

Alluvial zones in Switzerland



Sensegraben (BE/FR)



Plaun Segnas Sut (GR)

Alpine willow herb (*Epilobium fleischeri*)



Umiker Schachen – Stierenhölzli near Brugg (AG)

Dark-leaved willow (*Salix nigricans alpicola*)



Idas blue (*Lycaeides idas*) on willow herb (*Epilobium dodonaei*)



Nest of the little ringed plover (*Charadrius dubius*)

The Rhône in spate at Finges (VS)



Concerted efforts

Various partners are involved in the protection of alluvial zones. Their individual responsibilities are listed below:

	Nature protection	Forestry	Agriculture	Other areas
Federal authorities	- designate alluvial zones of national importance; - introduce the relevant ordinance*; - assess the compatibility of proposed projects with the AZO objectives; - carry out monitoring with regard to the Federal Inventory; - grant subsidies.	- assess the compatibility of proposed forestry projects and programmes with the AZO objectives; - grant subsidies for forestry work carried out in line with the AZO (management of forest reserves, biotope enhancement measures, etc.).	- assess the compatibility of proposed agricultural projects with the AZO objectives; - grant subsidies for extensive management of agricultural land in alluvial zones.	- assess the compatibility of construction and flood protection projects, etc., with the AZO objectives; - maintain an alluvial zones advice centre, providing guidance on enforcement of the AZO for the cantonal/communal authorities and the land managers.
Cantonal (or, if appropriate, communal) authorities	- define boundaries of alluvial zones of national importance and designate buffer zones; - ensure legal protection; - arrange for the removal of detrimental factors; - prepare a management plan or revitalization project; - carry out cantonal-level monitoring with regard to Federal Inventory sites; - coordinate the allocation of federal subsidies.	- designate forest reserves; - bring forest development and management plans into line with alluvial zone protection objectives; - organize the allocation of federal subsidies.	- advise farmers on the introduction of extensive management of farmland in alluvial zones and provide aid for this purpose; - organize the allocation of federal subsidies.	- adapt cantonal spatial planning to alluvial zone protection objectives; - award concessions and building permits for projects which conform with the AZO; - carry out flood protection projects where life or significant assets are threatened, combining such projects, if possible, with revitalization measures.
Communal authorities	- may organize information and management for site visitors.	- use commune-owned forests in accordance with alluvial forest protection objectives.		- adapt communal legislation and land-use planning to the AZO and the boundaries of alluvial sites.
Landowners and - managers		- bring forest use into line with alluvial forest protection objectives; - receive subsidies for certain types of forestry work carried out in line with the AZO.	- manage farmland extensively in alluvial zones; - receive payments for ecological performance and compensation for loss of income.	

*Alluvial Zones Ordinance (AZO) of 28 October 1992

Compensation for alluvial zone protection

Under the relevant laws and ordinances, landowners and - managers who accept a reduction in income in the interests of conservation are entitled to receive financial compensation. Payments are also made for various types of ecological performance that do not generate profits.

Compensation is paid for upkeep measures required or losses incurred annually. But aid is also payable for one-off contributions, such as revitalization measures or the development of a protection and management plan. Financial aid may also be paid from agriculture, forestry or watercourse engineering budgets. The allocation of subsidies is co-ordinated by the cantonal nature protection agencies.

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• Bestand hat nur der Wandel. Gletschervorfelder und alpine Schwemmebenen (booklet on glacier forelands and alpine alluvial plains); SAEFL, 1998; no. 310.715 (available in French, German and Italian)

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• Vollzugshilfe zur Auenverordnung [Aid to enforcement of the Alluvial Zones Ordinance]; SAEFL, 1995 (available in French and German)
• Bewirtschaftungskonzept für Auenwälder [A concept for alluvial forest management]; SAEFL, 1999 (available in French and German)
• Gletschervorfelder und alpine Schwemmebenen als Auengebiete [Glacier forelands and alpine alluvial plains as alluvial zones]. SRU 305; SAEFL, 1999 (available in French and German)
• SAEFL Dossier on alluvial zones (factsheets on the protection of alluvial zones), (available in French and German)



Alluvial zones in Switzerland

Given the wealth of lakes, rivers, streams and glaciers in Switzerland, water plays a major role in shaping the country's natural landscapes. Alluvial zones represent a **transitional area between land and water**, where elements of wilderness and **natural dynamics** can still be observed. Floods and dry periods, erosion and sediment deposition give rise to constant transformations. Rivers may change their course or overflow, submerging dry areas, destroying existing habitats and creating new ones. These dynamic processes are responsible for the extraordinary **diversity of species and habitats** found in alluvial zones.

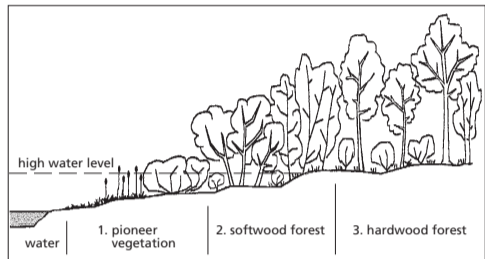
Throughout the centuries, man has sought to contain and modify watercourses in order to protect life and property against flooding and to reclaim land for agriculture. Today, the few natural watercourses remaining in Switzerland no longer pose a major risk. Rather, they themselves now deserve protection, in view of the important role they play in the water cycle, their biological richness and their beauty.

Four major European rivers – the Rhône, Rhine, Inn and Ticino – rise in the Swiss Alps, and their upper and middle reaches flow through this country. The Swiss Alps are also home to some of Europe's most important glaciated areas. This means that Switzerland has a special responsibility to participate in efforts to conserve Europe's alluvial zones.

An ecosystem shaped by water

Alluvial zones can be roughly divided into three areas.

1. As the profile of the river bed is frequently modified by water and sediment, only **pioneer plants** can flourish here, developing rapidly between periods of flood and establishing themselves anew each year. Willow shrubs may also take root in the coarse gravelly soils.



2. Alluvial terraces adjoining the river bed are dominated by willow and alder. Conditions here are sufficiently stable (between periods of flooding) to permit the development of pioneer forests, known as **softwood forests**.
3. Terraces lying further away from the watercourse and higher up are rarely flooded, but they are still (permanently or periodically) influenced by groundwater. If vegetation grows undisturbed for several years or decades, a **hardwood forest** will develop, comprising species such as ash, maple and elm, or even beech, oak and spruce.

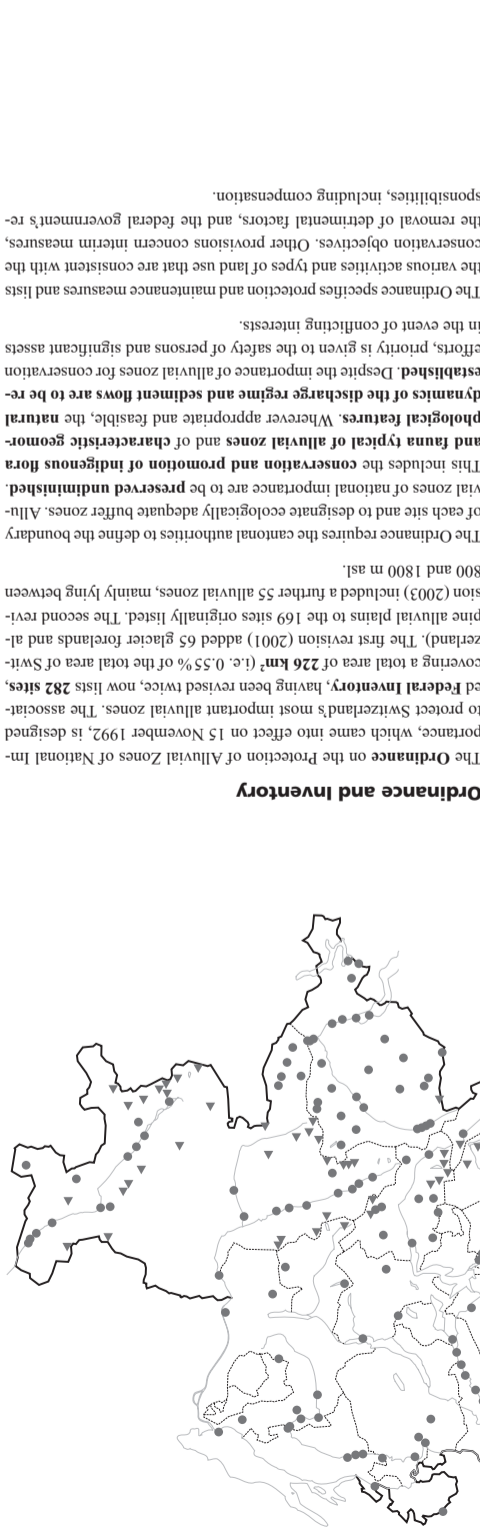
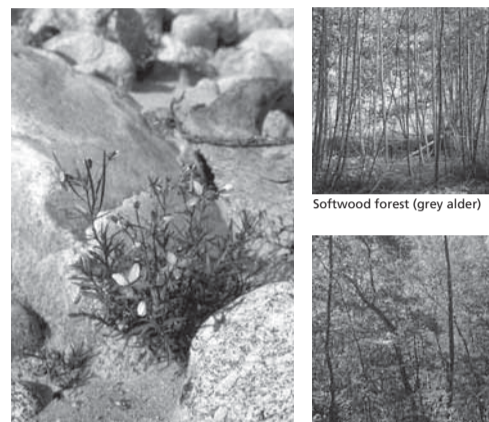
At altitudes of up to 700 m above sea level (asl), hardwood forests are the most important alluvial plant community in terms of extent. From

1000 m asl, however, they disappear entirely, and softwood is the only type of alluvial forest belt. From around 1600 m asl, softwood species are no longer found either, as the forest gives way to shrubs. Finally, in glacier forelands and alpine alluvial plains above the tree line, pioneer plants are the dominant type of vegetation.

Exceptional diversity

Within a small area, there is a wide variation in factors such as age (the period that has elapsed since a specific site was formed or regenerated by flooding), humidity, and structure and nutrient content of the soil. Alluvial zones thus represent **complex mosaics of highly diverse habitats**.

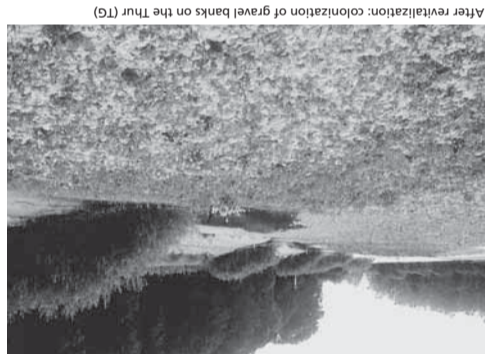
To date, almost **1200 plant species** have been recorded in Switzerland's alluvial zones, although the actual total is probably in excess of 1500 species. This would mean that 0.55% of the area of the country accounts for half of the total variety of Swiss flora. There is also a great diversity of wildlife: the various alluvial habitats support **butterflies, dragonflies and grasshoppers** at different stages of their life cycles and provide food and refuge for **amphibians, fish** and numerous species of **birds and mammals**.



Alpine alluvial zones
There are two types of alpine alluvial zones: glacier forelands and alpine alluvial plains. Habitats of both types are characterized by dynamic processes, with the landscape being constantly transformed. Like pine alluvial plains, habitats of both types are characterized by dynamic processes, with the landscape being constantly transformed. Like lowland alluvial zones, they comprise waterbodies and adjoining areas with the typical zonation. On account of the altitude, pioneer vegetation is dominant, while forests are relatively rare.
Glacier forelands are surfaces that have been exposed by the retreat of glaciers since the Little Ice Age (around 1850). Two different types of area are to be distinguished. Along glacial streams a characteristic transition from water to land (zonation) can be observed, shaped by the alternation of flooding, erosion and sediment deposition. Outside the zones subject to the influence of streams, a different pattern of vegetation is found in the areas now free of ice. The receding glaciers have left behind a rich variety of landforms and soil types of different ages. From the tongue of the glacier to the areas that have been uncovered since 1850 a typical succession is detectable, with the various stages juxtaposed. In glacier forelands, a highly diverse mosaic of plant communities can be found within a very restricted area.
Alpine alluvial plains are found in relatively broad, flat uplands of alpine valleys. They exhibit the same zonation as the lower-lying alluvial zones. In contrast to the glacier forelands formed relatively recently, many alpine alluvial zones have been used by mountain farmers for generations. Unlike those in lowland areas, alpine alluvial zones are still largely intact. The aim should be to ensure that they can continue to develop unimpeded and that they are protected from any factors that may lead to their degradation.

Ordinance and Inventory
The Ordinance on the Protection of Alluvial Zones of National Importance, which came into effect on 15 November 1992, is designed to protect Switzerland's most important alluvial zones. The associated Federal Inventory, having been revised twice, now lists 282 sites, covering a total area of 226 km² (i.e. 0.5% of the total area of Switzerland). The first revision (2001) added 65 glacier forelands and alpine alluvial plains to the 169 sites originally listed. The second revision (2003) included a further 55 alluvial zones, mainly lying between 800 and 1800 m asl.
The Ordinance requires the cantonal authorities to define the boundary of each site and to designate ecologically adequate buffer zones. Alluvial zones of national importance are to be preserved undiminished. This includes the conservation and promotion of indigenous flora and fauna typical of alluvial zones and of characteristic geomorphological features. Wherever appropriate and feasible, the natural dynamics of the discharge regime and sediment flows are to be re-established. Despite the importance of alluvial zones for conservation efforts, priority is given to the safety of persons and significant assets in the event of conflicting interests.
The Ordinance specifies protection and maintenance measures and lists the various activities and types of land use that are consistent with the conservation objectives. Other provisions concern interim measures, the removal of detrimental factors, and the federal government's responsibilities, including compensation.

Revitalization
In stabilized alluvial zones where erosion and sedimentation processes are at least partly reactivated and a discharge regime giving rise to periodic flooding is permitted, the biotic communities typical of alluvial zones may be regenerated. The habitat is thus revitalized.
Of course, this is not always possible. Unrestricted natural dynamics cannot be permitted in areas where human life and property are threatened. Nonetheless, revitalization remains an option for numerous stretches of watercourses.
The main measures employed for the revitalization of alluvial zones are as follows:
• definition of boundaries within which a river is allowed to flow freely
• relocation of dams to permit more extensive flooding
• increasing average regional flow rates and flood discharge
• in exceptional cases, lowering the alluvial zone profile to create new areas for flooding.
Local activities such as landfills, earthworks, drainage, gravel extraction, etc. may also be factors leading to the degradation of alluvial habitats.
In cases where genuine revitalization is impossible for safety reasons, biological diversity can be preserved or even enhanced by creating alternative habitats. The following measures may be appropriate:
• reopening old side channels
• restoring or excavating oxbow lakes
• diverting tributaries to flood specific areas of land
• creating ponds.
and sediment deposition still occurring and a discharge regime that permits periodic flooding.
However, despite the lack of natural dynamics, even stabilized alluvial zones still represent valuable habitats. On the Central Plateau, where all the major rivers have been modified, the alluvial character of many forests may be preserved for long periods thanks to shallow water tables accessible to tree roots.
In the case of the alpine alluvial plains listed in the Federal Inventory, the situation is different: only 5 of a total of 66 sites have an altered discharge regime (e.g. because they lie below a reservoir).



Protection of alluvial zones
Geographical distribution of alluvial zones of national importance
▲ Lowland alluvial zones: riverine floodplains, deltas and lacustrine floodplains
● Alpine alluvial zones: glacier forelands and alpine alluvial plains

Ecosystems under threat
As a result of watercourse modifications, the draining of floodplains and (more recently) transport infrastructure developments, nearly 90% of Switzerland's alluvial zones have disappeared. Similar trends have been observed in neighbouring countries.
Low residual flow rates (due to hydropower facilities) in most alpine watercourses, the damming of rivers and the deepening of river beds have gradually transformed alluvial vegetation, with the development of drier, less typical plant communities.
Eutrophication of habitats (due to excessive nutrient input) has also contributed to the loss of diversity of alluvial vegetation.
Biological exchanges along rivers and streams and between watercourses, banks and surrounding areas are impeded by barriers such as dams, weirs, transport infrastructure and intensively cultivated land.
Local activities such as landfills, earthworks, drainage, gravel extraction, etc. may also be factors leading to the degradation of alluvial habitats.
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third can still be described as active alluvial zones, i.e. with erosion and sediment deposition still occurring and a discharge regime that permits periodic flooding.
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