

Alpine Land Use at Obergurgl, Tyrol, Austria (ALPO) –

Assessing the Toponomastic, Historical, Geobotanical, Palaeoecological and Landscape-Archaeological Developments towards today's Landscape and Ecosystems at the Micro-region of "Putzach"

Project Final Report for the ALPO-Time-Frame 1.7.2010 – 31.12.2011

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Within our research initiative ALPO interdisciplinary research was performed in 2010 (second half) and 2011 with an overall budget of 20'000 Euro on the prehistorical and historical ecosystems, landscape, and land-use developments of the micro-region of Putzach in the Ötz Valley near Obergurgl, Austria, with five project leaders and four employed scientists.

Key questions concerned assessing (1) written historical sources and topographical maps for the local microtoponym of Putzach, assessing (2) changes in plant diversity communities due to land-use changes in historical and modern times, assessing (3) long-term trends in Holocene flora and vegetation development at Putzach under climatic and human/livestock constraints using palynological and carpological methods in order to better understand historical changes towards the extant plant diversity, and assessing (4) the former impact and landscape-use by local inhabitants and pastoral societies on archaeological grounds.

As all research partners and subfields thereby presented extensive reports on their respective outcomes in their fields (see attachments A & B for Toponymy, C & D for Geobotany, E-H for Palaeoecology, and I & J for Archaeology), the present report therefore aims at summarizing the available ALPO-results in view of a possible use of at least parts of the research experience and results in a

interaction between the ALPO-partners for a future, more extensive study in the macro-region of the Upper Ötz Valley.

The area of Obergurgl is extremely rich in toponyms (Fig. 1), some of them proved to have been given by the Roman population (names of Alpine Romance origin). Given the assumption that micro-toponyms (field names) reflect onomastic, ecological, agricultural, and socioeconomic information, it was therefore slightly disappointing that ALPO-research done on archival material from the Tyrolean State Archive (concerning e.g. rent-rolls, cadastral land registers, tax assessments etc.) as well as on published literature (Stolz 1926 & 1953, Scharr 2001) and on topographical maps turned out to show – at first sight – no evidence of the name Putzach (completely in contrast to the regular use by today’s inhabitants of the village of Obergurgl). It is not until the indirect evidence from a map from 1864/1887 (Dritte Landesaufnahme: *Putzach Kar* nearby) and a direct evidence from a map from 1952 (US Army Map Service: *Hinter Putzach*; Attachment A) that the name first occurs. This may be due to the fact that Putzach is a relatively small and historically insignificant area, as from the name “Putzach” itself, it becomes clear that the name originates in the Romanic loanword “*Putz*” and the German word-ending “*-ach*” indicating an “area with springs” or an “area with wet spots” (n.b.: this means that – on the basis of the Romanic loanword – the name has been given by the German speaking population and therefore has to be interpreted as being not older than 1500 years at the most!). However, as this is the result of a random inspection of the two oldest cadastral land registers (from 1627 and 1776/77) as well as of the digitalized maps from the Tyrolean State Archive (the oldest reaching back until the year 1774), we cannot preclude the existence of records of the name older than these documents as well as of earlier agricultural activities. Given the narrow time frame of the project further inspections proving this were not possible.

Nevertheless, the non-occurrence of onomastic data is in good accordance with the topographical mapping of major track-ways and main important pastures throughout the upper Gurgler Valley (Attachments A & B), which all occurred on the Eastern side of the Gurgler Ache river as shown on the seven available maps for the end of the Little Ice Age period from 1774 to 1860 (e.g. Gurgler Alm, and with an upward livestock track and human pathway continuation on the Gurgler Ferner (=glacier) itself necessary for access of adjacent Alpine valleys in the west and south towards the Valley of Vent and the South Tyrol), showing therefore a prevalent historical use of these areas for pasture, and implying a probably only irregular or singular use of the possible pastoral grounds west of the Gurgler Ache for the times before ca. 1860 (the time of the retreat of the local Gurgler glacier at the end of the little Ice Age).

On the other hand this possibly late upcoming of the name Putzach is corroborated by the archaeological excavation and studies of at least six building structures at Putzach (livestock enclosure with stable, pastoral huts, abris), which show that most of them or eventually all of them may date from the last ca. 150 years only (Attachments I & J). Absolute radiocarbon or dendrochronological dates were not possible on the available resources found within the excavated settlement structure, however, no indication of older building structures (i.e. older than the 19th century) were obtained.

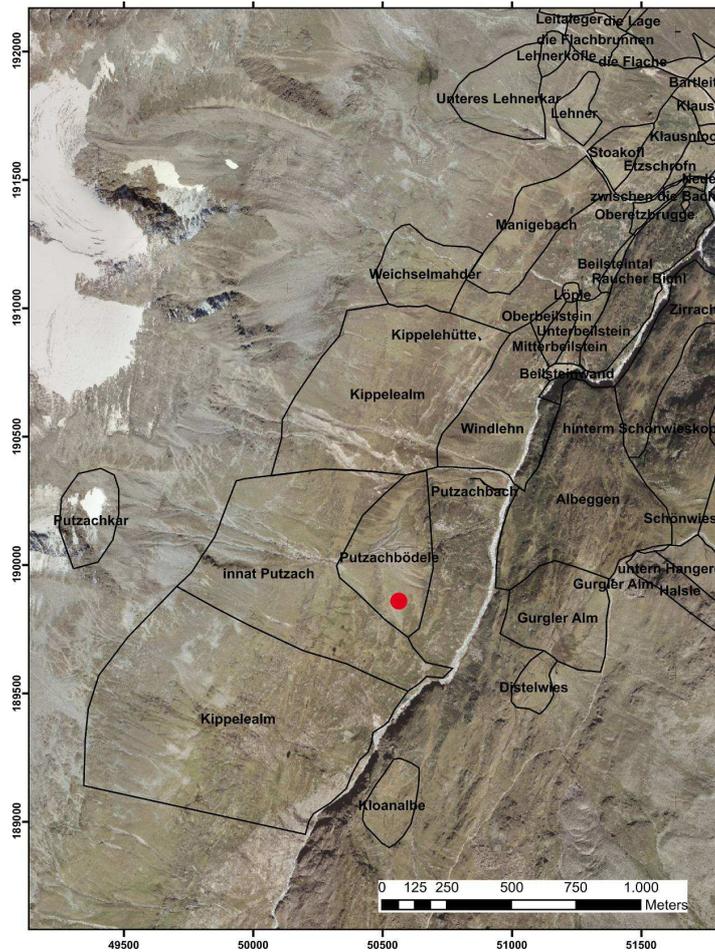


Fig. 1: View of the ALPO research area (locales by R. Kaufmann & A. Zanesco; aerial photo © BEV, Vienna 2003)

Given that a pastoral system of transhumance and bringing up and down sheep from and to high alpine pastures still existed until 1963 (as known from local information at Obergurgl) an extensive land-use of Putzach since the 19th century and up to the early 20th century is probable. These historical track-ways towards the West and South surely passed close-by the known six building structures which themselves were probably regularly used as enclosures and abris in case of quickly changing mountain weather. Additionally, a transhumance pathway from adjacent valleys back to the Gurgler Valley would have allowed to use all advantages of such an agglomeration of buildings and enclosures for a rest after a possibly exhausting walk over the nearby Gurgler Glacier with its glacier tongue in the vicinity of Putzach (according to all

topographical maps of the 18th and 19th centuries; see Attachment A). The main use of this Putzach area might therefore have been more in the context of livestock transhumance rather than in the regular use as pasture, given that the Putzach area shows major risks in mudflows and rock slides (from the Putzach creek in the summer half year) and snow avalanches (in the winter half year), at least today, but foreseeable probably also back in historical times.

As another indication and in addition, it is only the “Kulturen-Skelett” map from 1860 and the Austrian special map from 1925/1934 that show first pastoral buildings about one kilometre north of Putzach in the area called “Kippelen Alpe” (near and above the Beilstein area). Summing up, these indications for rather young pastoral activities at the Putzach area coincide with the available palaeoecological results from the small (ca. 20 m²) bog stratigraphy “Inneres-Putzach-Moor” (2300 m a.s.l., informal name; site abbreviation IPM) studied for palynological and carpological remains (Attachments E-H). Even if the time-relative interpolation and interpretation of the complete bog stratigraphy still lacks the results of two additional radiocarbon dates for the upper third of the peat stratigraphy (radiocarbon dates to be delivered in early 2012 by the according measurements at the ETH Zürich, Switzerland) a pronounced change in plant diversity and vegetation types is recorded palynologically for the younger, historical time period (Attachments E-F). These remarkable changes comprising typical pastoral plant indicators (see details below) may well be related to changes in land-use concerning the more extensive utilization of the Putzach area as pasture by probably mainly sheep and goat (massive presence and rise in spore amounts from coprophilous fungi).

Such records of relatively modern and possibly micro-climatically driven land-use changes (e.g. loss of glacier grounds and easy access to livestock track-ways on the eastern side of the Gurgler Ache Valley system) seem therefore to have also affected the composition of the plant and vegetation structure of the Putzach area (and the mowing area “Weichselmähder Am Beil” to the North as well as the Kippele-Alm area in between).

In the context of all these probable land-use changes to be foreseen for at least the time span of the last 150 years, it becomes clear that major results are to be gained by comparing historically used plant communities (i.e. species composition and diversity) with actually managed and recently abandoned ones in order to understand the recent development of subalpine plant systems under different management regimes and cessation (see Attachments C & D). In total 89 relevées were analysed for plant species richness and classified using several statistical methods and environmental parameters such as slope inclination, and geological features. Additionally, the six different plant communities belonging to three different plant associations (*Caricetum goodenowii*, *Sieversio-nardetum strictae*, and *Junipero-Arctostaphyletum*, the latter exclusively found at Putzach

on steep, sunny and relatively dry slopes) and turning out to be relevant for our research area were characterized for Ellenberg indicator values. For the Caricetum goodenowii association only one variant (with *Phleum commutatum*) occurred at Putzach, whereas the Sieversio-Nardetum consisted of three subassociations (trifolietosum pratensis, actually managed or recently abandoned, the subassociation typicum, which was historically used, and the subassociation vaccinietosum, recently abandoned or historically used).

As a result of these geobotanical studies it becomes clear that the time of abandonment and the types of land-use management were the predominant factors responsible for the differences and the divergence of according plant communities on the level of subassociations. The results performed within this ALPO research also clarified that plant species composition changed much stronger compared to plant species number for the last two centuries or so. Species diversity, however, did not significantly decrease after the cessation of historical land-use at Putzach, very probably because of the actual extensive grazing regime by sheep. This in turn clearly delayed the immigration of competitive tall forbs and dwarf shrubs as known from other Alpine areas, and prevented mid-term reforestation by arrolla pine (*Pinus cembra*) and larch (*Larix decidua*) at these ecotonal altitudes at 2200-2300 m a.s.l. due to the scarce today's presence of seedlings of these trees.

In addition to these geobotanical features, an attempt was made to compare the actual local vegetation at Putzach with the presence or absence of pollen from identical species, genera or families found by the palynological studies within the uppermost 36 cm of peat (representing less than the last 2 millennia) in the bog "Inneres-Putzach-Moor". Calculation of similarities between the two data sets was done quantitatively (Bray-Curtis similarity) and qualitatively (i.e. Jaccard-Index). Even if the two data sets were not really and directly comparable (as a multi-locality and multi-core analysis for palynology would have been necessary for this, but out of the financial and time frame within the ALPO project) the highest similarity between the pollen and actual vegetation records occurred within the peat depth of 19-23.5 cm, probably pointing to a very similar historical – possibly of Roman or Medieval age – local vegetation composition that can be compared with the today's one. Increasing profile depth showed the prominent role of dominant taxa such as grasses (Poaceae, Cyperaceae), but the qualitative similarity was substantially influenced by all rare taxa. This finally leads to the conclusion that stochastic processes played an important role which means that a new study and comparison between actual and past vegetation will need readjustments concerning the project design (see below).

Concerning the prehistorical flora and vegetation developments major results of regional interest were performed at the bog "Inneres Putzach-Moor" by

palynological and carpological means (Attachments E-H) in order to clarify and disentangle the role of past (= prehistorical) climate and human activities in this fragile ecosystem of known high biodiversity. In this context one of the main aim of this research was to try to correlate palynologically revealed vegetation and land-use changes to the already known prehistorical archaeological findings and sites in the Gurgler Valley (Zanesco 2012).

Thanks to three radiocarbon dates obtained so far on terrestrial plant remains (Tab. 1; one additional radiocarbon date in 33 cm peat depth was rejected as being too young or methodologically incorrect; I. Hadjas, ETH-Zürich, pers. comm. 11/2011) and even if a more precise analysis of the peat stratigraphy in terms of a more continuous sample resolution would be a desideratum for the future, the following palaeoecological and palaeoclimatological reconstruction can be proposed for the Putzach area:

Interestingly enough, the bog “Inneres Putzach-Moor” started its growth in its small, about one meter deep geological cuvette around 8000-7500 BC, during the known early local presence of Mesolithic societies, where hunter and gatherers regularly visited and used the Gurgler Valley and especially the important resting and working place of “Beilstein” about one kilometre north of Putzach (visited since 7800 BC; Zanesco 2007 & 2012). During this time period peat growth was probably also positively sustained by the synchronous cold-humid climatic oscillation (CE2/Venediger-oscillation; Haas et al. 1998). The local vegetation (see Attachments E-H) was revealed to have been dominated by mixed forests of hazel trees (*Corylus avellana*), pines (*Pinus cembra* and *Pinus mugo*, both present as pollen and as plant macrofossils), as well as green alder (*Alnus viridis*). The forest was thereby much higher in altitude than the bog “Inneres Putzach-Moor”, with a forest limit probably around 2350-2400 m a.s.l. and a tree line approximately 50 m higher. The interpretation of the early development of the local flora and vegetation benefits thereby from the comparison with already known palynological studies at the Gurgler Alm, Schönwies I and Rotmoos Bog (Vorren et al. 1993, Bortenschlager 1984) allowing broad-scale regional conclusions.

Tab. 1: Radiocarbon dates performed so far (as per 20.12.2011) for the peat stratigraphy of the bog “Inneres Putzach-Moor”.

ETH-44122: 33 cm peat depth: -885 ± 30 BP = calibrated: 1978 AD (2-sigma-mean value)
(Date rejected as too young or methodologically incorrect)

ETH-44123: 55 cm peat depth: 5930 ± 35 BP = calibrated: 4810 ± 100 BC (2-sigma-mean value)

ETH-43808: 66 cm peat depth: 7125 ± 40 BP = calibrated 5990 ± 80 BC (2-sigma m.v.)

ETH-43807: 103cm peat depth: 8335 ± 40 BP = calibrated: 7410 ± 110 BC (2-sigma m.v.)

The first presence of some few fir (*Abies alba*) pollen occurred around 6500 BC and the subsequent rising importance of fir is paralleled by a decrease of the importance of hazel, and is followed by rising spruce (*Picea abies*) values. However, it has to be mentioned that this evidence for fir and spruce is only of regional importance, as both species never reach altitudes of far more than 1800 m in the Ötz Valley and in other Alpine areas. Even if macrofossils show the ongoing presence of arolla pine, the time span between ca. 6500 and 6000 BC is strongly characterized by a sharp decrease of tree pollen in general, implying that the forest limit was massively reduced to altitudes just around or – more likely – below the studied bog complex. This may have happened due to a strong climatic deterioration known from all over the Alps as well as from the Northern Hemisphere in general (also known as “8.2 kyr event”, or CE-3 / Misox oscillation; Haas et al. 1998) as the non-pollen palynomorph diversity (algae etc.) and Cyperaceae sum do in addition clearly show water logging of the bog area at that time.

After this excursion of cold and wet climate for about 250 years, the local pine values did quickly recover and the arolla pine (*Pinus cembra*) is present at timberline above the “Inner Putzach-Moor” bog. In the understory dwarf shrubs such as alpenrose (*Rhododendron*), blueberry (*Vaccinium myrtillus*) and cranberry (*Vaccinium vitis-idea*) were present, and which were followed by heather (*Calluna vulgaris*) later on. A well grown arolla pine forest was than locally present, whereas green alder did probably grow – similarly to today’s situation – on wet and steep slopes and ditches. However, green alder did not have the same importance at Putzach as before the climatic reversal around 8200 years ago.

Later on, a peak in microscopical charcoal particles at about 3500-2000 BC (radiocarbon dates pending) may fall into the first presence of pastoral societies in the Gurgler Valley. As no macrofossil charcoal was found within these layers, the according fires of natural or anthropogenic provenience may have regionally occurred, for ex. on the opposite valley flanks of the pasture Gurgler Alm (Vorren et al. 1993, Bortenschlager 1970, 1993 & 2000, Zanesco 2007 & 2012). This would possibly corroborate a first Neolithic or Bronze Age presence of farmers and their livestock. However, and as the recorded human impact in terms of typical anthropogenically or livestock related plants are scarce, this first land-use may have been very local only at that time.

In the upper third of the palynologically studied peat profile the presence of chestnut (*Castanea sativa*) and horse chestnut (*Juglans regia*) pollen may represent time periods younger than the Roman Ages, as these plants were first cultivated by the Romans (and later during Medieval Times) in the Tyrol. Dating of this phase by radiocarbon is pending here too, however, it becomes

clear that heather (*Calluna vulgaris*) and Ericaceae in general, as well as juniper (*Juniperus*) became more prominent, and were paralleled by a rise in herb diversity – which in turn can be interpreted as typical pastoral indicators – and which finally lead to the today’s extensively used sheep pasture (see above).

Conclusions and possibilities for future project proposals following ALPO:

It becomes clear from our ALPO-initiative and results above, that only interdisciplinary work between the already available research partners (toponymy, geobotany, palaeoecology, archaeology) will be successful in implementing a long-term research strategy on past and extant land-use in an Alpine setting like the one near Obergurgl. A publication of the ALPO results is therefore planned for the near future in an international scientific journal.

On the other hand, it also became clear that a new research objective would not be successful without the input of additional fields such as geography, soil chemistry and historians. A future proposal will therefore have special need to find project partners in soil chemistry and textures, as well as historians interested in the history of nature, which is a relatively young field of research and where only few colleagues in Central Europe are possibly interested and available to work in an Alpine setting. Also, a new project will not be possible without the integration of the experience of Professor em. Gernot Patzelt (Univ. of Innsbruck) and his colleagues involved in their former research initiative of the Ötz-Valley-Study within the international “Man and Biosphere” programme (e.g. overview by Patzelt 1996). Unfortunately, Prof. Patzelt’s interdisciplinary results performed during the last 25 years are in very large parts not published up to the present day.

The ALPO results have also made also clear that the today’s Alpine pasture, mowed meadows and cultural landscape is an expression of the running or ceased exploitation traditions and that our understanding of today’s climatic and anthropological controls on vegetation and ecological changes is dependent on the accurate and precise knowledge of historical and prehistorical interactions between past climate, farmers adaptation, livestock pressure and natural hazards in such a highly sensitive mountainous region such as the Ötz Valley Alps.

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