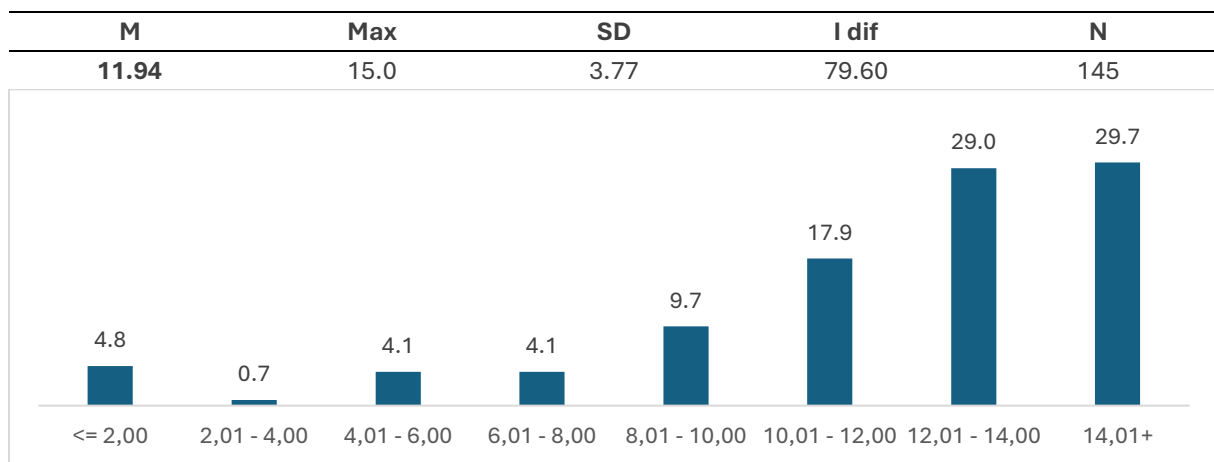
5.1.3 Pressure III – Relevance of Sustainability Challenges

The results in Pressure III aim to assess the relevance of various sustainability challenges. Participants were asked to rate how important they consider specific sustainability issues. The evaluation was conducted on a scale from 0 (not important at all) to 3 (very important).

Table 3: Descriptive Statistics of Pressure III

Items	M	SD	I dif	I dis	N
1. Implementation of the energy transition (switch from fossil fuels such as oil, gas and coal to renewable energies such as solar, wind and water).	2.46	0.84	82.00	0.73	145
2. Better expansion and affordability of public transportation (bus, rail, train).	2.54	0.82	84.67	0.74	145

3. New technologies for flying and driving with environmentally friendly energy (e.g. hydrogen or electricity).	2.28	0.98	76.00	0.72	145
4. Promoting environmentally friendly ways of earning money / producing and buying products.	2.27	0.93	75.67	0.71	145
5. Helping ski resorts to become more environmentally friendly.	2.39	0.88	79.67	0.75	145



Graph 2: Distribution of Scores for Pressure III

The results show the perceived relevance of various sustainability challenges. Item 2, which addresses the expansion and affordability of public transport (bus, train, tram), received the highest rating with an average score of 2.54 and an item difficulty of 84.67. Item 1, focusing on the transition to renewable energy (e.g., solar and wind energy), was also rated highly (M = 2.46, item difficulty 82.00).

Item 5, which highlights the promotion of environmentally friendly measures in ski resorts, scored an average of 2.39 (item difficulty 79.67). Lower ratings were given to new technologies for emissions-free transportation, such as hydrogen or electric vehicles (Item 3, M = 2.28, item difficulty 76.00), and sustainable production and consumption methods (Item 4, M = 2.27, item difficulty 75.67).

The overall average score for this category is 11.94, with a standard deviation of 3.77. The most frequent score range is 12.01–14.00 points (29.7%), while extreme scores below 2.00 points are rarely reached (4.8%). This indicates that most participants consider sustainability challenges to be important to very important.

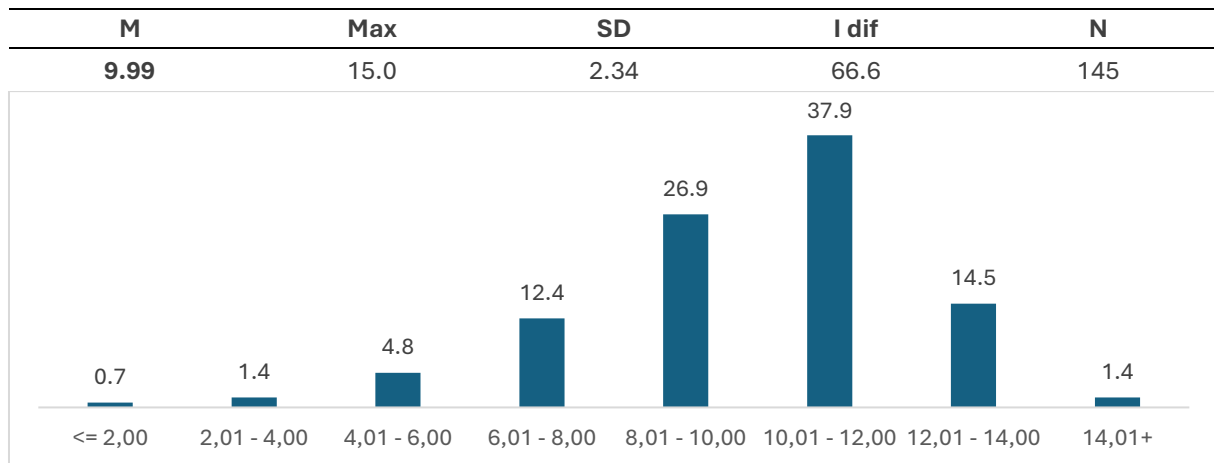
5.2 „State“ - Components

5.2.1 State I - Environmental Attitudes

The survey results from 145 snowboarders aim to capture their attitudes toward environmental issues. Participants were asked to indicate their stance on various environmental aspects. Responses were rated on a scale ranging from a minimum value of 0 (strongly disagree) to a maximum value of 4 (strongly agree).

Table 4: Descriptive Statistics of State I

Items	M	SD	I dif	I dis	N
1. For me, an intact natural environment is an essential part of a good life.	3.47	0.80	86.75	0.68	145
2. It reassures me when I think about the environmental conditions in which our children and grandchildren are likely to live.	1.74	1.54	43.50	0.69	145
3. It means a lot to me to live in such a way that I feel at peace with the environment.	3.08	1.01	77.00	0.72	145
4. It is important to me that new environmentally friendly snowboard equipment is produced.	3.10	1.03	77.50	0.71	145
5. Our current lifestyle and snowboarding practices are damaging the sport of snowboarding in the long term.	2.33	1.27	58.25	0.70	145
6. If politicians pursue the protection of the environment more consistently, this will have many positive economic consequences for the ski resorts and for us as guests.	2.67	1.31	66.75	0.73	145
7. Science and technology will solve the challenges that climate change poses for snowboarding. That's why we don't have to change our lifestyle or snowboarding practices.	1.07	1.14	26.75	0.74	145
8. Climate and environmental protection should be a priority across Europe, even if this might have a negative impact on the economy.	2.97	1.11	74.25	0.68	145
9. The simple fact is that in order for us to do well, we need to keep our economy growing.	1.57	1.22	39.25	0.69	145
10. Our world has already reached its natural limits and we should respect that.	2.81	1.28	70.25	0.70	145
11. We can only save the climate and the sport of snowboarding if we fundamentally change the way we live and snowboard. Even if we have to restrict ourselves to do so.	2.66	1.16	66.50	0.71	145
12. Water extraction for artificial snowmaking should be considered more carefully throughout Europe.	2.61	1.23	65.25	0.72	145
13. Products made for snowboarding should be sustainable (e.g. quality / durability and environmental compatibility).	3.30	0.99	82.50	0.73	145
14. The state should ensure that special rules in the economy ensure that more things are produced that are good for the environment and fewer that harm the environment.	3.15	1.11	78.75	0.71	145
15. Everyone should and must take responsibility in their own environment to ensure that our children and grandchildren can also snowboard and live in a world worth living in.	3.44	0.89	86.00	0.70	145



Graph 3: Distribution of Scores for State I

The results show participants' attitudes toward various environmental statements. Item 1, which emphasizes the importance of an intact natural environment for a good life, received the highest rating with an average score of 3.47 and an item difficulty of 86.75. Similarly, Item 15, highlighting the responsibility of each individual to protect the environment for future generations, was strongly supported (M = 3.44, item difficulty 86.00). Item 13, focusing on sustainable products for snowboarding, was also rated highly (M = 3.30, item difficulty 82.50).

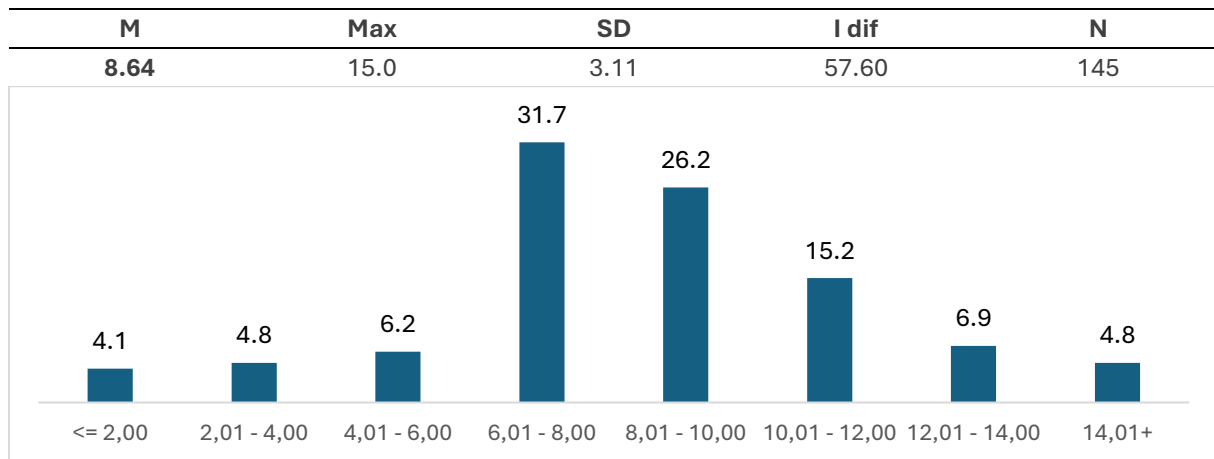
Lower ratings were given to Item 7, which questions the ability of science and technology to solve the challenges of climate change (M = 1.07, item difficulty 26.75), and Item 9, which emphasizes the necessity of economic growth (M = 1.57, item difficulty 39.25). The overall average score is 9.99, with a standard deviation of 2.34. Most participants scored within the range of 10.01–12.00 points (37.9%), while extreme scores below 2.00 or above 14.01 points were rare (0.7% and 1.4%).

5.2.2 State II - Soziale Innovationen

The State II results from 145 snowboarders reflect the perception and acceptance of social innovations in the field of sustainability. Participants were asked to rate how relevant they consider certain social innovations. Responses were evaluated on a scale from 0 (not attractive at all) to 3 (very attractive).

Table 5: Descriptive Statistics of State II

Items	M	SD	I dif	I dis	N
1. A repair station for snowboards and equipment in the ski resorts.	2.19	0.88	73.00	0.71	145
2. Use a rental board in the long term or share a board with others instead of having your own snowboard.	0.89	0.96	29.67	0.69	145
3. Form or look for car pools for the journey to and from the ski area.	2.32	0.92	77.33	0.73	145



Graph 4: Distribution of Scores for State II

The results show how participants evaluate social innovations in the context of sustainability. Item 3, which focuses on forming carpool groups for traveling to and from ski resorts, received the highest rating with an average score of 2.32 and an item difficulty of 77.33. Item 1, which highlights the establishment of repair stations for snowboards and equipment in ski resorts, was also rated as relevant ($M = 2.19$, item difficulty 73.00). The lowest rating was given to Item 2, which suggests long-term rental solutions or sharing snowboards ($M = 0.89$, item difficulty 29.67).

The overall average score is 8.64, with a standard deviation of 3.11. Most participants scored in the range of 6.01–8.00 points (31.7%), followed by 8.01–10.00 points (26.2%). Extreme scores below 2.00 and above 14.01 points were rare, both at 4.8%.

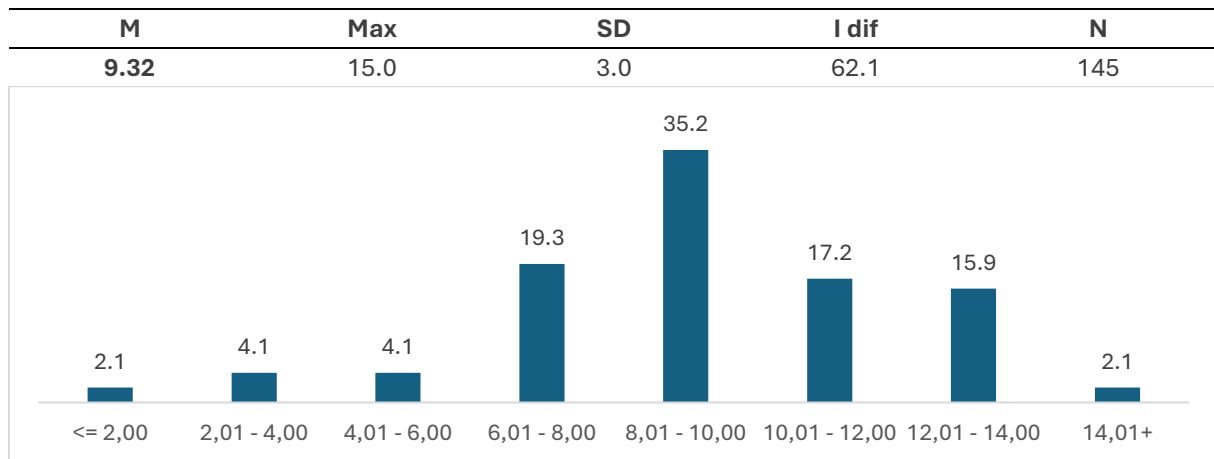
5.3 „Response“-Components

5.3.1 Response I - Extension of Product Lifespan

The survey results from 145 snowboarders aim to capture their attitudes toward extending the lifespan of products in the context of sustainability. Participants were asked to rate how important they consider measures to prolong the life of equipment and materials. Responses were rated on a scale from 0 (never) to 4 (always).

Table 6: Descriptive Statistics of Response I

Items	M	SD	I dif	I dis	N
1. When I buy new things for snowboarding, I make sure that the product is produced fairly and sustainably.	2.30	1.17	57.50	0.69	145
2. Instead of buying new snowboard equipment, I buy used equipment or sell on my old equipment.	2.19	1.24	54.75	0.70	145
3. If snowboard equipment (e.g. snowboards, bindings or boots) is damaged or broken, I will repair it or have it repaired.	2.97	1.04	74.25	0.68	145



Graph 5: Distribution of Scores for Response I

The results show participants' attitudes toward extending the lifespan of products in the context of sustainability. Item 3, which focuses on repairing damaged snowboard equipment such as bindings or boots, received the highest rating with an average score of 2.97 and an item difficulty of 74.25. Item 1, emphasizing the purchase of sustainably produced snowboard products, was also rated highly (M = 2.30, item difficulty 57.50). Item 2, suggesting the purchase of used equipment or reselling old gear, received lower ratings (M = 2.19, item difficulty 54.75).

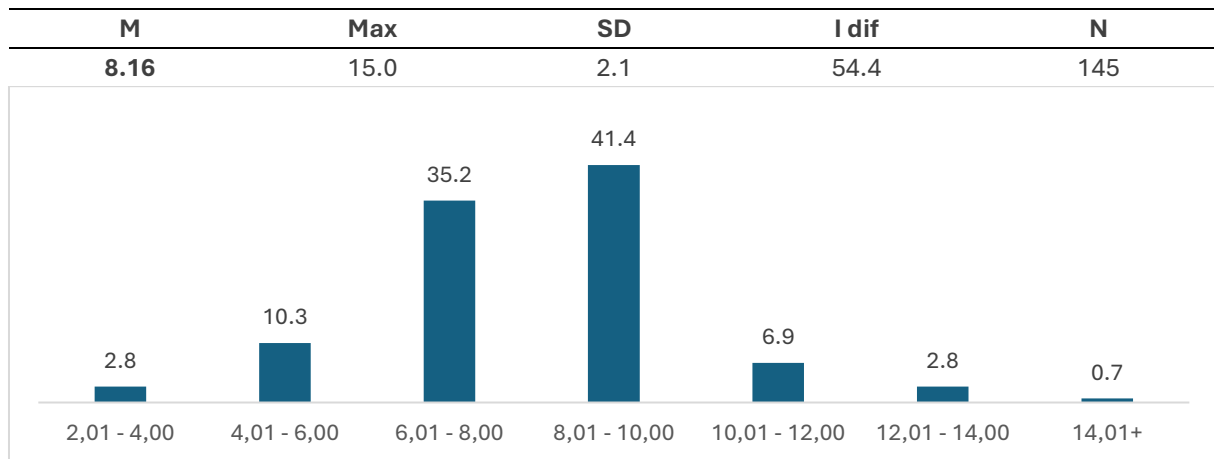
The overall average score for this category is 9.32, with a standard deviation of 3.00. The most frequent score range is 8.01–10.00 points (35.2%), followed by 6.01–8.00 points (19.3%). Extremely high scores above 14.01 points and very low scores below 2.00 points are both rare, occurring at 2.1%. These results indicate that most participants consider measures to extend product lifespan as relevant.

5.3.2 Response II – Transport

The survey results from 145 snowboarders aim to capture their attitudes toward sustainable transport solutions in connection with winter sports activities. Participants were asked to indicate how often they use specific eco-friendly transport options. Responses were rated on a scale from 0 (never) to 4 (always).

Table 7: Descriptive Statistics of Response II

Items	M	SD	I dif	I dis	N
1. In the last 12 months, I have traveled to and from the ski resort by car.	3.17	1.06	79.25	0.70	145
2. How often do you use environmentally friendly means of transportation (e.g. bike, train or bus) to get to the ski resort?	1.45	1.22	36.25	0.68	145
3. I could imagine doing without my car in the future and using my bike or public transport.	1.91	1.26	47.75	0.69	145



Graph 6: Distribution of Scores for Response II

The results show how participants evaluate sustainable transport solutions related to winter sports activities. Item 1, describing the use of cars for traveling to and from ski resorts in the past 12 months, received the highest average score of 3.17, with an item difficulty of 79.25. Item 3, examining the idea of giving up cars in the future and using public transport or bicycles instead, was rated with an average score of 1.91 (item difficulty 47.75). The lowest rating was given to Item 2, addressing the use of eco-friendly transport options like buses, trains, or bicycles ($M = 1.45$, item difficulty 36.25).

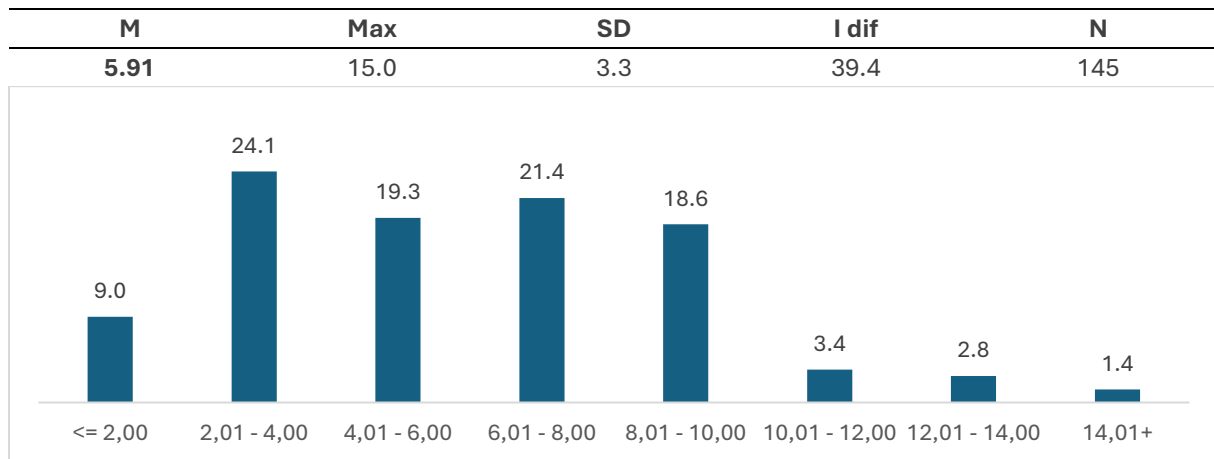
The overall average score is 8.16, with a standard deviation of 2.10. The most frequent score range is 8.01–10.00 points (41.4%), followed by 6.01–8.00 points (35.2%). Extreme scores below 2.00 points (2.8%) and above 14.01 points (0.7%) are rare. These results indicate that the use of sustainable transport options is rated low overall, while cars remain the preferred choice.

5.3.3 Response III - Sustainable Accommodations

The survey results from 145 snowboarders aim to capture their attitudes toward sustainable accommodations in the context of winter sports activities. Participants were asked to indicate how often they choose sustainable accommodation options. Responses were rated on a scale from 0 (never) to 4 (always).

Table 8: Descriptive Statistics of Response III

Items	M	SD	I dif	I dis	N
1. When choosing (vacation) accommodation, I used environmentally friendly offers (e.g. on Viabono or Ibex Fairstay) or made my parents aware of them.	0.79	1.14	19.75	0.69	145
2. When choosing (vacation) accommodation, environmentally certified accommodation played a decisive role for me.	1.25	1.35	31.25	0.68	145
3. I can imagine staying in environmentally certified accommodation during my vacation in the future.	2.70	1.15	67.50	0.72	145



Graph 7: Distribution of Scores for Response III

The results show participants' attitudes toward sustainable accommodations. Item 3, which addresses the willingness to stay in eco-certified accommodations during vacations in the future, received the highest rating with an average score of 2.70 and an item difficulty of 67.50. Item 2, highlighting the importance of eco-certified accommodations when choosing a place to stay, was rated with an average score of 1.25 (item difficulty 31.25). Item 1, describing the use of eco-friendly options such as youth hostels or nature-friendly houses, received the lowest rating with an average score of 0.79 (item difficulty 19.75).

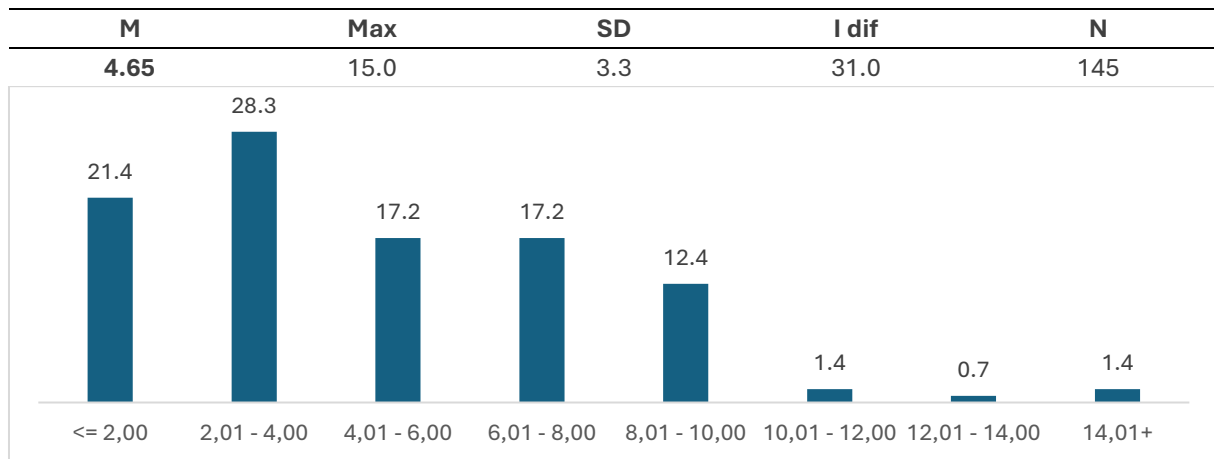
The overall average score for this category is 5.91, with a standard deviation of 3.30. The most frequent score range is 2.01–4.00 points (24.1%), followed by 4.01–6.00 points (19.3%). Extremely high scores above 14.01 points are rare (1.4%), as are scores below 2.00 points (9.0%). This indicates that participants' willingness to use sustainable accommodations varies significantly.

5.3.4 Response IV - Use of Sustainable Options

The survey results from 145 snowboarders aim to capture their willingness to use sustainable options in the context of winter sports. Participants were asked to indicate how often they use various sustainable options. Responses were rated on a scale from 0 (never) to 4 (always).

Table 9: Descriptive Statistics of Response IV

Items	M	SD	I dif	I dis	N
1. I rent snowboard equipment for the period in which I ride (in the store or online).	0.38	0.94	9.50	0.71	145
2. I lend out my snowboard equipment when I don't need it myself.	1.50	1.27	37.50	0.69	145
3. I can imagine renting snowboard equipment in the future or lending mine.	1.84	1.30	46.00	0.70	145



Graph 8: Distribution of Scores for Response IV

The results show participants' willingness to use sustainable options in winter sports. Item 3, which explores the idea of renting snowboard equipment or lending one's own gear in the future, received the highest rating with an average score of 1.84 and an item difficulty of 46.00. Item 2, focusing on lending one's own snowboard equipment, was rated with an average score of 1.50 (item difficulty 37.50). The lowest rating was given to Item 1, addressing the rental of snowboard equipment for the duration of use, with an average score of 0.38 (item difficulty 9.50).

The overall average score for this category is 4.65, with a standard deviation of 3.30. The most frequent score range is 2.01–4.00 points (28.3%), followed by scores below 2.00 points (21.4%). Extremely high scores above 14.01 points are rare (1.4%). These results suggest that sustainable options like renting or lending equipment are generally less commonly adopted.

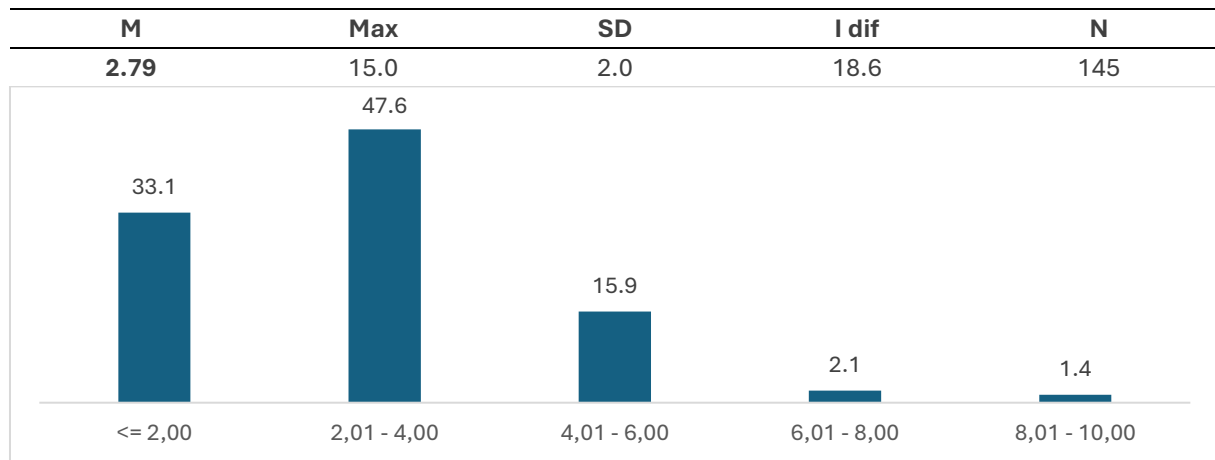
5.3.5 Response V - Civic Engagement

The survey results from 145 snowboarders aim to assess their willingness to engage in civic activities for environmental protection. Participants were asked to indicate how often they participate in various forms of engagement. Responses were rated on a scale from 0 (never) to 4 (always).

Table 10: Descriptive Statistics of Response V

Items	M	SD	I dif	I dis	N
1. I take part in activities or projects in climate or environmental protection groups, such as tree planting or litter collection campaigns.	1.59	1.23	39.75	0.70	145
2. I have already supported online campaigns or petitions for climate or environmental protection issues by giving my signature.	1.93	1.44	48.25	0.69	144
3. I share and spread climate and environmental issues on social media (e.g. Instagram, Tik Tok, Twitter, WhatsApp, Snapchat) to raise awareness.	1.27	1.34	31.75	0.68	145
4. I take part in climate protection demonstrations (e.g. Fridays for Future).	0.74	1.05	18.50	0.72	145

5. I have donated something to an environmental or nature conservation organization or pointed it out to my parents.	1.43	1.36	35.75	0.71	145
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Graph 9: Distribution of Scores for Response V

The results show participants' willingness to engage in climate protection activities. Item 2, which describes supporting online campaigns or petitions through signing, received the highest rating with an average score of 1.93 and an item difficulty of 48.25. Item 1, focusing on participation in projects such as tree planting or litter collection campaigns, was rated with an average score of 1.59 (item difficulty 39.75). The lowest rating was given to Item 4, which addresses participation in climate protection demonstrations such as "Fridays for Future," with an average score of 0.74 (item difficulty 18.50).

The overall average score for this category is 2.79, with a standard deviation of 2.00. The most frequent score range is 2.01–4.00 points (47.6%), followed by scores below 2.00 points (33.1%). Extremely high scores above 14.01 points are very rare (1.4%). The results indicate that participants' willingness to engage in active civic climate protection varies and tends to focus more on digital and indirect actions.

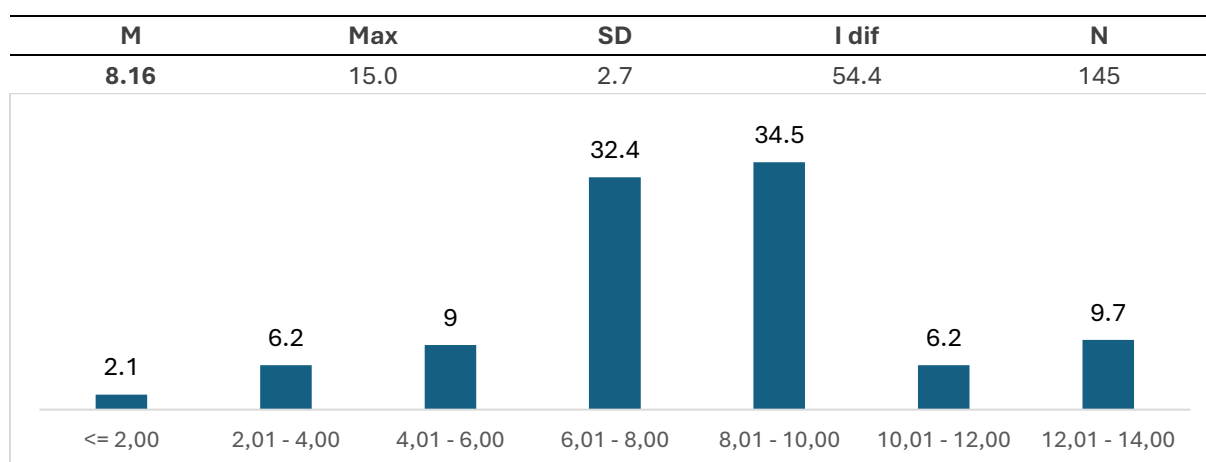
5.3.6 Response VI - Environmentally Conscious Behavior in Ski Resort

The survey results from 145 snowboarders aim to assess their attitudes toward environmentally conscious behavior in ski resorts. Participants were asked to indicate how often they engage in various eco-friendly practices in ski resorts. Responses were rated on a scale from 0 (never) to 4 (always).

Table 11: Descriptive Statistics of Response VI

Items	M	SD	I dif	I dis	N
1. I only ride on marked pistes and designated routes.	2.33	1.13	58.25	0.70	145
2. I only go snowboarding when it has snowed naturally. Not when snow cannons are in use.	1.32	1.10	33.00	0.68	145
3. I save water, waste and energy (e.g. no long hot showers, no throwing away food, disposing of	2.87	1.07	71.75	0.71	145

garbage properly, using less plastic, always switching off lights).



Graph 10: Distribution of Scores for Response VI

The results show how frequently participants engage in environmentally friendly behavior in ski resorts. Item 3, which focuses on actions such as saving water, reducing waste, and conserving energy (e.g., taking short showers, avoiding food waste, reducing plastic use), received the highest rating with an average score of 2.87 and an item difficulty of 71.75. Item 1, addressing staying on marked slopes and designated routes, was rated with an average score of 2.33 (item difficulty 58.25). The lowest rating was given to Item 2, which describes snowboarding only on natural snow without snow cannons, with an average score of 1.32 (item difficulty 33.00).

The overall average score for this category is 8.16, with a standard deviation of 2.70. The most frequent score range is 8.01–10.00 points (34.5%), followed by 6.01–8.00 points (32.4%). Extremely low scores below 2.00 points (2.1%) and very high scores above 14.01 points (0%) are rare. The results indicate that specific environmentally friendly behaviors in ski resorts are practiced with varying frequency.

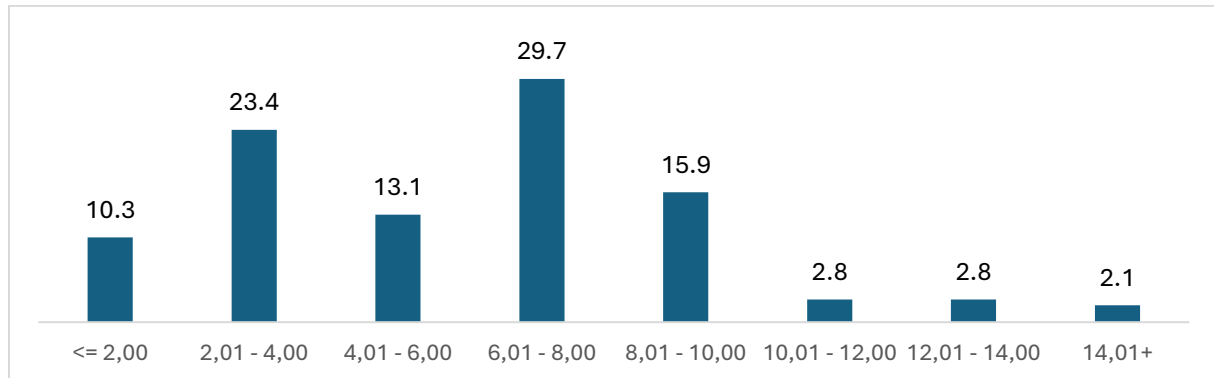
5.3.7 Response VII - Sustainable Ski Resorts

The survey results from 145 snowboarders aim to assess their perception of sustainable ski resorts and their significance for environmental protection. Participants were asked to indicate how often they use various measures and features of sustainable ski resorts. Responses were rated on a scale from 0 (never) to 4 (always).

Table 12: Descriptive Statistics of Response VII

Items	M	SD	I dif	I dis	N
1. I spent my vacation in a ski resort that is environmentally certified.	1.36	1.25	34.00	0.69	145
2. Environmental certificates were important in my decision for a ski resort.	0.90	1.11	22.50	0.70	145
3. I can imagine using environmentally certified accommodation in the future.	2.56	1.20	64.00	0.68	145

M	Max	SD	I dif	N
6.03	15.0	3.4	40.2	145



Graph 11: Distribution of Scores for Response VII

The results show how participants perceive sustainable ski resorts and their importance for environmental protection. Item 3, which describes the willingness to stay in eco-certified accommodations in the future, received the highest rating with an average score of 2.56 and an item difficulty of 64.00. Item 1, referring to whether participants have spent their vacation in an eco-certified ski resort, was rated with an average score of 1.36 (item difficulty 34.00). The lowest rating was given to Item 2, which highlights the importance of environmental certifications when selecting a ski resort, with an average score of 0.90 (item difficulty 22.50).

The overall average score for this category is 6.03, with a standard deviation of 3.40. The most frequent score range is 6.01–8.00 points (29.7%), followed by 8.01–10.00 points (15.9%). Extremely high scores above 14.01 points are rare (2.1%), as are scores below 2.00 points (10.3%). The results indicate that participants prioritize the use of eco-certified ski resorts and accommodations to varying degrees.

6 Analysis

The subsequent calculations aim to create a central metric that shows how many of the respondents can be considered “environmentally conscious”. Additionally, metrics for the individual components of the environmental consciousness indicator ("Pressure," "State," and "Response") were to be determined.

The key features of the scales are presented in the following table:

Table 13: Standardization of Subscales

Items	M	SD	I dif	I dis	N
Pressure2	10.23	3.42	68.20	0.72	145
Pressure3	11.94	3.77	79.60	0.71	145
State1	9.99	2.34	66.60	0.70	145
State2	8.64	3.11	57.60	0.69	145
Response1	9.32	2.98	62.13	0.72	145
Response2	8.16	2.11	54.40	0.71	145
Response3	5.91	3.31	39.40	0.70	145
Response4	4.65	3.32	31.00	0.69	145
Response5	2.79	1.99	18.60	0.70	145
Response6	8.16	2.69	54.40	0.68	145
Response7	6.03	3.37	40.20	0.70	145

Table 13 shows that the subscale "Pressure3" has the highest values, with an average score of 11.94 and an item difficulty of 79.60, indicating strong awareness of the related topics. In contrast, "Response5" has the lowest values, with an average score of 2.79 and an item difficulty of 18.60, showing low implementation of sustainable actions in this area.

The smallest variation is seen in "State1" (SD = 2.34), suggesting that participants rated these statements more consistently. The largest variation is in "Response3" (SD = 3.31), indicating widely different opinions or behaviors.

Overall, the results show that participants are more aware of ecological challenges ("Pressure"), while sustainable actions ("Response") are less frequently practiced.

For the two subcomponents "Pressure" and "State," a sum score was calculated for each. These sum scores were then adjusted to a scale from 0 to 15. Since each component used two individual scales, the sum values were divided by two. The individual items

within these two components correlate strongly with each other and result in a common dimension in factor analysis. Therefore, the calculation of the sum scores is both meaningful and appropriate: they represent two related patterns, with the individual items acting as indicators.

The characteristics of the two sum scores, "Pressure" and "State," are presented in the following table.

Table 14: Sum Scores of the Component Scales "Pressure" and "State"

	M	Max	SD	Skew	Kurtosis
Sum scores 'Pressure'	11.09	15.00	3.59	-1.26	1.50
Sum scores 'State'	9.32	15.00	2.72	-0.73	1.08

For these two scales, it was determined that a person is considered "environmentally conscious" in the respective component if they achieve a higher score than the average. Environmental consciousness is thus assessed on a scale from "high" to "low," rather than in categories such as "present" or "not present." Therefore, it makes sense to label individuals as "environmentally conscious" if their score is above average.

For "Pressure," the threshold is set at a score of at least 11.1 (higher than the mean of 11.09). This means that a person must fall within the upper range of the scale to be considered "environmentally conscious" in terms of perceiving ecological risks and challenges. This relatively high threshold is justified content-wise, as respondents already have a high awareness of ecological risks. Therefore, a person must rate the "Pressure" items as "very threatening" or "very important" to be classified as environmentally conscious.

For the "State" component, the threshold is set at a score of at least 9.33 (higher than the mean of 9.32). This means that a person must be in the upper third of the possible values to be considered "environmentally conscious" in terms of perceiving the current environmental state. This medium-high threshold is contentually sensible because environmental attitudes are often present but not shared by all respondents. A score above average indicates that the person perceives the state of the environment as concerning and is likely to support social innovations to address environmental issues. Thus, a high but not extreme score on this scale is deemed appropriate for identifying a group with an environmentally conscious attitude.

For the "Response" component, the seven different subareas were retained because they describe different behaviors that are not always interconnected. This is due to the fact that many possible eco-conscious behaviors were captured across various everyday contexts, but not all of them are practiced simultaneously. Therefore, the criterion for "environmentally conscious behavior" was set that a person must score above average in at least four of the seven "Response" areas. This means that a person must act with above-average environmental consciousness in more than half of the areas to be classified as part of the "environmentally conscious acting" group. The following table shows the frequencies of the occurrences:

Table 15: Thresholds of the 3 Subcomponents "Pressure," "State," and "Response"

Subcomponents	%	N
Pressure		
>11.10	62.8	91
≤ 11.10	37.2	54
Total	100.0	145
State		
>9.33	54.5	79
≤ 9.33	45.5	66
Total	100.0	145
Response		
7 = for all 7 scales	8.3	12
6 = for at least 6 scales	10.3	15
5 = for at least 5 scales	14.5	21
4 = for at least 4 scales	20.0	29
3 = for at least 3 scales	13.8	20
2 = for at least 2 scales	17.9	26
1 = for at least 1 scales	8.3	12
0= for none of the scales	6.9	10
Total	100.0	145

Overall, in the first two categories ("Pressure" and "State"), the distribution is close to half of the respondents. Based on these three components, the "environmentally conscious group" was finally identified. This group consists of those who exceed the respective threshold in all three subcomponents ("Pressure," "State," "Response"). The overall value indicates the percentage of respondents that can be classified as part of the "environmentally conscious" group.

This group is characterized by the following:

- For "Pressure", the score is above 11.10 (62.8% of respondents).

- For "State", the score is above 9.33 (54.5% of respondents).
- For "Response", the person scores positively in more than half of the possible behavioral areas, at least 4 out of 7 scales (20% of respondents).

This group demonstrates a strong overall environmental consciousness, as they score above the defined thresholds in all three key components: perceiving ecological risks as significant, having an awareness of the current environmental state, and displaying environmentally conscious behaviors.

Table 16: Division of the "Environmentally Conscious Group" and "Non-Environmentally Conscious Group"

	N	Percent (%)
Non-Environmentally Conscious Group	96	66.2
Environmentally Conscious Group	49	33.8
Total	145	100

The following table shows the values of the self-assessment asked at the very beginning of the questionnaire for the snowboarders.

Table 17: Self-Assessment of Environmental Consciousness

	N	Percent (%)
No reply	3	2.1
Yes	107	73.8
No	10	6.9
Don't know	25	17.2
Total	145	100

The two tables reveal significant differences between the snowboarders' self-assessment of their environmental consciousness and the actual classification of their environmental awareness. In the first table, 73.8% of respondents consider themselves environmentally conscious, while only 6.9% claim to be not environmentally conscious. An additional 17.2% are unsure and respond with "don't know," while a small group (2.1%) provides no answer.

However, the analysis in Table 17 presents a different picture: Only 33.8% of snowboarders actually meet the criteria to be classified as the "environmentally conscious group," while the majority, 66.2%, are considered non-environmentally conscious. This result suggests that snowboarders may be more optimistic in their self-assessment of their environmental consciousness than the strict analysis of the evaluation criteria indicates. This proportion is not representative of the population as a

whole, but only provides an indication of the general environmental awareness in the sample studied. The following table shows the key statistical values for the "environmentally conscious group" of the field test compared to the remaining respondents ("non-environmentally conscious").

Table 18: Characteristics of the "Environmentally Conscious Group" Compared

		N	M	SD	M differences
Pressure2	environmentally conscious	49	12.40	1.94	3.28
	non-environmentally conscious	96	9.12	3.49	
Pressure3	environmentally conscious	49	14.16	1.05	3.36
	non-environmentally conscious	96	10.80	4.14	
State1	environmentally conscious	49	11.47	1.48	2.23
	non-environmentally conscious	96	9.24	2.34	
State2	environmentally conscious	49	10.94	1.94	3.47
	non-environmentally conscious	96	7.47	2.93	
Response1	environmentally conscious	49	10.56	2.50	1.88
	non-environmentally conscious	96	8.68	3.01	
Response2	environmentally conscious	49	9.41	2.04	1.90
	non-environmentally conscious	96	7.51	1.85	
Response3	environmentally conscious	49	8.14	3.08	3.36
	non-environmentally conscious	96	4.78	2.82	
Response4	environmentally conscious	49	6.30	3.29	2.50
	non-environmentally conscious	96	3.80	3.01	
Response5	environmentally conscious	49	3.78	1.97	1.50
	non-environmentally conscious	96	2.28	1.81	
Response6	environmentally conscious	49	9.31	2.11	1.74
	non-environmentally conscious	96	7.57	2.77	

	environmentally conscious	49	8.32	2.81	
Response7					3.46
	non-environmentally conscious	96	4.86	3.03	

Further analysis in Table 18 highlights significant behavioral and perceptual differences between the environmentally conscious group and the non-environmentally conscious snowboarders. The environmentally conscious group scores higher across all categories (Pressure, State, Response). Notably, they rate external pressures (Pressure3) more strongly (mean difference 3.36), perceive environmental conditions more critically (State2, mean difference 3.47), and respond more actively to challenges (Response3, mean difference 3.36). These findings indicate that the environmentally conscious group demonstrates greater sensitivity and engagement with environmental issues. The largest differences appear in how they perceive environmental conditions (State2) and their proactive responses (Response7, mean difference 3.46), suggesting higher motivation and action-oriented behavior.

Table 19: Role Perception through Environmental Type Characteristics

Role	non-environmentally conscious (%)	environmentally conscious (%)	Total (%)
Sustainability-oriented	45.8	51	47.6
Environmentally concerned	46.9	44.9	46.2
Environmentally passive	5.2	2	4.1
Growth-oriented	2.1	2	2.1
Total	100	100	100

Table 19 shows that, overall, 47.6% of respondents are classified as sustainability-oriented, and 46.2% are environmentally concerned. Together, these two pro-environmental types account for almost 90% of the "environmentally conscious group." In contrast, growth-oriented (2.1%) and environmentally passive (4.1%) individuals are underrepresented, reflecting the strict criteria used to define the "environmentally conscious group," which focus on active and deliberate environmental behavior.

Table 20: Share of the "environmentally conscious group" in the environmental types

Role	non-environmentally conscious (%)	environmentally conscious (%)
Sustainability-oriented	63.77	36.23
Environmentally concerned	67.16	32.84
Environmentally passive	83.33	16.67

Table 20 illustrates this trend by showing the share of the "environmentally conscious group" within each environmental type. Only 36.23% of sustainability-oriented individuals and 32.84% of environmentally concerned individuals meet the criteria to be part of the "environmentally conscious group." This demonstrates that not all members of these pro-environmental types qualify, likely due to the strict evaluation model. For example, only 16.67% of environmentally passive individuals and 33.33% of growth-oriented individuals are part of the "environmentally conscious group," as expected given their generally lower engagement in environmental behaviors.

7 Evaluation

Environmental Awareness

The “Pressure” dimension reveals a generally high sensitivity among respondents toward ecological challenges. In Table 14 the average score of 11.09 (SD = 3.59) indicates an awareness of environmental issues, with 62.8% of participants scoring above the threshold of 11.10. The high scores in this dimension may reflect snowboarders' internal perspective (attitudes), as described by Neugebauer (2004), which highlights their recognition of external environmental threats, such as climate change and habitat destruction (Climate Change & Wildlife).

The “State” dimension in Table 14, which reflects perceptions of the current state of the environment, shows an average score of 9.32 (SD = 2.72). Here, 54.5% of respondents scored above the threshold of 9.33 (Table 15), suggesting a moderate to high level of concern about environmental conditions. However, not all participants demonstrated the same level of critical awareness. This variation could result from differences in knowledge or personal experience with environmental issues. Additionally, the perception of environmental conditions might be overshadowed by the focus on personal enjoyment, such as leisure and recreation, associated with snowboarding.

The “Response” dimension, which measures active environmentally conscious behavior, shows significantly lower scores in comparison. As shown in Table 14, 20% of respondents met the criteria for environmentally conscious actions by performing above average in at least four out of seven subcategories. This highlights a considerable action gap: while snowboarders seem to and critically evaluate environmental problems, they often fail to translate this awareness into proactive behavior. Possible explanations for this gap include a lack of knowledge about actionable steps, convenience barriers, or low personal accountability.

Discrepancy between Self-Perception and Actual Environmental Awareness

The analysis reveals a significant gap between self-perception and actual behavior. While 73.8% of participants considered themselves environmentally conscious, only 33.8% met the behavioral criteria (Table 16 and Table 17). The results suggest that despite their awareness, snowboarders may lack actionable knowledge or motivation to address issues like CO₂ emissions from transportation (Transportation) or the environmental impact of artificial snowmaking (Water Scarcity and Chemicals).

Group Differences in Environmental Awareness

The analysis shows that the environmentally conscious group scored significantly higher across all dimensions. As shown in Table 18 the “Pressure” subscale (e.g., Pressure3, difference of 3.36 points) highlights their stronger perception of external environmental threats. Similarly, the “State” subscale (e.g., State2, difference of 3.47 points) indicates a more critical evaluation of environmental conditions. In the “Response” dimension, particularly in proactive behaviors such as supporting sustainable projects (Response3, difference of 3.36 points), the environmentally conscious group demonstrated significantly greater engagement actions like supporting sustainable projects (Water Scarcity and Chemicals & Environmental and Natural Damage).

Role of Environmental Orientation

The typology of respondents in Table 19 indicates that 47.6% are classified as “sustainability-oriented”, and 46.2% are “environmentally concerned”. Together, these two pro-environmental groups account for roughly 80% of the sample. However, in Table 20 only 36.2% of sustainability-oriented individuals and 32.8% of environmentally concerned individuals meet the criteria for the environmentally conscious group. The typology of respondents shows that while many participants have positive environmental attitudes, only a small fraction translate these into actionable behaviors. This supports the theoretical distinction between internal attitudes and external behaviors and highlights the specific challenges in the snowboarding context, such as the reliance on transportation (Transportation) and the environmental costs of slope maintenance (Environmental and Natural Damage). These findings underline the need for practical measures that address both dimensions of environmental awareness.

8 Conclusion

The findings reveal a significant gap between snowboarders' environmental awareness and their proactive behaviors, emphasizing the need for targeted interventions. While many respondents demonstrate a high sensitivity to ecological challenges (Pressure) and concern about environmental conditions (State), only 20% engage in consistent environmentally conscious actions (Response). This highlights the importance of translating awareness into actionable behavior.

The Role of Education in Environmental Awareness

Education is key to closing the gap between environmental awareness and action. While traditional programs focus on spreading knowledge, creative approaches like games can make learning about climate change and sustainability more fun and engaging, especially for young snowboarders and other winter sports enthusiasts.

One example is a card game designed to teach players about the environmental impacts of winter sports. In the game, players could face decisions like choosing travel options, managing a ski resort, or using artificial snow. These decisions would have consequences, showing how actions affect the environment, such as increasing or reducing carbon emissions. Players could earn points for making sustainable choices, like using public transport or supporting renewable energy.

Using games like this can make learning about environmental issues more interactive and enjoyable. It helps people think about solutions and encourages them to make better choices. Snowboard associations and resorts could include such games in their programs and snowboard schools to inspire them to take real steps toward sustainability while enjoying the process.

Other Recommendations for Snowboard Associations

The gap between awareness and action underscores the need for comprehensive education and awareness-raising programs. These programs should emphasize not only the importance of environmental protection but also provide practical solutions that snowboarders can integrate into their sport. Based on the findings and practical recommendations from the literature, snowboard associations should consider the following measures:

1. Educational Campaigns:

Raise awareness about actionable environmental steps, focusing on:

- Promoting the environmental benefits of eco-friendly travel options like trains and buses (WWF, 2013).
- Highlighting the impact of artificial snowmaking and encouraging water-saving practices in resorts (Wipf et al., 2005).

2. Incentive Programs:

Introduce reward systems that make sustainable choices more attractive:

- Discounts or rewards for those who carpool, use public transport, or support eco-friendly accommodations (Reimoser, 2016).

- Partnering with sustainable ski resorts to offer perks for minimizing the ecological footprint.

3. Sustainable Resort Practices:

Collaborate with resorts to implement resource-efficient and eco-friendly infrastructure:

- Minimize terrain modifications during slope construction (Stott, 2019).
- Prioritize renewable energy sources for snowmaking and ski operations.
- Reduce or eliminate the use of chemicals in artificial snow production.

4. Visibility and Engagement:

Actively engage snowboarders by making sustainable options more visible and appealing:

- Clearly communicate the benefits of sustainable ski resorts and offer financial incentives for choosing them.
- Organize and promote initiatives such as slope restoration or reforestation projects to encourage direct involvement.

These strategies align with the needs identified in the evaluation and address the discrepancy between awareness and action. By fostering both awareness and practical opportunities, snowboard associations can empower snowboarders to adopt sustainable behaviors. Minimizing artificial snowmaking, promoting eco-friendly travel, and supporting sustainable ski resorts are not only feasible but also effective ways to expand snowboarders' ability to act in environmentally conscious ways.

Ultimately, snowboarding destinations and organizations have a unique opportunity to lead by example. Through collaboration and innovation, they can ensure the sustainability of winter sports while preserving the natural landscapes that are integral to their future. By bridging the gap between attitudes and actions, snowboarding can remain a viable and environmentally responsible activity for generations to come.

9 References

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