INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Tento projekt je spolufinancován Evropským sociálním fondem a Státním rozpočtem ČR InoBio – CZ.1.07/2.2.00/28.0018

Silviculture and regeneration of silver fir

Selection forest

Mendel University in Brno

evropský sociální fond v ČR · EVROPSKÁ UNIE · MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY · OP Vzdělávání pro konkurenceschopnost

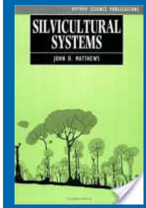
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

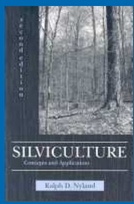
European silver fir - Abies alba Mill.

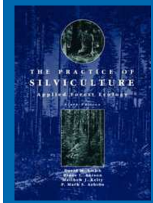
- Silver fir is one of the endangered species in Europe, which is suffering in particular from unsuitable management tools and economic pressure, in spite of its ecological value for European forest ecosystems.
- The aim of WP is to provide a platform for concerted activities from different scientific disciplines in close co-operation with practitioners in order to contribute to the maintenance of Silver fir by improving the knowledge and the management tools.

IUFRO Working Party **1.01.09 – Ecology and silviculture of European silver fir**

Literature







MATTHEWS, John D. *Silvicultural Systems*. 1st ed. Oxford : Clarendon Press, 2001. 12284 s. ISBN 01-985-4670-X.
SMITH, David Martyn. *The practice of silviculture : applied forest ecology*. 9th ed. New York : Wiley, c1997. 537 s. ISBN 04-711-0941-X.
NYLAND, Ralph. *Silviculture : concepts and applications*. 2nd ed. Long Grove, Ill. : Waveland, 2007. 682 s. ISBN 15-776-6527-9.

Dengler, A.:, Waldbau auf ökologischer Grundlage. 2. Band Baumartenwahl, Bestandesbegründung und Bestandespflege., Hamburg und Berlin, Vlg. P. Parey 1982. 280 s.
Mayer, H.:, Waldbau auf soziologisch-ökologischer Grundlage., Stuttgart-New York, G. Fischer Vlg. 1984. 513 s.

Silver fir

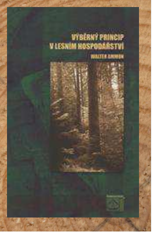
Kramer , W. 1992: Die Weißtanne (Abies alba Mill.) in Ost und Südosteuropa. Eine Zustandsbeschreibung. Gustav Fischer Verlag, Stuttgart / New York. 405 S.

Korpeľ, Š., Vinš, B.: Pestovanie jedle. Bratislava, Slovenské vydavateľstvo pôdohospodárskej literatúry 1965. 340 s.
Peřina, V., Kadlus, Z., Jirkovský, V.: Přirozená obnova lesních porostů. Praha, SZN 1964. 167 s.
Sokol, A.: Jedľové porasty. In: Pěstění lesů III. Praha, SZN 1956. S. 439-446
Kadlus, Z., Zakopal, V.: Pěstování jedle ve světle nových poznatků. Zprávy lesn. výzkumu, sv. XVI., 1970, č. 1, s. 24-32
Vyskot, M. a kol.: Pěstění lesů. Praha, SZN 1978. 448 s.

Selection forest

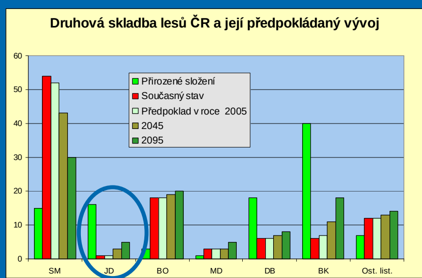
Ammon, Walter "Das Plenterprinzip in der Waldwirtschaft", 4. Aufl., Verlag Paul Haupt Bern; Stuttgart; Wien, 1995, ISBN 3-258-04820-7
Heinrich Reininger "Das Plenterprinzip", Leopold Stocker Verlag, Graz-Stuttgart, 2000
Jean-Philippe Schütz "Der Plenterwald", Parey Buchverlag, Berlin, 2001
SCHUETZ, Jean-Philippe. Der Plenterwald und weitere Formen strukturierter und gemischter Wälder. Wien : Parey Buchverlag, 2001. 13207 s. ISBN 38-263-3347-0.
REININGER, Heinrich. Das Plenterprinzip : oder Die Überführung des Altersklassenwaldes. Graz : Stocker Verlag, 2000. 238 s.

KORPEĽ, Štefan; SANIGA, Milan. Výberný hospodársky spôsob. 1. vyd. Praha : Vysoká škola zemědělská, 1993. 127 s.
AMMON, Walter; FAVRE, Louis-André; SCHULER, Anton. Výběrný princip v lesním hospodářství : závěry ze 40-ti let švýcarské praxe. Kostelec nad Černými lesy : Lesnická práce, 2009. 157 s. ISBN 978-808-7154-250.



Species composition

In the natural composition of our forests was silver fir represented by (16%) (15% spruce), still had in 1950 represented 2.9%, at present, however, its share dropped below 1% of the forest area of the Czech Republic.
The concept of representation of the target species in the forests of the CR is expected to gradually increase the proportion of fir forests in the next 50 years at 3%, and 100-year term at 5%.During one rotation period should be secured and guaranteed fir regeneration to 130 000 ha (ie an annual average of 1.3 thousand hectares).
Besides the natural regeneration will have to be fir, of course (given the extent of its current representation) regenerated by artificial way.



Characteristics and requirements for the regeneration and silviculture of silver fir

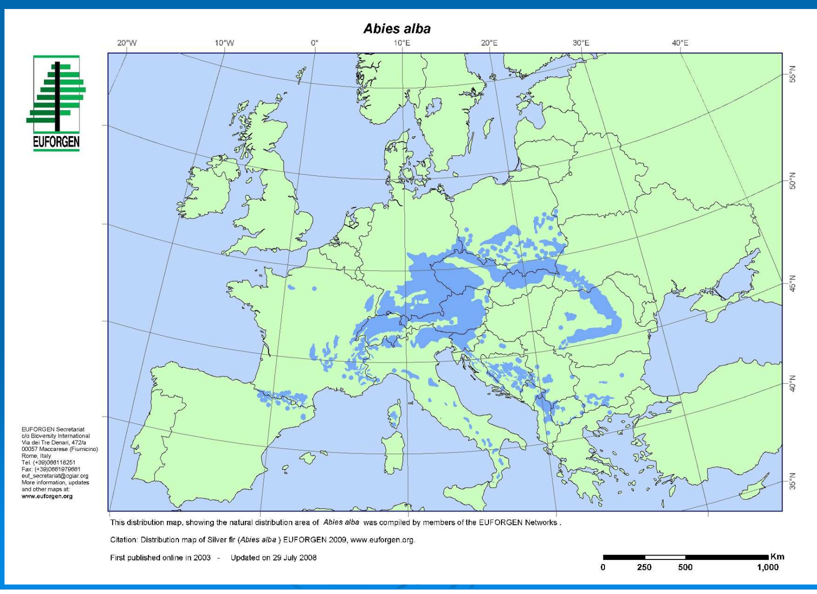
Generally known properties of fir is mainly **its ability to tolerate shade** (some decades). Its demands for a light are influenced by a complex of other climatic factors (temperature, precipitation, humidity, soil moisture, air flow) and the character of soil factors. It is logical that the habitat conditions are favorable, thereby reducing demands on light. In contrast, in the colder higher elevations, or on drying and themineral-poor soils on the lower end of its extension, the demands on light fir significantly higher (Svoboda 1952).

Fir needs shade in young stage for healthy growth

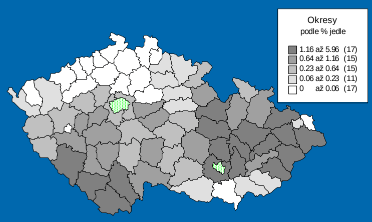
In close connection with the light should review the **requirements of fir for temperature**. The average annual temperature should not fall below 5 to 8 ° C, in summer should be the average temperature of 12 ° to 15 ° C (Korpeľ, Vins 1965).
Fir requires **adequate moisture regime**. Its successful growth and development is subject to favorable, high relative humidity, in particular, but plenty of rain (during the growing season of at least 350 to 400 mm).
It is not only sensitive to dry periods, but also severe winters, late frosts and air flow.
Silver fir may be regarded as our most delicate coniferous species because in addition to the above mentioned requirements for moisture and temperature requires for its successful growth and deep, the nutrient rich soil (Kadlus and digged 1975, Sokol1956).

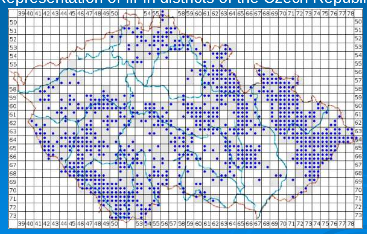
Abies alba is a large evergreen coniferous tree growing to 40–50 m (exceptionally 60 m) tall and with a trunk diameter of up to 1.5 m. The largest measured tree was 68 m tall and had a trunk diameter of 3.8 m. It occurs at altitudes of 300-1,700 m (mainly over 500 m), on mountains with a rainfall of over 1,000 mm.

Extension of fir in Europe

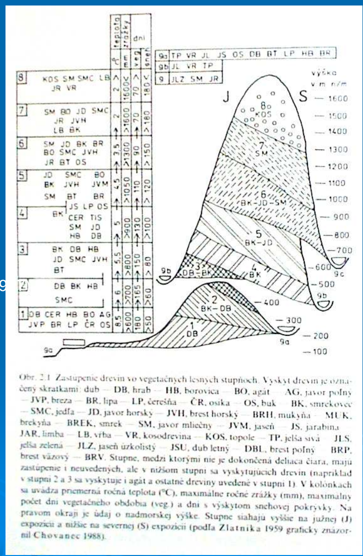


Extension of fir in Czech republic and forest vegetation zones

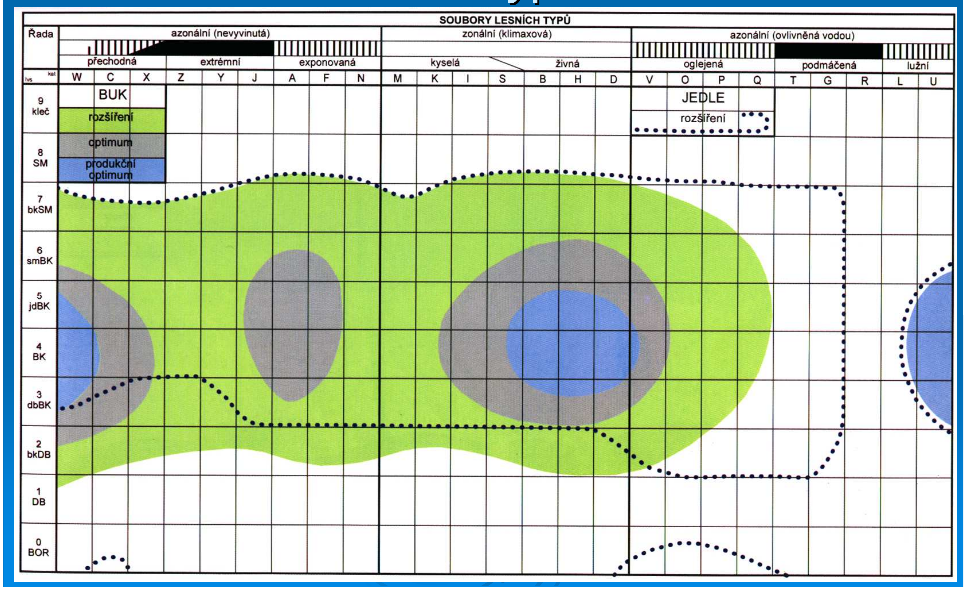




Representation of fir in districts of the Czech Republic (SLHP 19



Extension of fir and beech in groups of forest types



Backman's growth law

conception of organic time by Gaston Backman (1883-1964)

The conceptual basis of Backman's function of growth, is the postulate that the logarithm of growth rate is negatively proportional to the square of time's logarithm

$$\log H = K \cdot \log^2 T$$

kde: $H = \frac{v}{v_1}$

v - je běžný přírůst,

v_1 - je maximální běžný přírůst,

$T = \frac{t}{t_1}$

t - je věk při přírůstu v,

t_1 - je věk při maximálním přírůstu v_1,

K - je konstanta.

Variable T is called an organic time, which is expressed by the fact that a physical time interval for the organism has a different degree of effectiveness in youth than in old age (at any stage of development of the organism time passes at different rates).

From Backman studies on the concept of organic time implies several key findings:
a) the greater is the maximum growth rate and the sooner it reaches, the shorter the life expectancy;
b) the later reaches the maximum growth rate, the longer it lasts for life;
c) the longer the life, the greater the average rate of the final overall size of the organism;
d) life is shorter, more and more of the total time of growth attributable to stage youth.

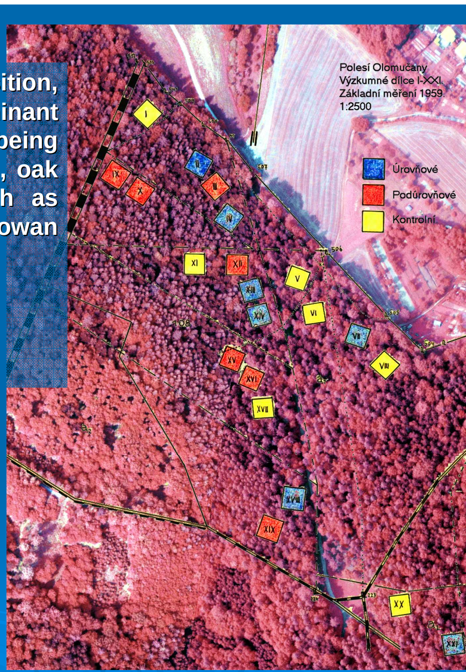
Backman distinguishes three types of growth:
- space-time type that first acquires space and then uses the time is growing rapidly and its growth relatively quickly subsiding;
- time-space type that uses the first time and only later acquires space. In the beginning, then slowly grows, its growth rate which increases later and remains long on a high level;
- type that grows evenly throughout life.

Ideas about organic time are of great importance in silviculture and forest management

Stand 123C$_7$, Olomučany Forest District, Křtiny Training Forest Enterprise

- **The stand is situated on a plateau slightly sloped towards NE at an altitude of 460 m (co-ordinates 49º19'25'' N and 16º40'11'' E).**
- **The total area of the stand is 10.84 ha.**
- **From the viewpoint of forest typology, the stand was ranked among forest type 3S6, i.e. oak/beech communities of *Luzula* type with *Carex digitata.***
- **In 1960 when the stand was aged 39 years, Department of Silviculture of the Faculty of Forestry in Brno established there permanent thinning plots according to a traditional layout (low thinning, high thinning, control).**

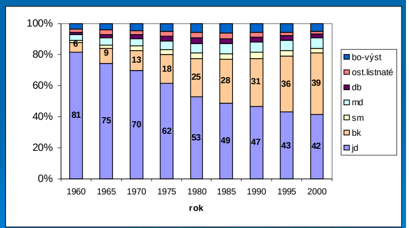
In the present species composition, silver fir and beech show dominant position, other species being European larch, Norway spruce, oak and interspersed species such as hornbeam, birch, goat willow, rowan and aspen.



Stand 123C7, Olomučany Forest District, Křtiny Training Forest Enterprise

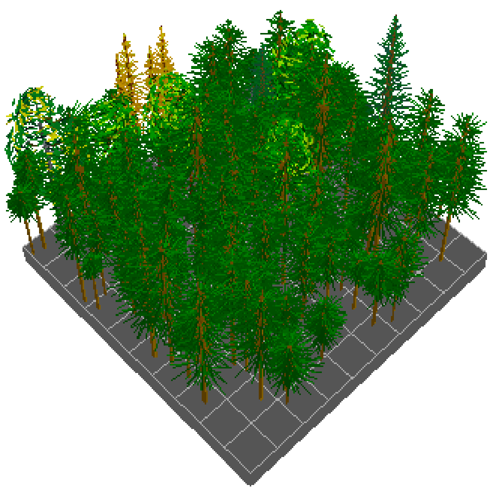
Basic mensurational data of the control plot in 1960 and 2000

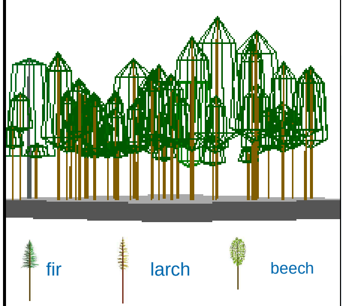
Species	Number of trees per hectare [N]	Mean tree h [m]	Mean tree d.b.h. [cm]	Mean tree v [m³]	Stand basal area (b.a.) [m².ha⁻¹]	Growing stock [m³.ha⁻¹]	Stand density	Species composition [%]
1960 – age 39 years								
Fir	3111	9.1	8.7	0.036	21.194	111.0	0.87	81.3
Beech	157	10.7	9.8	0.049	1.430	7.8	0.07	6.3
Spruce	54	9.4	9.6	0.050	0.473	2.7	0.02	1.7
Larch	96	10.7	10.0	0.104	0.860	4.9	0.04	3.4
Oak	36	10.6	10.1	0.051	0.341	1.8	0.02	1.5
Other broadl.	56	10.7	8.6	0.207	0.387	1.8	0.02	2.3
Scots pine-res. trees	11	25.0	43.3	1.706	1.593	18.3	0.03	3.4
Total	3521				26.278	148.3	1.07	100.0
2000 – age 79 years								
Fir	346	24.0	24.5	0.686	17.901	237.5	0.41	41.8
Beech	175	19.7	23.5	0.864	11.041	151.2	0.38	39.1
Spruce	21	25.2	27.6	0.864	1.386	18.5	0.03	3.1
Larch	39	29.7	30.5	1.096	2.942	43.1	0.06	6.9
Oak	14	24.0	26.4	0.674	0.791	9.6	0.03	2.6
Other broadl.	15	19.9	17.8	0.242	0.385	3.5	0.02	1.5
Scots pine-res. trees	11	27.6	52.2	2.759	2.313	29.6	0.05	5.0
Total	621				36.760	493.0	0.98	100.0

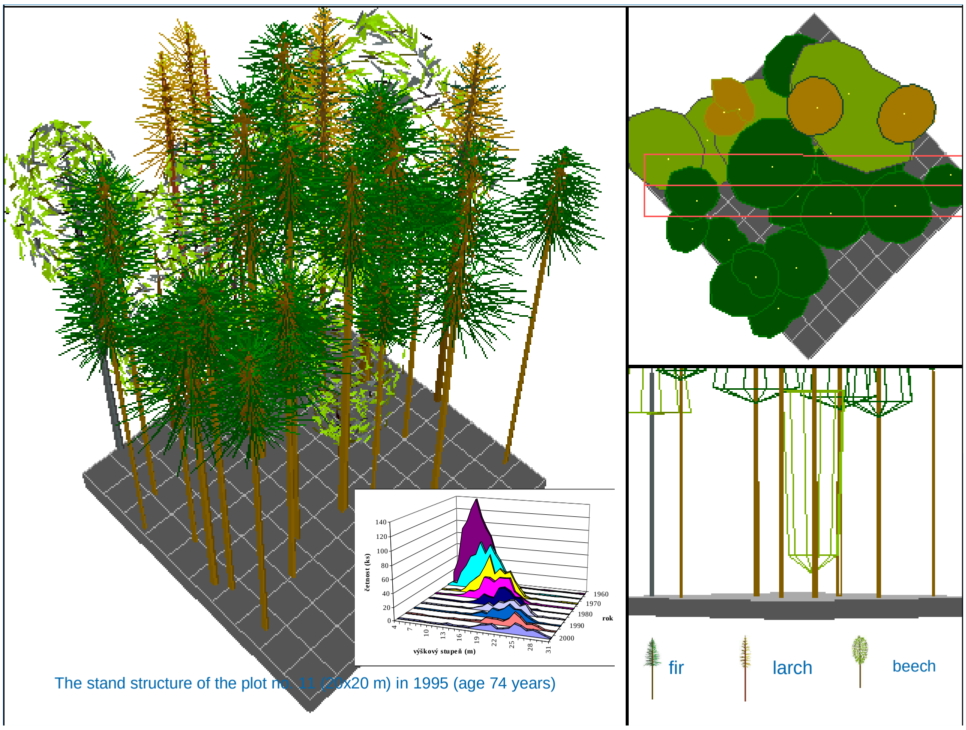


The proportion of initially dominant silver fir (81.3%) decreased to 41.8% in the course of 40 years. Originally interspersed beech trees (6.3%) increased their proportion 6.2 times, i.e. to 39.1% in the course of 40 years.

The stand structure of the plot no. 11 (20x20 m) in 1960 (age 39 years)

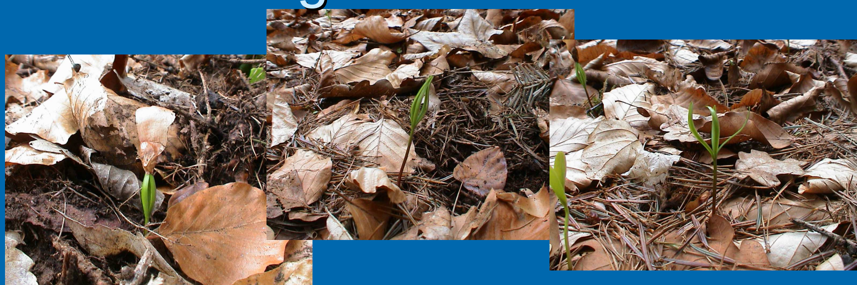






The stand structure of the plot no. 11 (20x20 m) in 1995 (age 74 years)

Natural regeneration of silver fir



The extent and quality of natural regeneration of fir are as in other species subject to four basic conditions:

- *presence of a sufficient number of trees able to produce seeds (genetically matching),*
- *suitable soil conditions for germination, germination and survival of natural seeding,*
- *favorable climatic conditions from the beginning to ensure natural seeding.*

In addition, success of natural regeneration of fir need 5 requirement, namely:

- ***suitable spatial structure of the restored stand** (height differentiation of vegetation).*

If any of these conditions are not met, the success of natural regeneration is severely restricted, either, but more frequently entirely excluded.

Natural regeneration of silver fir - potential problems and causes

When analyzing the difficulties of natural regeneration of fir is possible to describe three basic situations:

- *Fir natural seeding not arise in the restored stand.*
- *Natural seeding of fir die in the first years of life before their security.*
- *Natural seeding of fir seem secure, but die and do not apply in the subsequent stand.*

The cause of the first situation can be:
a) lack of resp., poor quality seeds,
b) unfavorable, unsuitable soil conditions for germination.

The causes are usually in second situation:
a) inadequate state of the upper layers of soil
b) unsuitable microclimatic conditions
c) adverse effects of biotic factors

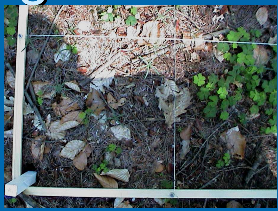
The third situation is caused by:
a) the sudden release of fir natural seeding is not growing,
b) severe damage to the destruction of natural seeding wasteful cutting and skidding,
c) damage of wildlife, insect and fungal pests,
d) competition from other species and weed.

Spatial regulation of natural regeneration

*Spatial regulation of naturally regenerated fir stands, respectively mixed stands with fir tree representation is built primarily on different varieties of **small-scale shelterwood fellings - gap fellings**.*

*In a similar way you can also use the spontaneous regeneration of fir stand in clearings, resulting in incidents such as harvesting. Besides shelterwood fellings fir can be successfully regenerated by form of **strip-shelterwood fellings**, respectively in the inner peripheral edge of **the border fellings**.*

Temporal regulation of natural regeneration



- *The basic parameter is the length of time editing regeneration time, which must be in the stands with the representation of fir significantly longer than in other stand types. If natural regeneration is to be successful and follow-fir stands to be environmentally stable,* ***must be regeneration time longer than 30 years, and no exception will be cases where from the first intervention to final felling of stand 60 or 70 years.*** *Thus stand reaches the height and thickness differentiated stand structure with vertical or stepped canopy closure. Regeneraiton of fir is always tied to a larger number of seed years.*

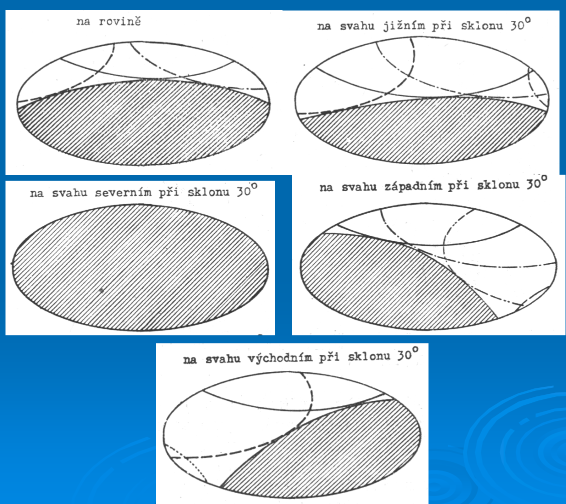
Artificial regeneration

- *If we want to increase the proportion of fir in our forests to the already mentioned 5%, it becomes artificial restoration of this important species silviculture chalenge.*
- *In terms of spatial arrangements can theoretically restore the artificial fir use all basic types of regeneration methods, the practical importance are only the first two:*
- *below the parent stand (underplantings)*
- *regeneration by strip felling (where the width of the cuts is smaller then h)*

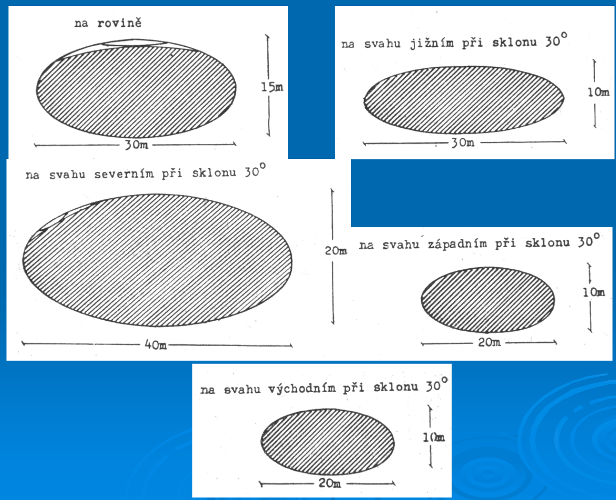
Artificial regeneration of fir on *strip fellings*

- *Regeneration by strip fellings are all types of regeneration clear cuts (gap felling, wedges, strips), whose width is less than the height of regenerated stands. Also included are classic border cutting with the outer edge, of course, again narrower than the height of the parent plants.*
- *Necessary protection against direct solar radiation is ensured by a suitable width and orientation of the applied cuts. Extremely interesting findings on this issue can be obtained from forgotten, forty year old study - Číhal, Jurča (1961).*

Illustration of the shadow boundaries shift of 20 June at clear cut elliptical gaps (40x20 m), height of the stand 30 meters (Číhal, Jurča 1961)



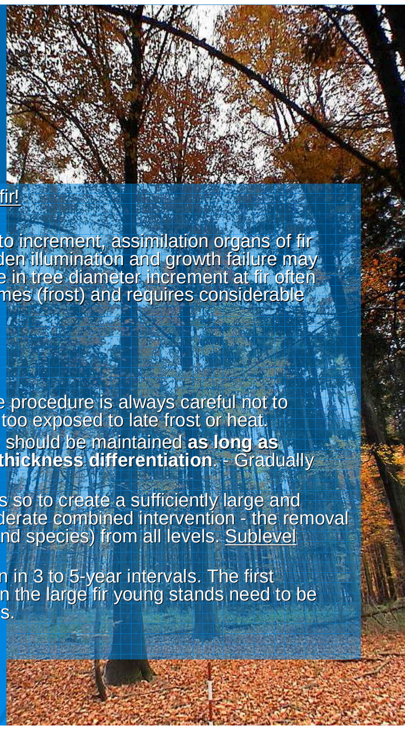
The size and shape of the clear cut gaps when requesting full-time permanent shade of 20 June, on stand height 30 m (Číhal, Jurča 1961)



Regeneration - conclusion

- *In both natural and artificial fir regeneration must primarily be respected basic biological and ecological requirements of this species. So that it can be raised its representation in our forests from less than 1% to 5% required. In simplified form it can be stated that the fir must be regenerated and subsequently grown on appropriate sites in mixed, age, height and thickness differentiated stands.*
- *Natural regeneration is of course primarily tied to the present of seed bearing trees in the stand. In the long regeneration time (30 to 70 years) appears to be most efficient and most effective form of various shelter cuts (gaps, strips, wedges).*
- *Artificial fir recovery will be applied everywhere, where we can not use natural regeneration. The basic rules are the same artificial recovery as the recovery of natural - long regeneration time and differentiated spatial arrangement of newly established stands.*
- *Essential for successful growth of fir is an effective protection against animals.*

Tending of fir



Need to respect the characteristics and requirements of the fir!

- Fir needs shade in youth, after releasing responds well to increment, assimilation organs of fir which was long time in shade is difficult to adapt to sudden illumination and growth failure may occur. After adapting to the new lighting and an increase in tree diameter increment at fir often occurs shell shake. Fir is sensitive to temperature extremes (frost) and requires considerable humidity.

Cleanings:

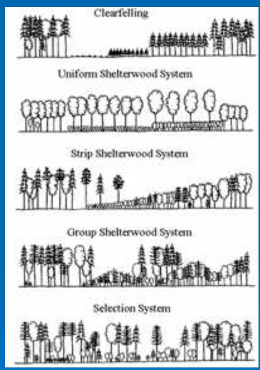
- in young stands keep the motto: "Soon, little, often." The procedure is always careful not to especially natural seeding or young-growth stand is not too exposed to late frost or heat.
- The main principle - Cultivate fir so that in young stands should be maintained **as long as possible (hot and humid) microclimate, height, and thickness differentiation**. - Gradually create vertical canopy closure
- Sufficiently release firs from main level and dominant firs so to create a sufficiently large and dense crown and a good root system. To achieve a moderate combined intervention - the removal of fir trees with narrow crowns and inadequate shape (and species) from all levels. Sublevel individuals are left to maintain a suitable microclimate!
- Thus we proceed in **young-growth stand** with repetition in 3 to 5-year intervals. The first intervention force of 3 to 10%, while the other 4 to 7%. In the large fir young stands need to be supported approximately 500 to 700 pieces dominant firs.

Tending

Thinning treatments:

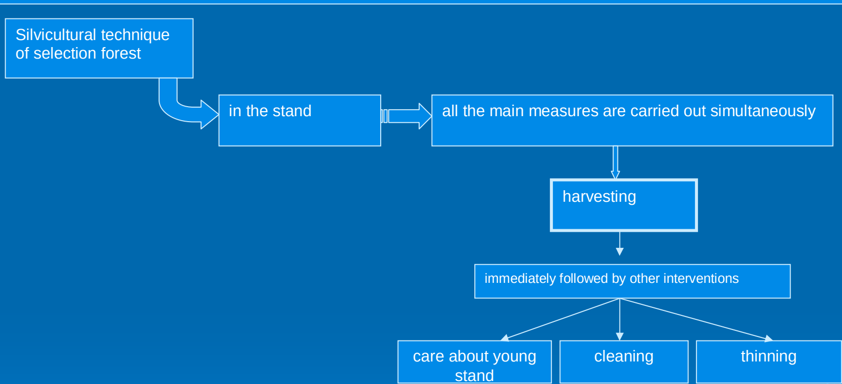
- Due to the current low representation of fir is necessary to support its representation in the forests. Firs are released to create a regular deep crown - to increase their resistance and durability.
- We use **thinning from above** to achieve graded structures stand (vertical canopy closure), suppressed firs are not removed (needs shade), using the skills of an exceptionally long response increased increment after accretion.
- We prefer **positive selection**, during thinning in fir stands we take care of a number of selected quality tree from main level of the stand (especially crown parameters), the spacing should not be less than 4 m. The optimum spacing of the target trees in pole-stage stand is 5 to 6 m.

Silvicultural Systems



- Complete removal of trees and artificial regeneration.
- Uniform opening of the canopy for regeneration purposes.
- Opening up promising groups of advance regeneration; comparatively short regeneration period.
- Opening up the canopy in narrow coupes.
- Rolling system.

Selection system



"A balanced uneven-aged stand (selection system) is a *temporal* and *spatial coexistence* of *regeneration*, *young growth*, *mature stand* and *old growth*, which highly *influence each other*."
Smith et al., 1997

"A forest managed as selection system consists of trees whose *crowns do not touch each other*, but *occupy the whole vertical growing space*. This forest has a *temporal* and *spatial continuity of structure* and is always managed through *selection fellings*."
Schütz, 1989

Tree Species

- The “classic“ species composition is silver fir (*Abies alba*), Norway spruce (*Picea abies*), beech (*Fagus sylvatica*) and arolla pine (*Pinus cembra*). Recently also sycamore (*Acer pseudoplatanus*), and ash (*Fraxinus exelsior*) are often used.
- the application of a selection system is not limited to these tree species

Advantages and limitations of the selection system.

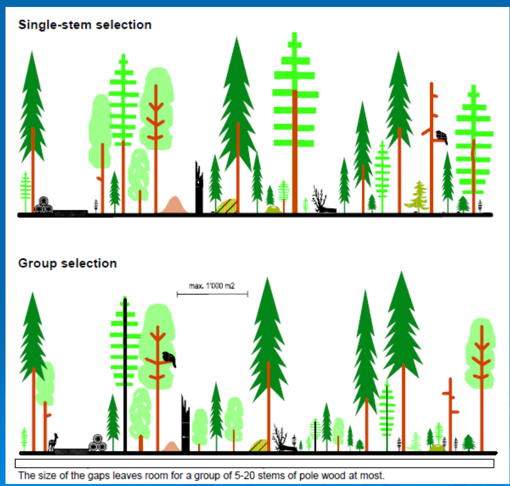
Advantages

- Emulates the gap-phase processes that occur naturally due to small blowdowns.
- The only silvicultural system that creates or maintains unevenaged stands.
- Excellent for promoting natural regeneration of shade-tolerant species.
- Provides excellent site protection, with little exposure to wind and insolation.
- Invasion by competing species is reduced due to maintenance of overstory and understory vegetation.
- Overstory provides continuous seed supply.
- Regeneration always has the protection (and competition) of older trees.
- Higher (biological and economical) gross production than evenaged systems, because growing space continually occupied, and more area allocated to growth of large, vigorous trees.
- Provides capital returns at short intervals.
- Provides a continuous flow of high quality timber.
- The canopy and associated vegetation maintain cover and food supply for wildlife species adapted to uneven-aged forests.
- Most aesthetically pleasing type of harvest.
- Provides a stable environment, including prevention of erosion, landslides and rapid runoff on steep slopes.

Limitations

- Complex, simultaneous operations (harvest, thinning, site preparation); work is spread throughout the stand and requires highly skilled workers and close supervision.
- Immediate operational costs are higher (crop trees scattered, frequent returns, etc.).
- Must ensure that intermediate cuts in younger age classes are not neglected while harvesting the crop trees.
- Must apply careful logging practices to minimize damage to residual trees and regeneration.
- To maintain mid-tolerant species in a stand dominated by tolerants, may need to combine group selection (followed by site preparation) with single-tree selection.
- Limited applicability to shade-intolerant species.

Forms of selection



Single-Tree Selection

- Single-tree selection is used in **uneven-aged silvicultural systems** in which individual trees of all size classes are removed more or less uniformly throughout the stand to achieve desired stand structural characteristics. The primary advantage of single tree selection is that it maintains tree cover and moderates environmental conditions. As a result, it is well suited for many nonmarket objectives and is ideal for protection forests.

- Single-tree selection methods are most appropriate for stands in which **shade-tolerant species** are desired.

- **Differences Between Managed and Unmanaged Uneven-Aged Stands**

Single-tree selection, in theory, simulates the natural gap-phase dynamics that occur in mature unmanaged natural stands (Bormann and Likens 1979). According to the **gap-phase hypothesis**, the death of a mature tree creates a canopy gap, and a new cohort develops in the patch of light that reaches the understory. The single-tree selection method differs from gap-phase regeneration in several respects (Nyland 1996):

- Selection cutting creates more gaps per unit area and with a more regular distribution than normally occur in a single year by natural gap-phase replacement.
- Foresters apply the selection method at regular intervals, creating a more uniform age class distribution over time.

Therefore, compared with unmanaged uneven-aged stands, single-tree selection stands have:
- (1) greater numbers of seedlings and saplings per unit of area,
- (2) less distance and more regular spacing between the regeneration openings, and
- (3) added understory brightening due to periodic thinning and regularly scheduled cutting to recruit new age classes across fixed proportions of the stand area at predictable intervals.

Group Selection

Group selection is an uneven-aged silvicultural system in which *trees are removed and new age-classes are established in small groups.*

Group selection is similar to single-tree selection in that it involves **periodic cuts** that:

- (1) establish and develop reproduction;
- (2) improve stand structure and quality;
- (3) create a balanced even-aged stand; and,
- (4) control residual stocking for an even flow of products.

These cuttings open the same fixed proportion of stand area in both group and single-tree selection methods. The distinctive feature of group selection is that these cuttings are concentrated into *fewer gaps of larger sizes*; one advantage is that intermediate and shade-intolerant species can be regenerated (Roach 1974, Nyland 1996).

- The basic steps of how to apply group and single-tree selection are similar, as are the advantages and disadvantages. Some studies have shown that the economics of timber harvesting using group selection compare favorably with those using clearcutting.

- There are several variations of the group selection method, including **patch selection**, **strip selection**, **group shelterwood**, and **group selection with reserves**. These methods are explained below.

Comparison of single tree and group tree selection.

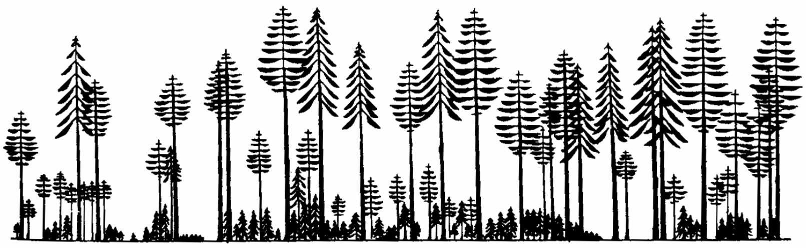
Single-Tree Selection

• Creates small openings, where reproduction of tolerant species is easily obtained.
• Reproduction develops in small, scattered openings.
• Site protection (from wind and sun) is excellent.
• Aesthetically pleasing.
• Need frequent, light cuttings to prevent domination of the growing space by canopy expansion.
• Operator training and careful planning will ensure protection of regeneration and residuals.

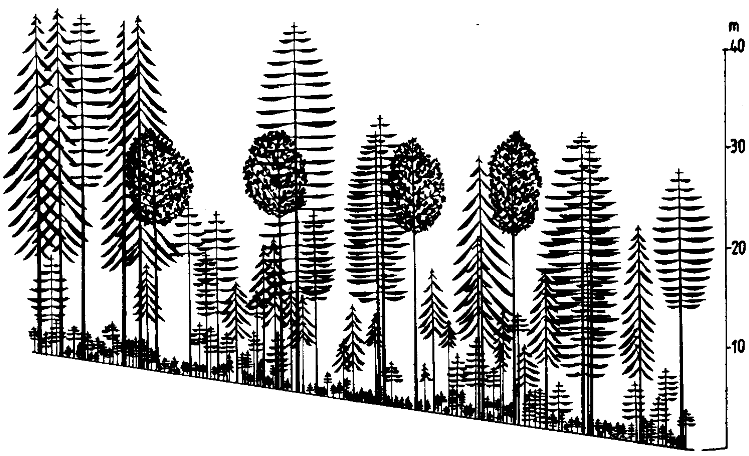
Group Selection

• Creates larger openings, suited to mid- and intolerant species.
• Regeneration grows up in small even-aged groups, promoting better stem form.
• Some loss in site protection and aesthetic appeal.

Vertical structure



Obr. 166. Typ zmiešaného smrekovo-jedľového výberného lesa na stanovištiach s ekologickým oslabením buka (Thun, 915 m n. m., Švajčiarsko, podľa AMMONA 1944)



Obr. 165. Výberný les tvorený ihličnatými drevinami (smrek-jedľa-borovica) s dôslednou výškovou diferenciáciou smreka a jedle (SL Smolník)

362

Control Method

The control method was developed by the French forester GURNAUD. It was put into practice in the forests of the Travers Valley by Henri BIOLLEY. It was chosen as being the most suitable as a guide to silvicultural treatment and most of all as a means to verify the results of the conversion into selection stands at regular intervals.

The most important elements of the control method are:

- **full callipering of all stands (100% cruise)**
- **before harvest, measurement on standing tree**
- **use of a single standard tariff for volume determination**
- **delimitation into permanent compartments.**

Biolley clearly defined the management objectives. They are to produce

- **continuously**
- **the highest possible quantity**
- **in the best possible way / with the highest possible quality**

using the resources provided by nature – soil, atmosphere and stand (the “forestry triptych”).

Optimising production and seeking a maximum of benefits (multiple uses of forests) are still the main objectives of a modern high quality silvicultural treatment (sustainable forest management).

DBH distribution as an Indicator

Zákon Liocourtův - v každém dokonalém výběrném lese, nalézajícím se v rovnováze, zmenšuje se počet stromů od jednoho stupně tloušťkového k druhému podle stálého poměru. Tuto skutečnost je možno matematicky zapsat:

$$N_n = a \cdot q^{-(n-1)}$$

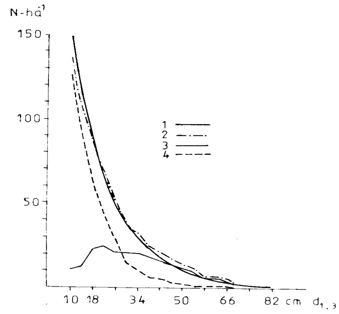
kde:

N_n - počet stromů příslušného tloušťkového stupně ni

a - maximální počáteční četnost v prvním tloušťkovém stupni

q - kvocient geometrické řady (zpravidla v rozmezí 1,3 – 1,5)

n - počet tloušťkových tříd



Obr. 168. Rozdelenie počtu stromov **podľa** hrúbkových stupňov spolu pre celý **súbor** stromov a pre dreviny vo výber**nom** lese na LS Kokava, dielec 9 d_1 **(podľa** PRIESOLA 1971): *1* – vyrovnaný **stav**, *2* – skutočný stav spolu, *3* – jedľa, **4 – buk**

365

More about control methods

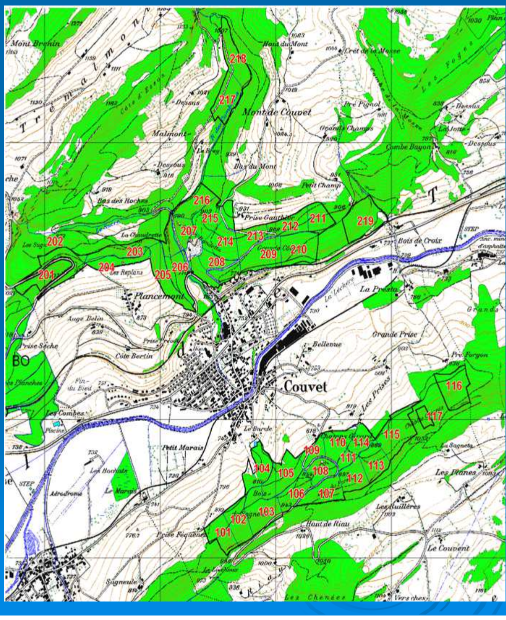
- http://oryx.mendelu.cz/hul2/index.php?option=com_content&task=view&id=32&Itemid=39

Geographical distribution of areas with a long tradition of selection systems (Schütz, 2001)

Couvet

- **Main Character (Exemplarity):** Couvet communal forest is treated since 1890 with the plenter system (selection forest system) initiated by Henry Biolley, jointly with the Control sampling Method. It has been applied uninterrupted up to now.
- It's one of the best examples of the good practice of the plenter system for fir-spruce-beech mixed forests at mountainous elevation.
- Two compartments on a north and south slope allow exemplifying the influence of aspect, as important site factor, on stand development.
- Results of the treatment are aptly documented from 16 successive full inventory form the Control Method. Economic results are available too.
- A well documented teaching trail is utilisable for self visit (didactic trail guide downloadbar).

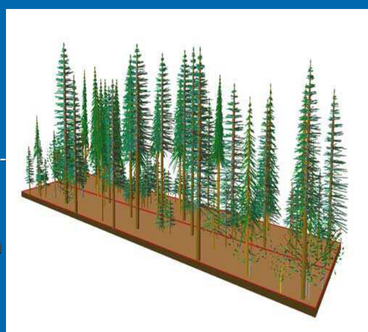
Couvet



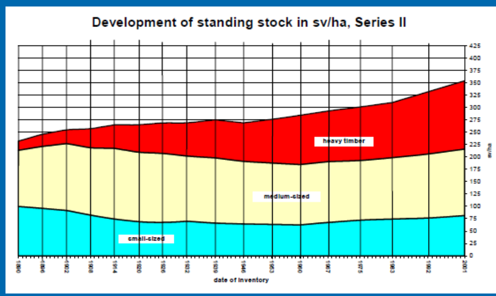
Area: 178 ha (101 ha N-Serie I, 77 ha S-Serie II)

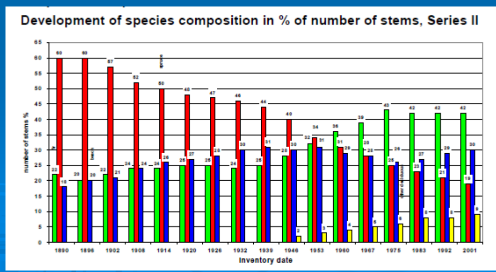
Couvet

- Typical forest structure Compartment I/9
- Standing volume 505 m3/ha; Basal area: 42 m2/ha; Distribution (small–medium-large) timber:10/16/74 %
- Small timber (dbh cat. 20,25,30), medium (dbh 35-50), large (more than 50)
- Yield: The increment of the initial stock has varied between 4.8 and 8.3 sv/ha/a (6.2 sv/ha/a on average). The increase in standing stock led to an appreciable rise in wood production, without any negative effects on regeneration.
- The development of the current increment is analogous in both management series. With an average ingrowth of 1.6 sv/ha/yr the regeneration of these stands seem to be ensured. Yet appearances are deceptive; an entire generation of young firs and maples are disappearing because of browsing by deer. In a couple of decades this will lead to a decrease in ingrowth.



Thanks to the treatment with the plenter method, applied now for over a century, and by increasing the average stem volume, the distribution within the marketable assortments has improved. Over 90% of the total yield put on the market is now saw wood, compared with 50% in the first management period.





Photos

- Couvet
- Zalesina