Paper

OITAF Ropeway Congress 2024

Touristic Sites and Environment

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Gössendorf. 15th January 2024

Abstract

With this presentation the wide range of points of contact between touristic sites and environment will be shown and information for environmentally compatible operations are given.

It is to observe, that interventions to nature due to constructing and operating of touristic sites, especially ropeways and downhill slopes, are fact and the most important objective should be to prevent or reduce environmental impacts to a minimum.

Initially, the objectives as well the marginal conditions of technical snowing (man-made snow) will be described. The topics also include the careful use of the resource water due to weather and climate conditions of the relevant region. These conditions are highlighted in the context of global climate change.

In a further step, the possibilities for improving the use of the available resources of water, electrical energy, fossil fuels, and the use of human resources and technical equipment are discussed.

In addition to the above topics, there are also some information about problems with wildlife and birds in the area of tourist facilities, especially cable cars and their stations.

Finally, the rules of the Alpine Convention and its relation to cable cars and tourist sites are explained.

1. Construction and operation of tourist facilities (cable cars, ski slopes) with special consideration of ecological conditions

Interventions in nature due to the construction and operation of tourist facilities, primarily cable cars and ski slopes, are given as a fact. In contrast, significant economic, social, and societal economic aspects persist. The goal must be to avoid or minimize ecological damage and impairments through the measures taken (construction, operation, maintenance, and management) and to take the utmost care of:

- Landscape character
- Landscape appearance
- Landscape stability

Natural conditions concerning the natural and ecological conditions, impacts originating from the mentioned facilities (cable cars, slopes, etc.) are possible in various areas. These include:

Water and water bodies: Influencing the general runoff situation both locally and on a large scale, effects on the stability, use, and usability of the landscape.

Ecosystems: Especially through ski slope construction, ecosystems can be affected, including water bodies in general, wetlands, forests, high-mountain and subalpine tall-herb communities, subalpine dwarf shrub heaths, alpine meadows (limestone grasslands, silicate grasslands, wind-swept edges), avalanche meadows, snow fields, scree and debris slopes, rock biotopes, glacier moraine biotopes, culturally influenced and culturally conditioned biotopes (fat and lean meadows, pastures, hedges, groves, etc.).

In the context of the planning and operation of tourist facilities, negative impacts should be avoided or minimized. This can be achieved in the case of ski slopes through careful planning of the alignment of ski slopes with accompanying measures such as silvicultural care to secure and stabilize the rejuvenation progress on the edge of the slopes.

Furthermore, negative impacts can be avoided by adapting to the natural terrain, gentle soil cultivation, minimizing terrain corrections, minimizing interventions in water bodies, and avoiding significant impairment of ecological functionality.

Excavations in the subalpine and alpine stages should be kept to a minimum, as the regeneration of the affected areas takes generations and is the most complex.

2. Technical snowmaking and slope preparation

Technical snowmaking can ensure the conditions required for skiing and provide sufficient protection for soil and vegetation.

The biggest misunderstanding in technical snowmaking lies in the frequently used term "artificial snow." It suggests an "artificiality" of snow and fuels myths and legends of (chemical) additives in snow water.

The often-mentioned enormous water consumption of technical snowmaking is misleading, as the water is not CONSUMED but USED. Usually, water is taken during the snowmelt period from local sources or water bodies and pumped into so-called "reservoirs." These reservoirs are situated as high as possible in the terrain for energy efficiency reasons. The pumping capacity for their filling is called up during times of energy surplus. In winter, the water is applied to the slopes in the form of snow and remains stored there. In spring, the snow melts, and the water returns to the natural cycle. It is essential to understand that the water is not consumed but is retained in the water cycle, just like natural snow. Although some of the used water evaporates during technical snowmaking, this is also a component of the natural water cycle.

Concerning the energy consumption of technical snowmaking, a strict distinction must be made between the connected load and the actual consumption. Large connected loads of the facilities are countered by the little-known fact that an average snowmaker is only used for about 240 hours a year. In other words, an average snowmaker works for a total of 10 full days a year and is idle for a total of about 355 days. Cable car and lift operators are strongly advised to use only green electricity for technical snowmaking. In this case, a snowmaker is as "clean" as an electric car. There are some parallels between a snowmaker and an electric vehicle. Both have similarly high connected loads ("consumption"). However, like a snowmaker, an electric car is not in use for the majority of the time and is parked.

In recent decades, the **energy efficiency** of technical snowmaking has greatly increased. Snowmaker manufacturers have intensively dealt with improving nucleation to achieve more efficient snowmaking. The starting temperature for technical snowmaking has moved closer to the freezing point.

It should be aimed for a part of the energy demand to be produced locally by the cable car companies themselves, for example, through photovoltaic systems. This could free the ski areas from the "media penalty box" by no longer serving as a welcome "favorite opponent" of NGOs, but becoming an **active partner in a reasonable and achievable energy transition**.

Example of energy consumption: At the Lech ski lifts, the energy requirement per cubic meter of snow averages 3.75 kWh. In total, about three times the amount of electrical energy is consumed in a season compared to a 115-bed 4-star hotel. Source: TR DI Michael Manhart, Lech ski lifts

3. Water balance in ski areas - gentle handling of the water resource - climatic conditions

Due to the widespread equipment of ski areas with snowmaking facilities, the extension of the ski operation period into the pre-winter season, and the higher snow consumption under changing climatic conditions, the water balance in ski areas will play an important role in the future.

Considering legal conditions, especially the EU Water Framework Directive, as well as the natural conditions, the construction and operation of a snowmaking facility must not unreasonably impair or disturb the water balance and the associated natural water cycle. This means:

- Comprehensive preliminary work must be carried out before implementing a snowmaking project - water management and climatic conditions, temporally differentiated availability of the required water quantity, local climatic conditions need to be determined.
    - Assistance: Long-term observations by hydrographic and meteorological services, project-related local measurements should be supplemented.
- Establishment of a monitoring network Parameters:
    - Air temperature, humidity (atmospheric area), water level and discharge (for surface waters and groundwater, including springs), water quality
- Sufficient water must be available in the required quantity and quality to allow proper operation of the facility while maintaining the good condition of the affected water bodies.
- When withdrawing water, appropriate tests of hydrological, hydrogeological, and ecological conditions must be carried out, and the results of the examination must be integrated into the projects.
- Surface waters located near or affected by slopes and snowmaking facilities must be protected through appropriate planning to maintain their good ecological condition.
- All measures (installations) on water bodies must consider the necessary flood discharge capacity of the water body.
- The construction of withdrawal structures must be coordinated with the secured minimum water quantity.
- The intake point must be designed to allow the migration of water-bound organisms throughout.
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The water use by technical snowmaking ranks lasts with about 1%, behind agriculture, industry, and drinking water supply in the respective regions. There are two ways to ensure sufficient water reserves for snowmaking in water-scarce times like winter and at high altitudes. One measure is the construction of reservoirs with a volume of 700 m^3 per hectare of slope to ensure sufficient base snowmaking. On the other hand, large watercourses or groundwater reserves in the valley bottom can also be used, but this usually leads to higher energy and infrastructure costs. Especially due to the high elevation of ski areas, pump stations and pipelines are often necessary.

In accordance with the EU Water Framework Directive, a ban on deterioration applies to the water balance both qualitatively and quantitatively.

Due to the effects of climate change, there will be a significant shift in the permafrost limit in the mountains (200 to 750 meters upward) in the next 100 years and problems ensuring natural snow guarantee for some ski areas. In addition, an increase in late winter precipitation by 20% is expected, which only positively affects the snow cover in very high-altitude areas. Only through technical snowmaking can a sufficiently reliable snow cover be offered for winter sports at an altitude of 800 m above sea level in the next 20 years. This applies not only to alpine skiing but also to cross-country centers, winter toboggan runs, etc. Therefore, technical snowmaking is currently considered an important adaptation.

Every winter sports resort should ensure a reliable season start in early December and provide alternative leisure activities for late winter, especially in areas with low altitudes. Other adaptation strategies to climate change include better cooperation between individual winter sports areas and better use of the inter-seasonal periods by those responsible in each destination. Summer tourism should also be promoted.

4. Energy efficiency in cable car companies

In the future it will become increasingly important for cable car companies to achieve a high level of energy efficiency. To ensure this in operations, the following measures are effective:

- Recording the current status of energy consumption:
  - Examination of energy supply contracts
  - Recording the electricity consumption of cable cars and lifts
  - Recording the consumption of water and energy of the snowmaking infrastructure (i.e., how much electricity and water do I need to produce snow for the ski area?)
  - Recording the fuel consumption of snow groomers
  - Recording the energy consumption in office/ticket/workshop buildings
  - Recording the consumption of kitchen appliances/cooling/ventilation in gastronomy
  - Recording the energy consumption of heating systems
- Analysis of operational processes:
  - Peak load management: Checking whether or how often the agreed capacity with the supplier is exceeded

- Slope grooming: How is slope grooming/operation/empty runs designed? Is rolling efficient?
- Verification of the efficient use of vehicles of all kinds - are they used energy-efficiently?
- Snowmaking concept: How much do I have to snow on each hydrant/slope point to bring/maintain the slope in perfect condition/have sufficient reserves – but at the same time not produce too much snow?
- Operation of cable cars and lifts: Checking whether the speed of the cable cars and lifts can be reduced during lower demand
- Operation of catering facilities and buildings in general: Checking whether the heating is optimally managed
- Avoiding idle runs and optimizing equipment usage, avoiding standby mode
- Are there application rules for employees

Taking into account the above points, organizational measures should then be taken, which are listed below in part:

- Introduction of demand-driven operation for cable cars
- Consideration of the energy efficiency of products of all kinds, whether new acquisitions or renovations
- Preference for energy-efficient drives in new installations
- Use/installation of suitable software for ongoing control and recording of energy consumption per cable/car/station/...customer point (basis for comparing several operating years)
- Recording the operating time of various installations
- Checking the electricity bills from suppliers
- Training, information, and sensitization of employees regarding the possibilities of energy saving:
  - Heating and ventilation of rooms
  - Proper operation of controls of systems/devices
  - Gentle handling of energy and water
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In addition, structural measures, measures to reduce energy procurement costs, examination of options for the self-production of electricity and heat, and the creation of an energy balance for the entire operation make sense.

5. Wildlife and winter sports areas:

Operators of ski areas are confronted with the disturbance of wildlife in four fundamental areas. These are construction measures, off-piste skiing away from designated slopes, the operation of snowmaking facilities, and the grooming of slopes during the day and at night. But even in summer operation, there can be disturbances to wildlife due to the take-off and landing areas of paraglider or hang-glider pilots.

Appropriate measures include targeted information for athletes on-site, as well as active visitor guidance and clarification of the issue, especially for young people. The creation of quiet zones such as wildlife protection areas or winter enclosures can be achieved through

cooperation and coordination with forestry authorities, hunting associations, and relevant sports associations. Moreover, disturbing activities such as the operation of snowmaking facilities and slope grooming at night should be reduced to an absolutely necessary minimum and aligned with the needs of wildlife.

Due to tourist use, the habitat of wildlife is narrowed. Habitat narrowing occurs on the one hand through the creation of dividing lines and the withdrawal of standing areas and on the other hand through disruptions from ski operations or tourism. These specifications must be taken into account in the planning of cable cars and ski slopes.

Due to disturbance (stress, escape, etc.), wildlife consumes up to twelve times as much energy as in a resting state. Locally, this can lead to, for example, elevated wildlife densities associated with an increase in wildlife damage (browsing and peeling damage) in ungulates. Indirectly, this can also endanger the functions of the forest or cause the loss of local wildlife habitats.

On the other hand, additional wildlife-friendly feeding areas are created when greening is done with site-appropriate seed. In general, during planning, attention should be paid to wildlife biological and ecological issues in the project area.

6. Alpine Convention and cable cars:

It is noted in advance that the Alpine Convention is an European institution that can be applied globally in terms of content. As part of the Alpine Convention, the contracting parties committed themselves to environmentally friendly use of the entire Alpine region. The goal is the sustainable use of resources, the reduction of current burdens, and the preservation of a common natural and cultural heritage. A total of 12 protocols are to be developed to support the implementation of the Convention.

The protocols on spatial planning and sustainable development, soil protection, nature protection and landscape conservation, mountain farming, mountain forest, tourism and leisure, traffic, and energy are already fully developed and legally effective. The protocols on population and culture, air purity, waste management, and water management are still pending. Although the Alpine Convention does not directly obligate individual cable car companies, it is accepted as an important framework requirement.

IPCC (2013): *Climate change 2013. The physical science basis. Working Group I contribution to the Fifth Assessment Report of the International Panel on Climate Change.* Genf: IPCC, 2215 Seiten (Website) (angenommener aber noch nicht im Detail bestätigter Entwurf)