



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

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

Natural forests dynamics in Europe

(temperate and boreal bioms)

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LECTURE SCHEME

- A - BIOMS – „temperate“ versus „boreal“
SMALL and LARGE developmental cycle
- B - Concepts of small developmental cycle
- C - Elementary features
How to identify the stages in situ?

MIXED DECIDUOUS FOREST - TEMPERATE

- more tree species, **deciduous** in particular
- key competitive factor: **light**
- **fine texture (horizontal structure)**
- growth space **more fulfilled** (fight for light)
- typ: mixed forests of middle and lower elevations in Central Europe

CONIFEROUS FOREST – **BOREAL**

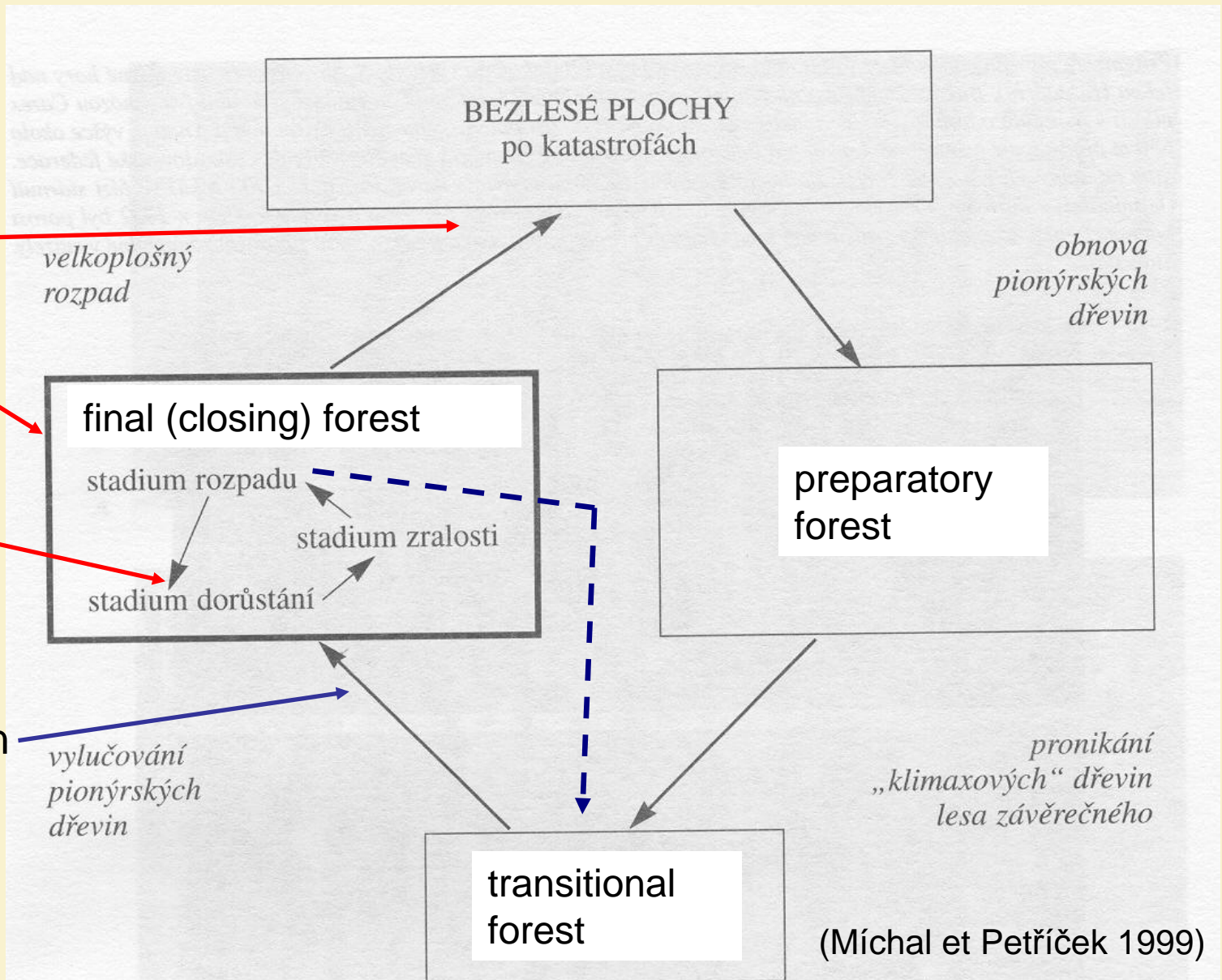
- less tree species, **coniferous** in particular
- key competitive factor: **heat**
- **coarse texture (horizontal structure)**
- growth space **more open** (soil radiation touch the soil surface – heat)
- typ: coniferous dominated forests of higher mountain elevations of Central Europe

A – SMALL and LARGE developmental cycle

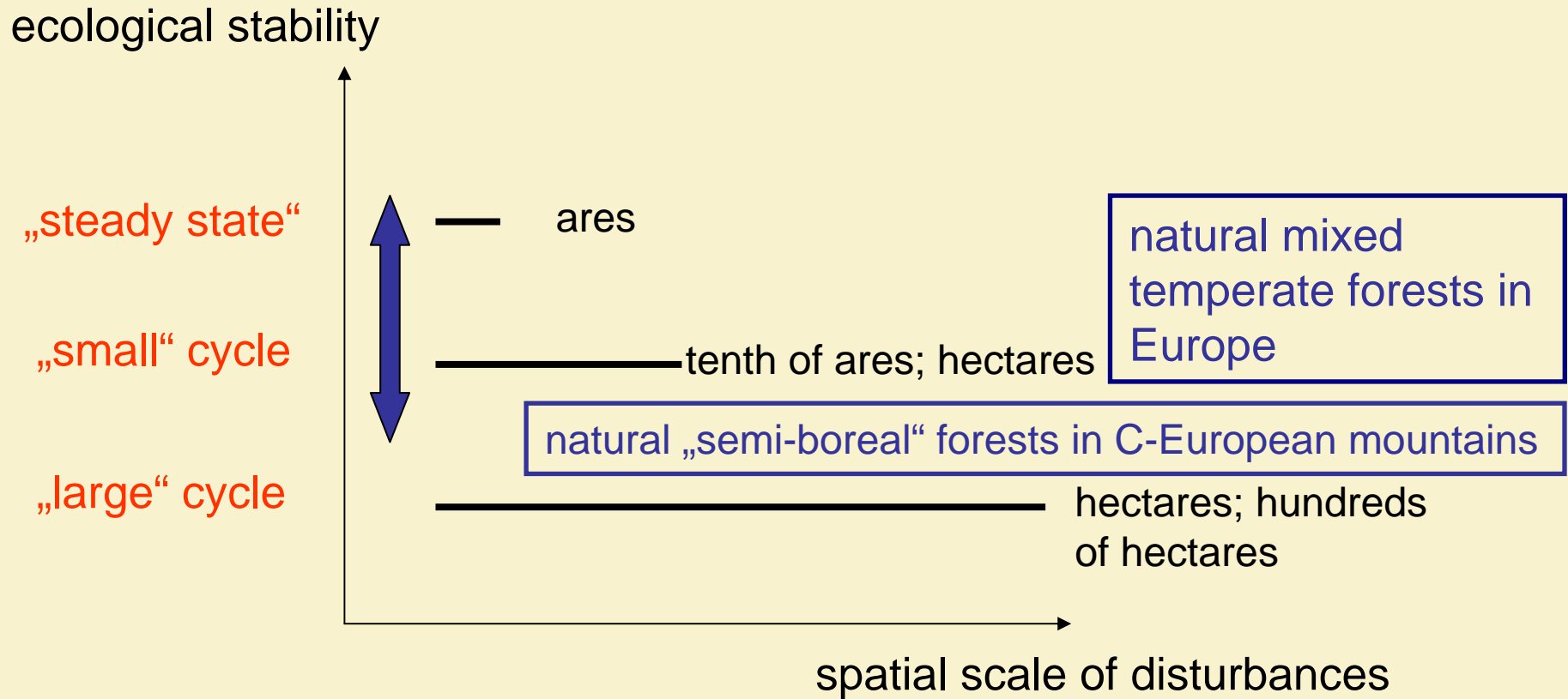
CYCLES

- „large“
- „small“
- steady state

C-European mountain forests



A – SMALL and LARGE developmental cycle



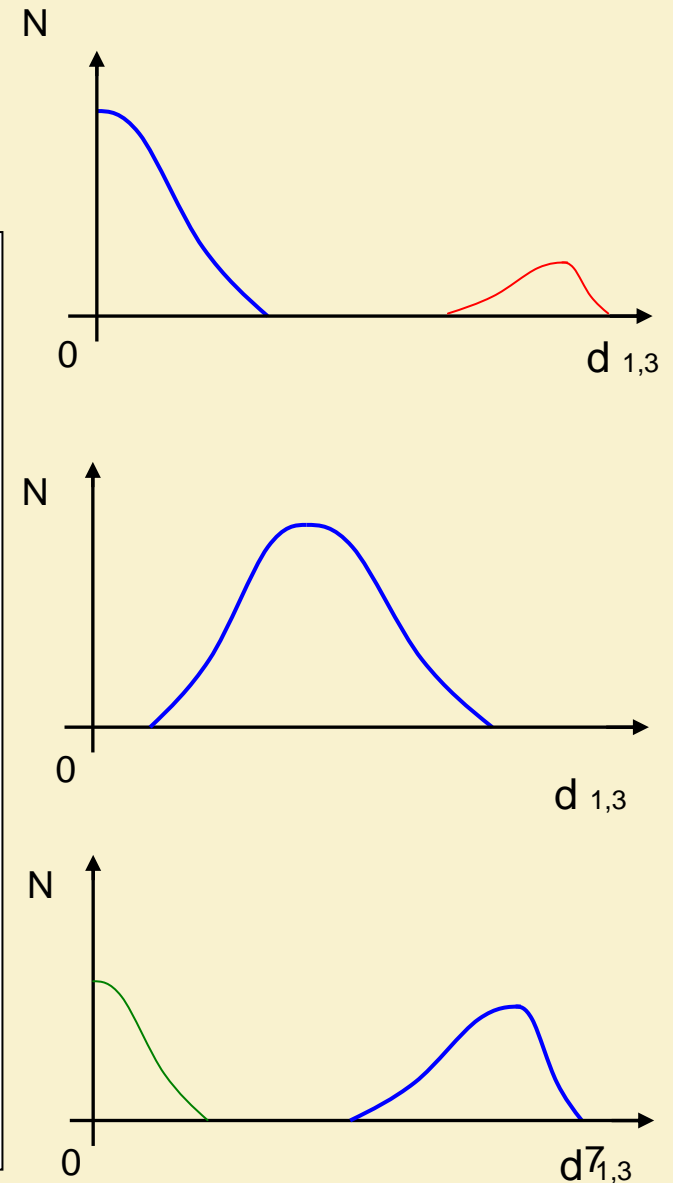
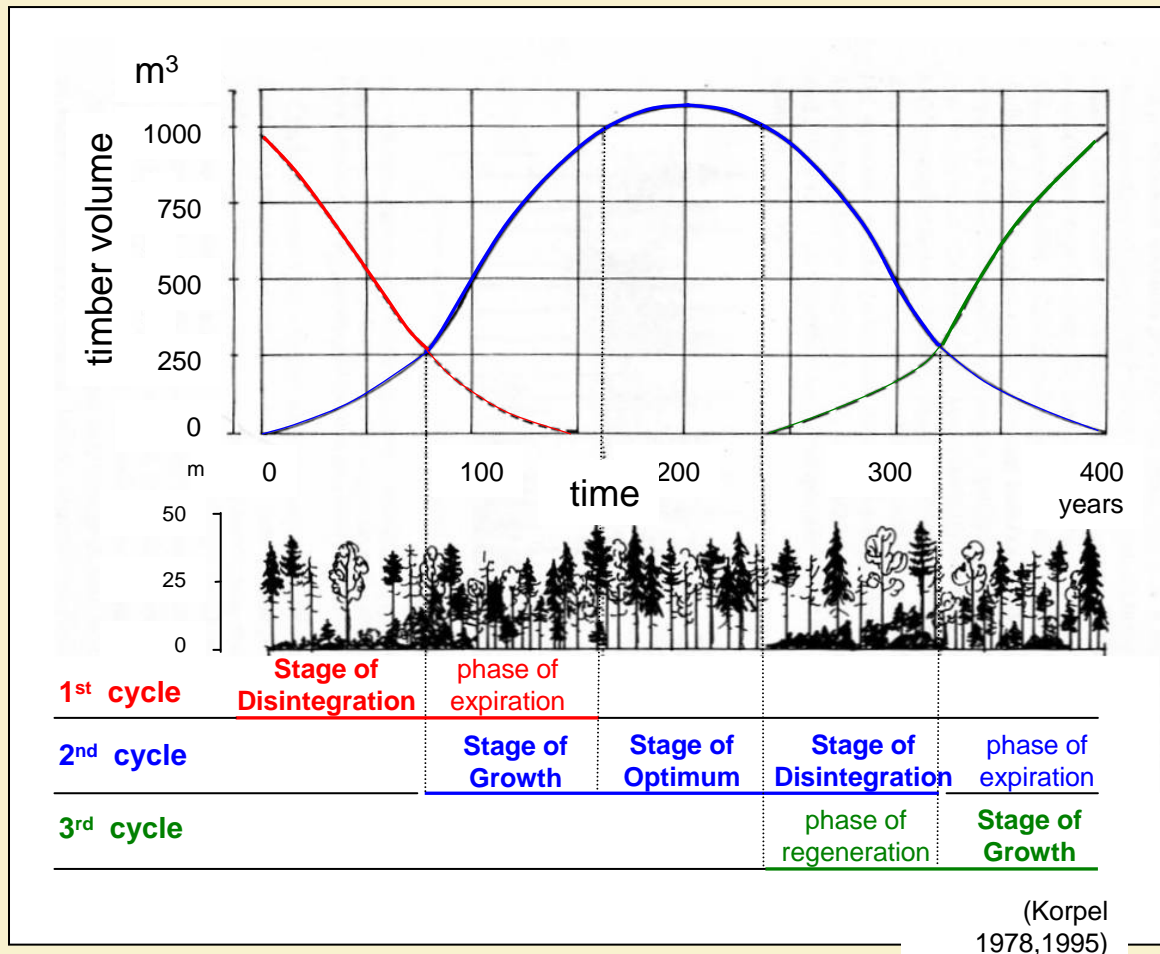
B – Concepts of SMALL developmental cycle dynamics

Theory development

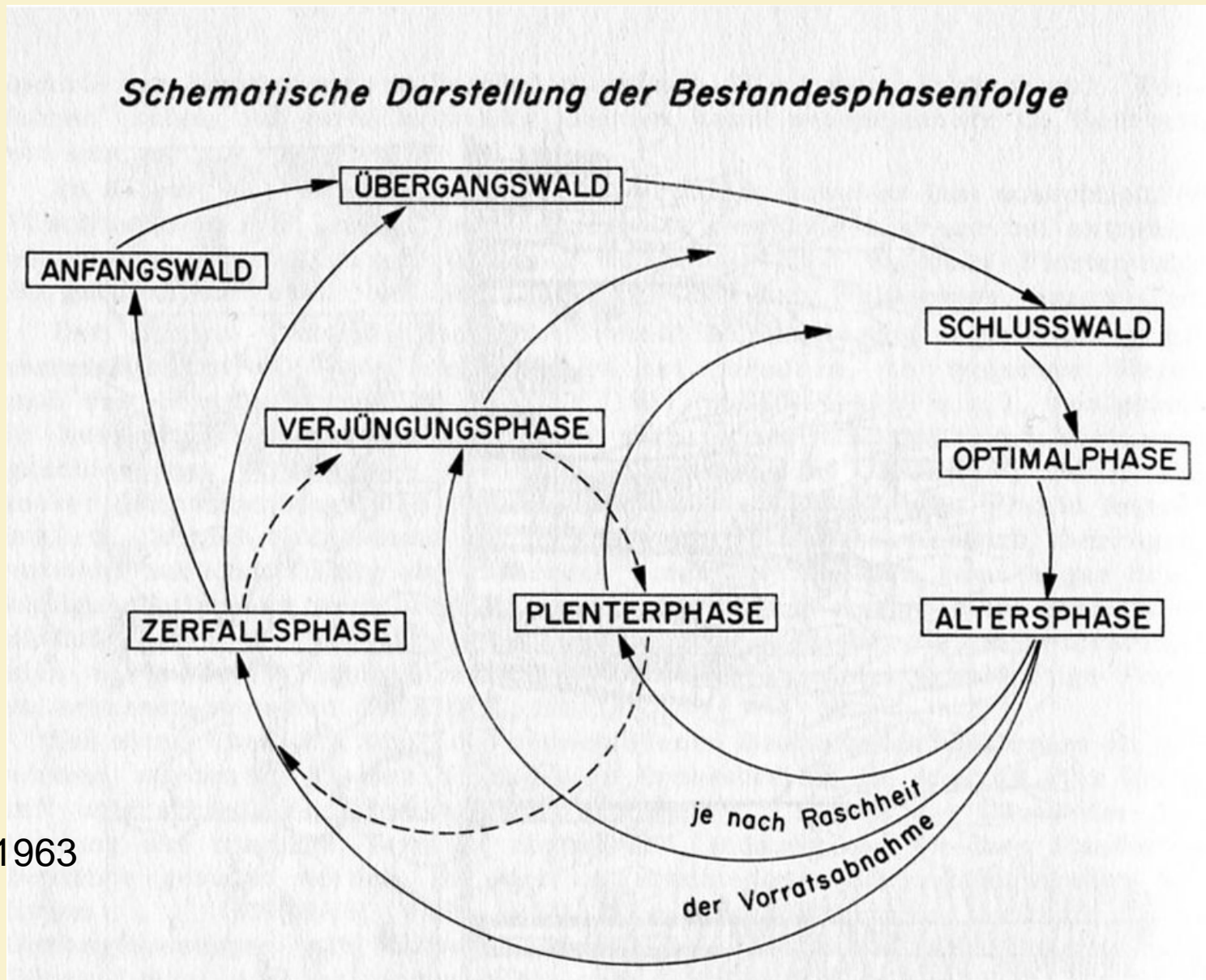
- Leibundgut 1959 (only phases), 1978 (phases, stages consideration)
- Zukrigl 1963 (only phases)
- Mayer et al. 1987 (only phases)
- Koop 1989 – application of Kropel' theory for the deciduous forests
(beech forests.)
- Korpel' 1978, 1989, 1995 (3 stages, every stage - 1-3 phases)
- Tabaku 1999, Drössler 2006 (only phases)
- Král et al. 2010 (exact determination of stages; steady state)
- and others !!!

B – Concepts of SMALL developmental cycle dynamics

Developmental cycle model (Korpel 1978, 1995)

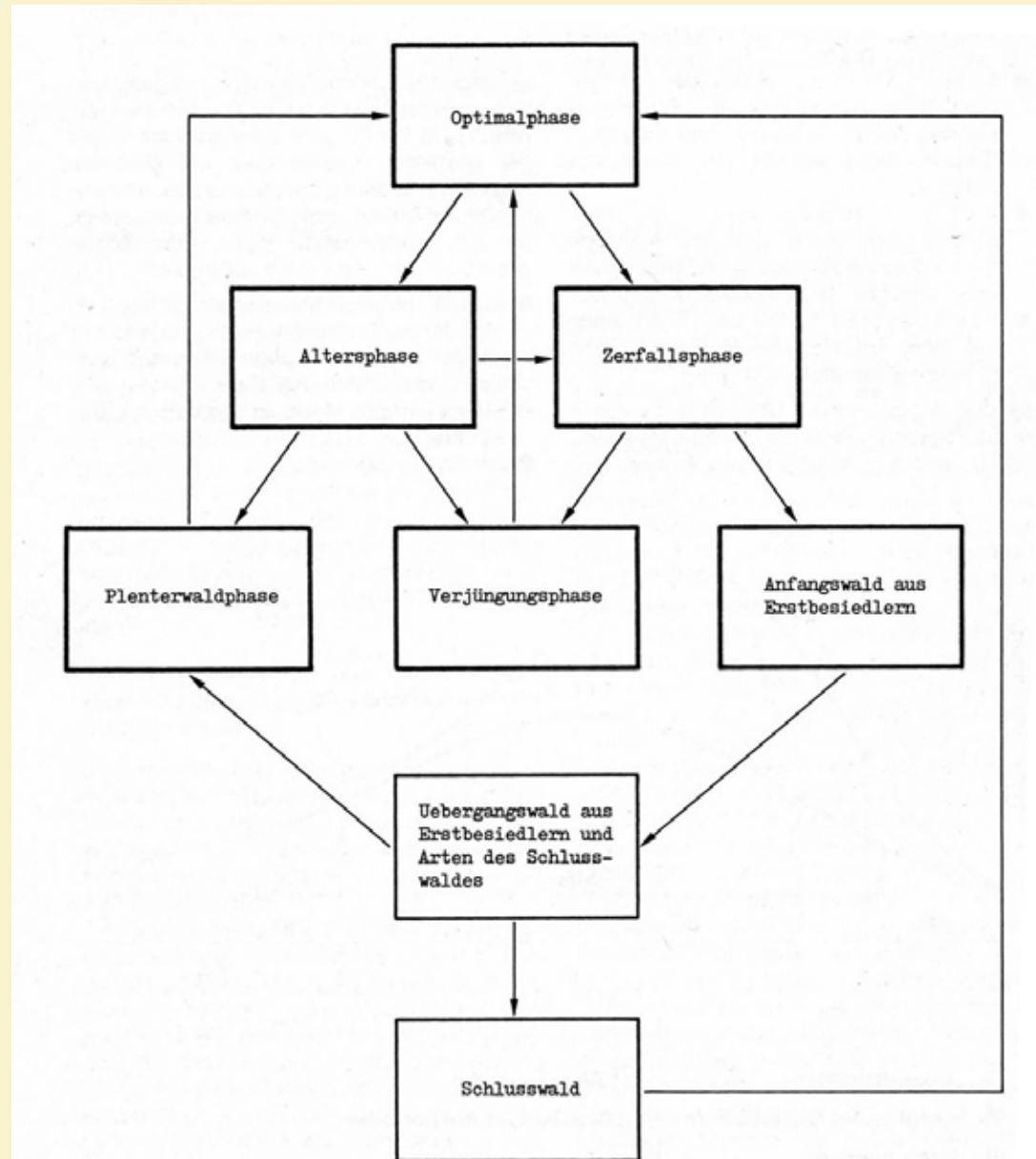


B – Concepts of SMALL developmental cycle dynamics



Zukrigl 1963

B – Concepts of SMALL developmental cycle dynamics



Leibundgut 1978

Darstellung 3: Phasenfolgen im europäischen Urwald.

B – Concepts of SMALL developmental cycle dynamics

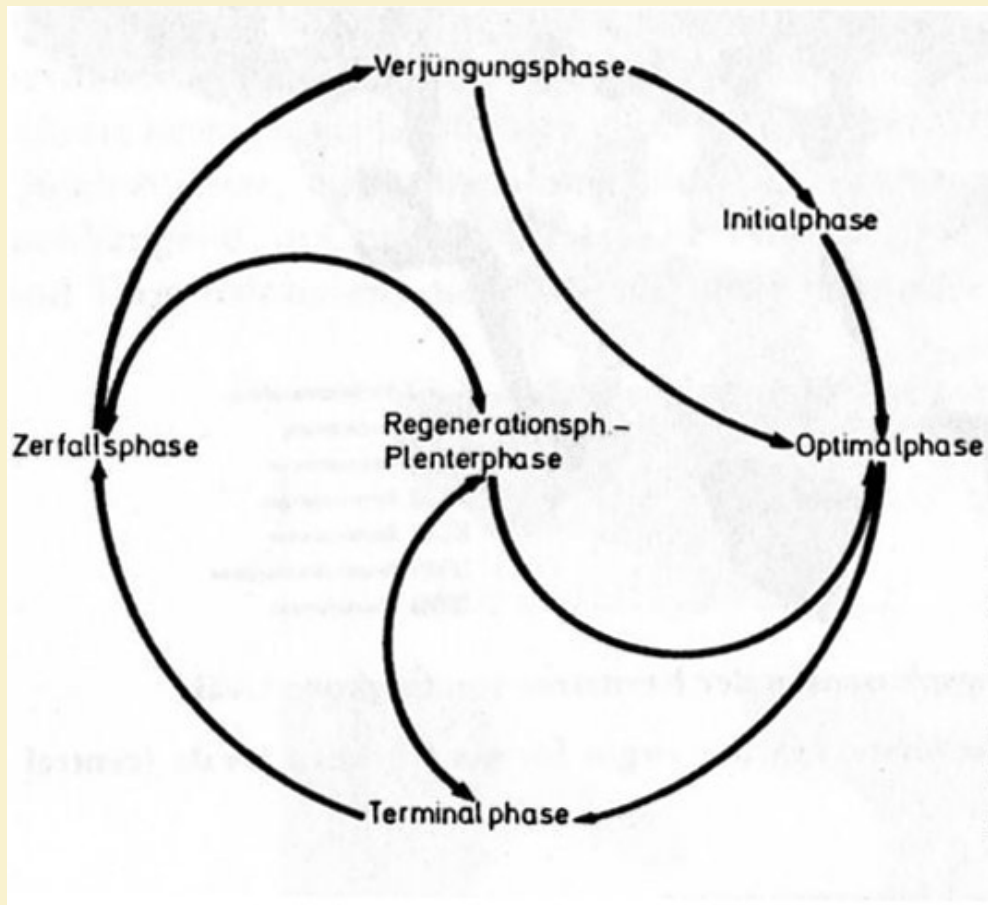
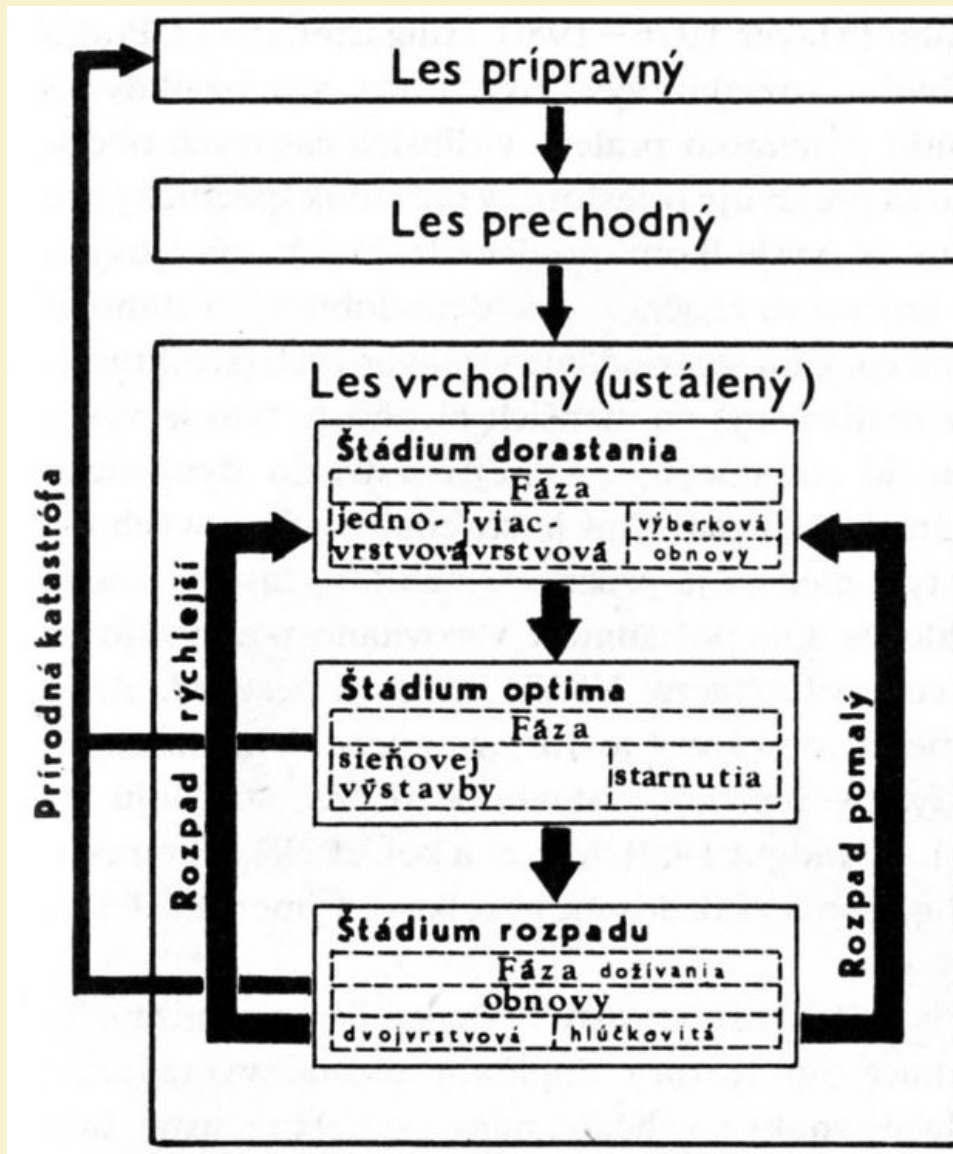


Abb. 9. Schematische Darstellung der möglichen Bestandesphasenfolge in montanen Fichten-Tannen-Buchen-Urwäldern

Fig. 9. Potential cycle of development phases in montane spruce-silver fir beech virgin forests

Mayer 1987

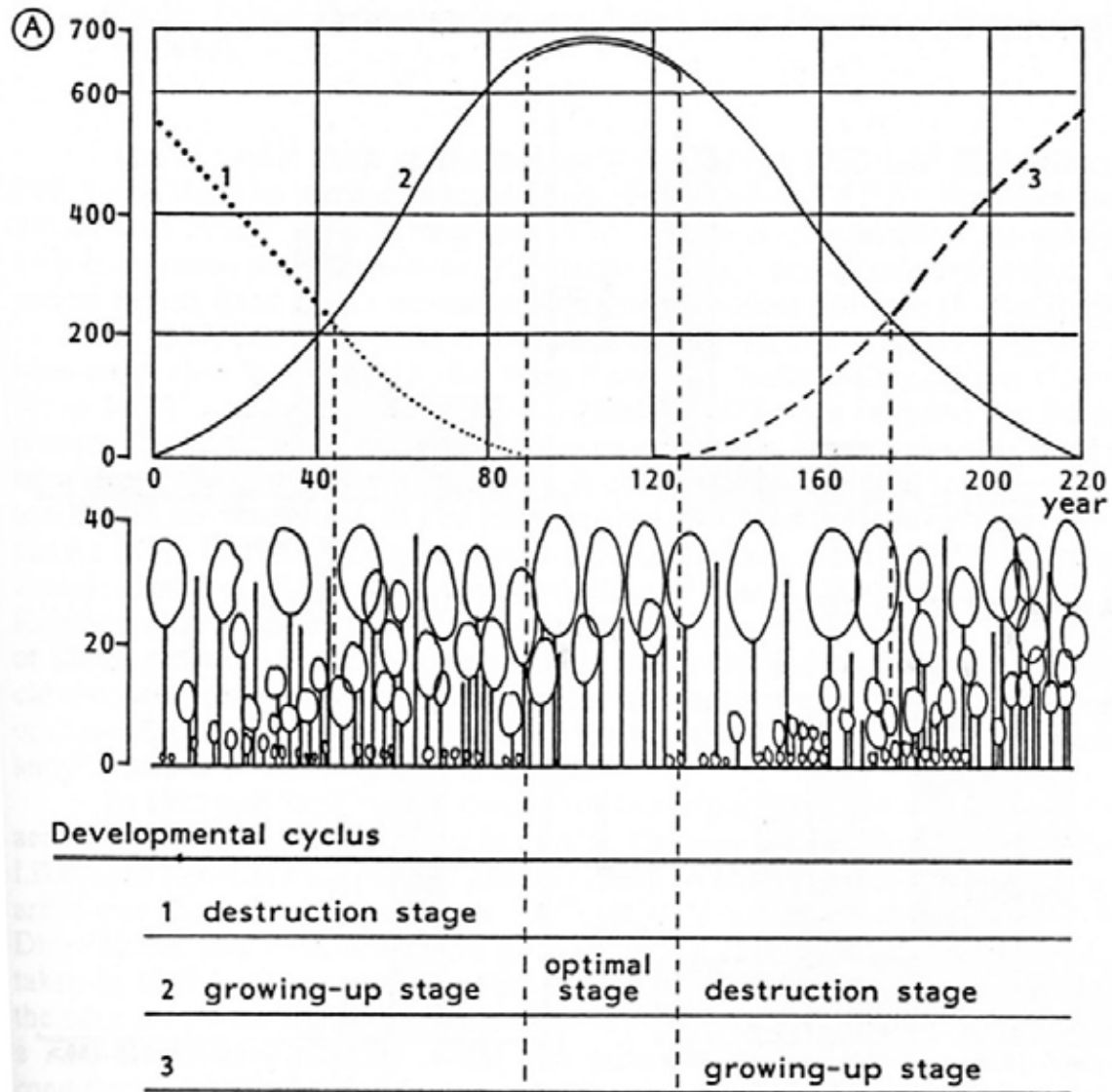
B – Concepts of SMALL developmental cycle dynamics



Obr. 1. Sled, cyklická nadväznosť vývojových štádií a vývojových fáz v závislosti od charakteru rozpadu v pralesoch Slovenska.

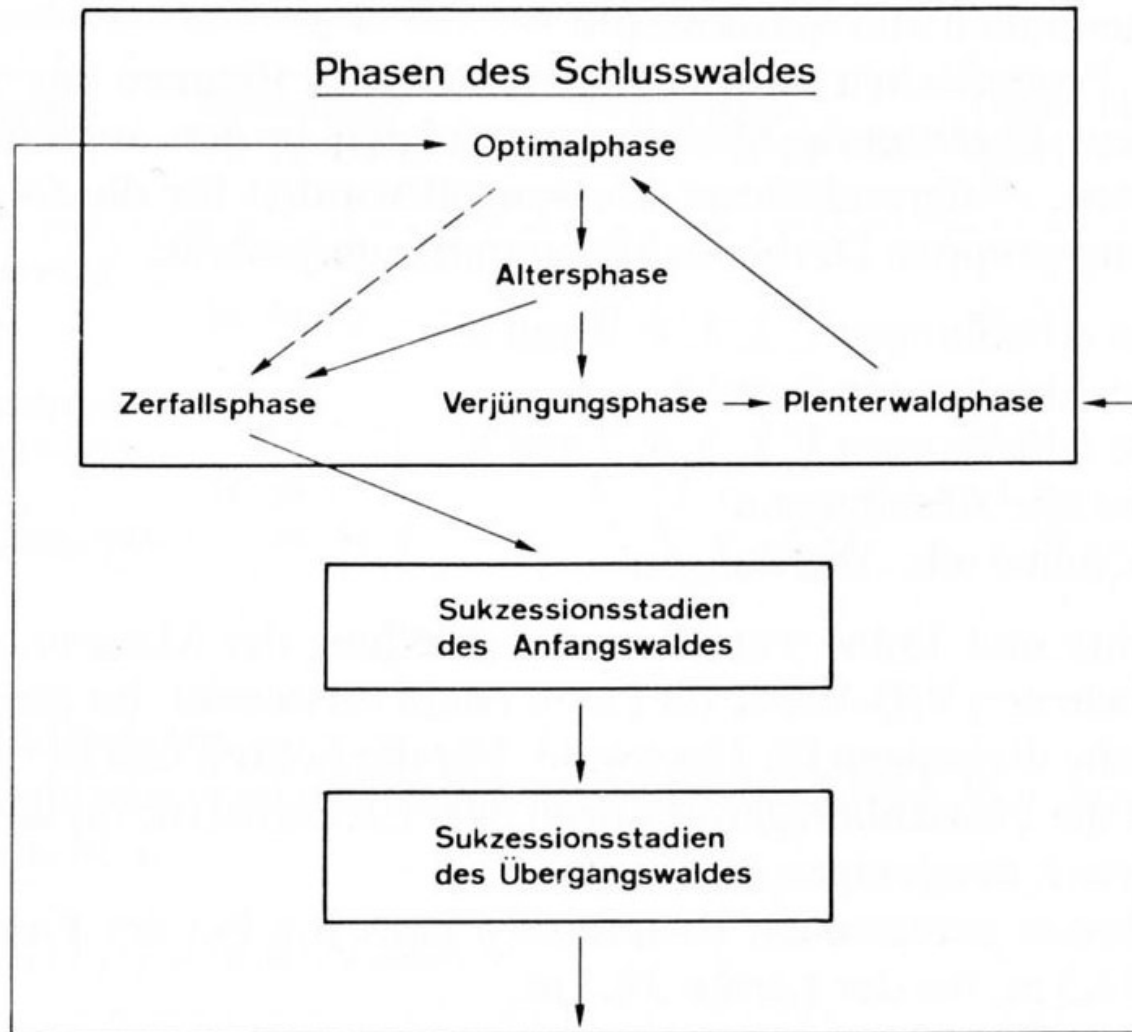
Korpeľ 1989, 1995

B – Concepts of SMALL developmental cycle dynamics



Koop 1989

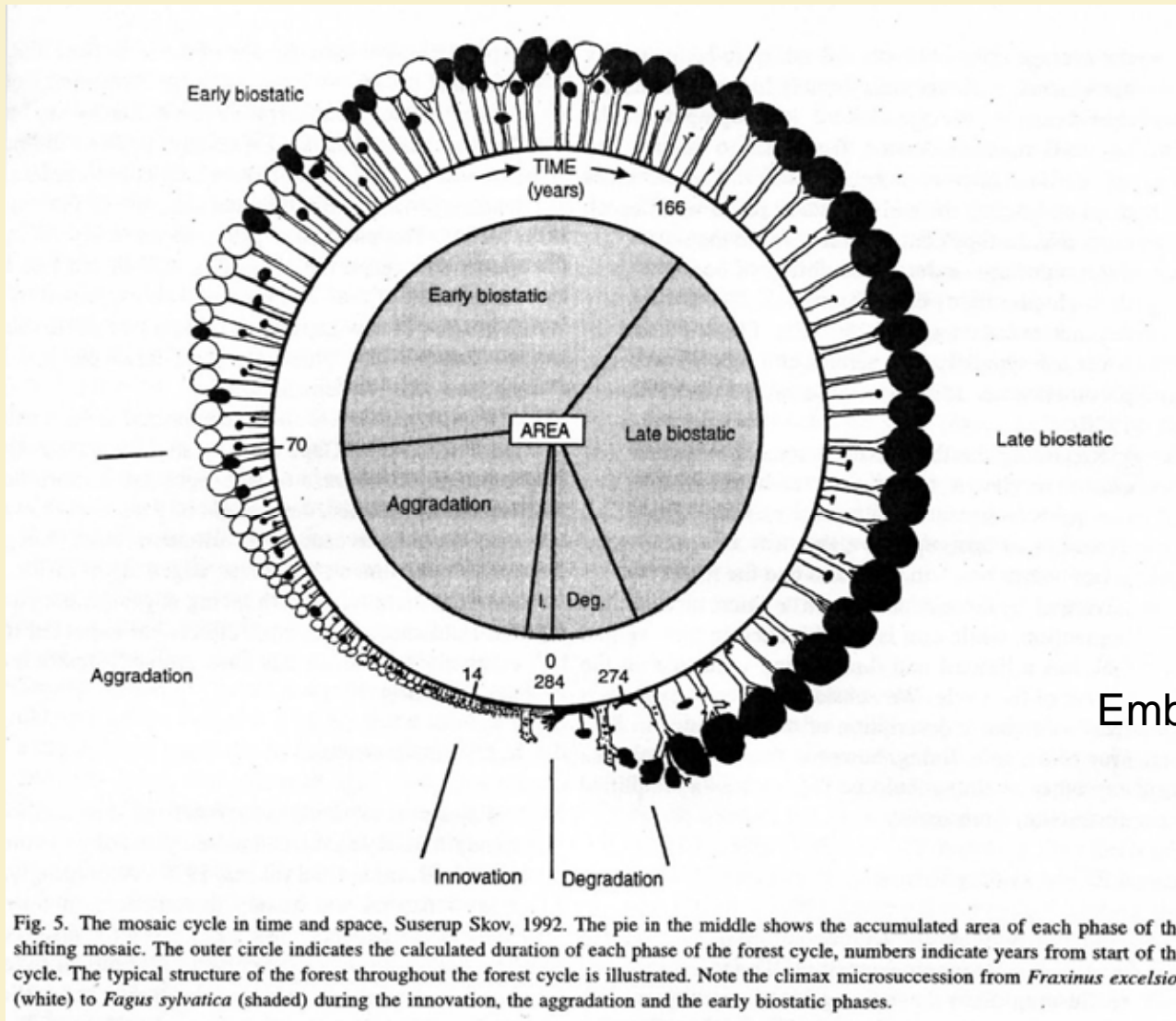
B – Concepts of SMALL developmental cycle dynamics



Leibundgut 1993

Urwald Derborence. Schema der Dynamik von Tannen-Fichten-Buchen-Urwäldern.

B – Concepts of SMALL developmental cycle dynamics



B – Concepts of SMALL developmental cycle dynamics

Christensen et al. 2007

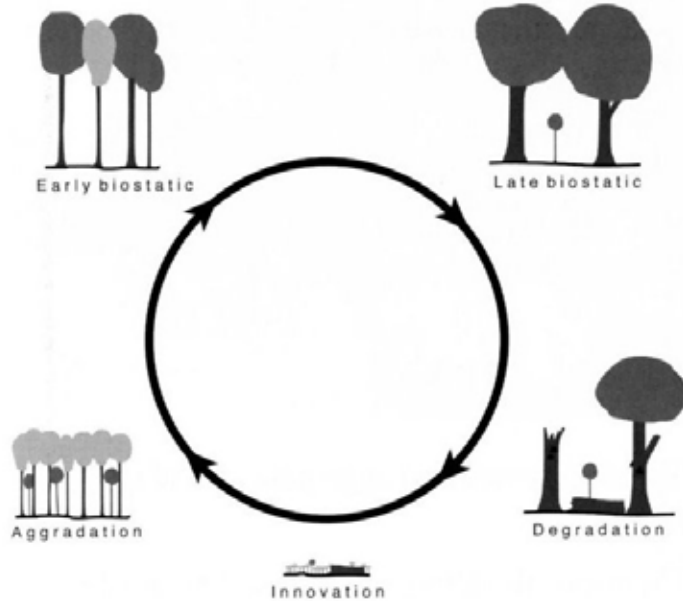


Fig. 1. Model of the basic forest cycle, including five developmental phases termed the innovation, the aggradation, the early biostatic, the late biostatic and the degradation phase, in accordance with Oldeman (1990). The definitions of the phases are described in Table 1.

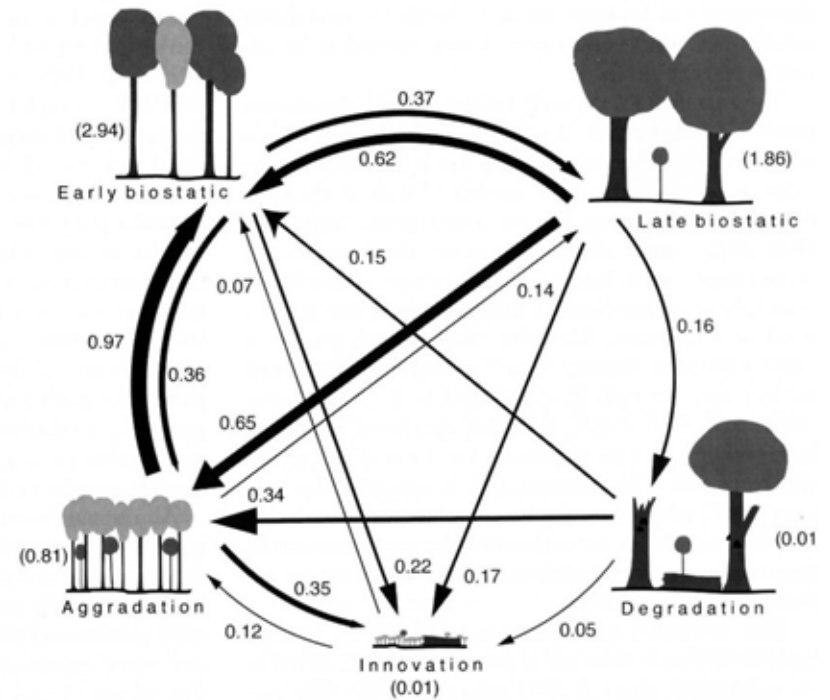


Fig. 4. Refined forest cycle model illustrating area of changes and non-changes (in ha) 1992–2002. The numbers written next to the illustrations of the phases are areas which not changed. The thickness of the arrows indicate the importance of different processes.

B – Concepts of SMALL developmental cycle dynamics

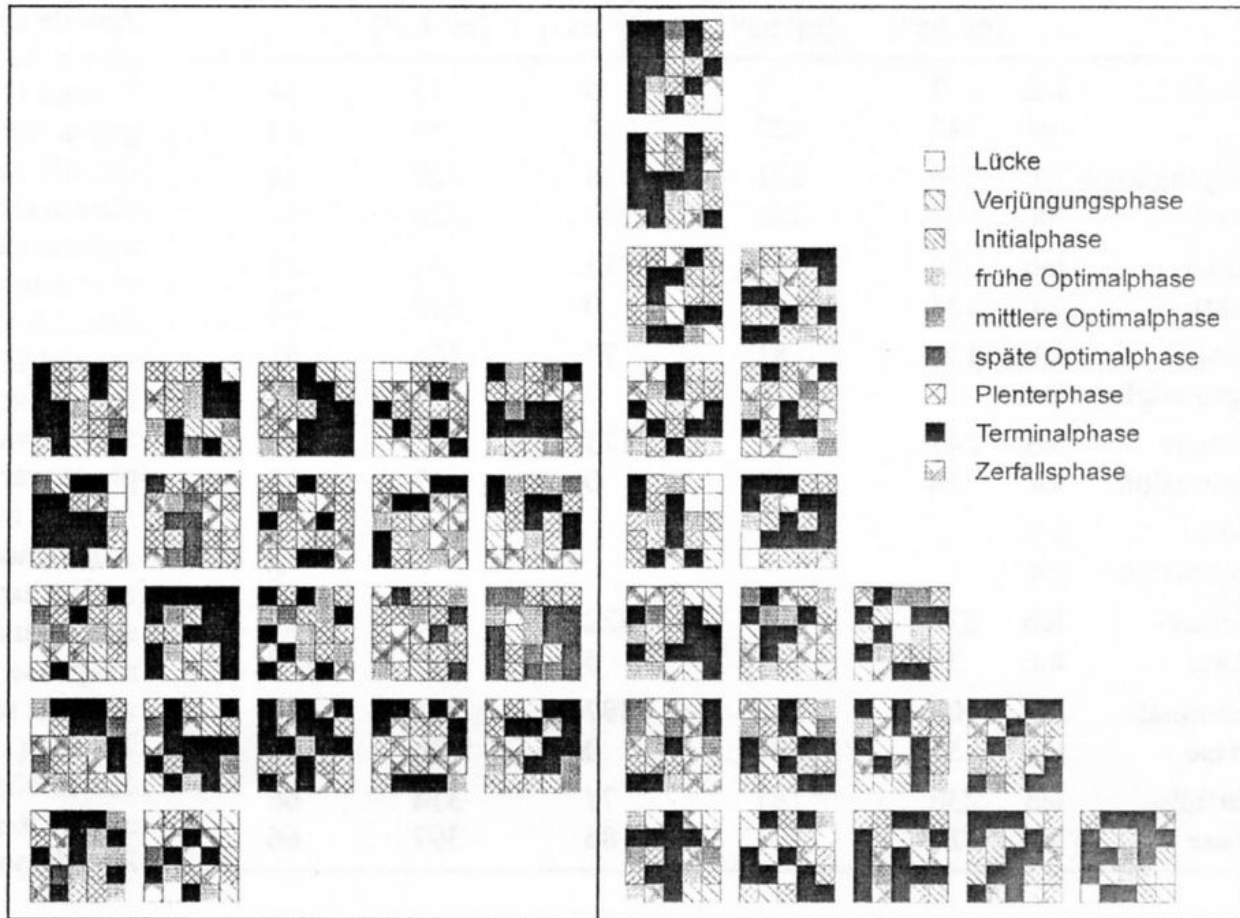


Abb. 3. Ausscheidung der Waldentwicklungsphasen auf 12,5 m x 12,5 m-Flächen für die Urwaldreservate Havešová (links) und Kyjov (rechts). Die einzelnen Probeflächen sind in Havešová 200 m und in Kyjov 20 m voneinander entfernt.

Forest development stages in Havešová (left) and Kyjov (right) determined on 12.5 m x 12.5 m squares. The distance between sample plots (62.5 m x 62.5 m) is 200 m in Havešová and 20 m in Kyjov.

Tabaku et al. 1999
Drössler et al. 2006

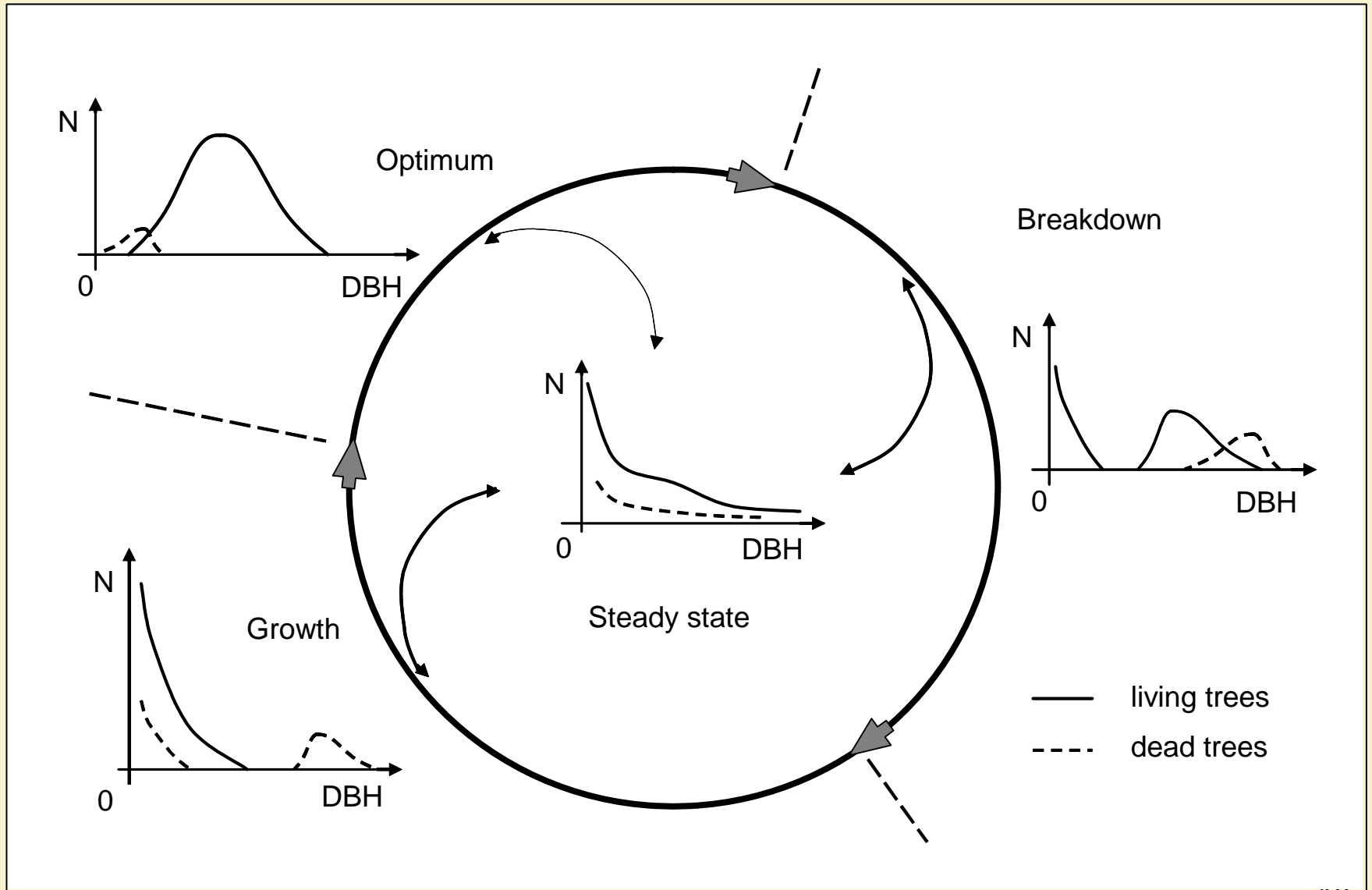
B – Concepts of SMALL developmental cycle dynamics

- Stages characterizes DBH distribution and volume development of trees and the living/deadwood ratio
- Phases presents different forms into the stages and they are characterized by stand type

Studied parameters:

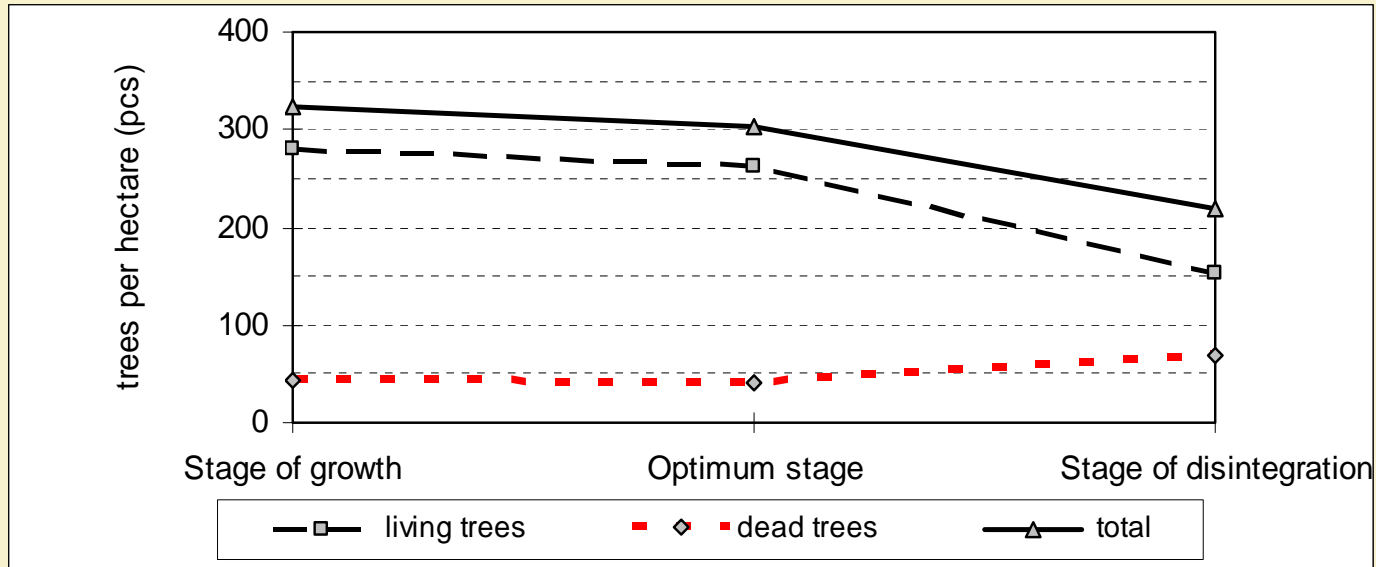
- 1) DBH distribution of living and dead trees, living- and deadwood volume, living/deadwood ratio, volume and ratio trends
- 2) Duration time of stages and whole developmental cycle
- 3) Size, shape and distribution of pathes

B – Concepts of SMALL developmental cycle dynamics

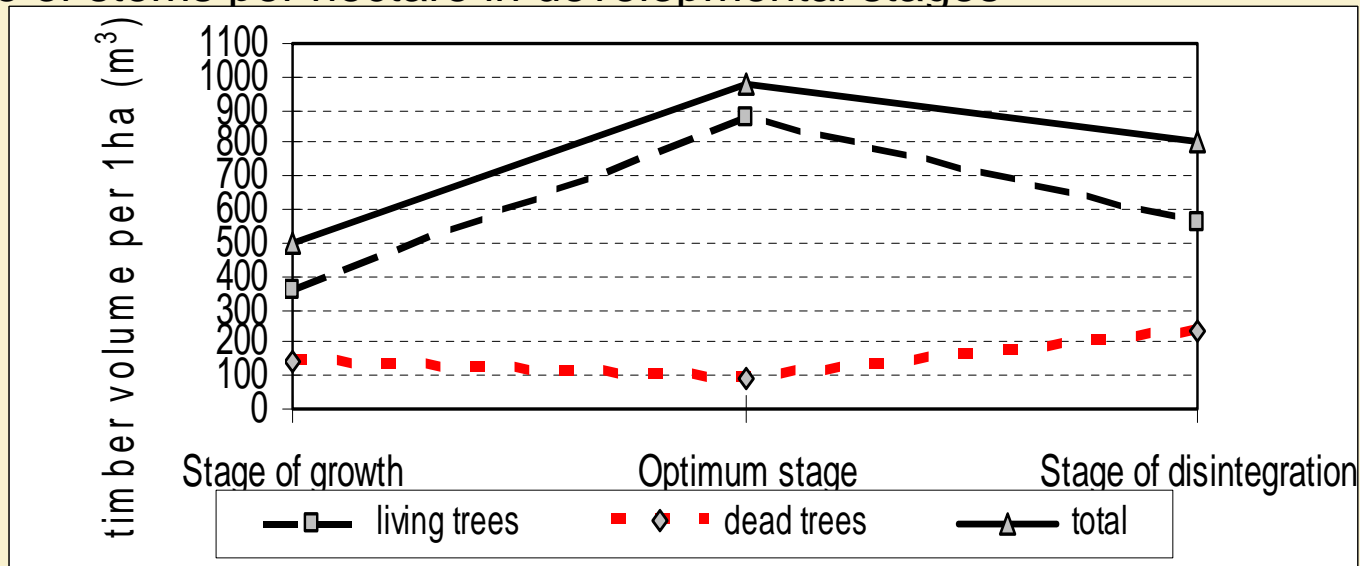


C – Elementary features of stages of „small“ developmental cycle

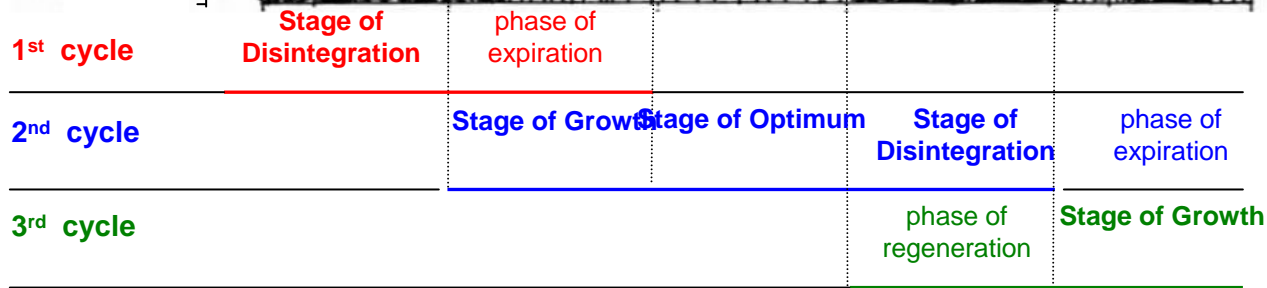
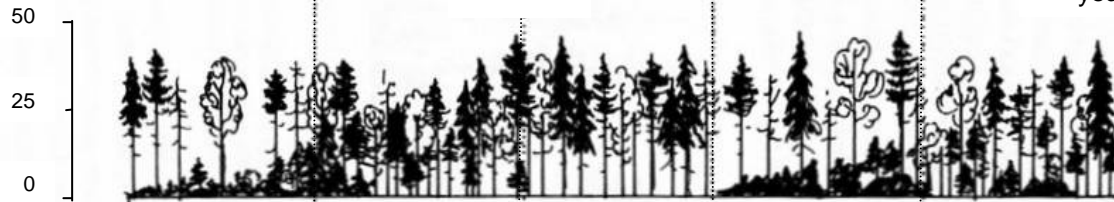
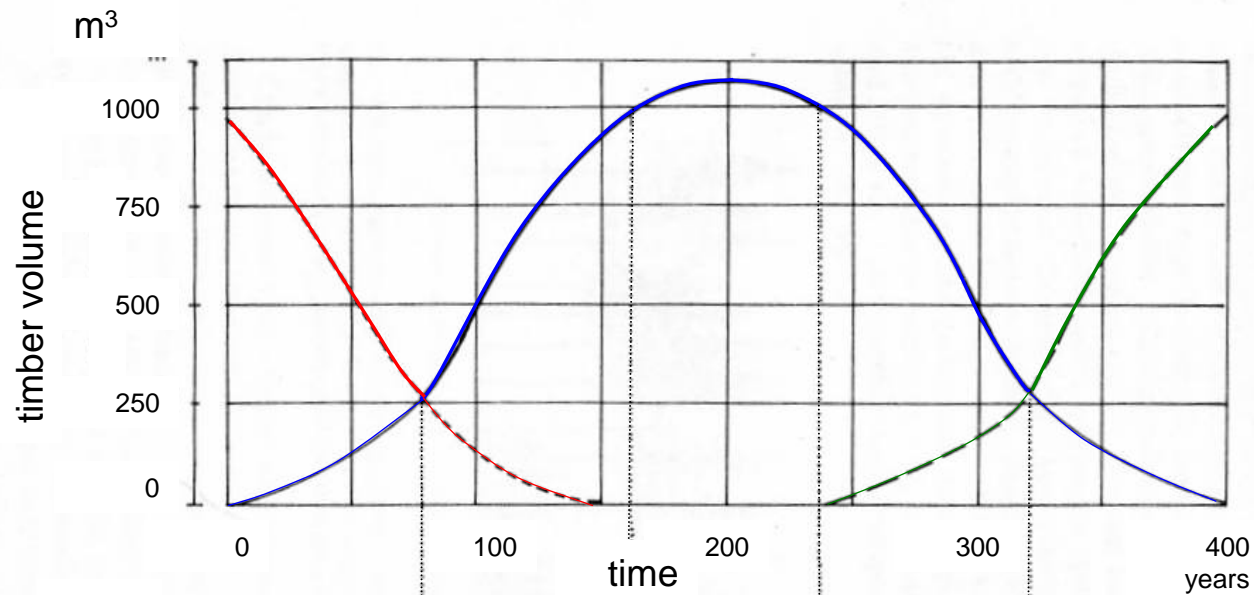
➤ Number of trees per hectare in developmental stages



➤ Volume of stems per hectare in developmental stages



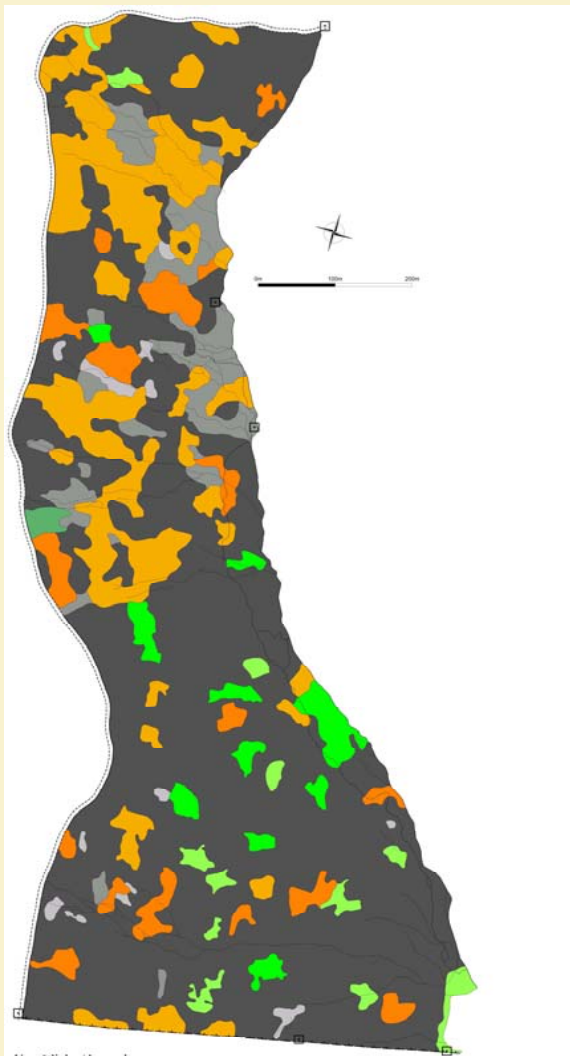
C – Elementary features of stages of „small“ developmental cycle



(Korpel 1989,1995)

duration time of developmental stages

C – Elementary features of stages of „small“ developmental cycle



Vysvětlivky / Legend:

	blokována sukcesní stadia / blocked developmental stages	0.48 ha
	stadium dorůstání / stage of growth	0.98 ha
	stadium dorůstání, fáze dožívání / stage of growth, phase of expiration	1.43 ha
	stadium dorůstání, výběrná fáze / stage of growth, phase of selection	0.17 ha
	stadium optima / stage of optimum	7.33 ha
	stadium optima, fáze terminální / stage of optimum, terminal phase	2.51 ha
	stadium rozpadu / stage of disintegration	2.81 ha
	stadium rozpadu, fáze zmlazování / stage of disintegration, regeneration phase	30.94 ha
CELKEM / TOTAL		46.65 ha

- average size of patches, variability of size
- distribution in the area
- edges segmentation, shape of patches

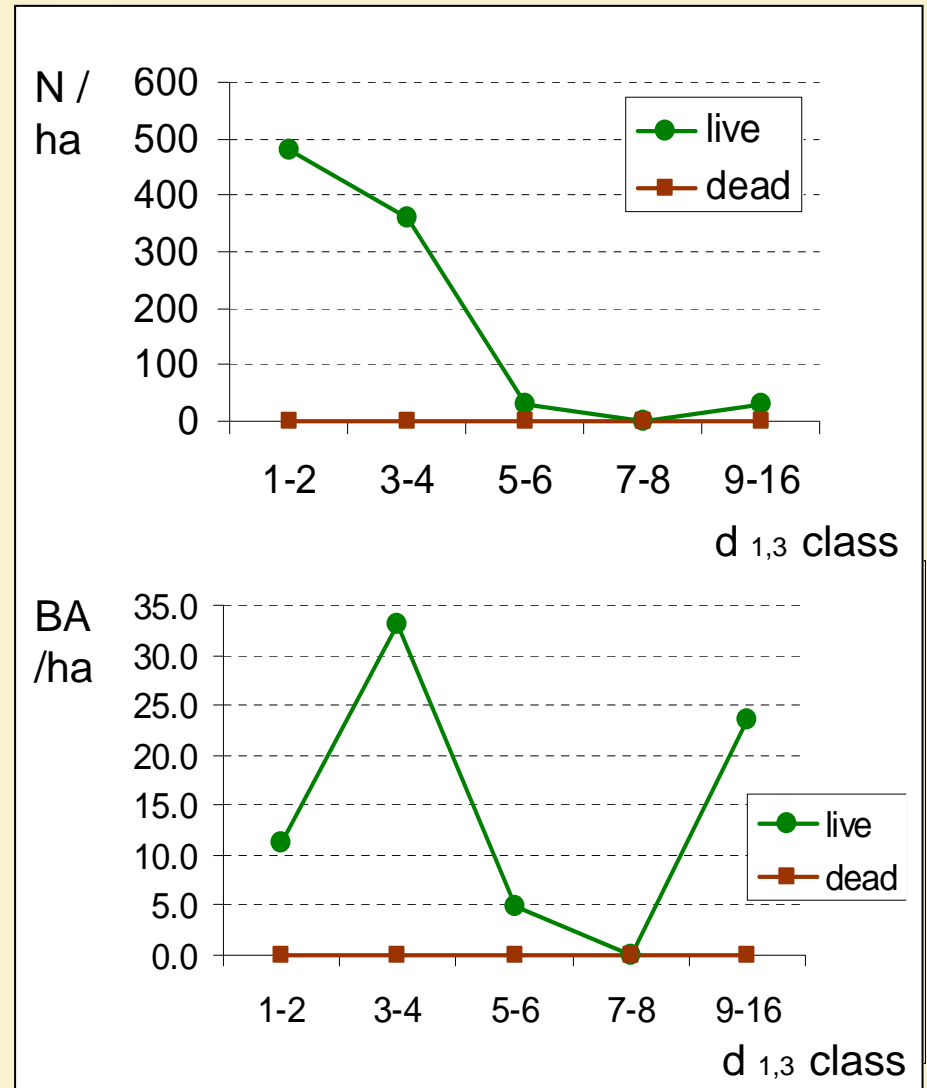
C – Identification of developmental stages and phases in situ



stage of growth, phase of expiration

Determination of classes

- **Stage of growth, phase of expiration**
- Stage of growth
- Stage of optimum
- Stage of optimum, terminal phase
- Stage of disintegration
- Stage of disintegration, phase of regeneration
- Steady state



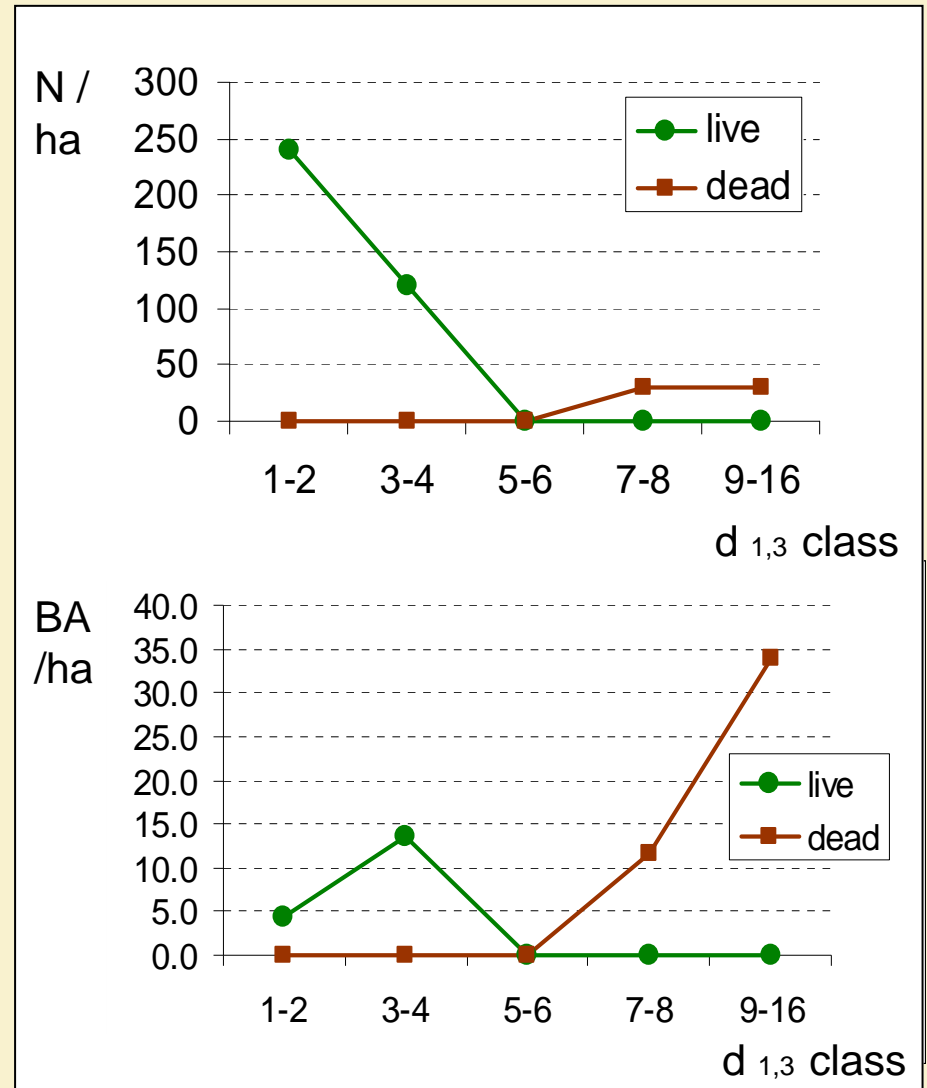
C – Identification of developmental stages and phases in situ



stage of growth

Determination of classes

- Stage of growth, phase of expiration
- **Stage of growth**
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- Stage of disintegration, phase of regeneration
- Steady state



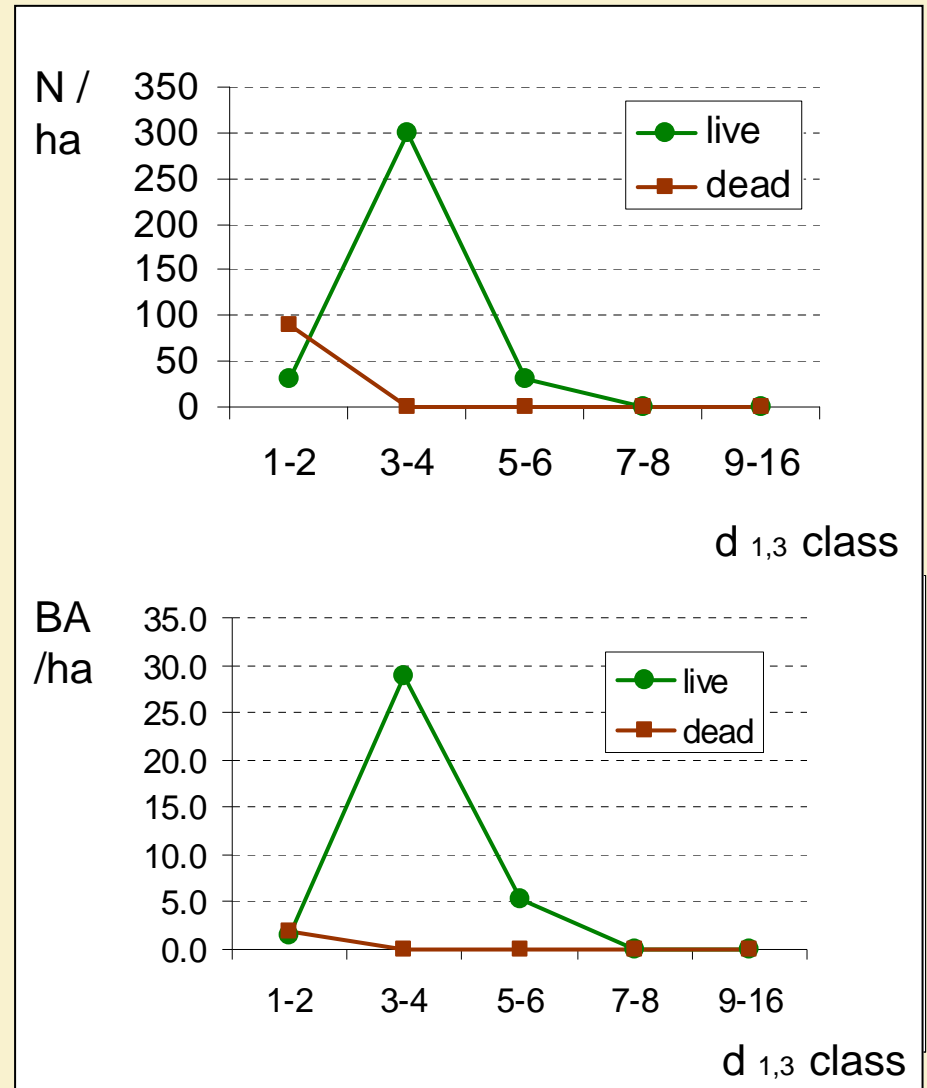
C – Identification of developmental stages and phases in situ

**stage of growth –
latest phase**



Determination of classes

- Stage of growth, phase of expiration
- **Stage of growth**
- Stage of optimum
- Stage of optimum, terminal phase
- Stage of disintegration
- Stage of disintegration, phase of regeneration
- Steady state



C – Identification of developmental stages and phases in situ



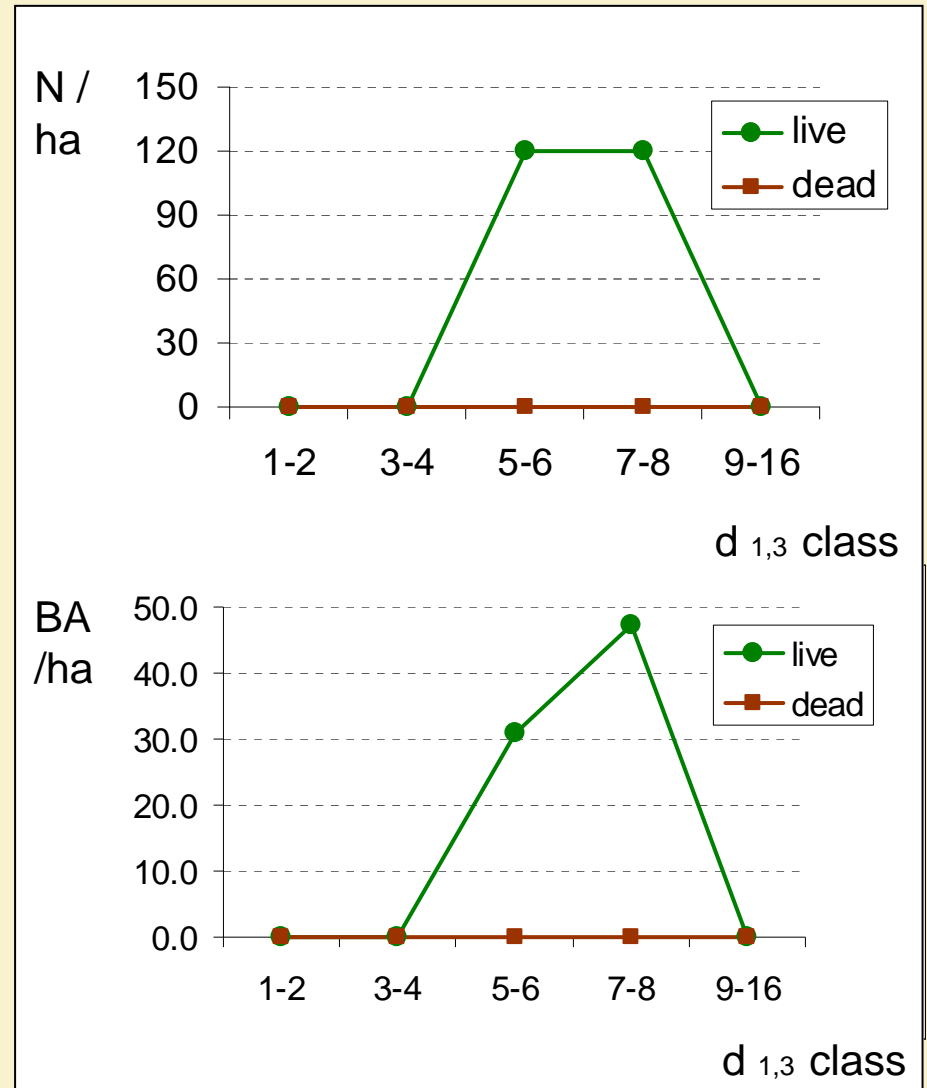
C – Identification of developmental stages and phases in situ



stage of optimum

Determination of classes

- Stage of growth, phase of expiration
- Stage of growth
- **Stage of optimum**
- Stage of optimum, terminal phase
- Stage of disintegration
- Stage of disintegration, phase of regeneration
- Steady state



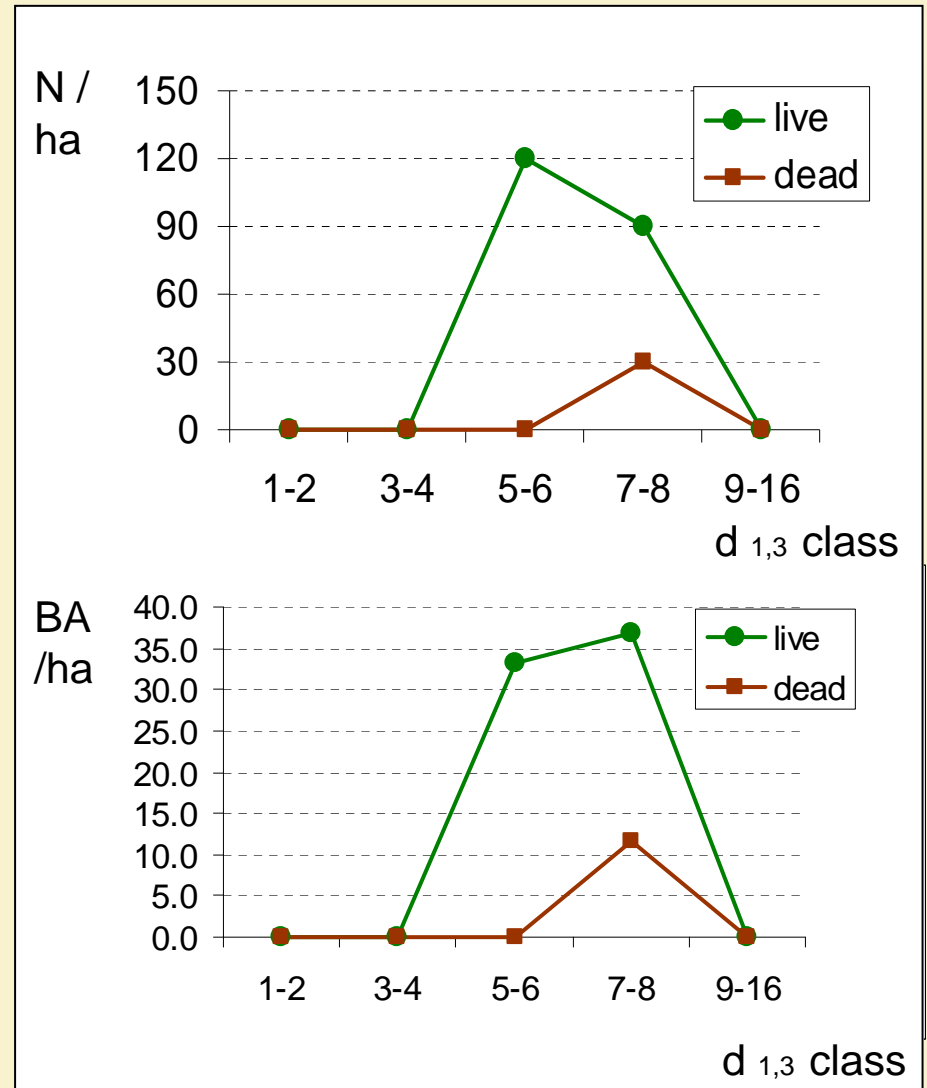
C – Identification of developmental stages and phases in situ



stage of optimum, terminal phase

Determination of classes

- Stage of growth, phase of expiration
- Stage of growth
- Stage of optimum
- **Stage of optimum, terminal phase**
- Stage of disintegration
- Stage of disintegration, phase of regeneration
- Steady state



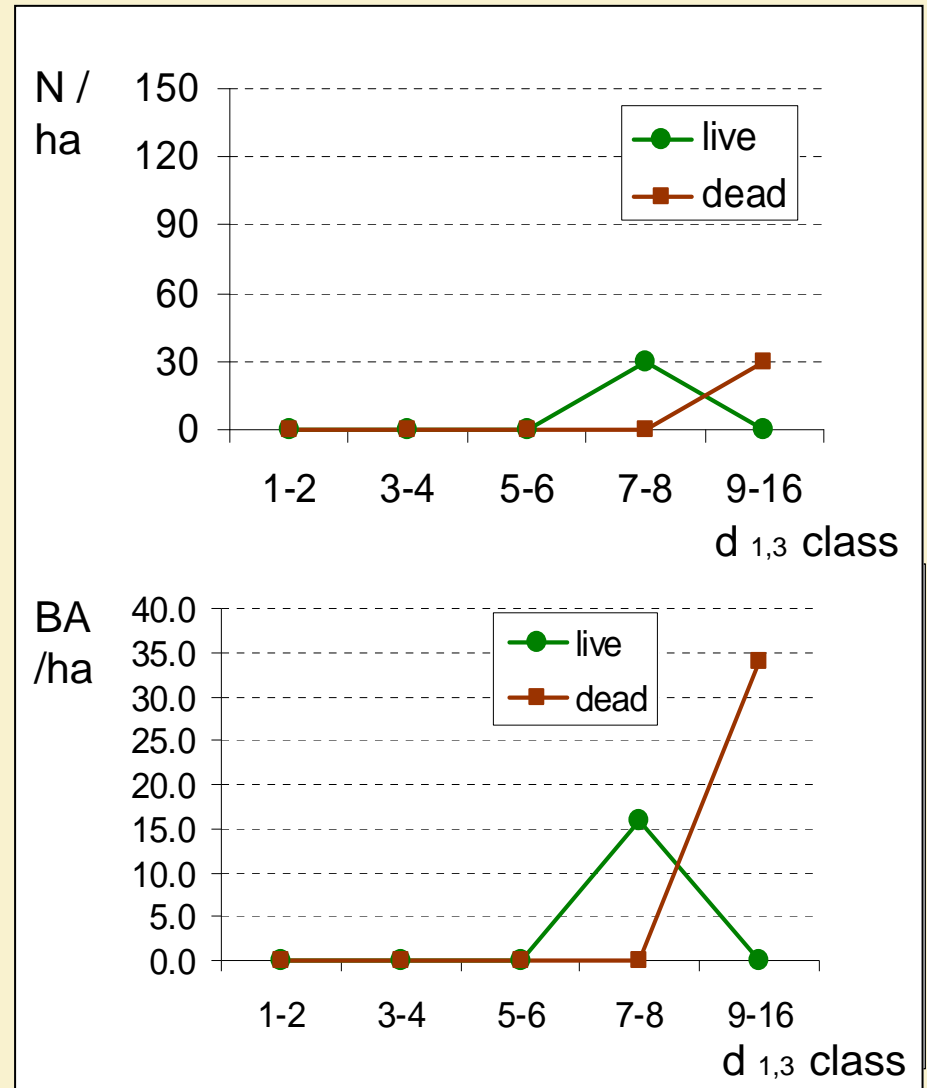
C – Identification of developmental stages and phases in situ



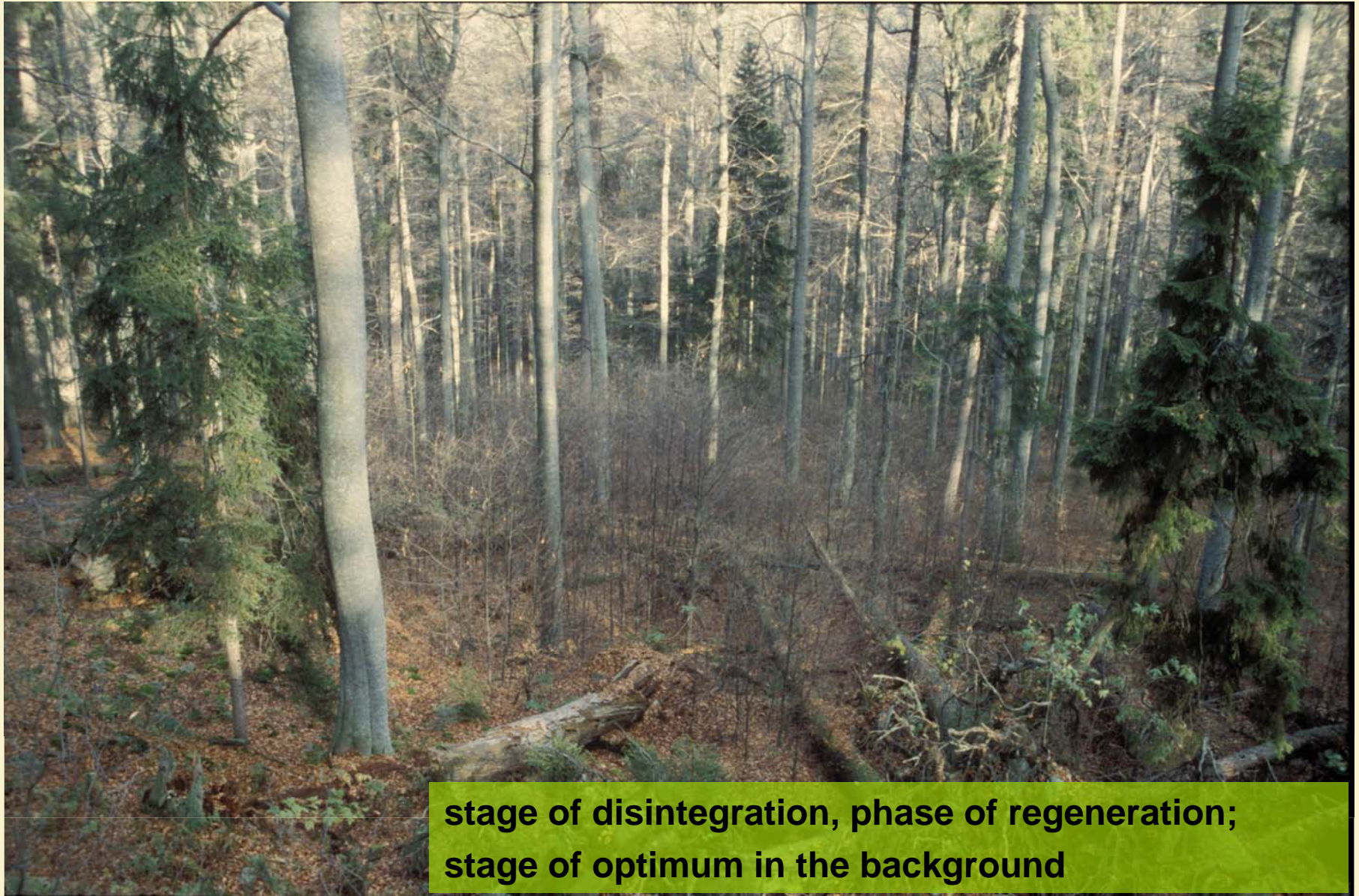
stage of disintegration

Determination of classes

- Stage of growth, phase of expiration
- Stage of growth
- Stage of optimum
- Stage of optimum, terminal phase
- **Stage of disintegration**
- Stage of disintegration, phase of regeneration
- Steady state



C – Identification of developmental stages and phases in situ



**stage of disintegration, phase of regeneration;
stage of optimum in the background**

C – Identification of developmental stages and phases in situ



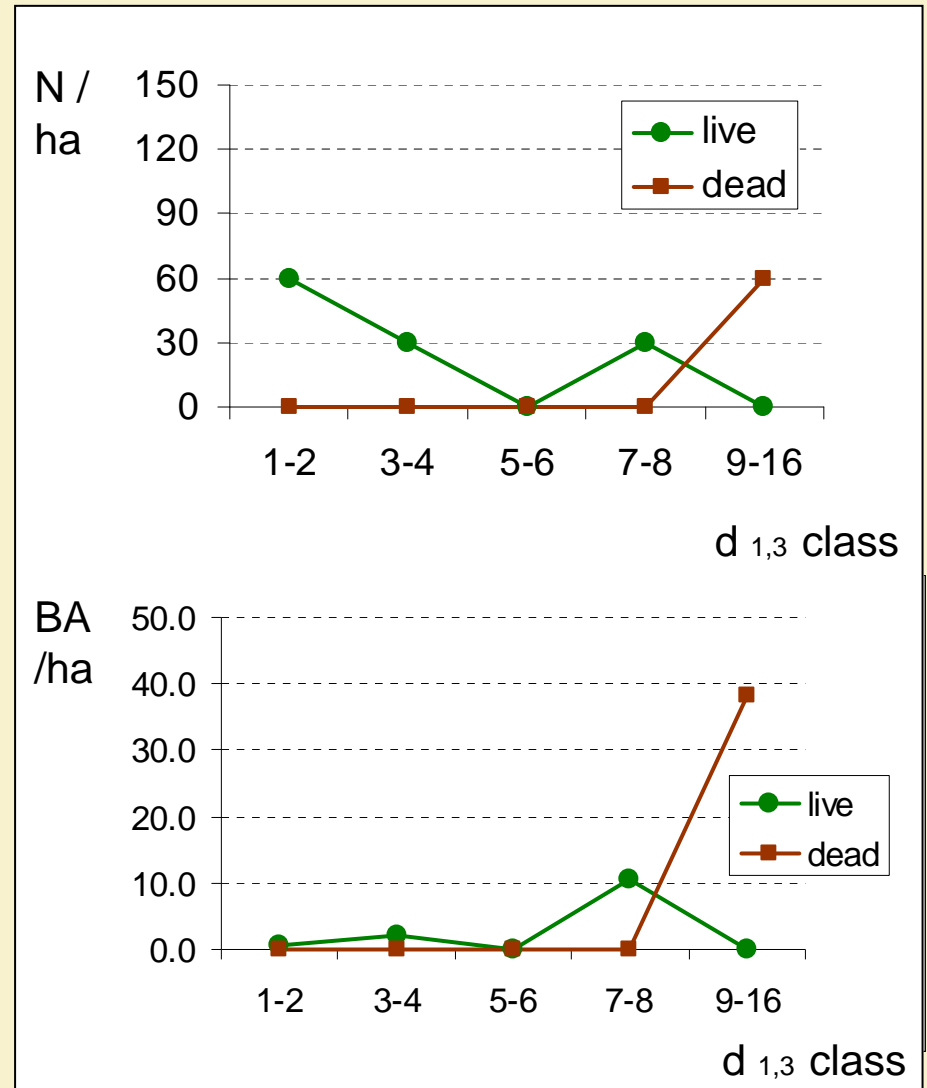
stage of disintegration, phase of regeneration;

**stage of disintegration –
phase of regeneration**



Determination of classes

- Stage of growth, phase of expiration
- Stage of growth
- Stage of optimum
- Stage of optimum, terminal phase
- Stage of disintegration
- **Stage of disintegration, phase of regeneration**
- Steady state



C – Identification of developmental stages and phases in situ

Steady state – zonal sites



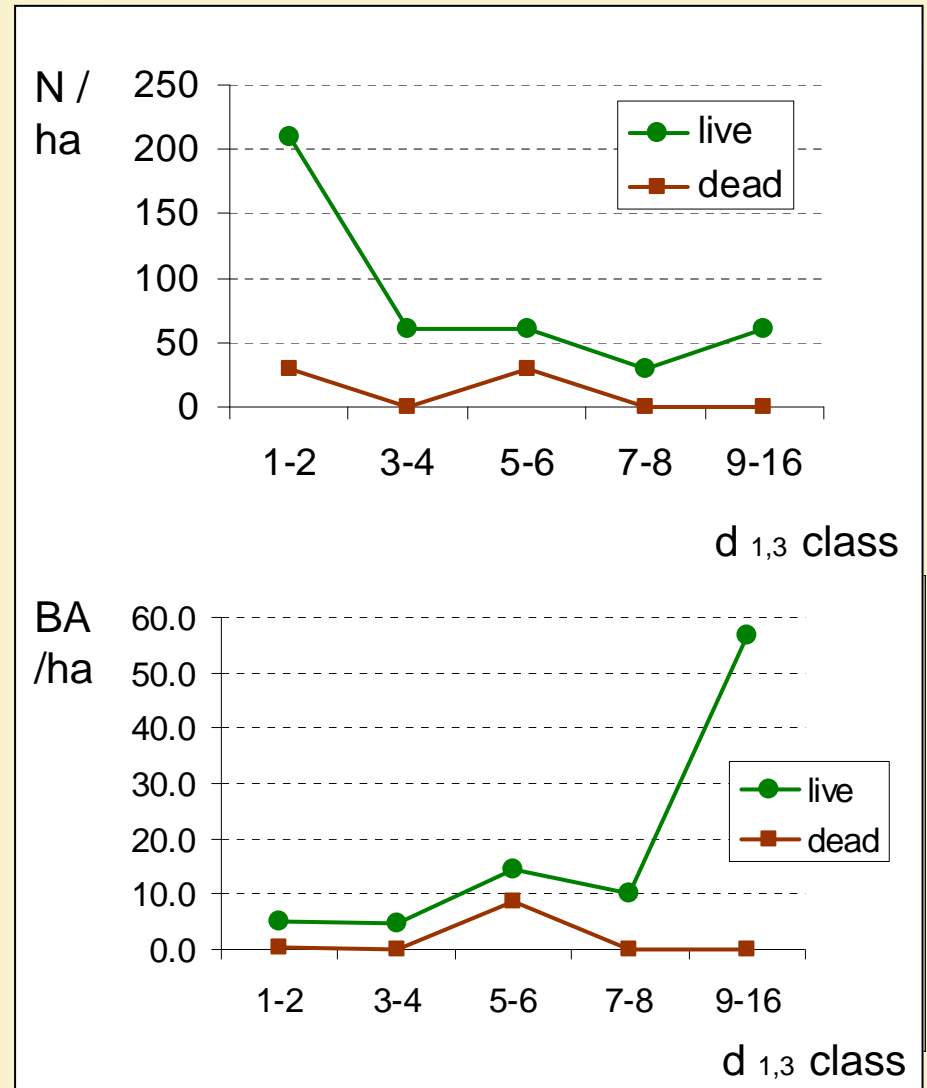
C – Identification of developmental stages and phases in situ



Steady state – zonal sites

Determination of classes

- Stage of growth, phase of expiration
- Stage of growth
- Stage of optimum
- Stage of optimum, terminal phase
- Stage of disintegration
- Stage of disintegration, phase of regeneration
- **Steady state**



C – Identification of developmental stages and phases in situ



Steady state??? – water-affected sites

C – Identification of developmental stages and phases in situ



blocked succession; stage of disintegration, phase of regeneration

Vylišení a mapování stadií:

- mapování v terénu do map např. 1:2000, 1:5000 = větší prostorová nepřesnost, široce definované mapovací jednotky = více subjektivní přístup
- determinace na výzkumných plochách – 1 plocha = 1 stadium a fáze (Slovensko)
- mapování s pomocí bodové sítě (např. 50x50 m) (Slovinsko, Holandsko)
- mapování pomocí rastru – mozaika (Německo, Albánie)
- mapování s mapou stromů („česká“ metoda)
- analýza prostorových dat z opakovaných měření – tzv. „Králov(sk)a(á)“ metoda – viz přednáška č. 5

Využití výsledků mapování stadií a fází – viz přednáška č. 12