World Heritage Sites

Protected Areas and World Heritage

SWISS ALPS JUNGFRAU-ALETSCH SWITZERLAND

The beauty of the Bernese Alps is internationally famous. They are the most extensively glaciated mountains in Switzerland and contain the largest glacier in Eurasia, the Aletschgletscher, a great range of glacial features and an outstanding record of the uplift and compression that formed the High Alps. Climate change can be measured by the varying retreat rates of its glaciers which also provide a diversity of ecosystems and examples of plant succession on the substrates they reveal. There is a wide variety of alpine and sub-alpine habitats The impressive North Wall of the Jungfrau, Mönch and Eiger are celebrated in European literature, art and mountaineering.

COUNTRY
Switzerland

NAME
Swiss Alps Jungfrau-Aletsch

NATURAL WORLD HERITAGE SITE
2001: Inscribed on the World Heritage List under Natural Criteria vii, viii and ix.
2007: Extension to the World Heritage site inscribed under Natural Criteria vii and ix.

STATEMENT OF OUTSTANDING UNIVERSAL VALUE [pending]
The UNESCO World Heritage Committee issued the following statement at the time of inscription:

The Jungfrau-Aletsch-Bietschhorn region is the most glaciated part of the European Alps, containing Europe's largest glacier and a range of classic glacial features, and provides an outstanding record of the geological processes that formed the High Alps. A diverse flora and fauna is represented in a range of habitats, and plant colonization in the wake of retreating glaciers provides an outstanding example of plant succession.

Criterion (vii): The impressive landscape within the property has played an important role in European art, literature, mountaineering and alpine tourism. The area is globally recognised as one of the most spectacular mountain regions to visit and its aesthetics have attracted an international following. The impressive north wall of the High Alps, centred on the Eiger, Mönch and Jungfrau peaks, is a superlative scenic feature, complemented on the southern side of the Alpine divide by spectacular peaks and a valley system which supports the two longest glaciers in western Eurasia.

Criterion (viii): The property provides an outstanding example of the formation of the High Alps resulting from uplift and compression which began 20-40 million years ago. Within an altitude range from 809m to 4,274m, the region displays 400 million-year-old crystalline rocks thrust over younger carbonate rocks due to the northward drift of the African tectonic plate. Added to the dramatic record of the processes of mountain building is a great abundance and diversity of geomorphological features such as U-shaped glacial valleys, cirques, horn peaks, valley glaciers and moraines. This most glaciated part of the Alps contains the Aletsch glacier, the largest and longest in Europe, which is of significant scientific interest in the context of glacial history and ongoing processes, particularly related to climate change.

Criterion (ix): Within its altitudinal range and its dry southern/wet northern exposures, the property provides a wide range of alpine and sub-alpine habitats. On the two main substrates of crystalline and carbonate rocks, a variety of ecosystems have evolved without significant human intervention. Superb examples of plant succession exist, including the distinctive upper and lower tree-line of the Aletsch forest. The global phenomenon of climatic change is particularly well-illustrated in the region, as reflected in the varying rates of retreat of the different glaciers, providing new substrates for plant colonization.

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The property is well managed, with a management strategy and plan in place, which have been developed through an exemplary participatory process. Almost all of the property is under some form of legal protection. Key management issues include the potential impact from climate change, the management of tourism, and the need to ensure effective coordination of management responsibility between federal, cantonal and communal levels of government.

IUCN MANAGEMENT CATEGORY
IV Protected Landscape

BIOGEOGRAPHICAL PROVINCE
Central European Highlands (2.32.12)

GEOGRAPHICAL LOCATION
The site is located in south-western Switzerland in the Bernese Alps, on the border between the French and German-speaking Cantons of Valais and Berne, about 25 km south of Interlaken and 20 km north of Brig. With the extension it covers the whole Aar massif from the Gasterntal in the west to the Grimselsee in the east, including the catchments of the Aletsch, Aar and Grindelwald glaciers. The centre of the site, Konkordiaplatz, is located at 46°30'00"N and 8°02'00"E.

DATES AND HISTORY OF ESTABLISHMENT
1933: The Canton of Valais assumed responsibility for protection of the Aletsch forest; and in 1938 for protection of the Märjelen, both on the Rhone valley slopes;

1960: Berne Canton assumed management for the Hinteres Lauterbrunnental Nature Protection Zone. This is also partially covered by the 1992 Breithorn Cantonal Game Reserve ordinance;

1966; Federal Law on the Protection of Nature and Cultural Heritage (SR 451) passed; this is the legal basis underlying subsequent ordinances protecting landscapes, hunting reserves, mires and fens;

1983: The Bernese Alps was first included on the Federal Inventory of Landscapes, Sites and Natural Monuments of National Importance; the area was revised in 1998;

1986: The protection of Baltschiedertal was defined by a contract signed between the communities of Baltschieder, Eggerberg and Mund, the Swiss foundation for Landscape Conservation & Protection and Pro Natura Valais. This states that the area should be kept in the same Condition as it was in 1986;

1994: The Ausserberg community joined the scheme.

LAND TENURE
Public and local communes. Approximately 16% of the site is owned by the community of Fieschertal. Most of the remainder of the property is owned by 26 local communes and their associated authorities. There are also some private landowners, mostly on the edge of the site. The largest private owners are the nature protection organisation *Pro Natura* at Alpes Understeinberg and Breitlauenen in the Hinteres Lauterbrunnental (500 ha), and the electric utility Kraftwerken Oberhasli (~ 8,500 ha) including the Lower and Upper Aar, Lauteraar and Finsteraar glaciers and the Bächli valley.

AREA
Total: 82,388 ha, comprising the 53,888 ha existing World Heritage Site plus extensions at both ends totaling 28,500 ha. 56% is within the Canton of Valais, 44% within the Canton of Berne to its north.

ALTITUDE
809m - 4,274m (Finsteraarhorn). 50% of the site is above 2,600, 9 peaks exceed 4,000m.

PHYSICAL FEATURES
The site is the crest of a wall of high mountains covered by the largest glaciated area in the Alps. The summit ridge is one of the great watersheds of Europe with nine peaks above 4000m – the

Finsteraarhorn, Aletschhorn, Jungfrau, Mönch, Schreckhorn, Gross & Hinter Fiescherhorn, Grünhorn and Lauteraarhorn. Below the glaciers, the landscape is deeply carved by rivers. The principal valleys on the north side run due north below the precipitous 20 kilometer north wall of the Jungfrau, Mönch and Eiger, thence to the Aar, a tributary of the Rhine which runs into the North Sea. The gentler south-facing slopes with their valleys from the Aletsch and Fiesch glaciers drain into the southwest running valley of the Rhône which flows into the Mediterranean. 95% of the site is untouched except for trails and mountain huts.

About half the nominated area is higher than 2,600m, much of it glaciated, since the boundary between the accumulation and ablation zones is around 2,700m on the northern and 2,900m on the southern slopes. The area covered by glaciers is 35,000ha, the largest continuous area of ice in the Alps which contains five of the seven longest glaciers in Switzerland. These include the Aletsch Glacier, at 96 sq.km and 23.3km, the largest and longest in western Eurasia, with 900 metre thick ice at Konkordiaplatz in 1991 where its bed is hugely overdeepened: the only other place outside the polar icecaps where such an enormous thickness of ice exists. There are classic examples of glacial U-shaped valleys such as the Lauterbrunnental, and every type of glacial and depositional feature: crevasses, meltwater gorges, moraines and glacier forelands. An ice-covered topographic breach runs between the Lötschenlücke, Grosser Aletschfirn and Grünhornlücke from which the Aletsch and Fiesch glaciers flow to the south. The Fiesch Glacier at 15.1km, is the second longest and third largest glacier in Europe. Glacier lengths were first measured in 1881 on the Lower Grindelwald, and in 1892 on the Aletsch and Fiesch glaciers. Some glacial tongues descend relatively low, and those of Aletsch and Grindelwald lower than any other glacier in the Alps. Moraines deposited as a result of this movement, show that the Aletsch glacier has been retreating since 1850.

For at least five hundred million years the area has been successively tropical sea, desert and arctic, with shifting plates and collisions which created three cycles of mountain uplift and erosion, accompanied by magmatism and vulcanism on land and undersea . The present geomorphology of the area reflects its uplift and compression during the Tertiary Alpine orogeny 20-40 million years ago. Between 900 and 4,274 metres, the region displays the thrust due to the northward drift of the African tectonic plate of very old crystalline rocks over younger calcareous sediments. The dominant rock types include old crystalline metamorphic rocks, granite and calcareous sediments, the latter being found only around the massif. This is dominated by the Aar Massif, the largest crystalline massif in the country, which extends as far as the Helvetic nappe system in the Wengernalp. It is comprised of two units, old metamorphics formed during the Caledonian orogenesis 400-450 million years ago, and granitic intrusions formed during the Hercynian orogenesis 300-350 million years ago. The dominant metamorphic rocks which form the peaks above 4,000m are gneiss and schists containing relatively uniform micas, with large amphibolite inclusions. The granite of the Aletschhorn is unique in being covered by a cap of gneiss, a relic of the old crystalline block. The summits of Grünhorn and Finsteraarhorn are composed of very hard green amphibolite. The Central Aar granite in the southwest of the Park, is the largest granitic massif in the country, 100km long, 9km wide and 500 sq. km in area.

During the Mezozoic period, the Aar Massif was covered by a tropical sea for approximately 200 million years. Sediments formed a thick horizontal layer of rock above the crystalline complex, measuring several kilometers in depth. During the formation of the Alps, it was subjected to severe compression, uplift and metamorphism, although there was no dislocation. The distribution of the Mezozoic rocks around the massif shows the deformations caused by the orogeny. The compression and uplift are recorded in the tilting of some of these layers towards the Rhone valley, along the Lötschberg south ramp, as well as by the almost vertical distribution of sediments in the Eiger-Wetterhorn-Grosse Scheidegg region. Most of this sediment cover slipped to the north during the formation of the Alps, leaving the Helvetian nappe exposed. In the process, the nappes dragged shards of the old crystalline rock, now visible at the summit of Jungfrau and Mönch, over the carbonate sediments of the north of the massif. The range is still lifting at 0.5-0.7mm a year and has the sharply eroded ruggedness characteristic of young mountain chains. The soils are predominantly acidic podsols with some rendzinas, but nutrient-rich in the glacier forelands. At high elevations there is permafrost.

CLIMATE

The climate of the site is strongly influenced by the prevailing west winds and the height of the mountains. These form a barrier between the cool wet sub-oceanic climate of the north and the rain-shadowed climate of the southfacing Valais slopes. On the north side the rainfall exceeds 2,200mm,

most falling in summer, but on the south side it is only 1,000mm, with more falling in winter. The Valais experiences a subcontinental climate at low and medium altitudes and is markedly semi-arid. Mean annual temperatures range from -8.5°C at Jungfraujoch to 9.1°C at Brig.

VEGETATION

80% of the site is covered by glaciers and barren rock; 6% is forested, 5.2% is alpine meadow, and 8% is scrub. The distribution and diversity of the vegetation is strongly influenced by altitude, aspect, climate and the diverse geology. Most species are calcicole or calcifuge, though they may be mixed. Within the nominated area there are 1,800 species of vascular plants and 700 mosses. The growing period decreases with altitude, but there are 529 species of phanerogams and pterydophytes above the tree line.

There are several vegetation zones. Broadleaf montane forest extends from 900m to 1,300m on north-facing slopes. On south-facing slopes the same zone is approximately 200m higher. This forest is dominated by beech *Fagus sylvatica* on the north side and by Scots pine *Pinus sylvestris* on the south side, which is too dry for beech. In Hinteres Lauterbrunnental in the north, the broadleaf forest is dominated by deciduous trees such as sycamore *Acer pseudoplatanus*, European ash *Fraxinus exelsior*, elm *Ulmus* glabra, silver birch *Betula pendula*, grey alder *Alnus incana* and green alder *A. viridus* on avalanche scars. The south-facing side receives lower rainfall and more sun. Consequently the vegetation cover typical of the central valley is xeric: the Valais rock-steppe. This grassland does not extend beyond 1,000m. It contains many xerophytic plant species such as *Koeleria vallesiana, Festuca vallesiaca, Stipa pennata,* mountain wormwood *Artemisia vallesiaca* and the shrubby savin juniper *Juniperus sabina.*

The subalpine zone lies between 1,300m to 2,000m, between the broadleaf and alpine zones. Norway spruce *Picea abies* is the characteristic species. In clear areas such as avalanche paths, green alder *Alnus crispa* proliferates. On the north-facing side, above Wengernalp and below Mittellegigrat, Norway spruce is mixed with dwarf Swiss mountain pine *Pinus mugo* ssp.*mugo*, European mountain ash *Sorbus aucuparia* and silver birch *Betula pendula*. Continental species replace Norway spruce on exposed south-facing slopes. Young soils on the proglacial margins are very quickly colonised by larch *Larix decidua*. In contrast, climax, forests are dominated by stone pine *Pinus cembra.* A good example of succession from pioneer vegetation to a climax forest occurs on the border of the Aletsch Glacier and in the Aletsch Forest. The moraine in this area was deposited in 1850 during the maximum extension of the glacier. As the glacier receded, the mineral-rich moraine was colonised by pioneer vegetation. On either side of the 1850 moraine, a larch and spruce forest has developed, characterised by ericaceous moorland dominated by Alpine rose *Rhododendron ferrugineum* and blueberry *Vaccinium myrtillus*. The zone directly above the tree line forms a girdle of moorland vegetation of hairy alpine rose *Rhododendron hirsutum* on base-rich soils and Alpine rose on acidic soils. Alpine grassland of *Festuca varia,* sedge meadows of *Caricon curvulae* and *C, firmae* are widespread and vary with the substrate, slope aspect and altitude. There are also many little mostly acidic sedgebogs and alpine fens.

FAUNA

The fauna of the site is predominantly of species adapted to subalpine and alpine conditions. 1,250 species have been confirmed, including 271 vertebrates: 42 mammals, 99 birds, 8 reptiles, 4 amphibians, 7 fish, 97 molluscs plus 979 insects. Typical species are chamois *Rupicapra rupicapra*, alpine ibex *Capra ibex*, red deer *Cervus elaphus* with some roe deer *Capreolus capreolus*. The red deer are not hunted and are beginning to damage the Aletsch forest. Other common mammals include the mountain hare *Lepus timidus*, fox *Vulpes vulpes*, ermine *Mustela erminea*, weasel *Mustela nivalis*, stone marten *Martes foina*, marmot *Marmota marmota* and the reintroduced Eurasian lynx *Lynx lynx*. Common reptile species include European asp viper *Vipera aspis*, viviparous lizard *Zootoca vivipara*, common wall lizard *Podarcis muralis* and, on the south side only, the green lizard *Lacerta viridis*. Amphibian species on the site include alpine salamander *Salamandra atra* and Alpine newt *Mesotriton alpestris*. Owing to its warmer climate, greater numbers of invertebrates are found in the Valais. A unique glacier species is the glacier flea *Isotoma saltans*, a species of springtail whose optimum temperature is barely above freezing.

The 99 birds include seven species important within Switzerland: rock partridge *Alectoris graeca*, Alpine accentor *Prunella collaris*, rock thrush *Monticolla saxatilis*, wallcreeper *Tichodroma muraria,* yellow-billed chough *Pyrrhocorax graculus*, snow finch *Montifrigilla nivalis* and citril finch *Serinus citronella.* Other notable species are lammergeier *Gypaetus barbatus*, golden eagle *Aquila chrysaetos*, European

kestrel *Falco tinnunculus*, black grouse *Tetrao tetrix*, hazel grouse *Bonasa bonasia*, rock ptarmigan *Lagopus mutus*, boreal owl *Aegolius funereus*, pygmy owl *Glaucidium passerinum*, black woodpecker *Dryocopus martius*, great spotted woodpecker *Dendrocopos major*, green woodpecker *Picus viridis*, red-billed chough *Pyrrhocorax pyrrhocorax*, and European nutcracker *Nucifraga caryacatactes.*

CONSERVATION VALUE

The Bernese Alps are the most extensively glaciated mountains in Switzerland, contain the largest glacier in Europe, the Aletschgletscher, a great range of classical glacial features and an outstanding record of the uplift and compression that formed the High Alps. Climate change can be measured by the varying rates of retreat of several glaciers which also provide substrates for notable examples of plant succession. There is also a wide variety of alpine and sub-alpine habitats. The range lies within a WWF Global 200 Eco-region, in a Centre of Plant Distribution and is part of an Important Bird Area. The impressive North Wall of the Jungfrau, Mönch and Eiger are celebrated in European mountaineering, literature and art.

CULTURAL HERITAGE

The site itself has a long tradition of conservation and is one of the Alpine areas least affected by man though the valleys around the site have a long history of habitation. Research on the evolution of vegetation reveals that human intervention in the landscape began approximately 3,400 years ago. There is archeological evidence that the area was inhabited by Celts, Romans and Alemans in the dry alais. There are remains of an elaborate canal irrigation system dating from the Middle Ages or possibly from Roman times, the canals obtaining their water from glacial rivers. Mining and quarrying for lead-zinc ores and soapstone were carried out in Lötschental and for iron in the Hinteres Lauterbrunnental until 1805. The impact of tourism began as early as the 18th century.

LOCAL HUMAN POPULATION

The site itself has never been much inhabited except by summering shepherds. The last mining occurred during the second world war for molybdenum from the granite in Baltschieder. Today the primary activities in the region are tourism, agriculture particularly livestock breeding, scientific research, licensed hunting and fishing in the Öschinensee and the surrounding valleys have a present population of 35,100. The mountainous part of the site is not inhabited year-round except for about ten people at the train station and the scientific research station, both at Jungfraujoch. The extension added three landing pads and 9 shelters, but no inhabitants. The Kraftwerke Oberhasli, a power plant operator in the Grimsel region, is the largest landowner within the perimeter. Its power plants dominate the local landscape but all construction site installations were removed by 2006.

VISITORS AND VISITOR FACILITIES

The area has been a popular tourist destination since the 19th century. The Jungfrau was first climbed in 1811 and the Finsteraarhorn in 1812. At first it received mostly summer tourists, but in the 1930s skiing became popular. Due to the steep slopes, visitors are only able to visit the site via the Jungfrau railway and the Trümmelbach funicular unless they are climbers. So the site is both exceptionally accessible to large nearby populations and rather inaccessible in itself. The Jungfrau railway was built between 1870 and 1912, taking visitors from Kleine Scheidegg (2,061m) to Jungfraujoch (3,454m) where the station has a restaurant. There is a well developed network of foot-paths on the margins of the site, but most of it is inaccessible to walkers. The site is popular with experienced mountaineers and there is a series of 37 shelters and five mountain refuges with a total of 1,582 beds. Most of these belong to the Swiss Alpine Club or to the Berne or Basel Academic Alpine Clubs. There are no ski resorts on the site, but skiing at their own risk by experienced sportsmen is long established. The Management Centre serves as a visitors' centre at present and the Aletsch Ecological Centre in Riederalp run by Pro Natura, has a similar function. This villa has an alpine garden and Pro Natura organises exhibitions, walks, classes and seminars and training on environmental issues. Its visitor numbers are not fully known but the Aletsch Forest receives 50,000 to 70,000 visitors a year. The hiking trail organization the Swiss Landscape Foundation *(Stiftung Landschaft Schweiz)* also promotes visitor information and excursions, There are seven helicopter landing pads and 3-4,000 overflights a year.

SCIENTIFIC RESEARCH AND FACILITIES

Nearly all the glaciers of the area have been measured, some continuously since the late 19th century. The high altitude research centre at Jungfraujoch, stands at 3,500m, a height for a research station

unique in Europe. It is permanently accessible by the Jungfrau railway, and well placed for the study of the physical environment, the atmosphere and astronomy. Research areas that are particularly strong include geology, glaciology, geomorphology, botany, zoology and tourism. The site is to be adopted, inventoried and monitored as a global benchmark case study area as part of the National Centres of Competence in Research (NCCR) North-South Initiative and Research Partnerships for Mitigating Syndromes of Global Change supported by the Swiss Association of Research Partnership Institutions. In the Aletsch forest just south of the site is the Reiderfunka Centre for nature protection.

MANAGEMENT

After expansion, 94.4% of the area within the World Heritage site, is protected under the Federal Inventory of Landscapes and Natural Monuments of National Importance (BLN Object 1507/1706). A further 2% is protected by other measures. 41% of the surface area is additionally protected as biotopes of national importance, cantonal and communal natural reserves, federal hunting reserves which cover landscapes, moors, alluvial sites and game reserves for licensed hunting and fishing. The forests are managed for conservation, not consumption.etc. The governments of 26 communes own nearly all the land, and they are agreed on the main aims of the conservation, but coordination of all the various regulations is necessary. Apart from tourism, the area is not developed except marginally, for hydropower, nor will further development occur. A generalised management strategy for protecting natural processes in order to maintain the existing dynamics of the site and its region was submitted in 2005. This was amplified by a detailed Action Plan in 2007 to become a Management Plan plus monitoring system listing all current and planned activities and detailing with costs, those for 2006. Long-term measures were also defined for both the World Heritage site and the region. 69 objectives were formulated, covering the landscape natural and cultural, flora and fauna, agriculture and forestry, hunting and fishing, industry and commerce, energy and transport, education and research, tourism and public outreach (MUW, 2007).

Currently several habitats in the site are of national importance and recorded in the federal inventories of raised and transitional bogs and fens of national importance. These are the transitional bog of Aletschwald and two fen moorlands, Understeinberg and Station Wengernalp. Two sites are also listed on the federal inventory of alluvial zones of national importance. These are Langgletscher Jegigletscher and Üssre Baltschiedergletscher. According to the law on the protection of alluvial zones of national importance, alluvial zones of national importance must be left intact. Several game reserves in the Valais such as Aletschwald, Alpjuhorn, Wilerhorn and Bietschhorn, are regulated by the laws on hunting and by the federal law on the preservation of nature and landscape. These areas are conserved, being vital to mammals and wild birds, and it is forbidden to hunt or disturb the animals. Appropriate agricultural and silvicultural methods must be used and applied in them. Hunting ibex within the site is regulated by ordinance. The mountain hare *Lepus timidus*, the rock ptarmigan *Lagopus mutus* and black grouse *Tetrao tetrix* are hunted in the Valais but not in Berne Canton. All the species that can be hunted benefit from a protection period, set by federal authority, that can be extended by the Canton. The nature conservation organisation Pro Natura, has signed a 99-year contract with the community of Ried-Mörel south of the World Heritage site for the protection of the Aletsch forest. Nationally, a bio-diversity monitoring programme is being established: monitoring already occurs of large mammals, game birds, lammergeier, golden eagle and mire vegetation. A comprehensive system has been designed for the site to cover threatened animals, ungulate populations, visitor numbers, access trails and shelters.

Virtually all the regulated activities occur on the margins of the site. These range from traditional alpine farming, landscape management by cooperatives, maintaining traditional irrigation channels, cheese cellars and sheep pens, dams, protection against floods, avalanches and falling rocks, and trails for cattle and visitors. Contracts have been signed between several communities, the *Office Fédéral des Eaux et de la Géologie,* and the Canton of Valais agreeing to renounce rights to the use of hydraulic power for 40 years, under an ordinance which forbids any building construction, and any modification of the land. The old-established Swiss Alpine Club maintains a large number of huts and hut approaches. Pro Natura, and the hiking trail organization the Swiss Landscape Foundation, by maintaining three areas within the perimeter under private law, contribute to the region's upkeep. The main work of the national UNESCO World Heritage Association (MUW) is based on: monitoring and directly controlling nature and habitat on the site, which it largely finances; education, awareness-raising and administration, which is financed by site funding; and mediation and coordination concerning transport,

tourism, promotion and product marketing, funding for which is the responsibility of regional organizations (MUW, 2007).

MANAGEMENT CONSTRAINTS

Global climate change and warming are significant threats to these glaciers, resulting in marked glacial retreat and increased slope instability. Studies undertaken and oscillations observed between 1850 and 1973 indicate that only three-quarters of the 1973 glacier area currently remains. Threats to the site may also come from the expansion of tourist developments. Part of the site directly borders existing winter sport areas at Kleine Scheidegg-Station Eiger Glacier-Belalp. The effective removal of waste and wastewater from mountain huts is a problem, solved at Jungfraujoch by moving wastewater to the Grindel water treatment centre via Kleine Scheidegg. In other border areas, tourist use is unlikely due to the steep topography, icy conditions, avalanches and rockfalls, or legal protection.

COMPARISON WITH SIMILAR SITES

The main bases for comparison with similar existing World Heritage sites are:

(vii) The superlative scenic beauty of the massif, especially its north wall and the vast glaciers on the southern side, all celebrated in European mountaineering, alpine tourism, literature and art,

(viii) The largest glacial complex in Europe incorporating the Aletsch and Feischer glaciers, the two longest in west Eurasia, and a wide array of glacial features spread over a Precambrian bedrock of crystalline rocks thrust over younger carbonate sediments;

(ix) The importance of its ecological processes measured by:

- The evolution of a glaciated landscape long studied by scientists from a fully equipped research station, monitoring the astrosphere, atmosphere and changing climate as revealed in the rates of glacial retreat;
- The existing pristine condition of the mountains, and the potential for its effective maintenance;
- The wide range of alpine and sub-alpine habitats with superb examples of ecological succession in the varying conditions left by retreating glaciers.

The most comparable World Heritage sites are high, large, temperate zone mountain massifs with impressive glaciation, in pristine condition and with geologic and biologic interest. Some ten sites qualify, without considering any tropical glaciated mountains. All are larger than this site and five, more than ten times its area. Some, such as the St Elias complex are so much larger, or such as Sagarmatha so much higher, or like The Three Parallel Valleys of Yunnan so much larger, higher and more various that a comparison is not between equivalents. The two most obvious comparisons are with the relatively smaller sites of the West Caucasus and Los Glaciares in Argentina, in rather different biogeographic regions. The first is a little lower but biologically richer, the second is primarily glacial. The rest are in temperate though again different biomes: the Canadian Rocky Mountains and Waterton-Glacier Parks, Te Wahipounamu in New Zealand and the Altai Mountains in Russia. Each has its characteristic biology, glaciation and scenery, but each except for Waterton, is more than twenty times the area of the Aar Massif. This underlines a unique aspect of the site: its combination of great accessibility, pristine quality, great scenery and world class glaciers in the smallest area of any comparable designated mountain range.

STAFF

Exact details of the staffing levels of the site are not available. All the employees, working at district or national level to protect the site are also engaged in other management activities. Employees responsible for the protection of nature and landscape in cantonal offices have academic and vocational training and university degrees, usually in biology or geography.

BUDGET

Funding is based on public-private partnerships. General site costs such as monitoring and maintenance are already funded by individual Cantons through their annual budgets, each putting in CHF75,000 a year, secure until 2012 for Berne, approved annually by Valais. Federal funds restricted to specific projects amount at present to CHF400,000-500,000 (US$367,000) a year. Pro Natura invests in the protected areas of Hinteres Lauterbrunnental and finances monitoring of the Aletsch Forest. A typical overall budget of CHF 2.84 million (US$2,330,000) per annum was estimated to be necessary for 2006-7, distributed under the programs for: increasing the visible profile of the site (31%),

site management & promotion of sustainable development (29%), regulation of perimeter use (13.8%) knowledge management service (13.7%) education & excursions (7.5%), monitoring & controlling (5%) (MUW, 2007).

LOCAL ADDRESSES

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