SimCoP: past, present & future

Work “around” Jean-Marc Ottorini’s growth simulator

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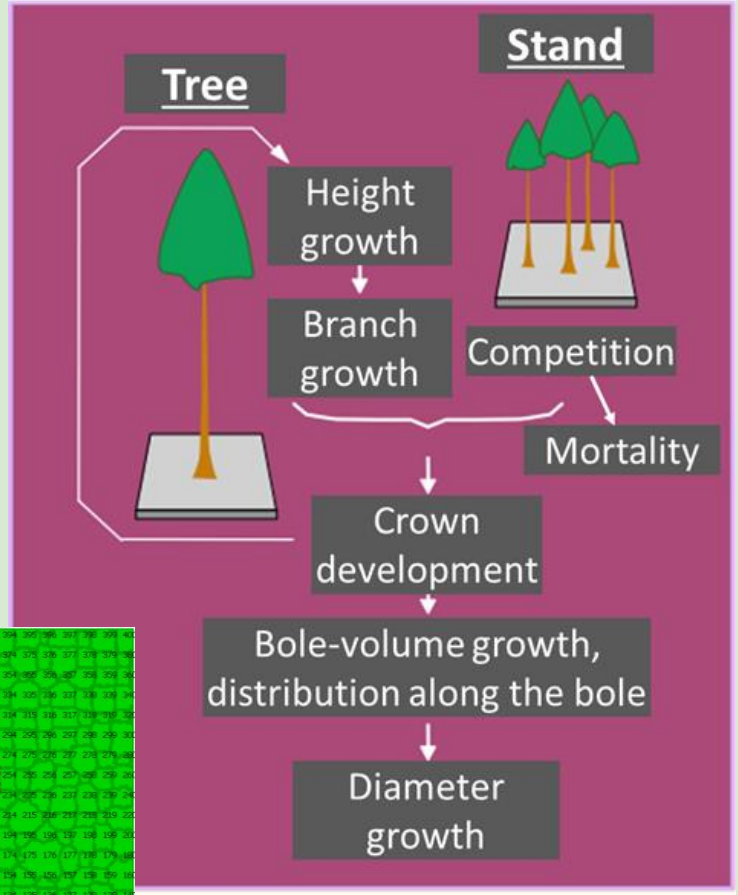
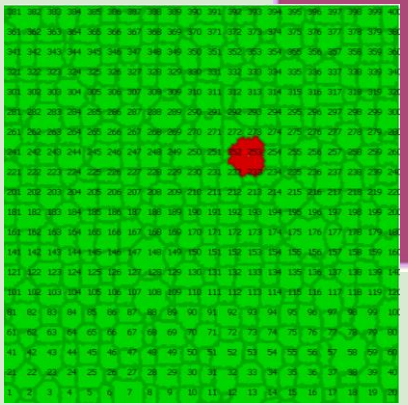
Past

Modelling approach & functioning

Mitchell (1975), Ottorini (1991, 1995)

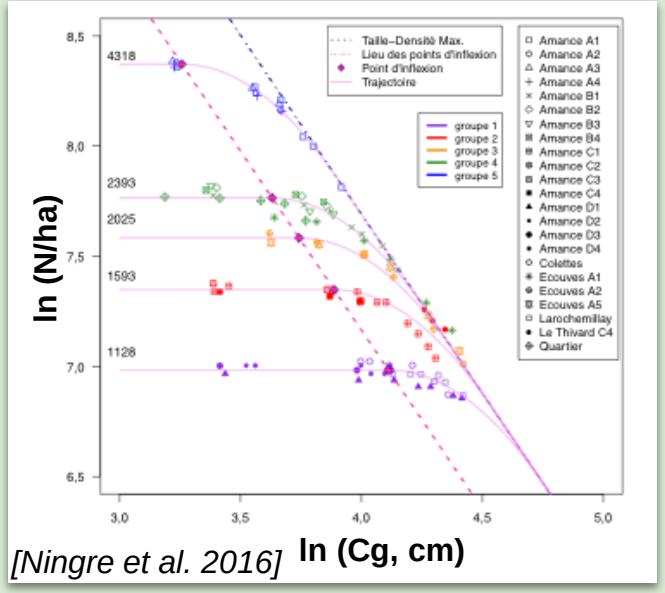
- “High biological explanatory value” *[Pretzsch 2001]*
- Semi-functional, spatially explicit
- Individual tree growth and development in a stand under anisotropic crown competition
- Dominant height growth model, Pressler’s rule, self-thinning line (mortality)
- Thinnings based on crown map
- Douglas fir





Capsis implementation, developments & evaluation

Self-thinning trajectories



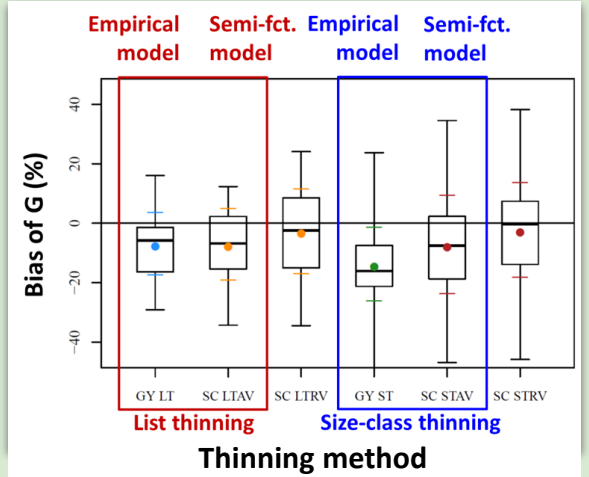
[Ningre et al. 2016]

Thinning algorithm

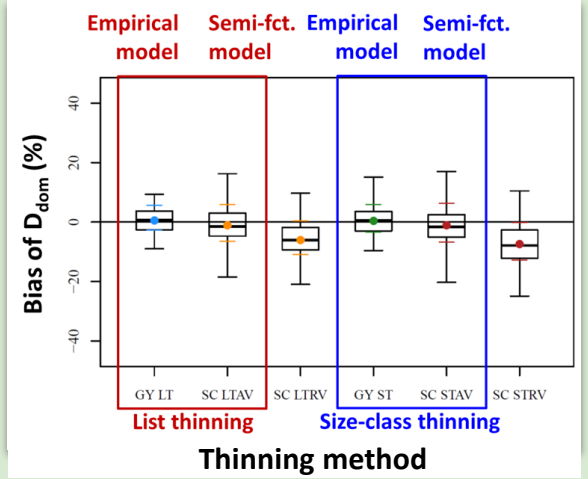
- Probability per size class
- Spatial distribution

Comparison

- Original SimCoP (C) vs. Capsis version (Java)
- SimCoP (semi-fct., Capsis) vs. empirical model vs. independent field data (preliminary results)



[Pulkkinen M]



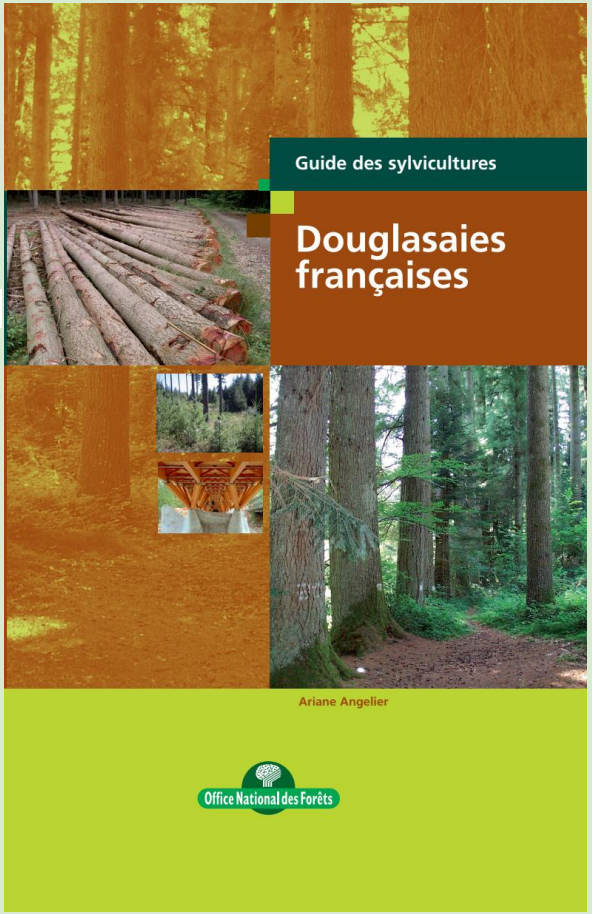
Silvicultural guidelines

Dominant height growth model

[Angelier 2006]

ONF guide

(1st version of 2007)



Present

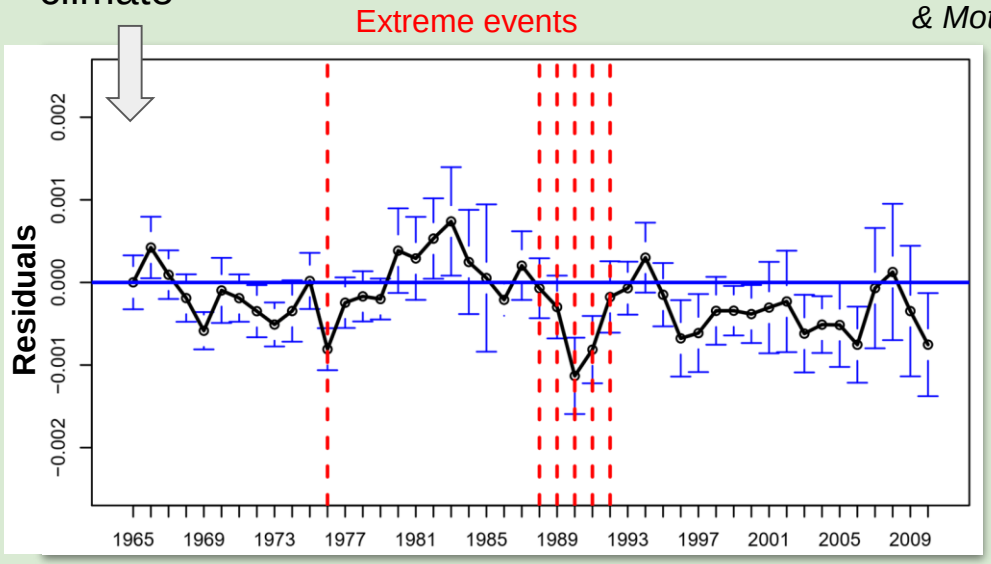
(ongoing)

Tree functioning & wood properties

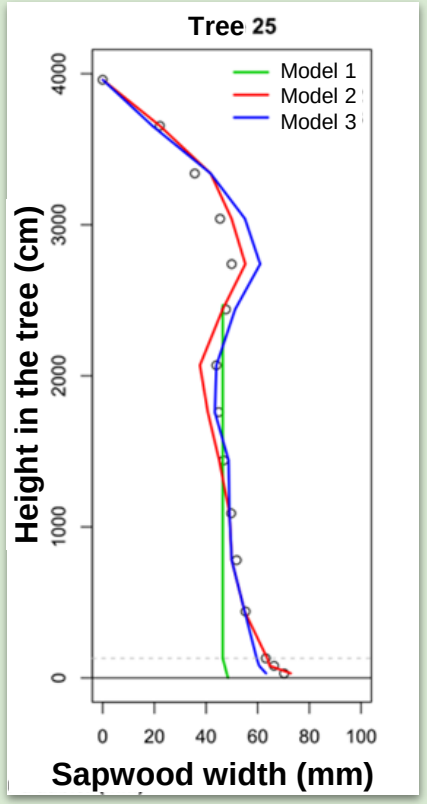
Growth allocation (extension of Pressler's rule)

Modelling of
- ontogeny
- silviculture
- climate

[Longuetaud F & Mothe F]



Sapwood width



Test of differ-ent model formulations

Tree functioning & wood properties

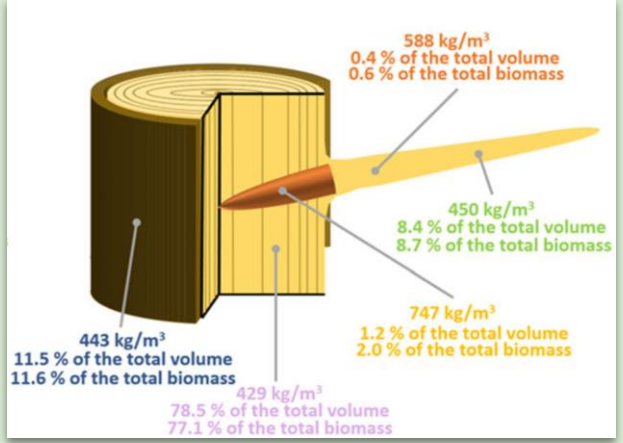
Biomass & nutrients

[Ottorini, Swanston et al. 2002]

- Bole (wood, bark)
- Each whorl (wood+bark, needles)

Bark thickness (volume)

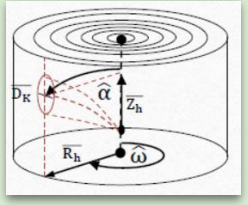
Density distribution



[Billard et al. 2020]

Branches/ knots

[Salzet 2019]



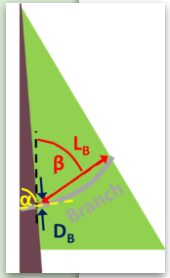
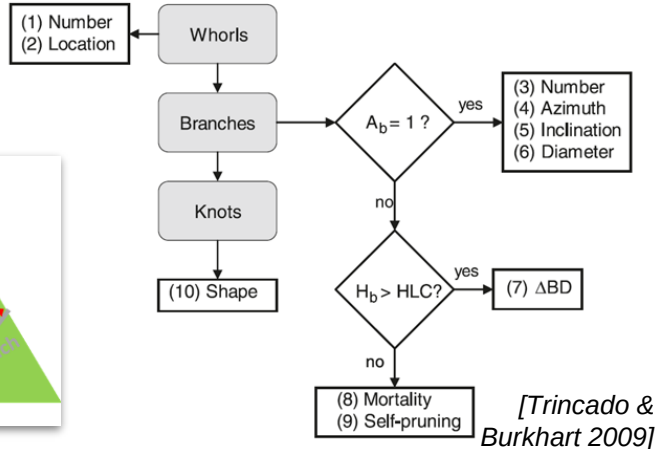
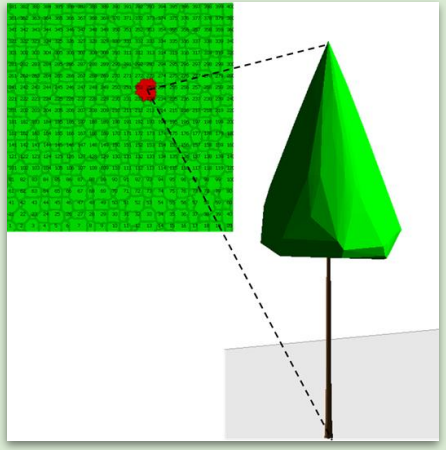


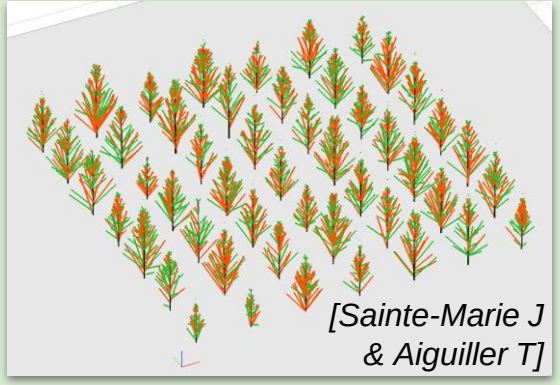
Fig. 2. Schematic diagram with the relationships between components, where A_b is branch age, H_b is branch height above ground, HLC is height to the base of the live crown, and ΔBD is the annual branch diameter increment.



[Trincado & Burkhart 2009]



Simulation of branchiness (first results)



[Sainte-Marie J & Aiguiller T]

Stand growth & management

Stand density management diagram

Graphical depiction of the relationships between stand or mean tree variables reflecting

- Density
- Dynamics
- Crown cover
- Structure

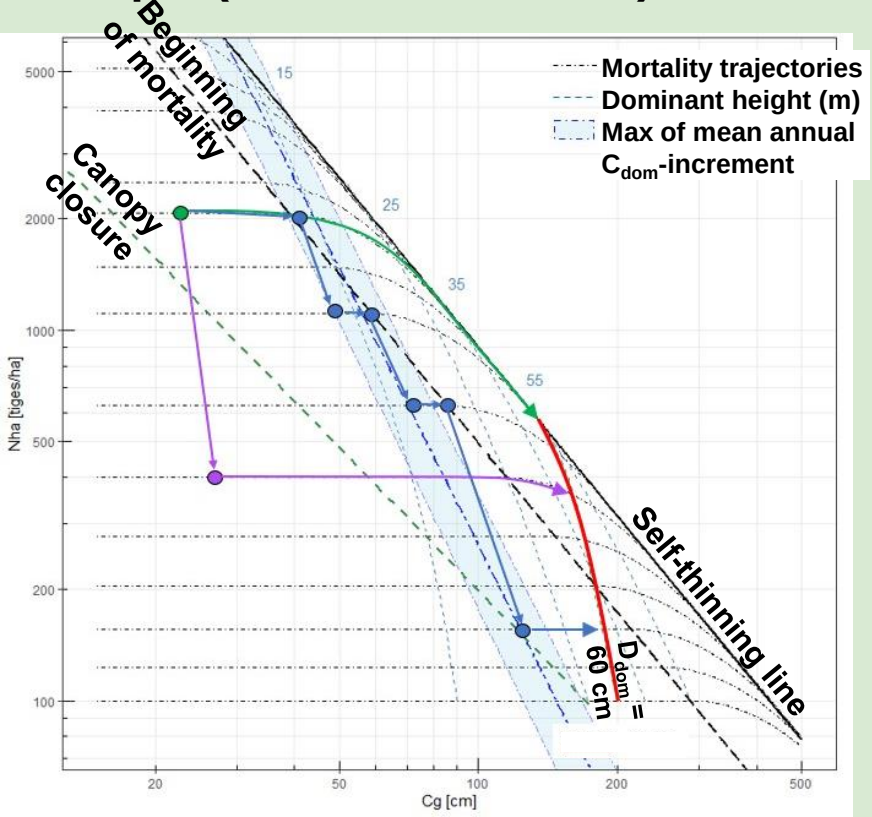
[Newton & Weetman 1994, Jack & Long 1996]

Zones responding to different objectives/criteria:

- Growth and yield
- Risk minimisation (wind, fire)
- Biodiversity conservation (species, structure)
- Carbon sequestration
- Protection (rockfall, avalanches)

[Carteron P]

Example (based on SimCoP)



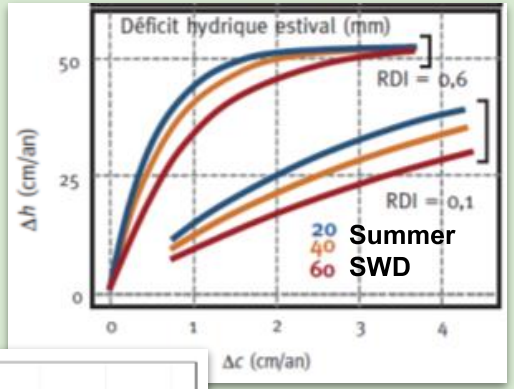
Future

Climate-related effects on growth

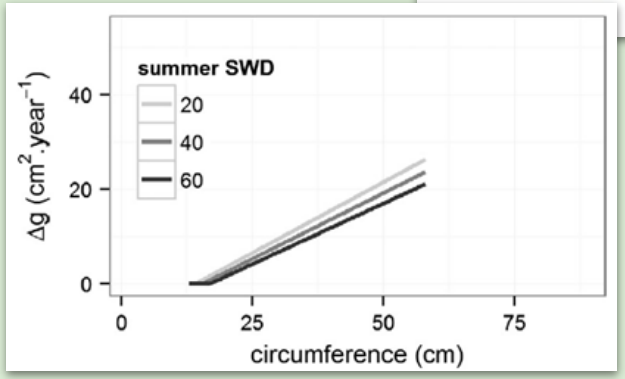
Extension of dendrometric rules

- GIS Coop *[Seynave et al. 2018]* Douglas
- Examples for oak

[Lebourgeois et al. 2017]

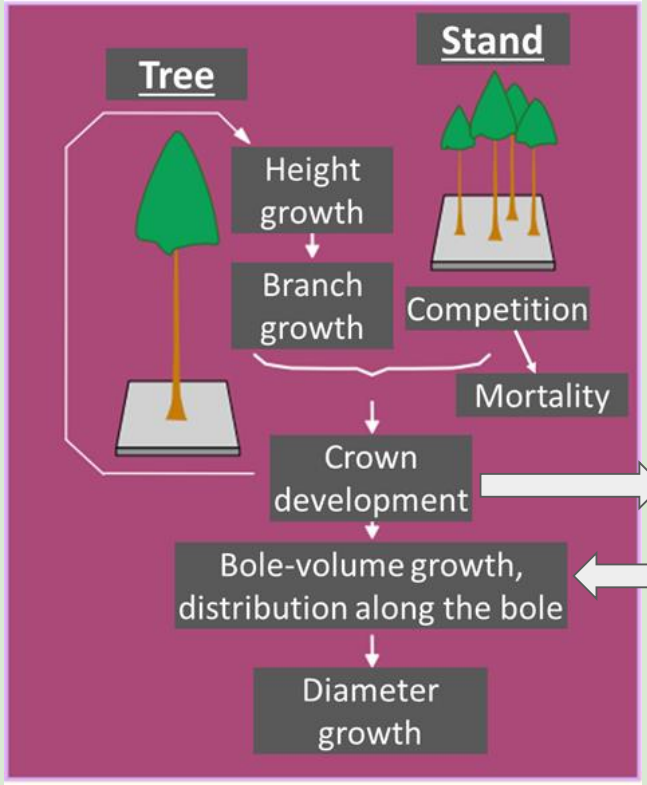


SWD = soil water deficit



[Trouvé et al. 2014]

Functional components



Wind effects (growth response to thinning, longitudinal allocation)

Carbon balance

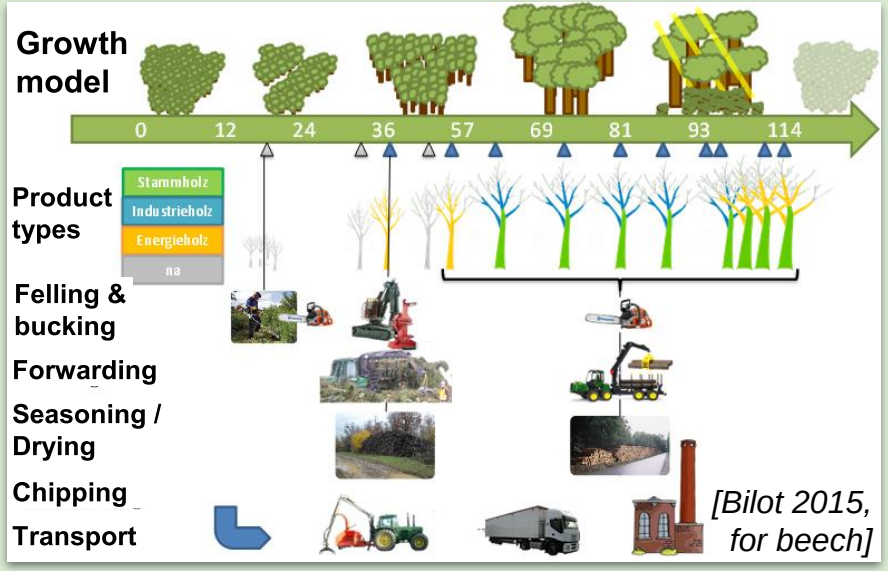
Assessment of forest management

Criteria types

- Production (volume, biomass)
- Wood quality (knottiness, heartwood/sapwood, heating value, extractives)
- Environment (nutrient exportation, energy balance)
- Socio-economic criteria (worktime)

...in relation with silviculture (SimCoP) & exploitation/supply (ForEnerChips)

- Summary as stand density manag. diagram

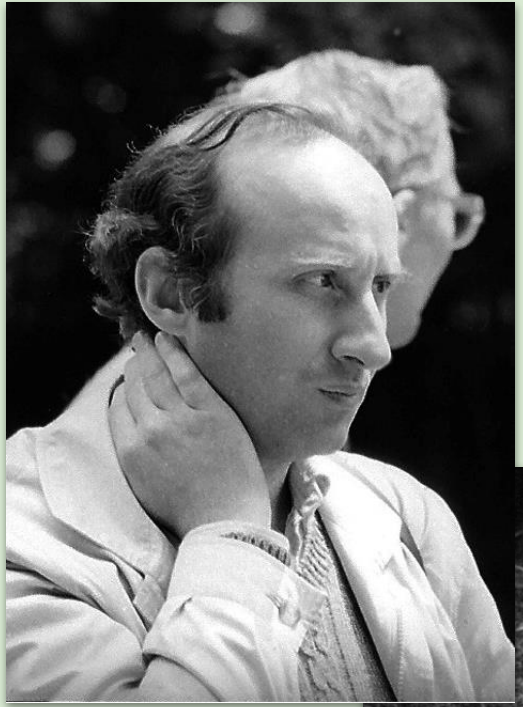


[Bilot 2015, for beech]

Adaptation of SimCoP to more heterogeneous stands ?

- *See SimCAP: beech-ash mixture (sycamore to be implemented)*

Thank you !



Thanks to René Canta for the pictures !