

Pro Silva Europe
Annual Meeting 2011 - field trip 2
" *Nature based forestry in district 'Salles'* "

forest enterprise:
Eckart Senitza - Gut Poitschach (Feldkirchen)

Excursion Guide
17.06.2011
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**Integration of structural dynamics
and nature conservation into
high intensive forestry**

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Forest enterprise Gut Poitschach – Revier Salles
"Nature based forestry with single tree fellings"



The private forest enterprise 'Gut Poitschach' covers about 840 ha productive forest in an elevation between 600 and 1200 m above s.l. Forestry is one branch in a mixed enterprise of woods, farming, hunting, fishery, energy production, rent and lease, timber transport and technical bureau for forestry consulting.

The forest area was generated through step by step acquisitions of forest and farmland areas (1885-1989) of the former iron processing industries and is in one families hands just since about 100 years (5 generations).

The history of enterprise and forest utilization and the changing framework had a strong influence at the forest development and structure. About 100 years ago new afforestation of former farmland occurred and in consequence large area clear cuts for supply of the pulp and papermills. Till 1975 also a sawmill of the own enterprise was running.

Today forestry is the most important branch: on the forest area of 840 ha an annual harvest of 4.000 to 5.500 cbm is cut. These fellings are thinnings and small scale ore single cuttings of mature trees. Forest regeneration is done by natural germination.

Within the tree species spruce is dominating with 74%, but also fir, pine, larch and especially beech, maple and ash are mixed within according to the site conditions.

Within the forest enterprise the growing stock of former young stands of lower stockings (1951: growing stock 150 Vfm/ha) has been transformed within 50 year resp. three generations into a high structured forest with high growing stock (mean stocking: 320 Vfm/ha). Years of massive snowbreak (1975 + 1979: 20.000 cbm) and windthrow (1990: 6.000 fm, 1998: 7.500 fm)

have partly destroyed the stands, but often irregular thinnings gave the impulse for higher structuring.

Because of the easy terrain conditions and the intensive system of tractor and skidding trails, logging can mainly be done by tractor and cable winches. Today 4 employed forest workers can execute 80% of the annual fellings and the stand maintenance. Cable cranes or harvester operations are seldom done by external service providers. In the same time all maintenance measures within the young stands and tree groups and also thinnings of the nature regeneration are done.

The aims and the practical steps of the forest treatments now since more than 15 years clearly point into the following direction: harvesting and maintenance must support natural regeneration and higher structuring. The selection of trees is done due to market conditions and individual maturity of the single trees. Value performance of the growing stock should be increased by selecting low quality trees, helping the individual concurrence situation of the trees for better development and avoidance of felling damages.

The goal is an (semi-)automatic woodproduction, where the input for planting, plant protection and maintenance of young stands should be reduced as much as possible. The changing site conditions afford differentiation in treatment, no general formula will work.

The timber is sold according to high differentiation of the sortings (large diameter timber, long construction wood, high and low quality roundwood, thin stems) to about 10 small and medium sawmills of the region. Fir, larch and pine are sold seperately to specialists.

Excursion guide



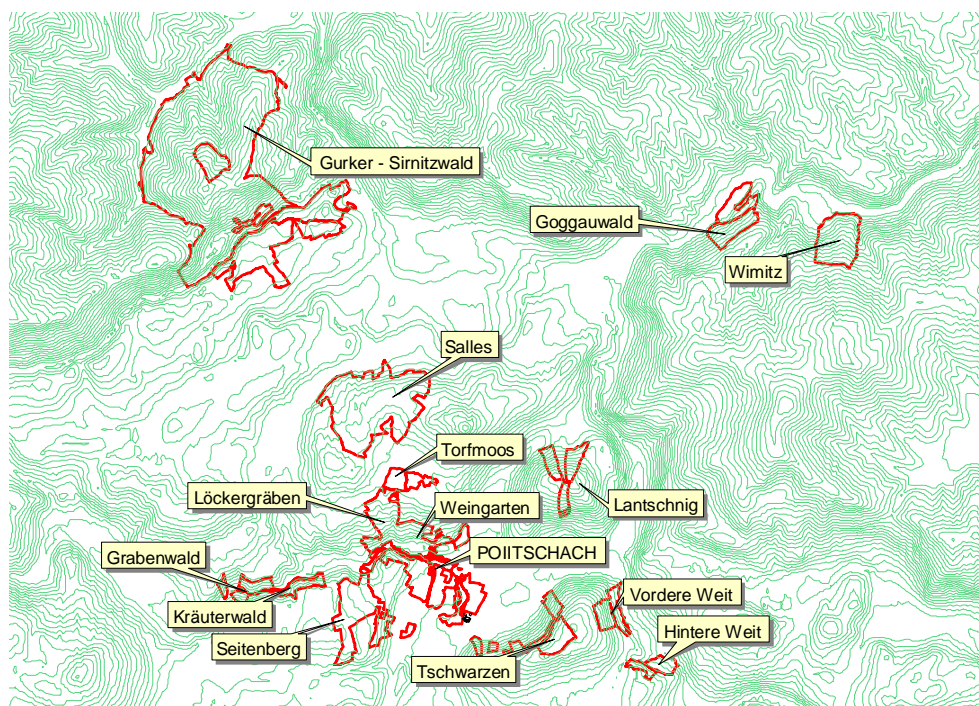
Presentation of the enterprise

basics: 945 ha whole area, 845 ha productive forest, protection forest 5 ha; 50 ha farmland, 25 ha pastures, 10 ha lake "Goggausee", 10 ha others (buildings, farm and industrial areas, water bodies, etc.)

www.senitza.at



situation of the areas



Branches of enterprise:

- Forestry: ca. 4.900 m³ annual harvest
- Agriculture: 45-50 ha farmland, seed production; pastures mainly under lease;
- Fishing: 10 ha "Goggausee", fishing licences (50 annual, daily)
- Hunting: 1100 ha hunting area, local hunters, district system (70-150 ha portions)
- Timber transport: 1 Truck for timber transportation, 12.000 m³ annual capacity
- Rent and lease: 3 industrial objects; over 20 apartments;
- Hydro Power Plants: 2 certified small hydro power plants (apr. 170 kW, 1.600.000 kWh/year)
- Forest consulting: planning and consulting for forest enterprises, natural conservation, biology, roads

Framework

- history of the enterprise - 'growing from the roots'
- personal responsibility
- embedding into the surroundings (neighbour relations)
- continuousness over 3 generations
- sustainable development with care for all branches of the enterprise



History of the business and the forest

Business history:

since 1600 – iron processing (key factor = energy of forest and water): nails, tools, wires, etc.

since 1880 – Paper and pulp production (Alex Ebner), acquisition of farmland and other industries

Acquisitions 1872-1923: in summary 39 single purchases in the area Poitschach-St.Ulrich-Goggau

Afforestation of former farmland (approx. 150 ha in whole area)

Forest development 1946-2001:

1902: 677 ha forest, 86 ha grassland, 63 ha pastures

1900-1914: afforestation of 120 ha fields and grassland

1918-1939: strong harvesting in mature forests (large scale clear cutting), financial crisis

1946-1951: forest area 806 ha; annual harvest ~ 3.000 m³/y,
with 1.200 m³ stem wood, 1.000 m³ pulpwood, 800 ster fire wood
growing stock above 50 years: 49.000 m³ equals 60 m³/ha

1972: forest area 900 ha

1992: forest area 830 ha; annual harvest 6.000 m³ growing stock or 4.980 m³;

growing stock 290 cmb/ha → aim: 330 cbm/ha

2001: forest area 843 ha; growing stock ~ 320 cbm/ha

Generation handover, objectives and financial demand

- preservation of forest growing stock and structure
- payout of 4 sisters
- severance payments for 8 employees
- investment into forest roads, 3 trucks + crane + trailer, tractor (2x), cable winches (2x), refurbishment of 2 hydro power plants, roofs & buildings (3x),
- acquisition of forest area (~ 25ha)

Personnel: employees and changes

personnel:

1946: 13 workers, 2 forest guards –

1992: 6 workers, 2 forest guards –

2002: 6 workers, 1 forest technician; ½ bureau employee, since 1992: 16 x personnel changes

2008: 4 workers, 1 trainee, 1 forest technician: 3 x personnel changes

actual:

1 forest technician (~70% intern, 30% consulting & planning), 3 forest workers, 1 truck driver, 1 trainee (forestry, agric.) 1 part time in office, cooperation with personal leasing, 1 graduate forest engineer (consulting)

Future development strategies

- continuous migration of forest system – value enhancement – improvement with broadleaf trees
- more intensive harvestings in selective cutting - higher annual yield (~5.000 => 6.500 m³/y)
- offering general forest service (consulting, measurements) - stronger integration
- selling electric energy as local dealer directly to the home
- heat supply – micronet - woodchip-heating, solar energy production



Excursion route – Salles



Aerial imagery from 1952 and 2007

Position and site conditions

district Salles: size 120 ha, with 11,5 ha pastures, elevation 800-900m, light inclination or flat areas, community Steuerberg
soil & vegetation: phyllite, slate, partly gravel deposits after ice age. Humid, moist soil, dominating rich herbs, oxalis acetosella, vaccinium myrtillus; very good nutrient and water supply; cambisols
transport conditions: nearly 100% tractor,
road density: 8.088 lm forest roads t.m. 75 lm / ha
 5.325 lin.m. tractor trails that means plus 49 lm / ha + fixed skidding lines
annual harvest: 2000-2003: ca. 900 m³/yr; 570-1700 m³/y; t.m. ca. 8-9 m³/ha,y

Actual forest structure (1992 - whole forest area)

vertical structure: mostly one stage, 13% dual stage stand types and uneven aged

increment: dGZ 9,1 Vfm/ha,y; lfZ ET spruce 8,2 Vfm/ha,y, total 7,6 Vfm/ha,y;
 lfZ after drilling spruce 10,2 Vfm/ha,y; total. 9,1 Vfm/ha,y;

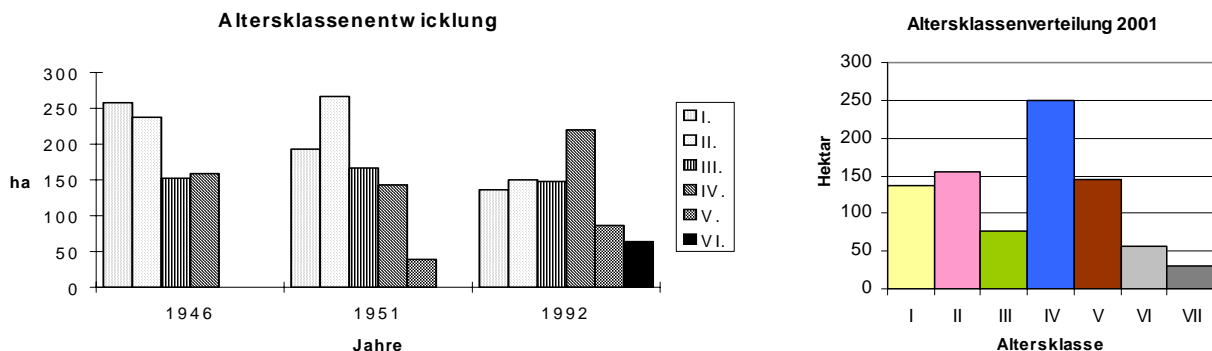
growing stock: mean growing stock 289 Vfm/ha; 232.000 Vfm

mean stand age: 55,6 years; rotation period 90-110 years;
mean density index 0,84

annual harvest for rot.period 100: after yield table 6.400 Vfm/y; with increment drilling 6.700 Vfm/J => 5.560 m³/year

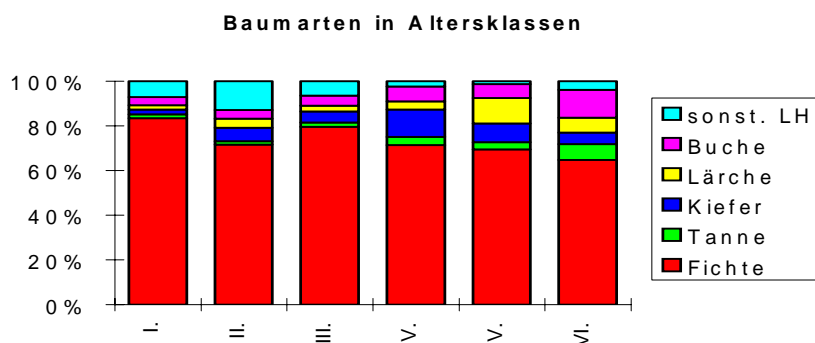
age classes: <41Jahre: 1946 - 61%; 1951 - 57%; 1992 - 36%

development of age classes 1946-2001



Tree species 1992: 74% spruce, 2% fir, 7% pine, 4% larch, 6% beech, 6% other broadleaf

tree species in age classes



silvicultural yield: 7.100 Vfm ~ 5.900 m³ (43% thinning 15% damaged logs, 42% final logging)



cable crane logging: 670 cmb thinnings, 480 cmb final harvest => 1.150 Efm/year
after building new tractor roads, reduction of cable crane terrain !

Free style silvicultural treatment – harvesting in district "Salles":

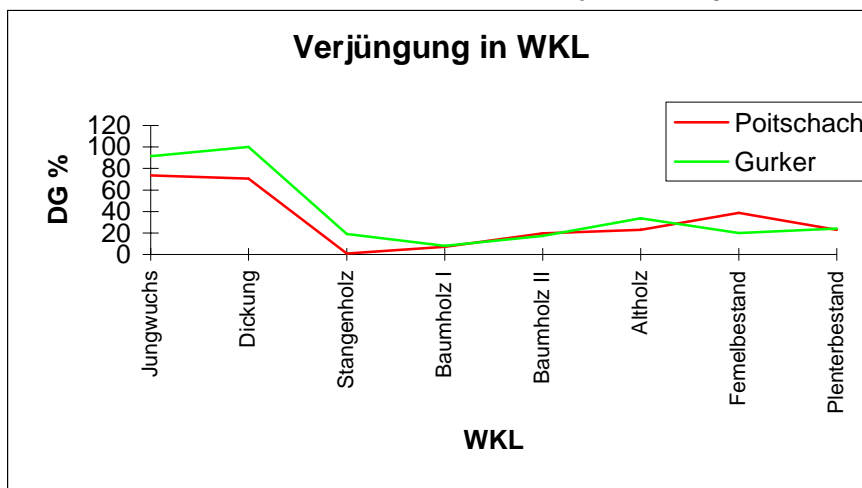
planned harvesting is superposed by windthrow, snowbreak and bark beetles (rarely)
annual cut – Salles: 2001-2007 differs from 200 to 1.200 fm – **annual mean 650 Efm/year**
harvesting below increment – goal: change of forests structure, improvement of quality

thinnings	38%	1746 Efm	Media 13-22cm	DB 15-38 €/fm
single cuts	31%	1410 Efm	Media 30-42cm	DB 40-58 €/fm
windthrow:	22%	1001 Efm	Media 20-32cm	DB 22-52 €/fm
barkbeetles:	9%	404 Efm	Media 24-32cm	DB 30-40 €/fm
total		4.561 Efm	mean diameter	profit contribution

windthrow: use for regeneration of light demanding trees (Larch)

Forest regeneration:

In 1992 about 28% of the whole forest area already with new generation



percentage of fir decreases with height class; also beech

automatic production is working !

Afforestation: 2008-2010: 11.800 trees, 270 maple and ash, 3500 Larch, 8.000 spruce. - as a result of windthrow.
"normal years" 2.000 trees/year mostly broadleaf and larch !

Integration of nature conservation and biodiversity

- network of old aged trees (broadleaf, fir / abies) as habitat for birds and insects
- creation of biotops - ponds, wetland
- integration of edges to agriculture land (tree rows, marshland, swamp)
- protected swamp areas – BIOSA (12 ha) (in Köttern) => agric. nature conservation program

Timber harvesting and silvicultural strategies 1992-2010

- cutting according to demand of the clients (specialists)
- 'scrape on the edge of the bowl'
- intensive maintenance processes
- 'technique of the unsound apples' ?

Risk + Natural Regeneration

Calamities (whole forest area):

snowbreak 1975: ca. 19.000 fm (easter days)

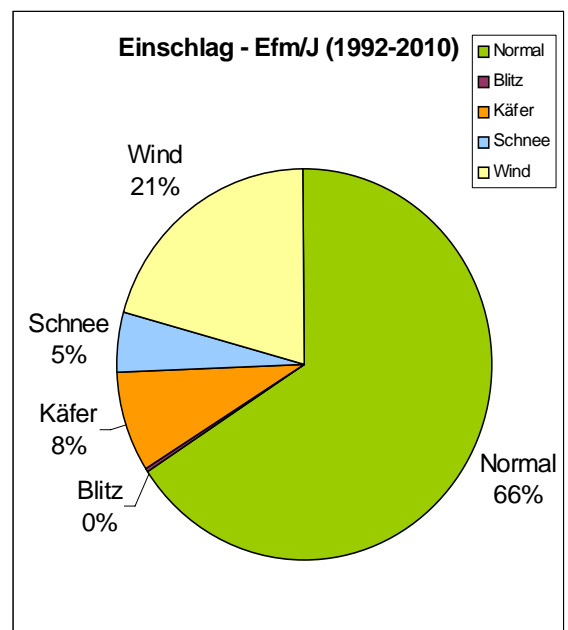
snowbreak 1979: ca. 20.000 fm (2nd-5th May)

windthrow 1991: 6.000 fm, windthrow 1998 ca. 6.000 fm, windthrow 2006: 4.400fm, windthrow 2008: 2.800 fm

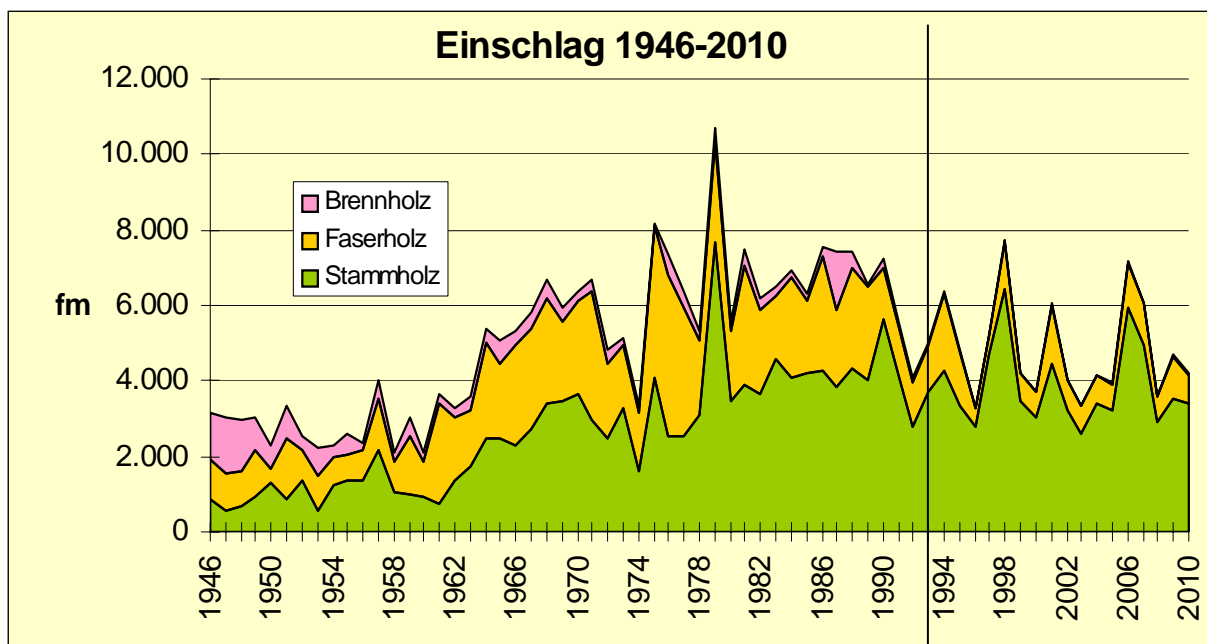
damage areas are the nucleus for structured forests !! –

Especially in the district "Salles" the strong snow breaks were the starting reason for structures !

Jahre	Normal	Blitz	Käfer	Schnee	Wind	Summe
1992	3.465		342		263	4.070
1993	3.229		1.255			4.484
1994	4.090		172	1.211	202	5.675
1995	2.219		399		1.375	3.993
1996	1.200			2.101		3.301
1997	2.841	25	448	606	1.299	5.219
1998	2.214		287	587	4.653	7.740
1999	2.859	79	213		1.052	4.204
2000	2.938	44	179	23	512	3.696
2001	5.575	15	399		56	6.046
2002	3.533		155		344	4.032
2003	2.978	25	272		195	3.470
2004	2.931	50	265		924	4.170
2005	3.690		161		88	3.939
2006	2.515		266		4.385	7.167
2007	4.970	55	965		95	6.085
2008	672		60		2.845	3.578
2009	3.345		1.120		216	4.681
2010	3.519		565		140	4.224
Efm/J (1992-2010)	58.782	293	7.525	4.529	18.644	89.773
Mittelwert	Normal	Blitz	Käfer	Schnee	Wind	Summe
Efm/J (1992-2010)	3.094	15	396	238	981	4.725
Anteile	65%	0%	8%	5%	21%	100%



Harvesting 1946-2010: Stem-/ Pulp- / Firewood



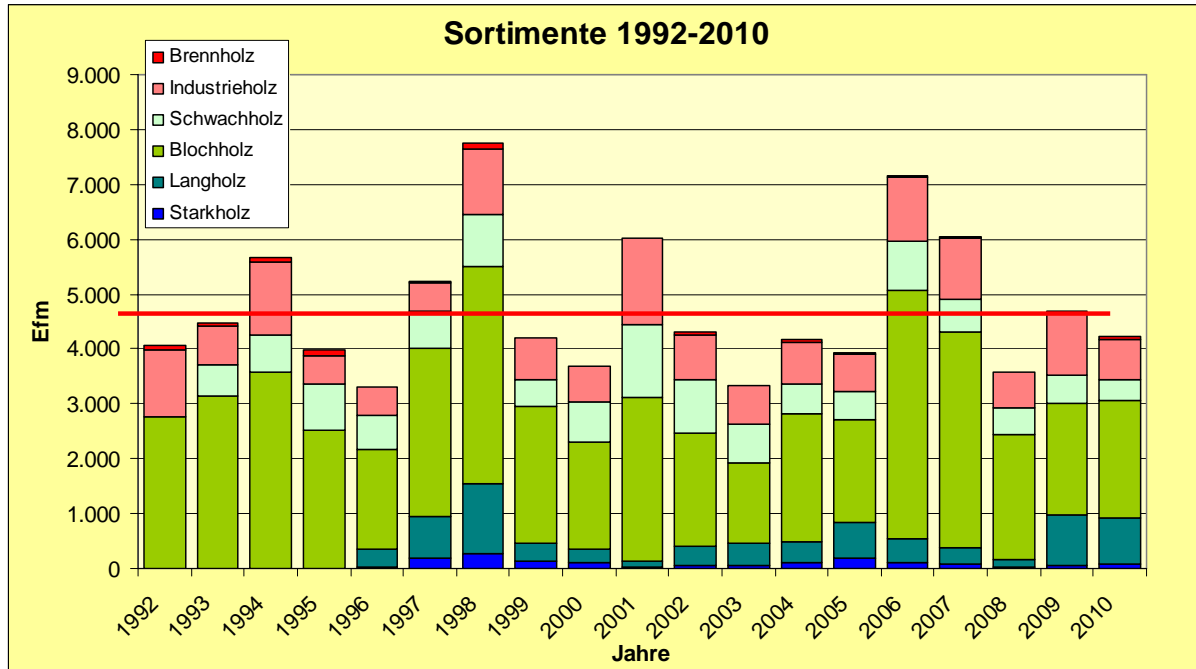
Annual Harvest:

1946-65: 3.100 m³ (Sawlogs 40%), 1966-91: 6.500 m³ (57% SL), 1992-2010: 4.800 m³ (80% SL)



Total Annual Harvest 1992-2010

- mean yield 4.800 Efm with a potential yield of 5.500 – 5.900 Efm (sustainable harvest)
- reserve of ~ 15% (900 fm/year) – mobilising for investments
- relatively high variability: 3.300 – 7.700 Efm (range should be 3.800-6.500 Efm)
- harvest structure 1992-2010: 57% trunk wood - 11% large diameter and long wood; 14% small wood, 18% industrial wood => reduction of industrial wood, enhancing long/large diameter



Permanent monitoring plot "Obere Roßhalt"

Prognaus:

- distance-independent individual-tree growth model, suited for uneven-aged mixed stands – growth conditions described by different continuous and non-continuous site variables
- 5 submodels: Basal Area increment model: $\ln(BAI)=a + b \cdot SIZE (BHD, H, CR) + c \cdot COMP (BAL) + d \cdot SITE$ (e.g.: slope, elevation, growth district,..); Crown ratio model, Height increment model, Mortality model, Ingrowth model. Parameterization with data from the Austrian National Forest Inventory

Sampling Plot data: Growing Stock: 661 m³/ha, density: N/ha =339, annual increment: LFZ= 7,4 m³/a, dg = 40 cm, HI = 36 m. Tree distribution: spruce: 85 %, fir: 4 %, larch: 6,5 %, pine: 3 %, beech: 1%.

Regeneration: Plenty of regeneration, although browsing by game = 45 % for spruce und 65 % for fir.

- Variant Studies, management scenarios: Different strategies: strict diameter harvesting, removing bad quality trees, no harvesting,..
- Weakness of model implementation: Defining different thinning strategies suited for transitions to uneven-aged management



Selection of mature trees – example

- individual selection depending on market demands
- working blocks (combination with maintenance of young tree groups)
- attention of felling direction to the logging system
- increment conditions and vitality

data of harvest (example):

Stem Analysis:

195 years – height 40 m
 145 years – height 38 m
 siteclass: FIBruck=14 dGz, FIBayern=17 dGz

Felling – key features

- single tree felling
- availability of personal and machinery
- shaping and logging (attention to logging system !)
- harvest task: within 2,2 day ~ 80 m³, income of 4.500-5.000,- € => extremely high liquidity !! (if the market demands)

"automatic forest production" already achieved !

50 m³ harvesting + maintenance with 50 working hours => volume 5.000 hours/year => 2-3 workers; actual 4 + external workers or forest service providers !

Infrastructure

road density: status 1992: forest roads 42,3 km (50 lm/ha); tractor trails 7,9 km (9 lm/ha) = 59 lm/ha
 status 2002: forest roads 50,3 km (59 lm/ha); tractor trails 21,5 km (25 lm/ha) = 84 lm/ha

road construction since 1992: 8 km forest roads, 13,6 km tractor trails / skidding trails

construction technique: shovel excavator - costs: under 1 € / lm; most important: the driver (!!)

implementation: current accessibility, single tree selection and cutting, calamities/barkbeetle, spatial division

Afforestation of agricultural areas

afforestation: Lawulnig (ca. 3,9 ha); Wachsenberg Sonnseite (0,5 ha), Tumpfwiese (0,3 ha), Gurker Randbestände (2,8 ha)

historical afforestations: 150 ha of former fields, grassland or pastures (1817-1861 Franz. Cadastral Map)

stand treatment and thinning – examples

timber quality and value of growing stock ? - development of sites and soil...

cultural monuments – old farm sites, single trees - historical development – acquisitions (Alex Ebner)

choice of tree species and reforestation techniques;

alternative methods - plowing and natural germination (Afforestation 1982 - 29 years)

Deckungsbeitragsrechnung Roßhalt - Bauholz 6,5 Meter Bestellung

Sortiment	LH-/St.bl.	Bloch	Ind.Holz	Schw.Bl	Summe	Media
Efm	39,9	23,8	5,0	10,0	78,8	41,43
%	51%	30%	6%	13%	100%	
Erlös	€ 3.195	€ 1.883	€ 140	€ 600	€ 5.818	€
Preis / fm	€ 80	€ 79	€ 28	€ 60	€ 74	€

	Menge	€/ fm	Euro	Media	Me*fm
Samonig LH	30,78	€ 79	€ 2.431	50,12	1543
Samonig Bl	23,84	€ 79	€ 1.883	38,57	919
Steiner	9,14	€ 84	€ 764	60,30	551
Hasslacher	10,00	€ 60	€ 600	20,00	200
Papierholz	5,00	€ 28	€ 140	10,00	50
	78,75	€ 74	€ 5.818	41,43	3263

Kosten	Forstarbeiter	Traktor	MS/fm	Gesamt	DB I
Sätze	€ 17	€ 12	€ 1,45		
Std./fm	54	18	78,75	€ 16	€ 58 je fm
Kosten	€ 918	€ 216	€ 114	€ 1.248	€ 4.570

Auszeige	Stück	fm	fm/Baum
	16	78,75	4,9



Primary thinning "Salles Lawulnig"

**Harvester – Forwarder
2009:**

Two thirds of the selection of trees was done by a forester, one third by an adjutant. In total 33 hours were invested. Overall costs were at 950 Euro (about 200 Euro / ha).

EDF Salles Lawulnig	Harvester Forwarder
Fläche [ha]	4,6
Efm	368
Efm / ha Entnahme	80
Bloche fm	37,87
IH fm	241,27
Behauholz fm	88,36
Media	14
Erlös - Bloch	€ 2.284
Erlös - IH	€ 8.742
Erlös - SchwBl	€ 4.175
ERLOS	€ 15.201

Erntekosten/fm	€ 22,00
Erntekosten	€ 8.085
DB I	€ 7.116
Förderung	€ 300
Förderbetrag	€ 1.380
GESAMT	€ 8.496
10% DB / fm	€ 23,12
66% DB / ha	€ 1.847
24%	
100%	

Data: 370 m³ - 80 m³/ha,

41,- € / m³ => gross margin 23,- / m³; subsidy equals the costs for marking the trees and more !

mean diameter 14 cm,

Motormanual Logging 2010:

- harvest: 60 cmb, Media: 17,23: 28 % saw logs, 48 % industrial wood, 24 % low diameter timber, proceeds: 2.970 € (49,5 €/fm), Harvesting costs: 24,11 €/fm; DB I: 25,39 €/fm.

Harvesting – "Schachtale" / "in the box" (2007 / 2009)

stand data: BH1-BH2; age 60-100; high percentage of pine (20%) with very low quality

- inkl. maintenance
- no additional work (afforestation, plant protection again browsing, weeds)

Nutzungen "Schachtale"

Jahr	Maßnahme	Efm	Media	DB	DB*Efm
2007	BH-DF	351	27	€ 38,5	€ 13.513,50
2007	Plenterung	125	35	€ 49,0	€ 6.125,00
2009	Plenterung	196	31	€ 28,0	€ 5.488,00
2009	Einzelstamm	186	33	€ 35,0	€ 6.510,00
		858	30	€ 36,9	€ 31.636,50
	5,6 Fläche [ha]	153			€ 5.649,38

Harvesting: ~ 860 m³ on 5,6 ha, 150 m³/ha;

Mean diameter: 30 cm; gross margin ~ 37 €/fm

Inventory with permanent plots and growth simulation

1991: Setting up a permanent monitoring plot (semi covered samples; 1 sample/2 ha) including regeneration inventory + taxation und stand-planning

Interpretation by Otto Eckmüller: Increment: dGZ 9,1 m³/a; av. growing stock 289 m³/ha

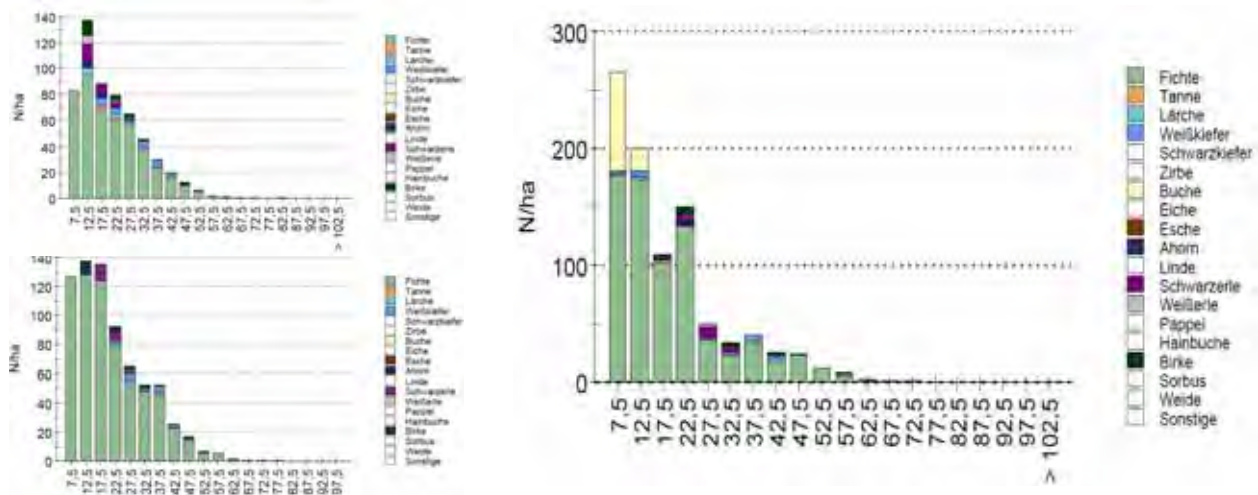
Annual increment yield table spruce: 8,2 m³/ha/a. sum: 7,6 m³/ha/a. increment from drilling: spruce: 10,2 m³/ha/a; sum: 9,1 m³/ha/a

2001: First repetition – mortality + ingrowth – Update of stand data, Taxation;

Evaluation with Prognaus:

- Evaluation 1991 + 2001 – Comparison for the district Salles
- 1991: grow. stock: 277 m³/ha, G = 25,8 m², N = 573
- 2001: grow. stock: 372 m³/ha, G = 33,3 m², N = 722; increment: 9,5 m³/ha/a + harvesting: ~ 7,0 m³/ha/a
- 2001-Simulation: growing stock: 332 Vfm/ha, G = 29,8 m², N = 904
- **Usage scenario:** e.g. 45 cm target diameter, 30% harvesting volume, 2 thinnings. hd=12m / hd=20m each 30%; pre commercial thinning hd=3m to N = 2.500/ha.
- **Result:** 40 years: Increment of growing stock to ~ 450 m³/ha; N stable at ~ 900 /ha, increment 12-13 m³/ha/a, Harvests: about 12 m³/ha/a. harvesting tree volume increases since 2010 to 0,8-1,4 m³/tree; wider distribution in BHD-classes, N closer to diameter distribution "Plentergleichgewichtskurve" sensu Schütz + more beech





Figures: Stem distributions in BHD-classes (1991, 2001 (observed), 2031 (simulated) for the district "Salles"

Pruning in commercial thinning stands

Costs: ca. 1-1,5 € / stem to 4m; max. 2,50 € /stem;

Overhead expense: 8.700 € for 15 ha resp. 580,- €/ha => lower then cultivations costs and costs for protection against browsing, etc.

Amount of pruned stands: Prunings since 1988; 1992 in sum 5.900 stems (15 ha); 20% in the district "Gurker", 80% district Poitschach (Salles, Seitenberg, Wimitz,...)

Actual situation: Markings and controlling of pruned stems; actually no new prunings; focus on stand treatments

Last harvest in the example stand:

2006 – Thinning: 240 Efm auf 2,8 ha d.s. 86 Efm/ha, Media 21,8 cm, DB 35 €/fm

Nature protection in agriculture

ÖPUL-models: Project development 2001
Planting of hedges and conservation of tree lines between fields

Hunting in district "Sales"

- roe deer: 2 male / 3 female, 1-2 fawn, red deer 1-(2),
- hunting quote to planning 80-90% - hunting technique changes, difficult in high structured forests
- selective browsing of roe deer: fir is growing partly undisturbed, but maple / ash are „Bonsai“-trees
- Challenge of climate change and adoption of tree species distribution, vegetation type

Overall resume – summary

6 key factors for successful implementation of nature based forestry

- Know how – competence – quality awareness
- Personal resources & technical equipment
- Integration of all branches (“can a tree grow without branches?”)
- Knowledge of growth potential & site development
- References, benchmarking & multiplication – public relations
- History as source of inspiration & orientation

(E.Senitz, 28.11.2003- updates 09.10.2008, 10.09.2009, 01.06.2011, 16.06.2011; translation E.Senitz, R.Gutzinger)