TECHNISCHE UNIVERSITÄT DRESDEN

Institute of
Forest Botany
and
Forest Zoology

Visual assessment of tree vitality via branch architecture

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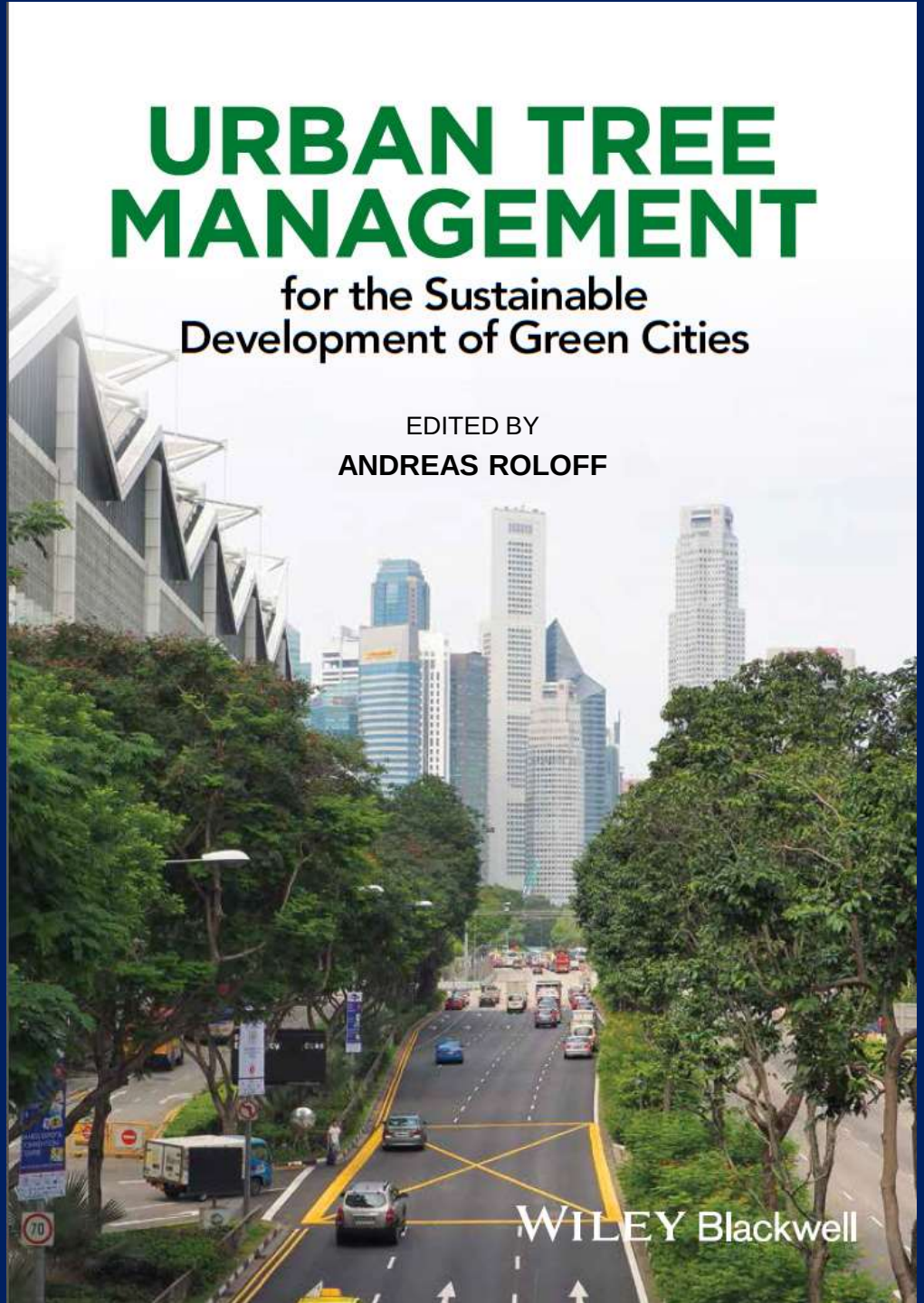
51st National Arboriculture Conference Arboric. Assoc.

Exeter UK 2017-09-13



Published in 2016


How
to determine / assess
tree vigor and vitality ?

by leaves i.e. crown transparency?

or by branching pattern?

Strain and stress (vitality) parameters in trees

	Practi-cability/ effort	Valid for many species	Objectivity by different evaluators	Correct-ness
Above ground				
Visible				
Leaf loss (transparency)	++	++	+	○
Branching pattern	++	+	+	+
Diameter increment	+	++	++	+
Shoot lengths	○	++	++	++
Pathogens	○	++	+	+
Fructification	++	++	○	○
Leaf size	○	++	○	○
Leaf yellowing	++	++	+	+
Physiological				
Water status…	–	++	+	○
Photosynthesis...	–	++	+	○
Nutrient balance...	– –	++	+	–
Enzymes...	– –	++	+	–
Hormones...	– –	++	+	–
Phenology...	+	++	+	○
Root system				
Fine roots	– –	+	+	○
Root tip damage	–	+	+	+

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Enzymes...	– –	++	+	–
Hormones...	– –	++	+	–
Phenology...	+	++	+	○
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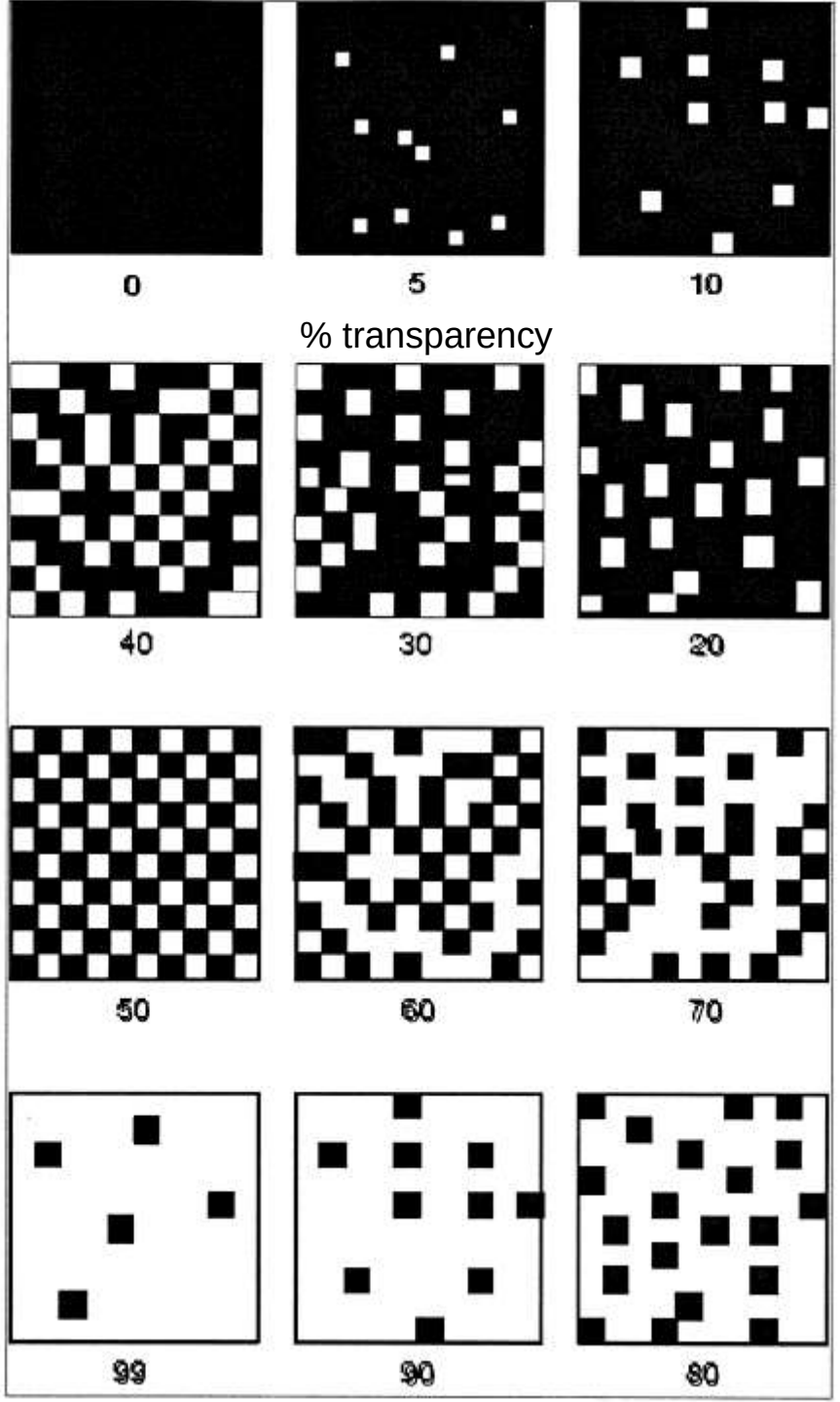


Crown transparency
‘Leaf loss‘

Damage classes:

0 0 - 10% leaf loss
1 15 - 25%
2 30 - 60%
3 65 - 95%
(4 100%**)**

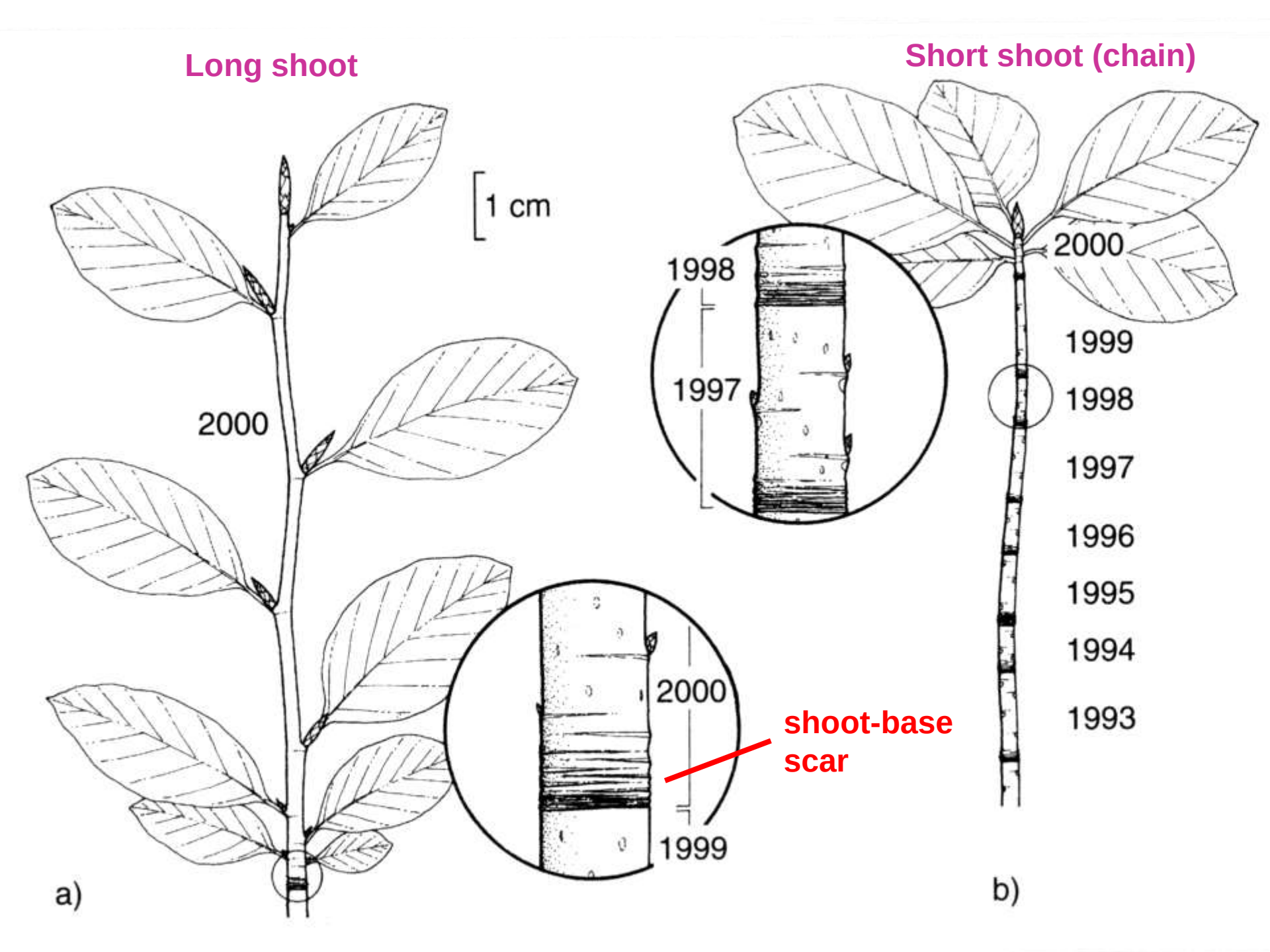
UN-ECE 2010

Judging Crown Transparency

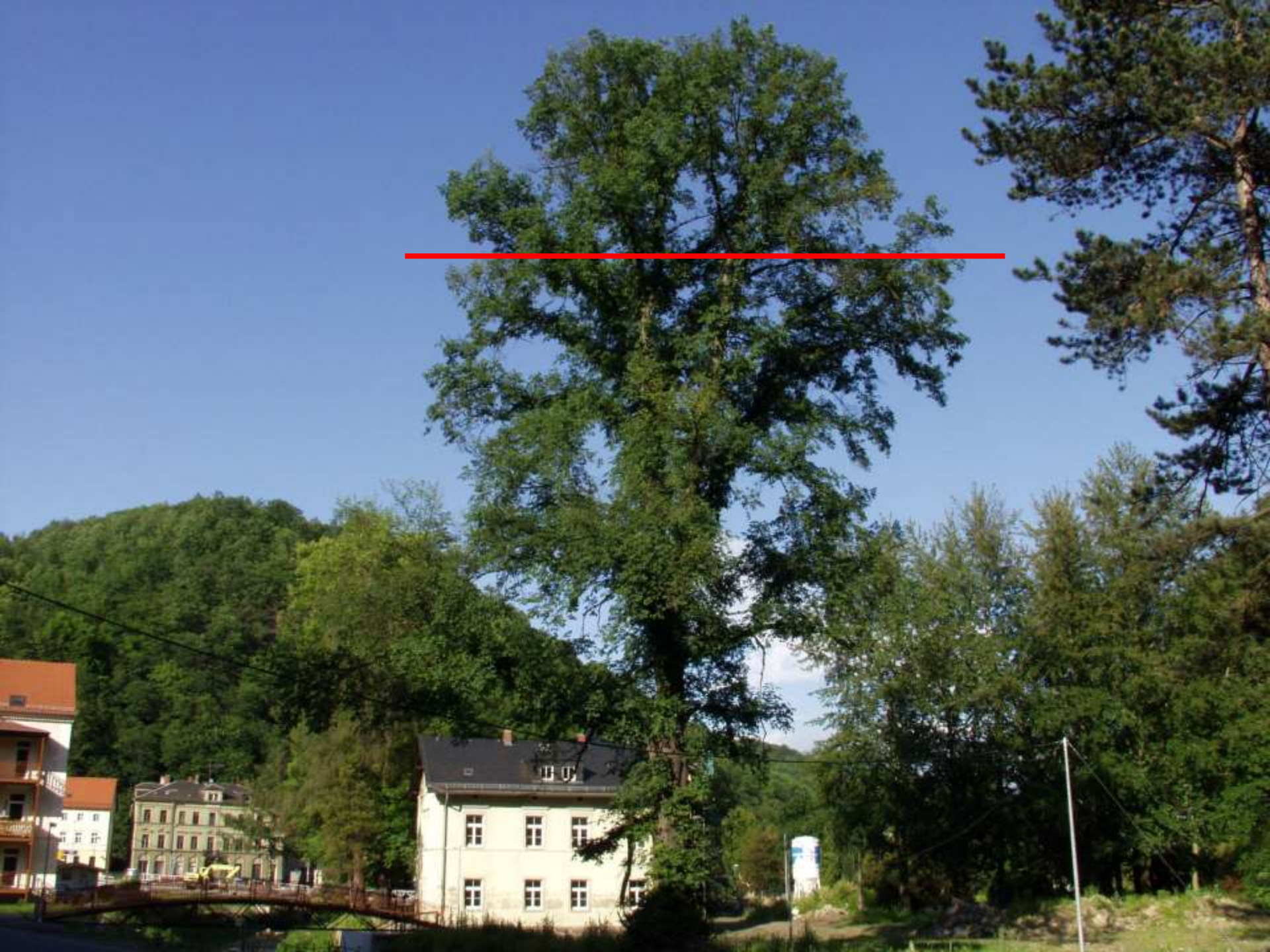
+ easy to learn
+ practicable
+ fast to carry out

– only 4 months per year applicable (in dicidious trees)
– in some species 0-10% crown transparency unrealistic
– problems by fructification and precipitation influence
– influence of tree age (+1% / year)
– improper interpretation as damage

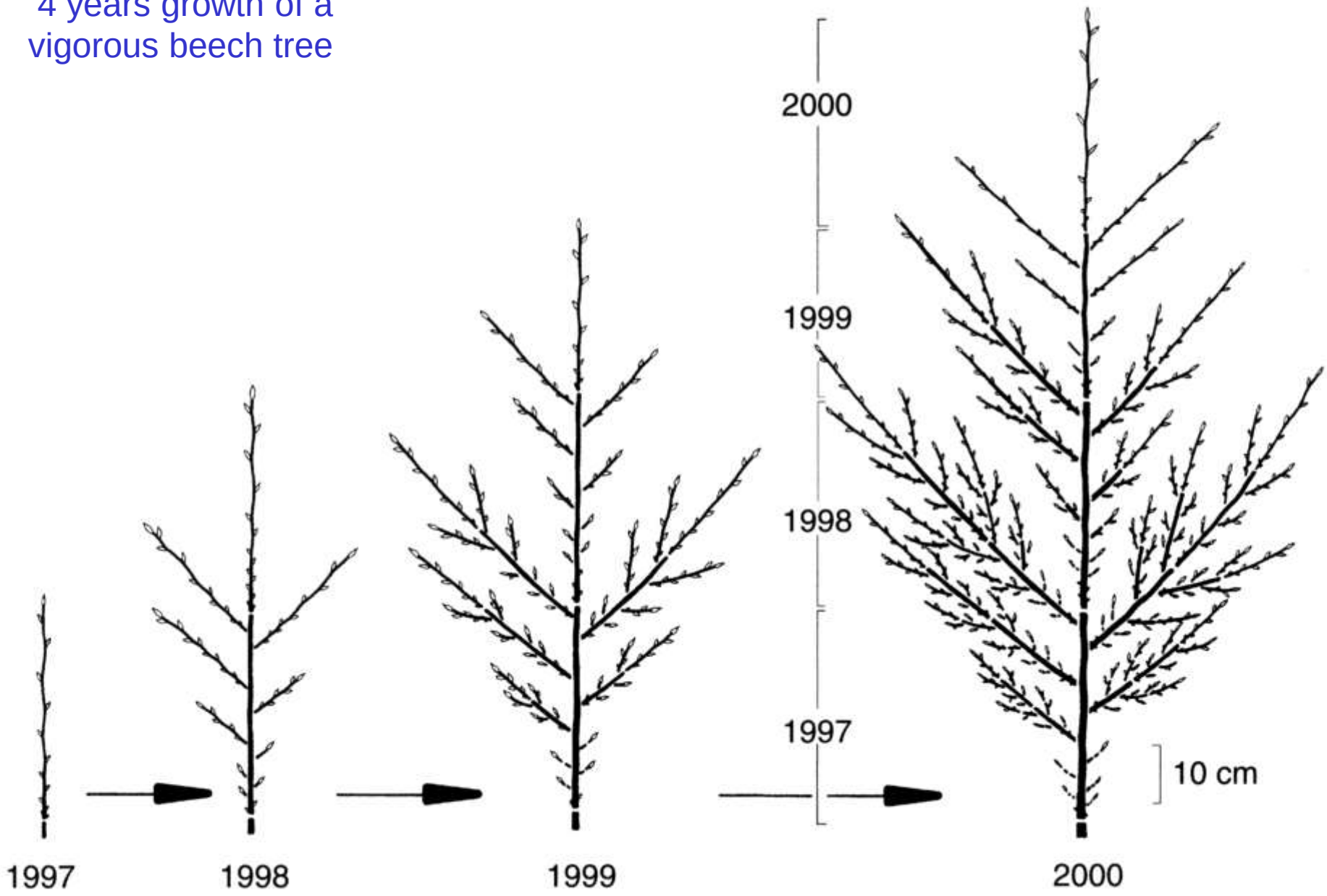
➢ **Consequence: vitality assessment by growth potential**


Long shoot
Short shoot (chain)
1 cm
2000
1998
1997
2000
1999
shoot-base scar
1999
1998
1997
1996
1995
1994
1993
a)
b)

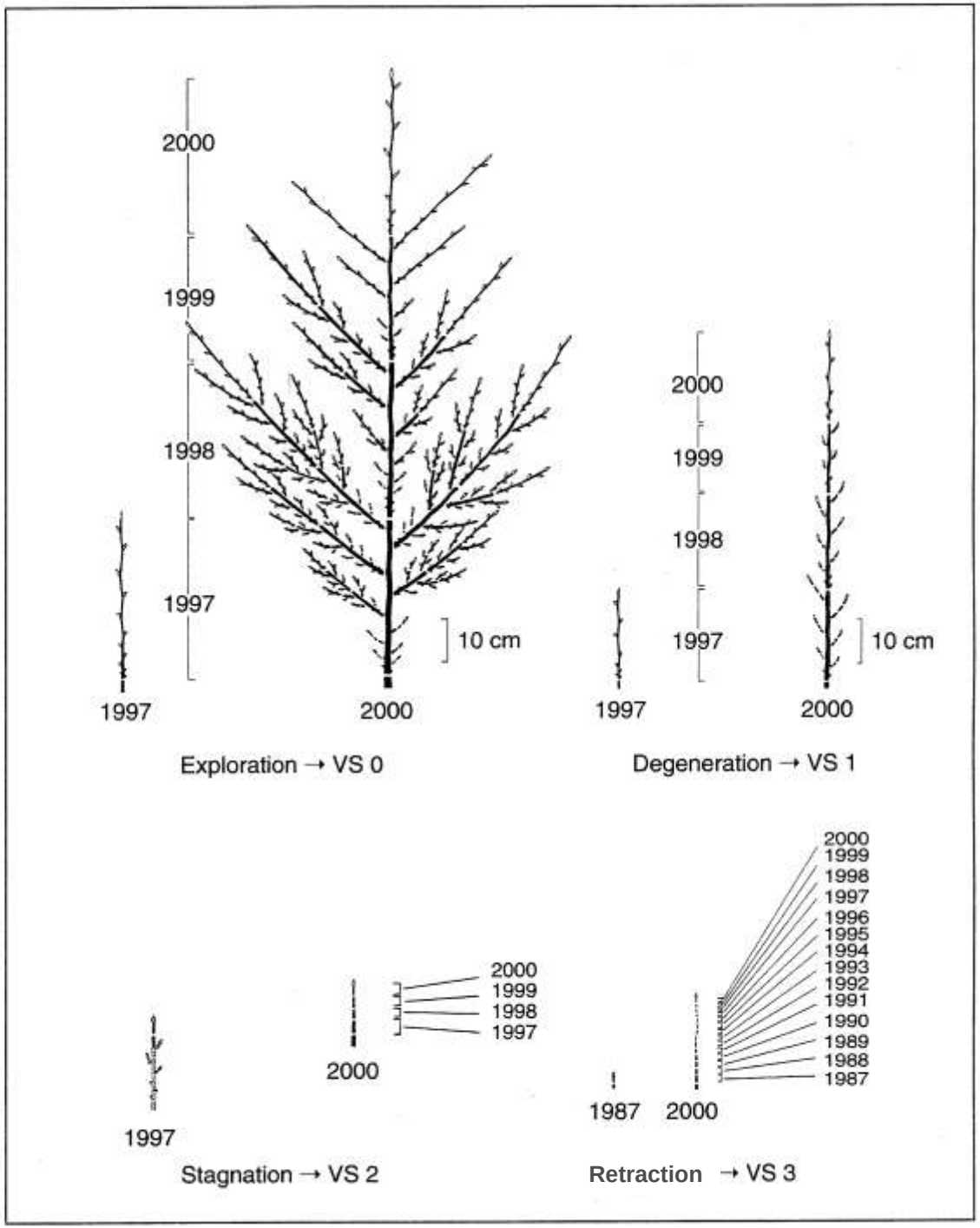

shoot-base
scar



4 years growth of a vigorous beech tree



4 growth stages as the basis for vitality classes (VS)



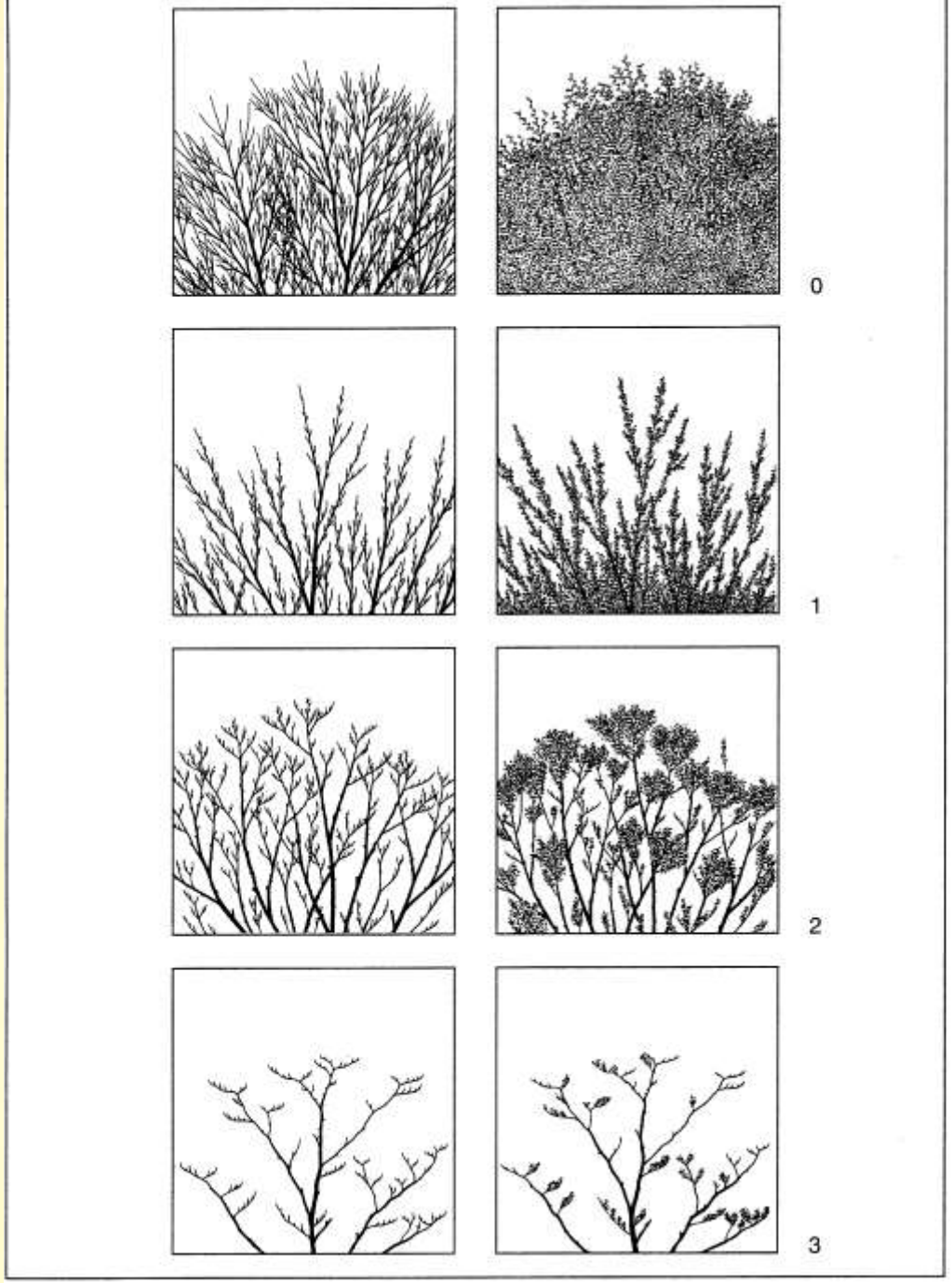


0


1


2


3



VS 0: long shoot-mode

network structure, crown extension

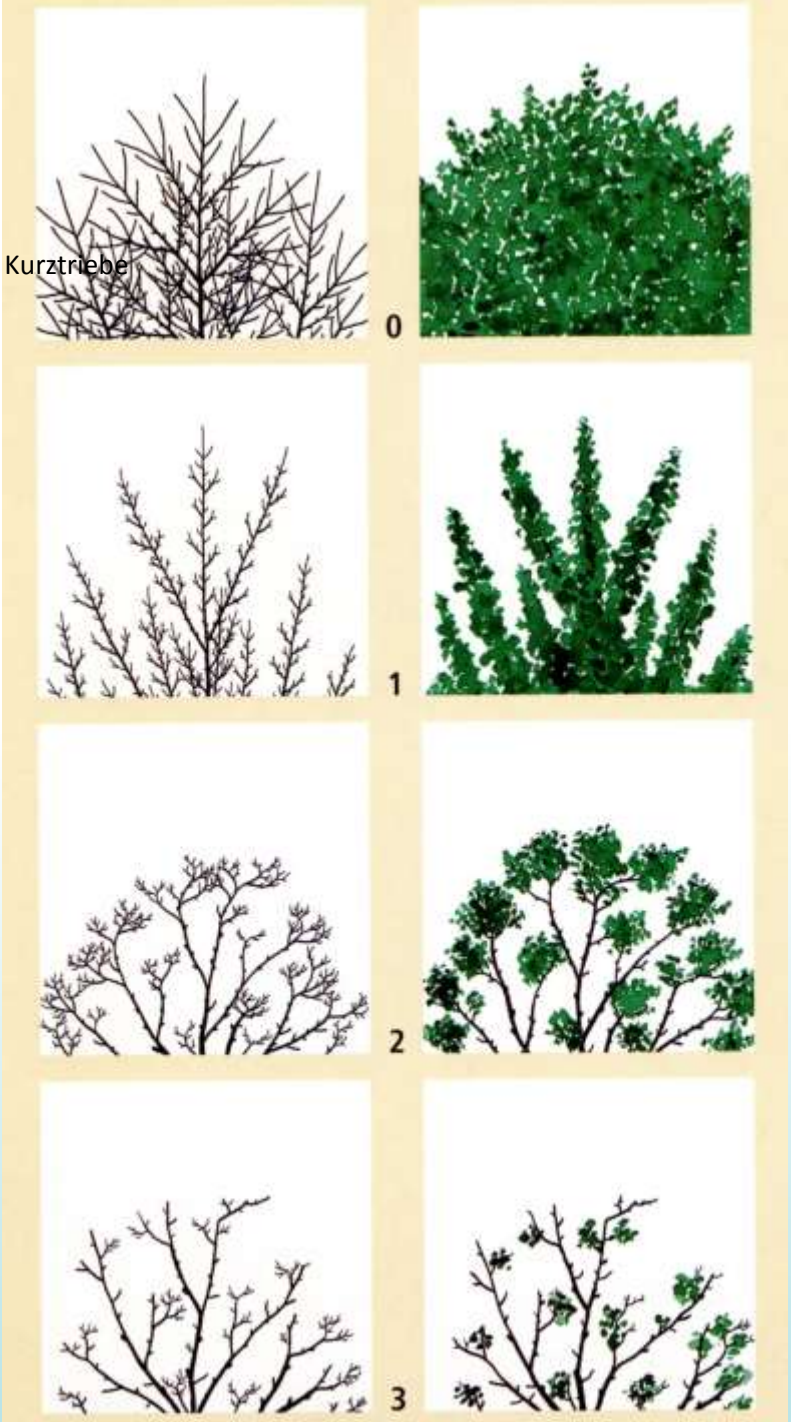
VS 1: spikey outline-mode

bottle-brush structures, outer crown thinning

VS 2: short shoot-mode
bushy structure, on hold

VS 3: retraction mode

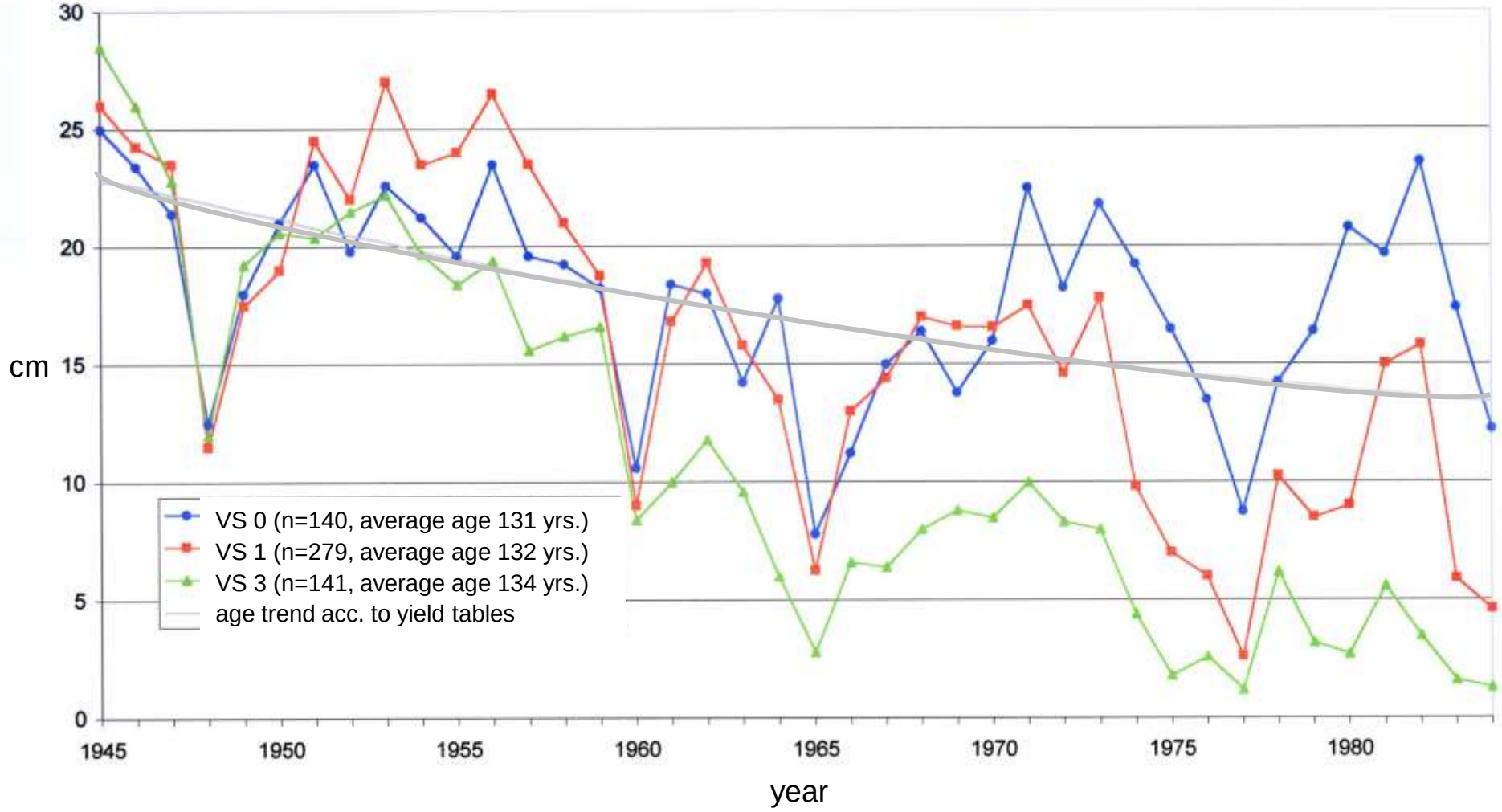
leader die-back, crown reduction


Kurztriebe
0
1
2
3

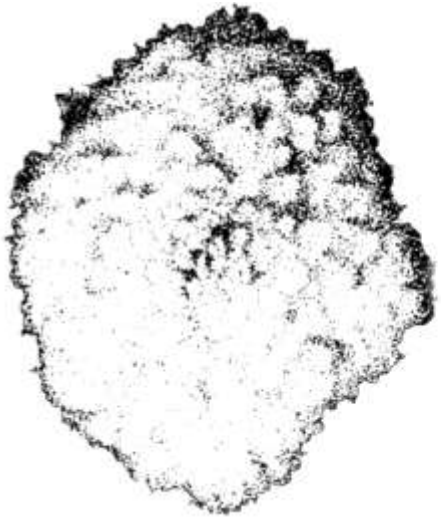

2005


2015

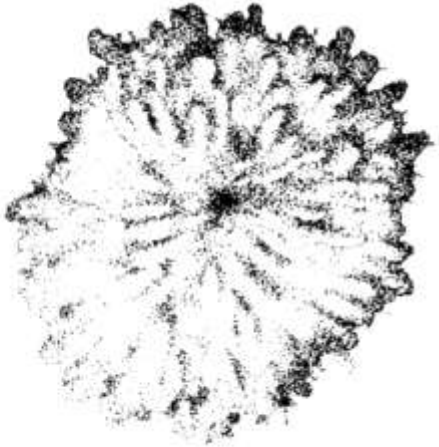
Annual length increment of the leader shoots of 100- to 160-year-old beech trees during 40 years
(differenciated into vitality classes VS)



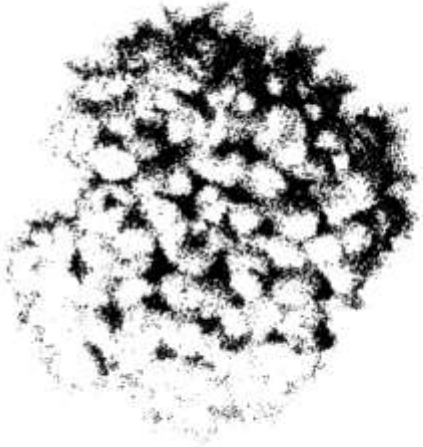
Vitality Classification in Aerial Photographs



VS 0



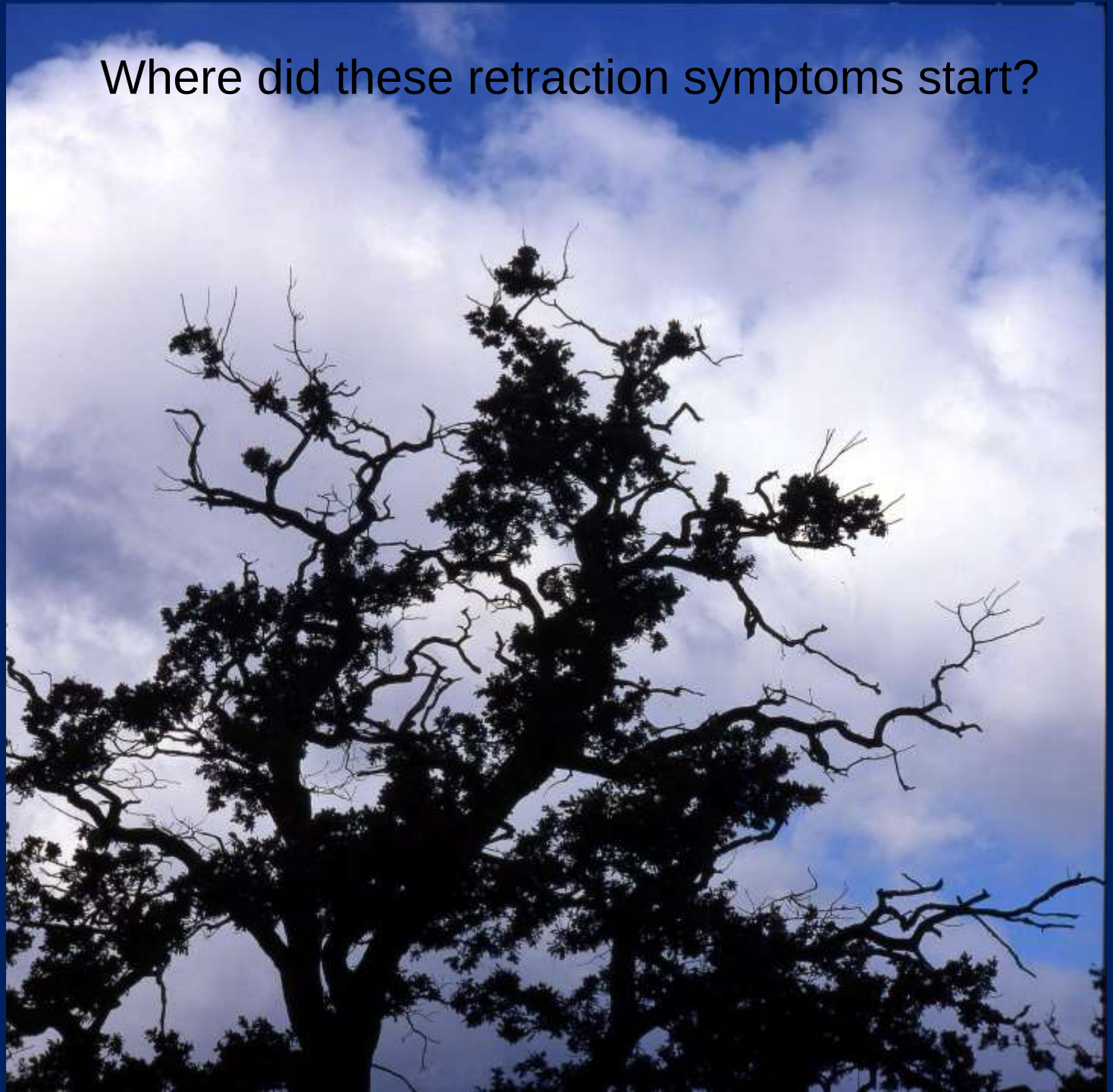
VS 1

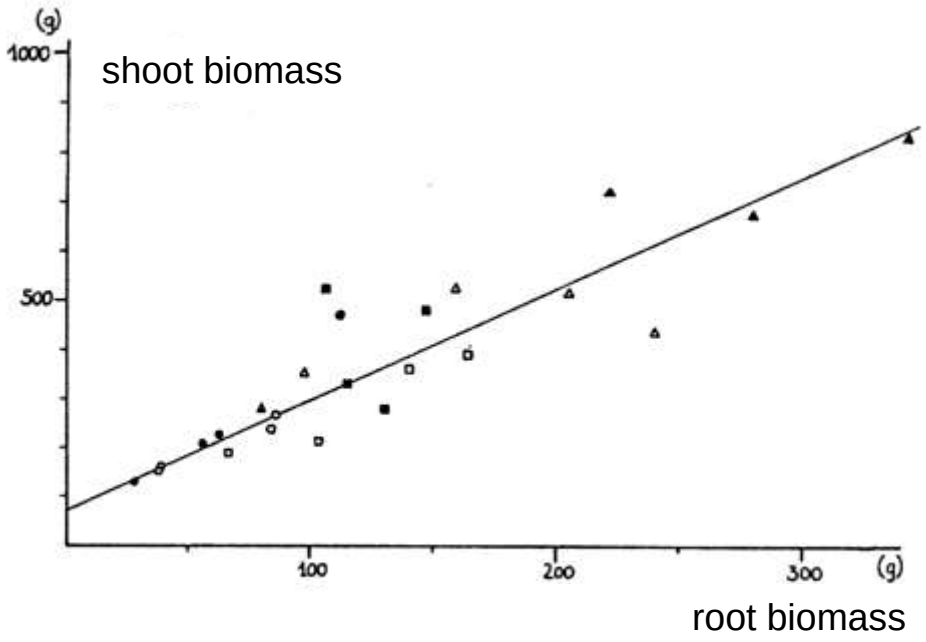


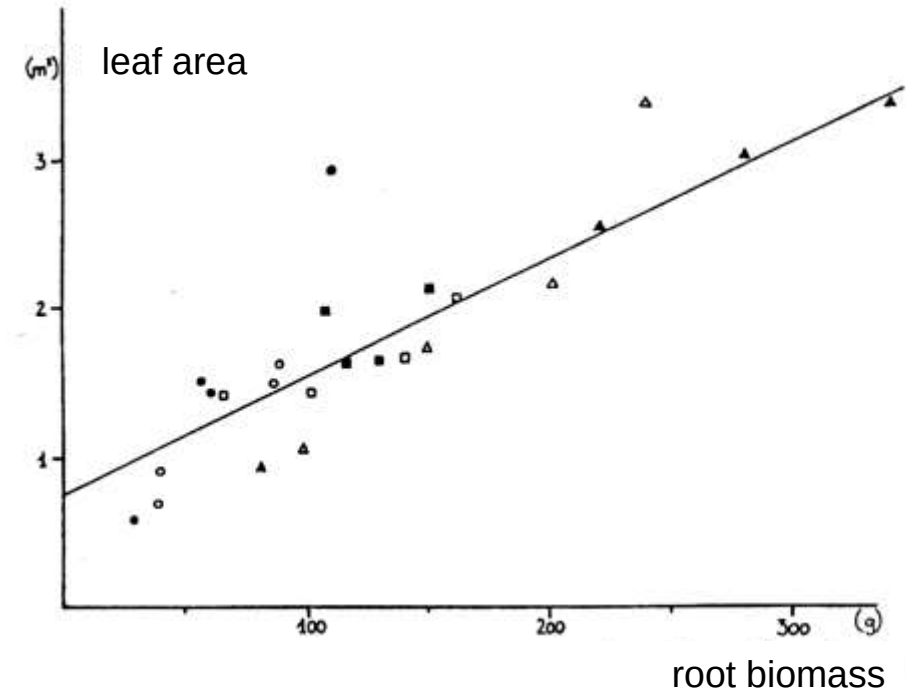
VS 2

VS 3

Where did these retraction symptoms start?

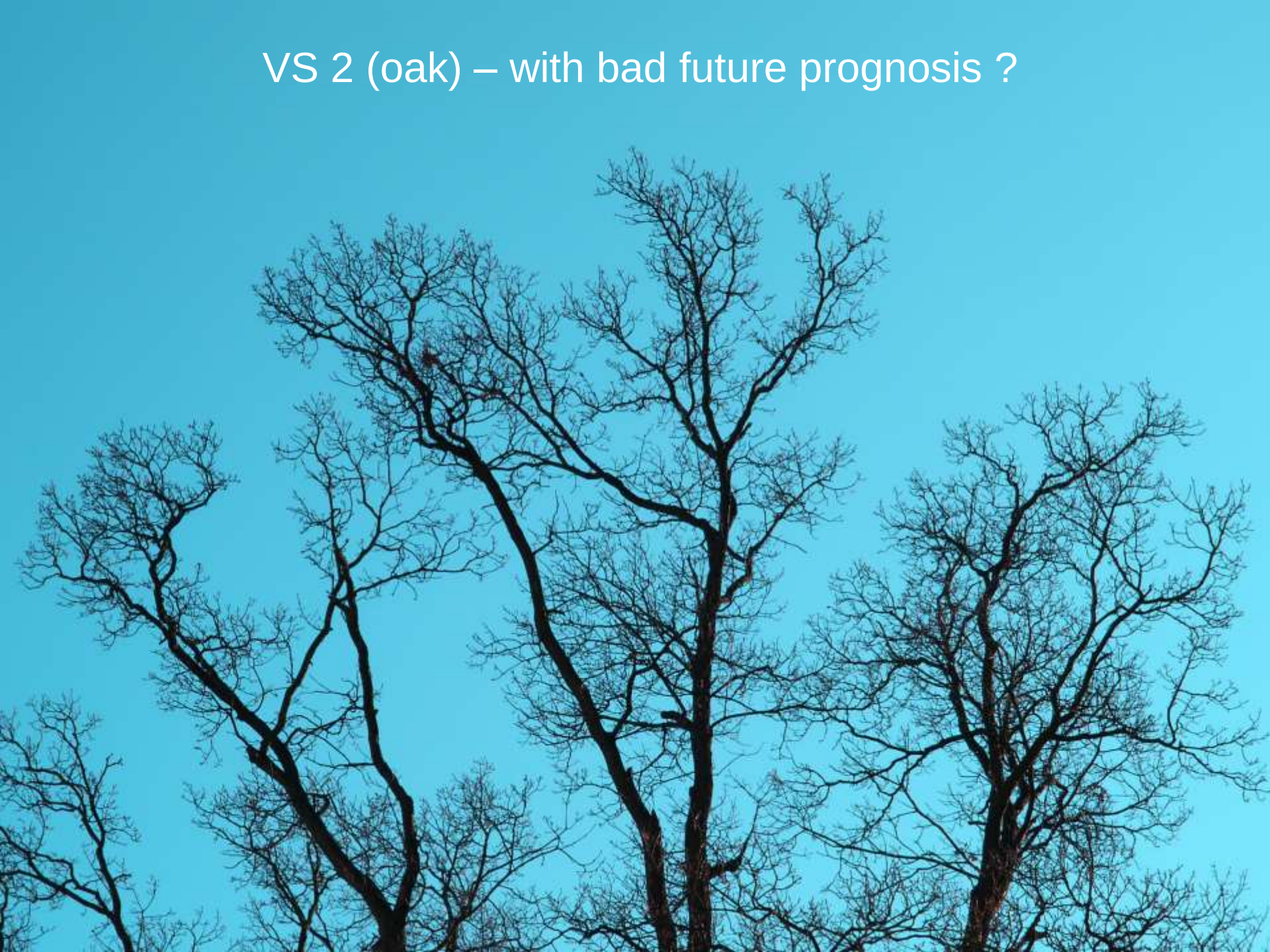






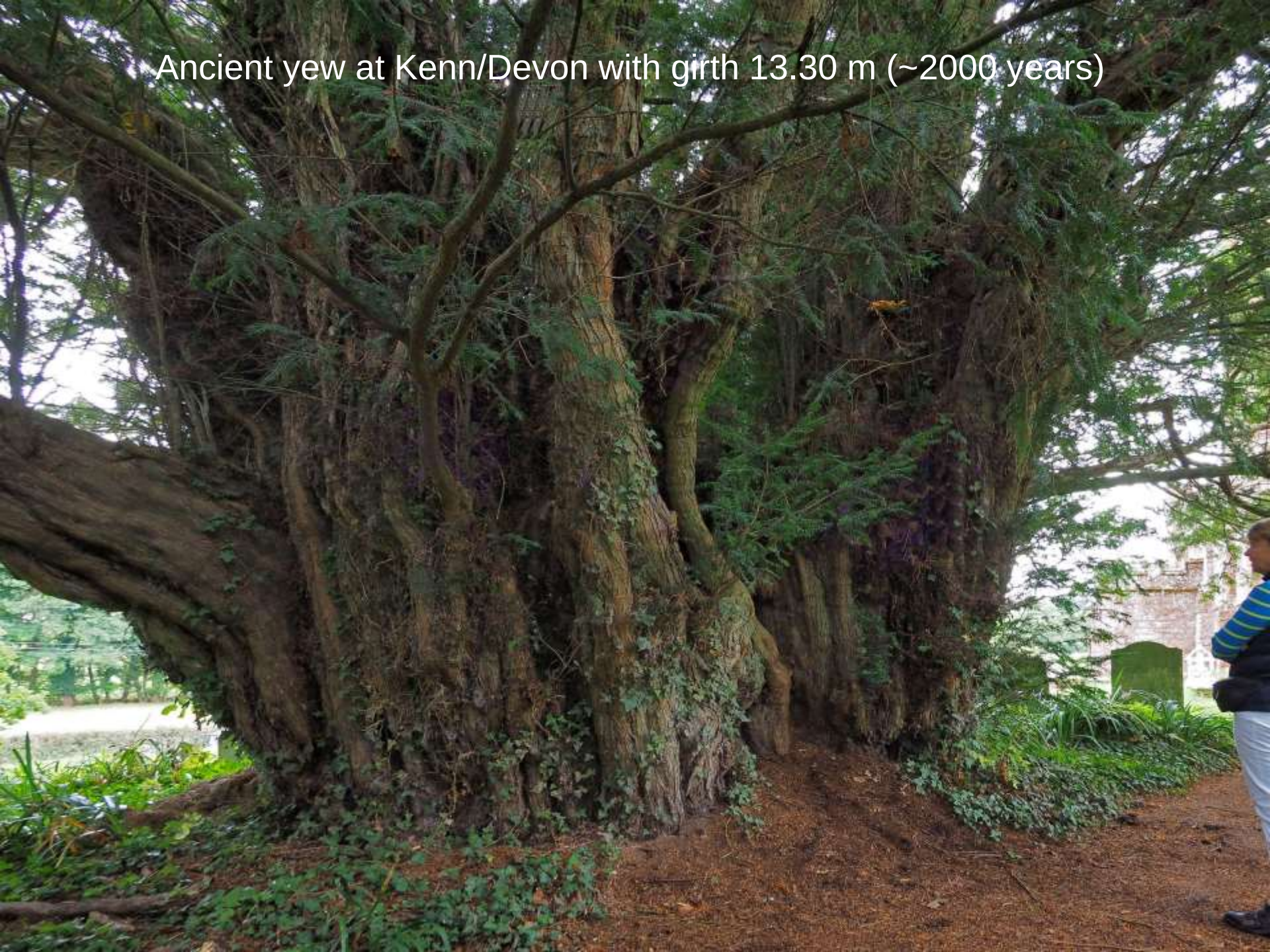
Interrelationship crown – roots!

VS 2 (oak) – with bad future prognosis ?




Ancient chestnut at Tortworth/Glostersh. with girth 12.50 m (~1000 years)


Ancient oak at Midhurst/Sussex with girth 13.30 m (~1300 years)


Ancient yew at Kenn/Devon with girth 13.30 m (~2000 years)


Ancient yew at Ashbrittle/Somerset with girth 12.30 m (~3000 years)

Classification of tree species into age groups for interpretation of vitality assessment

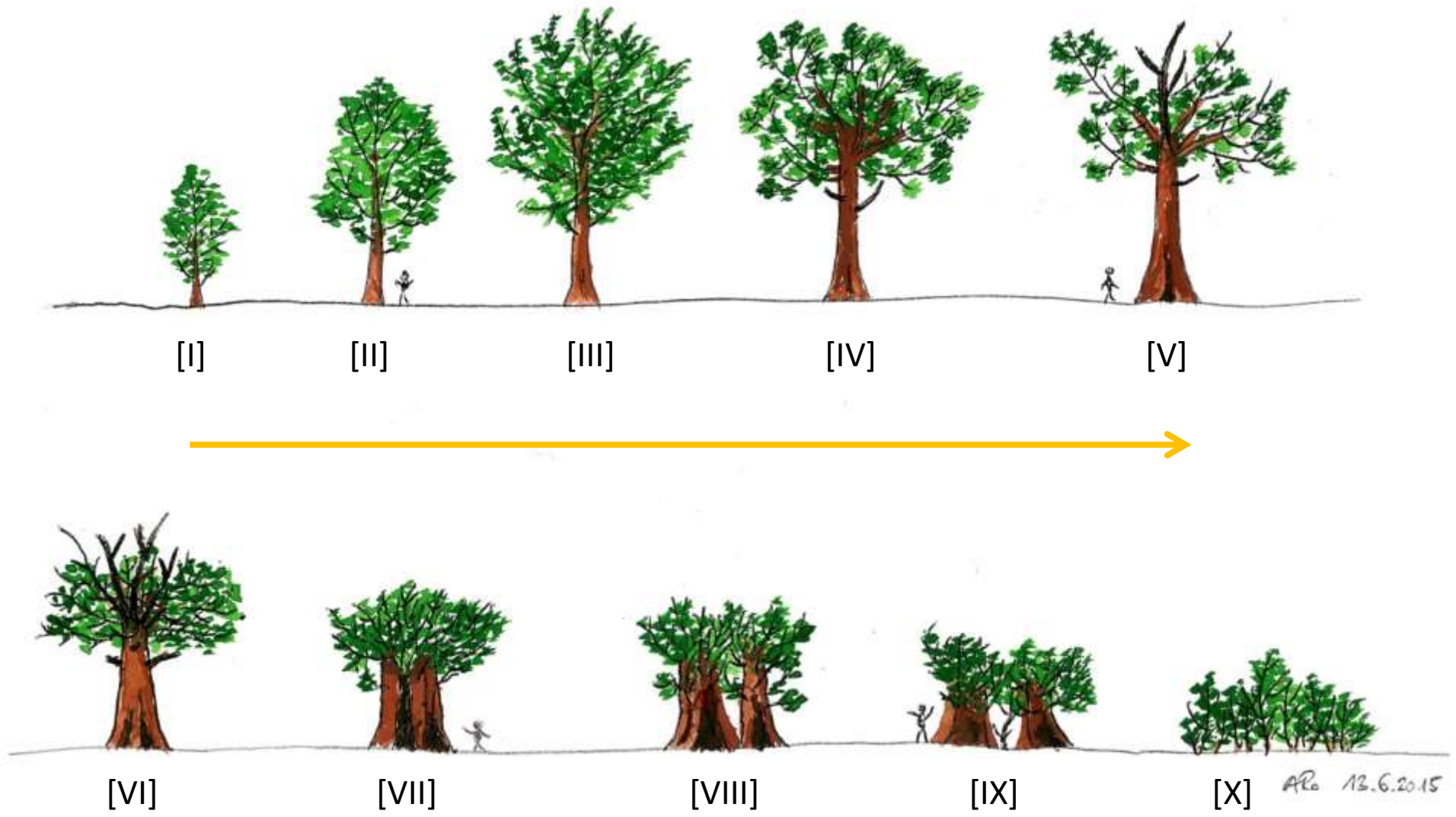
SL: "short-lived" with 80 to 100 years of life expectancy:
e.g. Alnus, Ailanthus, Betula, Malus, Prunus, Pyrus, Sorbus spec & others…

ML: "medium-lived" with 150 to 300 years of life expectancy :
e.g. Acer, Aesculus, Carpinus, Corylus, Fagus, Fraxinus, Gleditsia, Juglans, Liqidambar, Picea, Pinus, Platanus, Quercus rubra, Robinia, Salix alba, Sophora, Ulmus spec & others…

LL: "long-lived" with more than 400 years of life expectancy :
e.g. Tilia, Quercus, Castanea, Larix, Olea, Ginkgo, Taxus

Aging process long-lived tree species (LL, e.g. lime, oak):

schematic illustration by 10 different stages over a life cycle of 500 to 1000 years

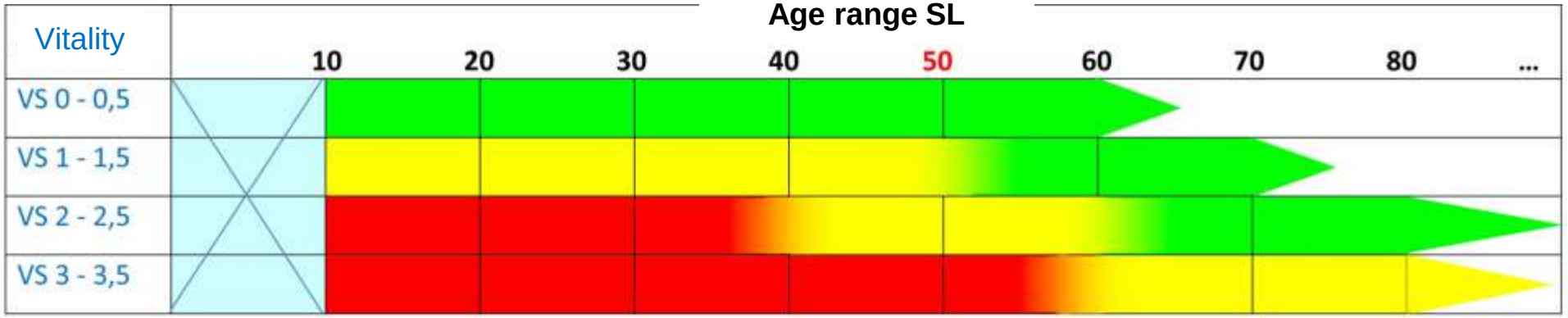


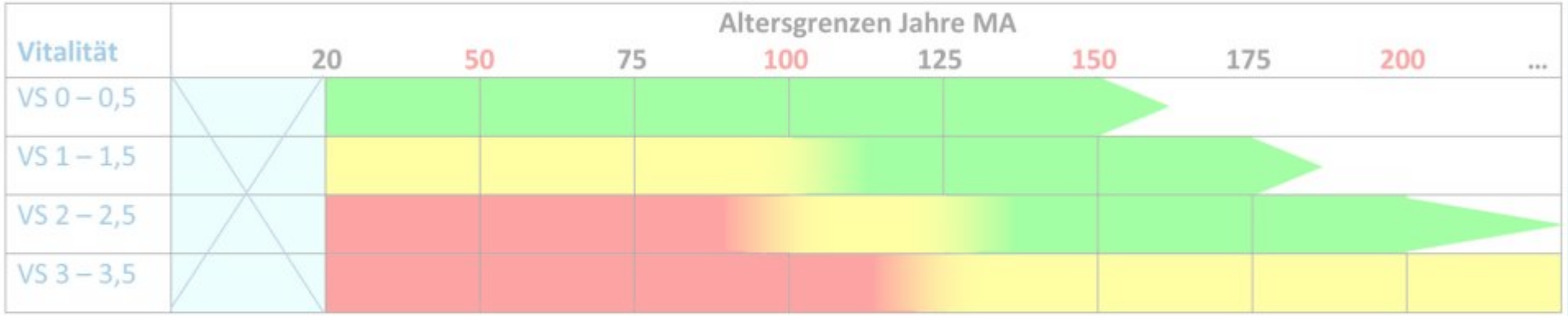
Vitality interpretation for short-lived tree species (SL) – max. age < 100 years

Declaration of an age range for which the specific vitality state (VS) is

age corresponding =	optimum/good
premature aging =	"warning"
senescence =	problematic

(can tell us something, but not necessarily)
(standard in old age)



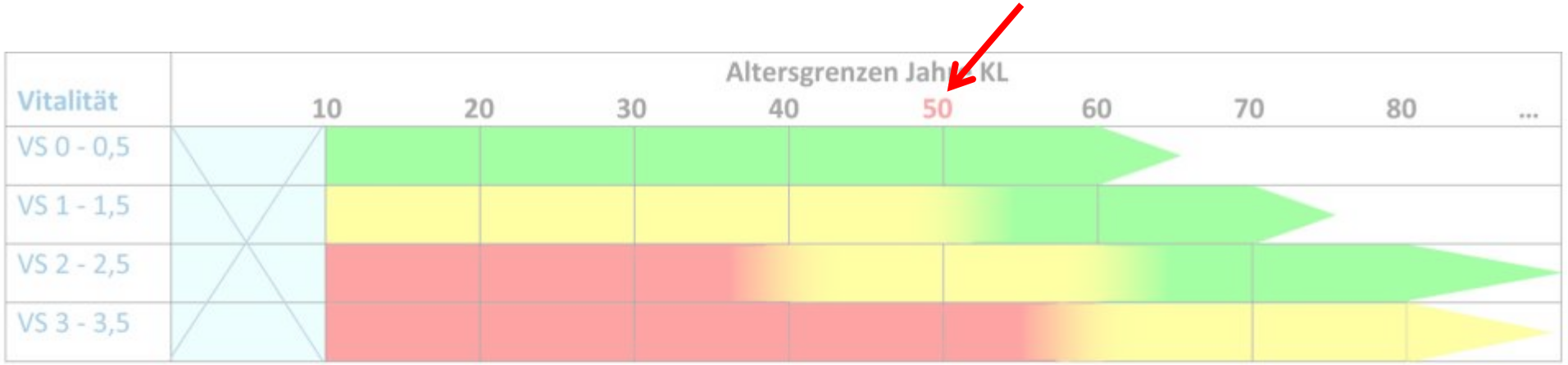


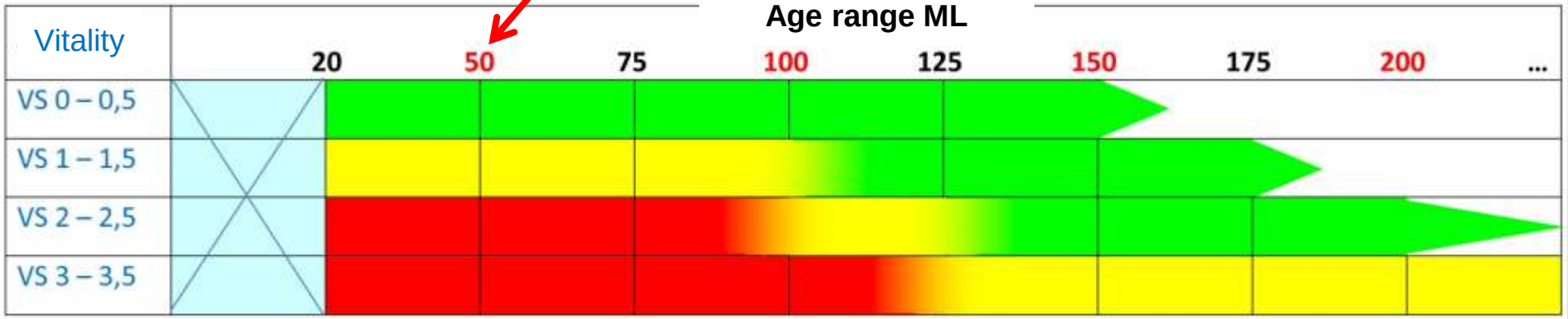
Vitality interpretation for medium-lived tree species (ML) – max. age 150 to 300 years

Declaration of an age range for which the specific vitality state (VS) is

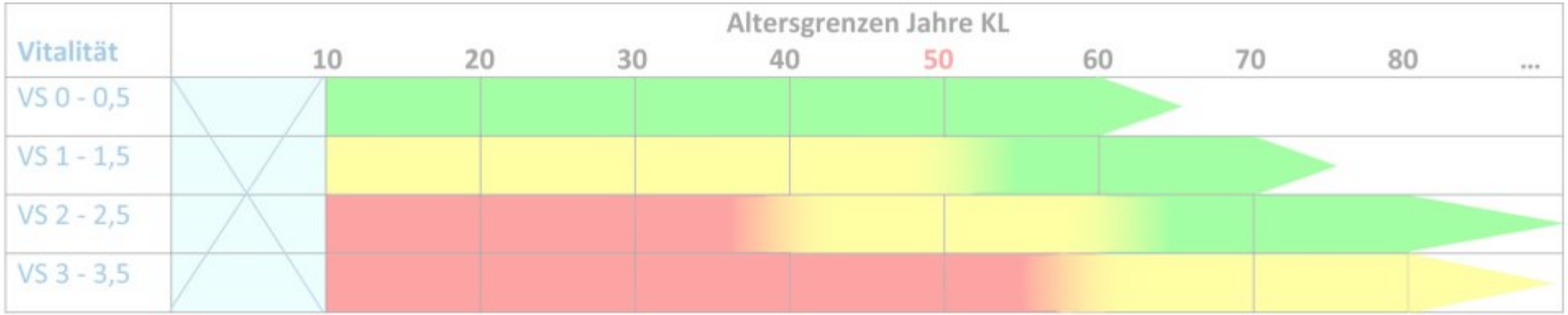
age corresponding =	optimum/good
premature aging =	"warning"
senescence =	problematic

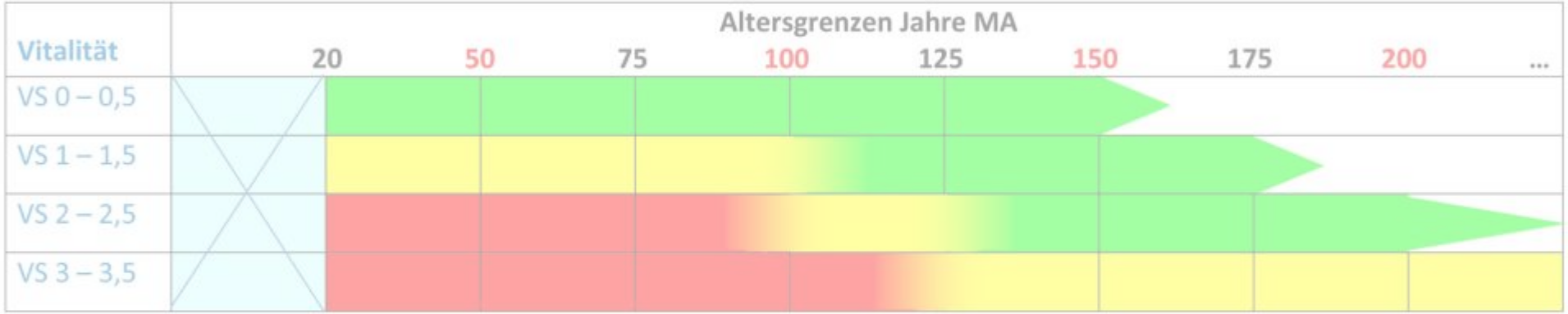
(can tell us something, but not necessarily)
(standard in old age)

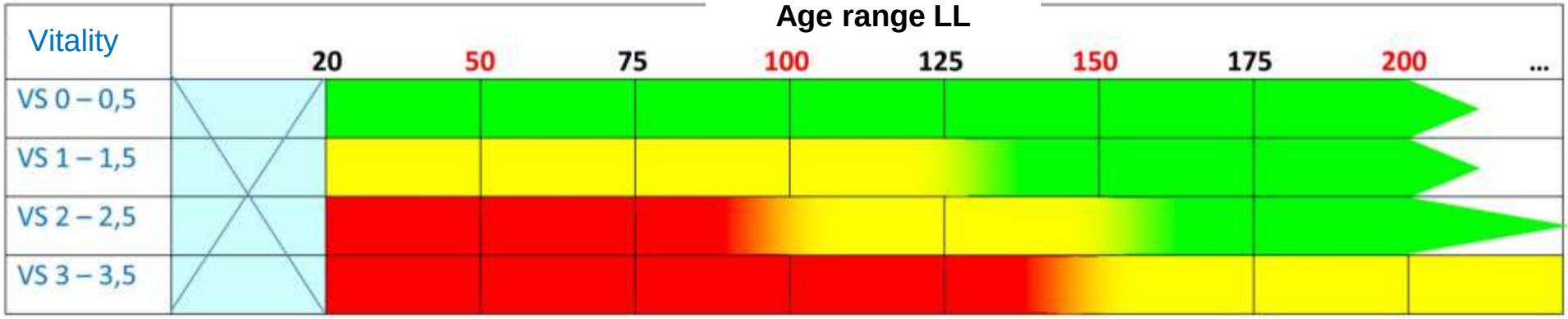




Vitality interpretation for long-lived tree species (LL) – max. age > 400 years







VS 2 (oak): when is it normal?
when senescence = bad future prognosis?

Vitality interpretation for long-lived tree species (LL) – max. age > 400 years

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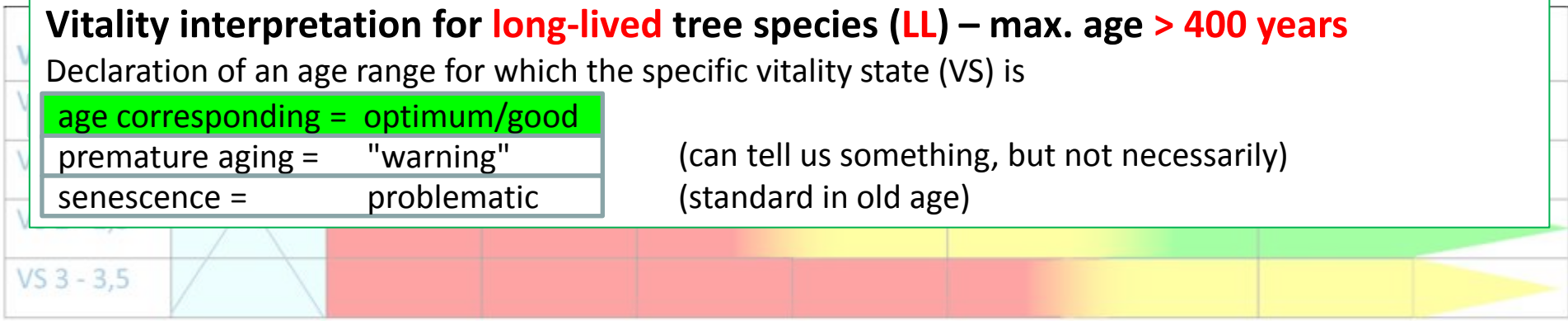

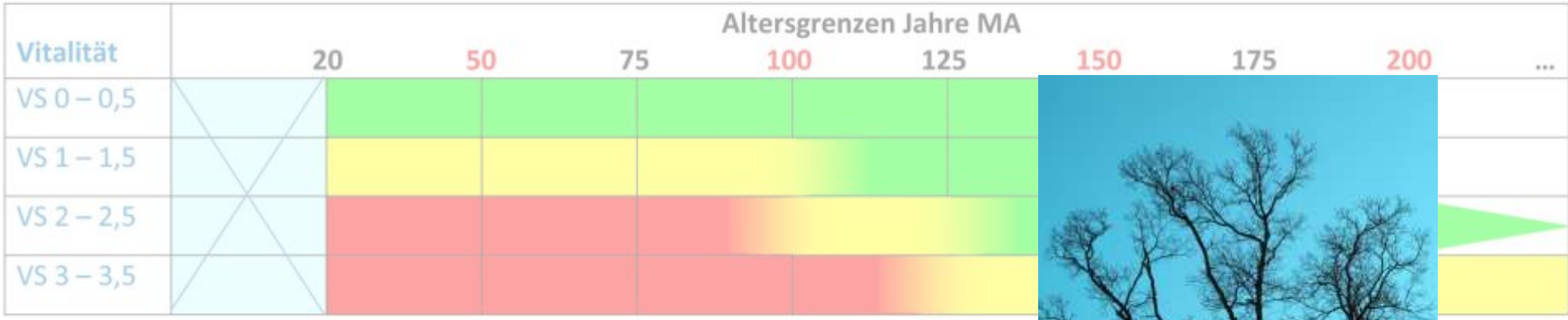

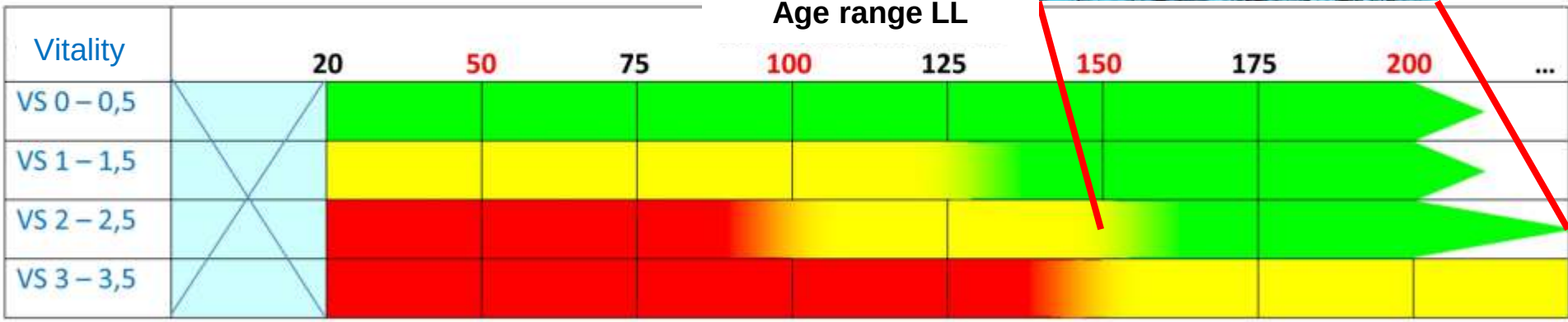

Vitality interpretation for long-lived tree species (LL) – max. age > 400 years

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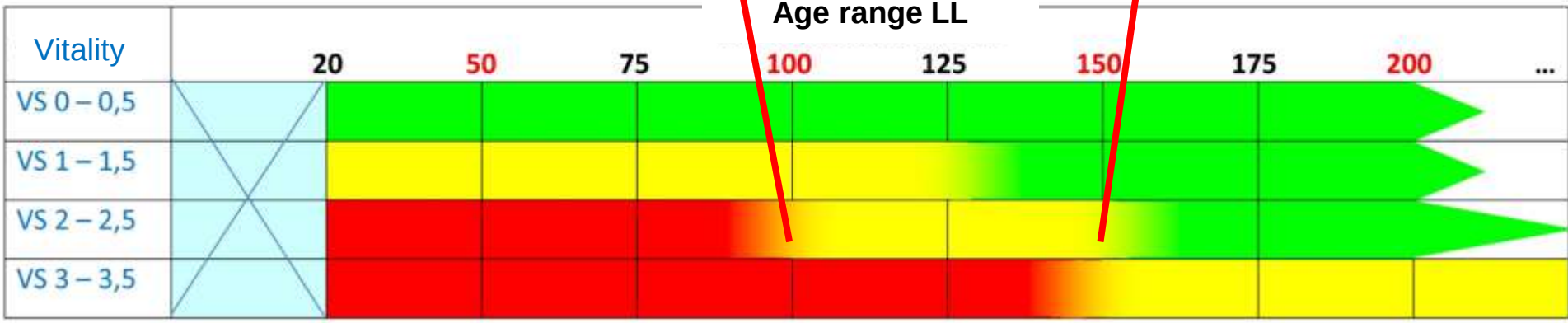
Age range LL



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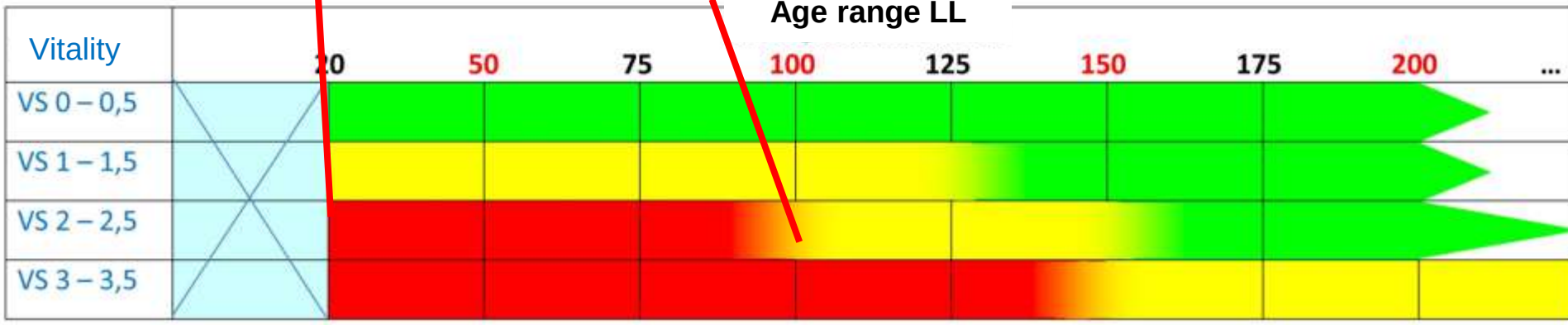

Vitality interpretation of tree species according to their life expectancy