



Austrian Federal Forest Research Centre Vienna



**International Training Programme
Conservation and Management of Forest Genetic Resources
in Eastern Europe**

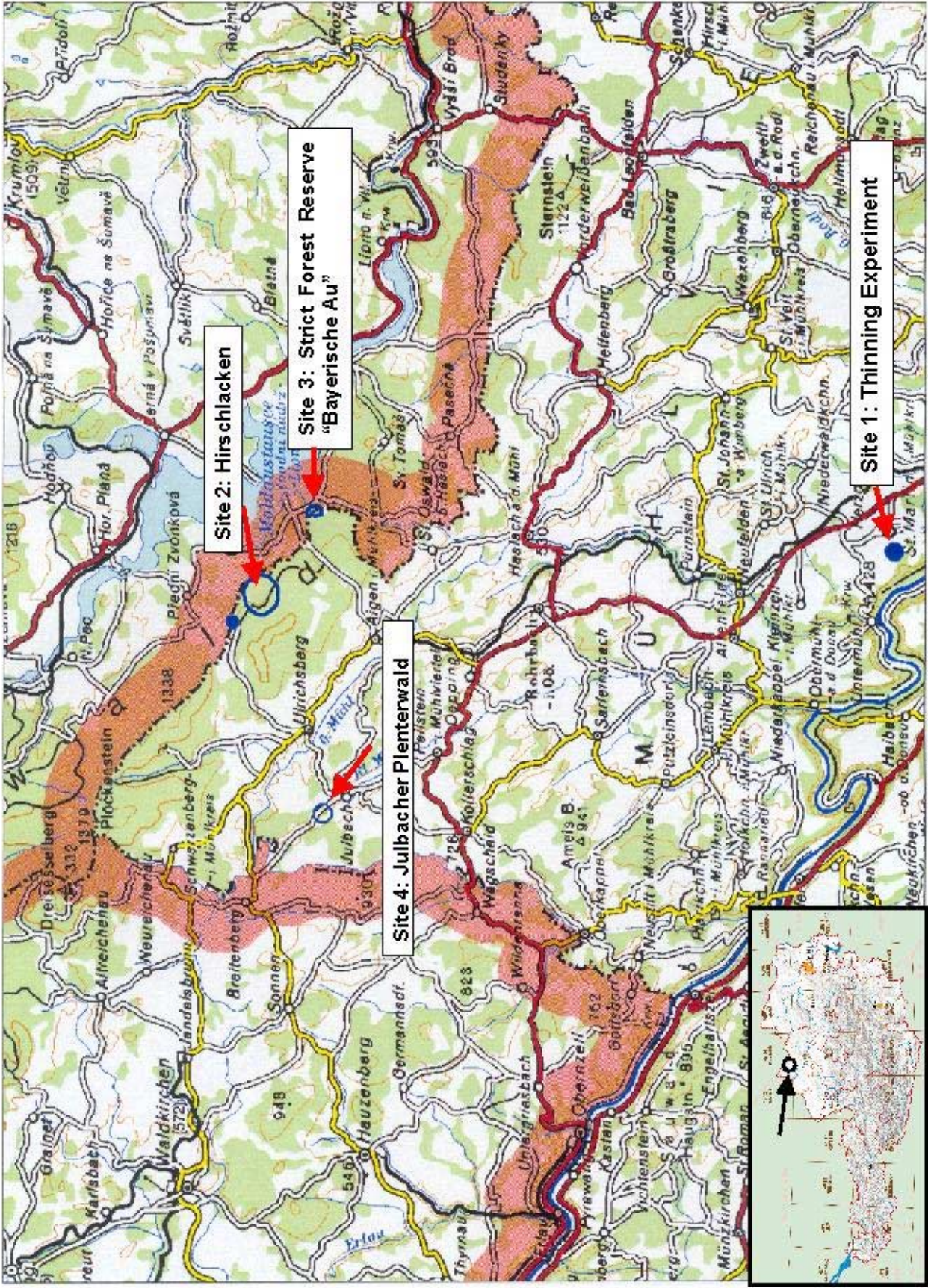
Field Trip

**Genetic resources conservation and
management in nature forest reserves and
forest gene reserves
in Austria's forestry practice**

5 May 2001

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**friendly hosted by
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and Johannes Wohlmacher (Forstamt Stift Schlägl)**



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Figure 1: Excursion Sites, EUFORGEN – Training Course, 5. 5. 2001

Forstamt Stift Schlägl

a private forest enterprise's approach to single tree selective cutting systems.

Short description of forests and enterprise

- Bohemian Forests, silicate bedrock, ca. 1000 mm precipitation per year, ca. 5°C average temperature, optimum of spruce in mixed spruce-silver fir-beech forests.
- Forested area of the enterprise: 6000 ha, 4 forest districts, 10 employees, 30 workforce.
- Currently 73 % spruce, beech and other broad-leaved species 23 %, silver fir 4 %.
- Disturbed species composition due to forest management, litter rowing, browsing, therefore also pure spruce forests.
- Former management following the age-class system.
- Over the past 40 years conversion of even-aged stands to uneven-aged multi-layered stands.
- As a model small scale forests with selective cutting systems owned by local farmers have been used.

Preconditions for application of the particular silvicultural system

- Forest ecology as a basis for the choice of tree species, soil redevelopment
- Sufficient road system, quick transportation of logs
- Forest management plan, grid sampling since 1960
- Use of simulation models - prediction of development of the development of growing stock

The general objective of the applied philosophy of forest management uses the *Plenterprinzip* to achieve sustainability in the single stand. This approach to sustainable forest management is based on the balance of increment and harvesting in the single stand.

Economic advantages:

- Approximately constant level of growing stock
- Selective harvesting of stems with achieved target diameter
- Optimisation of the piece/masse-relation
- Higher stability caused by improved height/diameter relation
- Optimum interest rates

Ecological advantages:

- Constant canopying with constant shading of the forest floor
- Redevelopment of the potential species composition
- Redevelopment of natural stand structures

Natural stand structure is a prerequisite to a process-oriented silviculture. The costs of the establishment and tending of a stand are minimised. At the same time the increase of value of the harvested logs leads to an arise of yield capacity. Particularly in forestry ecological improvements lead immediately to economic increase.

Investigation stand „Hirschlacke“

Stand of nearly pure spruce, individually mixed silver fir and beech; 130 years, since 1977 investigation stand for target harvesting, supervised by the Institute of Forest Growth of the University of Agricultural Sciences in Vienna - Univ.-Prof. H. Sterba.

Balance of increment and harvesting

Originally the harvesting of forests of this area was done by shelterwood system. This led to natural regeneration of pure spruce on wide areas. In a second step the remaining stand was cleared. The maintenance of the stand as the precondition for production was not foreseen in the former applied age class system.

The change to the new silvicultural system under consideration of the „Plenterprinzip“ was simple.

In the existing shelterwood stands the felling operations had been diminished. By keeping a harvesting interval of 5 years the harvesting was equivalent to the increment of the stand. At the same time the refilling of the growing stock to a desired level was given.

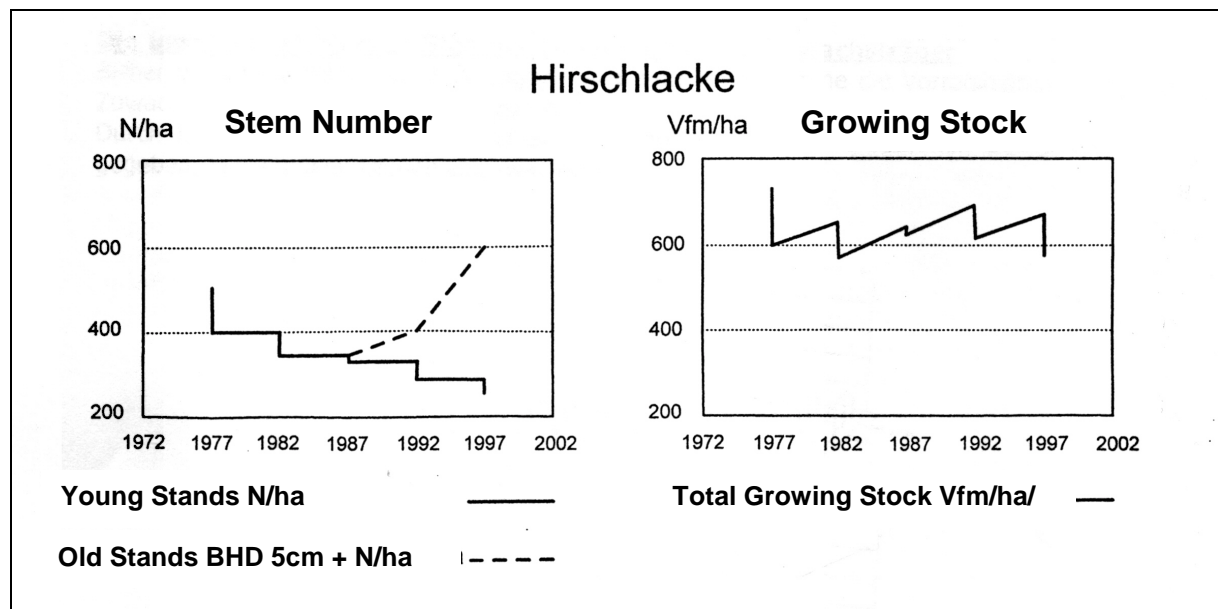


Figure 2: Stem number and growing stock in the experiment stand „Hirschlacken“ (REININGER 2000)

Even with decreasing of stem number of the remaining stand growing stock and increment can be kept on a constant level.

Until now half of the growing stock of the initial stand was harvested, without decreasing of the level of the growing stock and diminution of the growth production. By using a long rotation period, even stems with small dimensions can develop to desired harvesting dimensions. At the same time the number of stems is refilled by natural regeneration.

Although the surrounding stands have been destroyed by windfall because of their unstable structure, the investigation stand has been shown as stable against windfall and other natural disturbances like snowbreak. Even the target felling activities did not restrict the stability of the stand.



Figure 3: Stand structure and regeneration in the experiment stand „Hirschlacken“

Strict Forest Reserve „Bayerische Au“

The strict protected forest reserve “Bayerische Au” is part of the Austrian SFR-Programme (<http://fbva.forvie.ac.at/100/1306.html>). First investigations were started in 1989 by the University of Agriculture (ZUKRIGL 1990). Since that time the owner of the forest declared the forest as strict protected forest reserve by free decision. In 1999, the owner proposed that the reserve be included in the Austria-wide reserve network of the Federal Forest Research Centre (FBVA). The necessary recordings have been done in 1999, and the contract with the Republic of Austria was signed in the same year.

What makes the forest reserve so interesting and valuable is, among other things, is the isolated appearance of *Pinus uncinata* outside of the Alps.

Owner

Prämonstratenser Chorherrnstift Schlägl

Size

Forested area: 27.76 ha
Bog area without forest: 2.71 ha
Total area: 30.47 ha

The strict protected forest reserve is designed to have 30.47 ha of which 12.32 ha are Pine-Bog-Forests, 15.44 ha Spruce-Forests, and 2.71 ha unforested bogs.

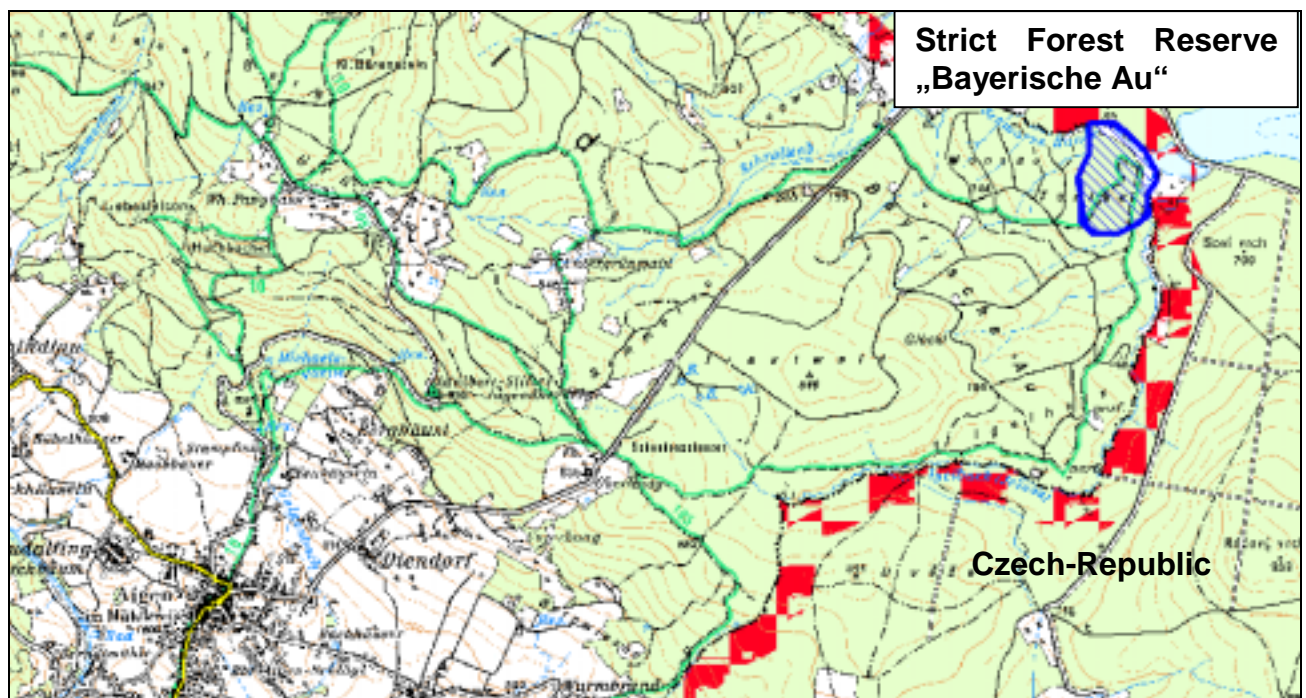


Figure 4: Location of the strict protected forest reserve “Bayerische Au”

Location

The strict forest reserve is located on the Austrian border to the Czech-Republic next to the River Moldava in Upper Austria. The area is part of the Bohemian Forests at approx. 48°40' latitude north and 14°03' longitude east of Greenwich. With 740 m a.s.l. the forest belongs to the lower montane level.

Climate:

- Sub-continental climate
- Medium annual temperature: 6.3°C
- Average annual precipitation: app. 1100mm
- Snow cover: 110 days (in medium), average snow height: app. 80cm
- Increased frost effects because of the hollow situation

Geology and soils

The parent rock is gneiss of the Bohemian mountains with mighty peatbogs. The depth of the turf reaches 4.6m.

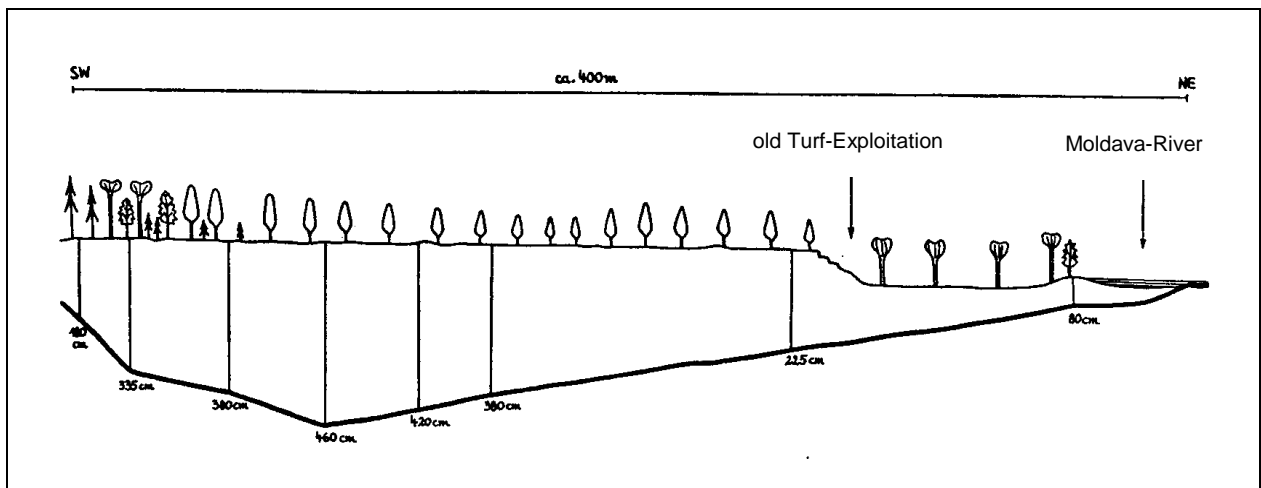


Figure 5: Borehole-profile from the bog "Bayerische Au" (DUNZENDORFER 1974)

Genetic Research

Pollen analyses have been done by KRAL (1983) in the middle of the bog. Because of the high rate of spruce, fir and beech pollen in a depth of 70cm, the bog could be developed in the middle age after deforestation.

Forest utilisation

Before 1989 little harvesting of turf, building of drainage ditches and harvesting of trees around the core area of the bog in the spruce forests. Actual slight touristic influences. The SFR present a very natural situation, without sustainable influences in the past.

Vegetation

The SFR is the only one *Pinus uncinata*-Forest in the Austrian part of the Bohemian Forest. The core area of the reserve belongs to the *Pinus uncinata* forest type, surrounded by a mixed Spruce-Bog-Forest. First investigation about the vegetation have been done by DUNZENDORFER (1974). A more detailed plant sociologic investigation about the forests was made by FLASCHBERGER & ZUKRIGL (1990).

The major natural forest communities of the reserve include:

Pinetum rotundatae, Pinus uncinata-Ausbildung

Pinetum rotundatae, Pinus mugo-Ausbildung

Sphagno girgensohnii-Piceetum

Vaccinio uliginosi-Pinetum sylvestris



Figure 6: Strict protected forest reserve „Bayerische Au“. Windthrow in a *Pinus uncinata* stand.

Pinetum rotundatae

In the centre of the reserve, *Pinus uncinata* build up sparse and open forests with an average height of 15m. The shrub layer is dominated by *Frangula alnus* and spruce. The second vegetation records in 1989 shows a natural increase of spruce in comparison with the records from 1974. In the herb layer *Vaccinium* species are dominant (*Vaccinium myrtillus*, *Vaccinium vitis-idea*, *Vaccinium uliginosum*). *Molinia caerulea* is commonly distributed in mosaic-like patches. Other characteristic species are *Andromeda polifolia*, *Eriophorum*

vaginatum, *Oxycoccus palustris* and the very rare *Drosera rotundifolia*. In drained areas *Calluna vulgaris* is more frequent. In the area-wide moss layer *Sphagnum magellanicum*, *Sp. angustifolium* and *Bazzania trilobata* are the most frequent species.

The tree layer is partly over 220 years old and is more or less one-storied. Beech is dominant; fir and spruce are mixed in at 25-50%. *Pinus uncinata* is conspicuously affected by snowbreak and/or windthrow. *Pinus uncinata* reaches a height of up to 18m with a BHD of 23cm. It exists a major portion of the dead wood in the stands.

This swamp forest is classified as a forest of high national importance in the bog catalogue of Austria (STEINER 1982).

Sphagno girgensohnii-Piceetum

The surrounding area of the swamp forest is dominated by this Turf-Moss-Spruce-Forest. Spruce is the dominant tree accompanied by *Pinus sylvestris*, *Betula pubescens* and in the transmission zone by *Pinus uncinata*. The shrub layer contains primarily spruce, *Frangula alnus* and *Betula pubescens*.

The herb layer is characterised by similar swamp forest species as in the *Pinus uncinata* stand supplemented by *Avenella flexuosa*. The moss layer is well developed with a high abundance but *Shagnum angustifolium* is missing.

In the two-storied tree layer, spruce and pine (*Pinus sylvestris*) reach sizes of up to 21m high and a BHD between 30 and 40cm. The age structure of spruce stands varies between 140 years in the first tree layer and 50 to 80 years in the lower tree layer.

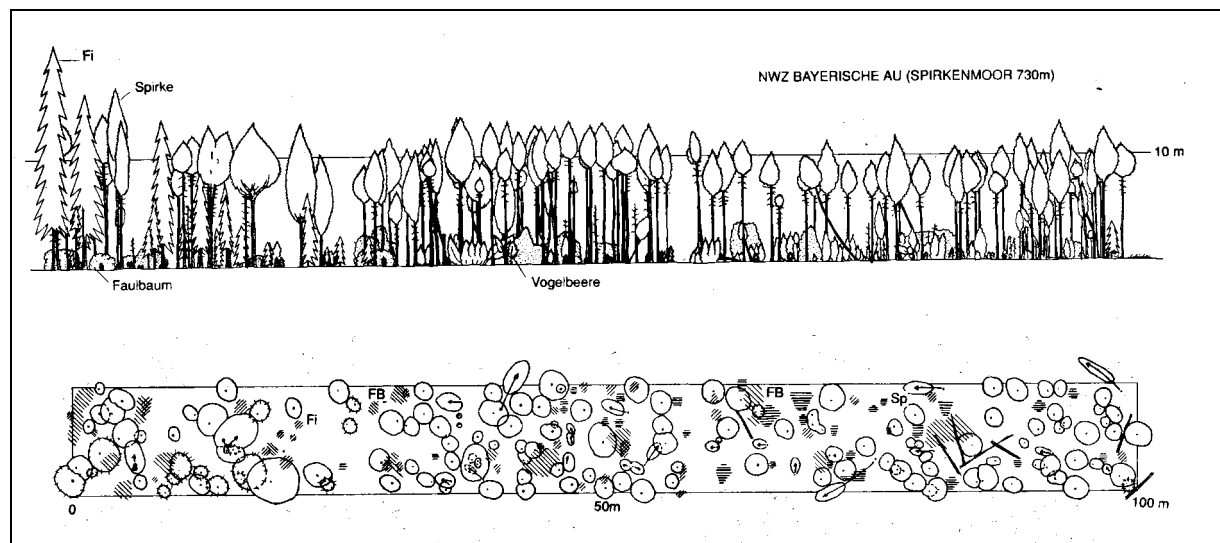


Figure 7: Vertical structure and ground plan of the forest type *Pinetum rotundatae*, SFR "Bayerische Au" (ZUKRIGL 1990)

Strict Protected Forest Reserve „Bayerische Au“

Map of Forest-Types and Sample Plots

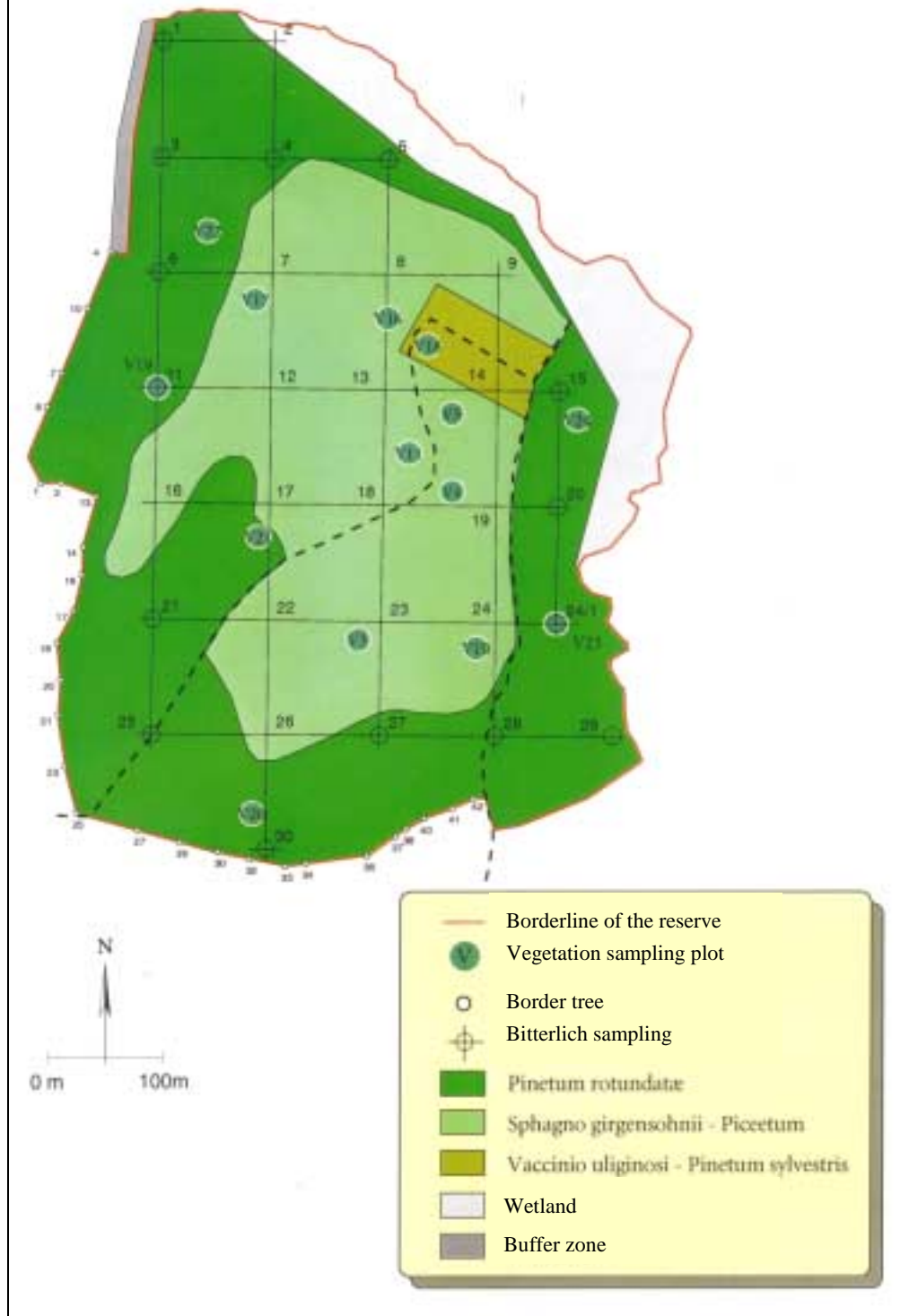


Figure 8: Vegetation map and sampling plot design of the SFR „Bayerische Au“

SFR "Bayerische Au" Vegetation-Table

B1 Tree-Layer 1
B2 Tree-Layer 2
S Shrub-Layer
K Herb-Layer

Vegetation-Plots	Layer	Pinetum rotundatae						Vaccinio uliginosi-Pinetum sylvestris	Sphagno girgensohnii-Piceetum						
		V016	V004	V003	V010	V005	V011	V017	V018	V021	V023	V020	V019	V024	V022
Trees															
Pinus uncinata Mill.ex Mirb.s.str.	B1	3	3	3	3	3	3	3		2a					
Pinus uncinata Mill.ex Mirb.s.str.	B2	2b	3	2b	1	2a	+		1						
Pinus uncinata Mill.ex Mirb.s.str.	S	1	2a	1					3	2b				1	
Pinus uncinata Mill.ex Mirb.s.str.	K	+	+	+	+	1	+								
Frangula alnus Mill.	B2	+	1	1	1	+	+		+			+	1	+	+
Frangula alnus Mill.	S	1	2a	2b	2b	2a	2b	2a			+		1	1	2a
Frangula alnus Mill.	K			1											
Picea abies (L.)Karsten	B1	1		+	+	+	2a	1	1	2a	3	2a	2a	2b	2a
Picea abies (L.)Karsten	B2	1					2b	2b	1	2b	2b	3	2a	2a	2b
Picea abies (L.)Karsten	S	+	+	1	1	1	1	+		1	1	+	1	2m	1
Picea abies (L.)Karsten	K							+	1	2b	1	1	3	3	4
Pinus sylvestris L.	B1							+	3	1	3	3	2b	1	
Pinus sylvestris L.	B2										+				
Betula pubescens Ehrh.	B1							+	1					2a	
Betula pubescens Ehrh.	B2								2a	3	+				
Betula pubescens Ehrh.	S	+				+			+					+	+
Betula pubescens Ehrh.	K														1
Herbs / Mosses															
Sphagnum angustifolium (Russ.)C.Jens.		3	3	2b	2b	4	2b	1	1	2b					
Vaccinium uliginosum L.		2a	1	+	+		1	1	1	+				+	
Calluna vulgaris (L.)Hull		+	+	+	+	+			+						
Vaccinium oxycoccos L.		+	1	1	+	+				+					
Dryopteris dilatata (Hoffm.)A.Gray				+		r	+								
Andromeda polifolia L.		+													
Eriophorum vaginatum L.		1													
Cladonia ciliata		+													
Cetraria islandica			+												
Hypnum cupressiforme Hedw.								+							
Molinia caerulea (L.)Moench		1	3	3	2a	3	3	1	5	2b			1	2b	2b
Vaccinium myrtillus L.		4	4	4	4	4	3	5	3	4	2b	3	3	3	2b
Vaccinium vitis-idaea L.		2a	2a	2a	2b	1	2a	2a	1	2a	1	1	1	1	2a
Sphagnum magellanicum Brid.		3	3	2b	2b	1	3	2b	1	3	1	2b	2b	2b	+
Bazzania trilobata (L.)S.F.Gray		1	1	1	1		2b	2a		2a	1	3	2b	2b	1
Dicranum polysetum Sw.		1	+	+	1	+	+	1		2a	+		+	1	
Pleurozium schreberi (Brid.)Mitt.		1	1	2b	2a	+	1	1	1	3	2a	1	+	2b	1
Dicranum scoparium Hedw.		1	+	+	1	1	1	2a	+	+	1	1	2a	2a	+
Polytrichum formosum Hedw.		+		+	+				+				+	+	1
Sphagnum girgensohnii Russ.													+		4
Avenella flexuosa (L.)Parl.													1		2m
Hylocomium splendens (Hedw.)B.S.G.			1	+				1		+		+	1	+	
Polytrichum strictum Brid.						+	+			1	+			+	
Sorbus aucuparia L.				+							+		+		
Dicranodontium denudatum (Brid.)Britt.L		+								+	1				+
Tetraphis pellucida Hedw.						+				+	+				+
Lepidozia reptans (L.)Dum.						+				+					+
Cladonia sp.							+			+					
Lophocolea sp.									+						
Pohlia sp.															+
Plagiothecium laetum B.S.G.															+
Sphagnum capillifolium (Ehrh.)Hedw.														+	
Sphagnum quinquefarium (Braithw.)Warnst												1			
Dryopteris carthusiana (Vill.)H.P.Fuchs													+		
Abies alba Mill.										+					
Calyptogeia muelleriana (Schiffn.)K.Müll										+					

Recording method: Braun-Blanquet

„Plenterwälder of Julbach“

selective cutting forests - a traditional approach to nature-oriented silviculture

The community of Julbach exclusively disposes of small scale forests owned by local farmers. Therefrom about 50 % have remained as „Plenterwald“ - selective cutting forests.

In the altitudinal zone above 500 m natural forests consist of mixed spruce-silver fir-beech forests with individually occurring maple and ash.

The overproportion of beech in the selective cutting forest of Julbach was caused by predominantly cutting of coniferous species when beech had no price in the market. In the middle and lower tree layer silver fir is still well represented. Generally a tendency to beech dominated structures can be observed.

Stem distribution and level of growing stock show a approximately balanced distribution, there is a remarkable proportion of high diameter classes.

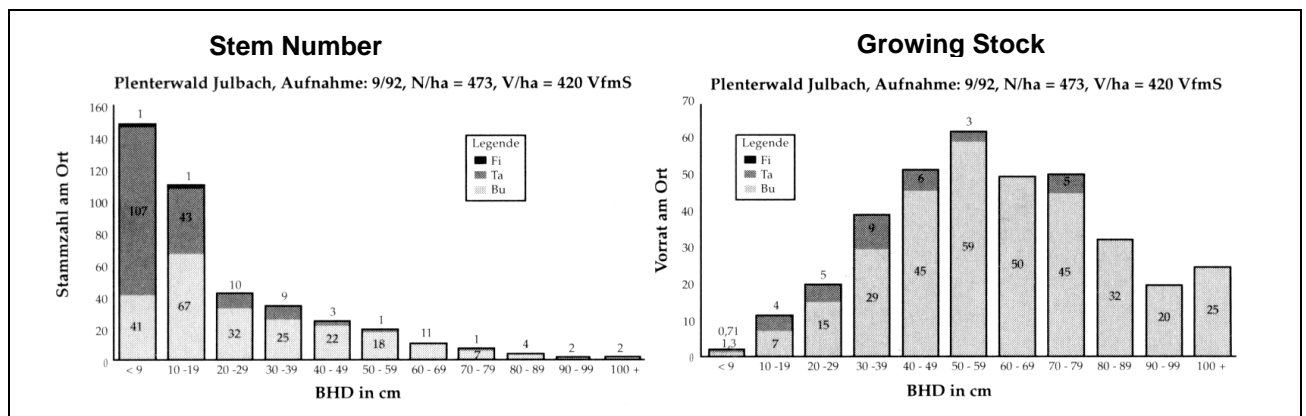


Figure 9: Stem number and growing stock in the „Plenterwald of Julbach“ (FILLA 1995)



Figure 10: Stand structure „Plenterwald of Julbach“

Literature

DUNZENDORFER, W. 1974: Pflanzensoziologie der Wälder und Moore des öö. Böhmerwaldes. Hrsg.: Amt der OÖ. Landesregierung, Linz: 89-92.

FILLA, K. (1995): Exkursionsführer für bäuerliche Plenterwälder. Bez. Bauernkammer Rohrbach.

FLASCHBERGER, J & K. ZUKRIGL 1990: Spirkenwald Bayrische Au. In: Naturwaldreservate in Österreich. Hrsg.: K. ZUKRIGL. Bundesministerium für Umwelt, Jugend und Familie. Wien: 181 –189.

FRANK G. & KOCH G. (2000): The Austrian Forest Reserves Programme. <http://fbva.forvie.ac.at/100/1306.html>.

GRABHERR, G. & MUCINA, L 1993: Die Pflanzengesellschaften Österreichs. Teil II Natürliche waldfreie Vegetation. G. Fischer, Jena, Stuttgart, New York.

KRISAI, R. & R. SCHMIDT 1983: Die Moore Oberösterreichs.

KILIAN, W., MÜLLER, F., STARLINGER, F. 1994: Die forstlichen Wuchsgebiete Österreichs. Eine Naturraumgliederung nach walddökologischen Gesichtspunkten. Wien, FBVA-Berichte 82/1994.

MUCINA, L., GRABHERR, G., WALLNÖFER, S., 1993: Die Pflanzengesellschaften Österreichs. Teil III. Wälder und Gebüsche. Stuttgart, Jena, New York. Fischer - Verlag.

REININGER, H. (2000): Das Plenterwaldprinzip oder die Überführung des Altersklassenwaldes. Stocker-Verlag. Graz, Stuttgart.

STEINER, G.M. (1982): Österreichischer Moorschutzkatalog. Hrsg. v. BM. f. Gesundh. u. Umweltsch., Wien.

ZUKRIGL, K. (1990): Naturwaldreservate in Österreich. Stand und neu aufgenommene Flächen. UBA-Monographien, Bd. 21. 1990. 232 S.

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