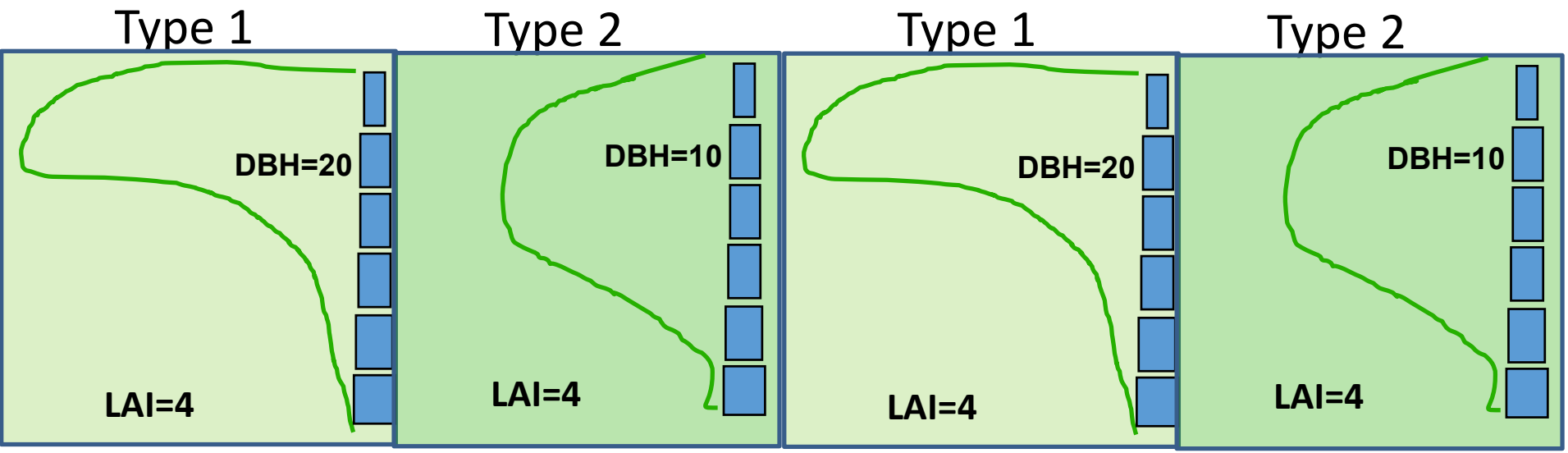
Formulation of a consistent multi-species canopy description for hydrodynamic models of mixed forests *Gil Bohrer, CEGE, OSU*

- Technological Convergence:
- Tree-level observations – remote sensing of crown shape, tree-level leaf density, species identification
- Mixed-vegetation in global vegetation models – PFT patches
- Hydrodynamic vegetation modeling – virtual tree-levels simulations

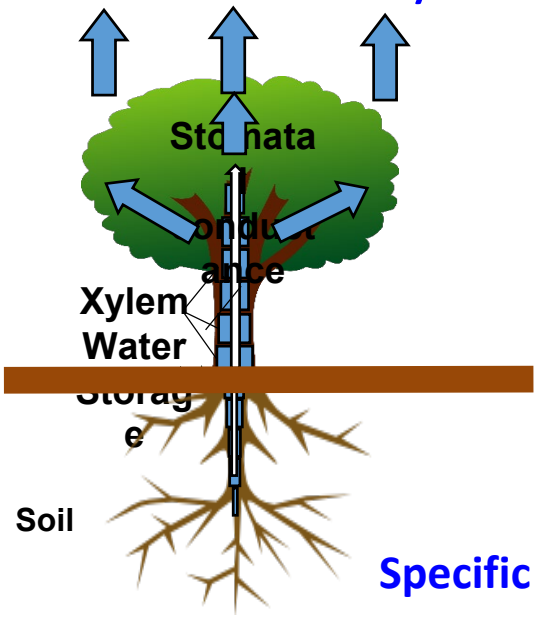
Problem – tree-level species/trait heterogeneity within patch

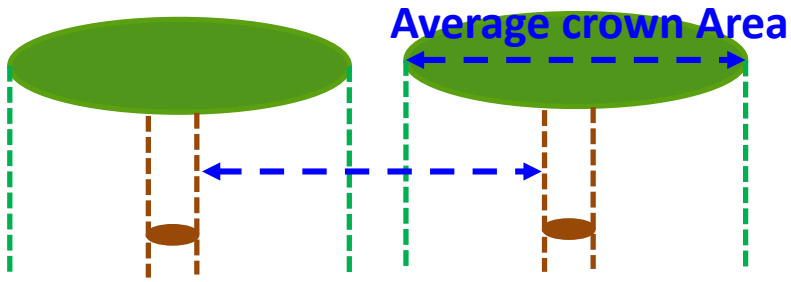


Plot-level, species-specific LAI_1=2, LAI_2=2
Plot area = 1, Species-specific coverage 1/2+1/2

Solution

Per ground area ≠ Per xylem area ≠ Per area under the tree



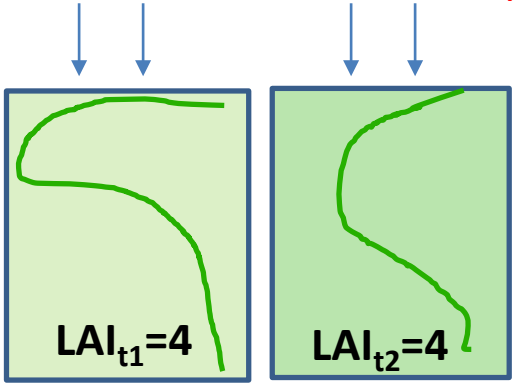


(basal xylem area)$_t$

Specific stand density = # trees$_{sp}$ / Total plot Area

Split forcing: vertically attenuated vs. horizontally mixed

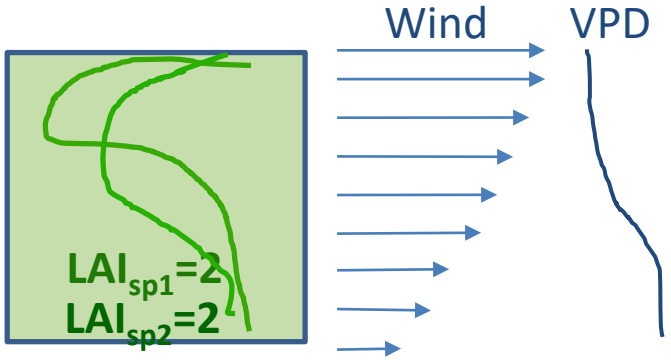
PAR; Net Shortwave; Precip.



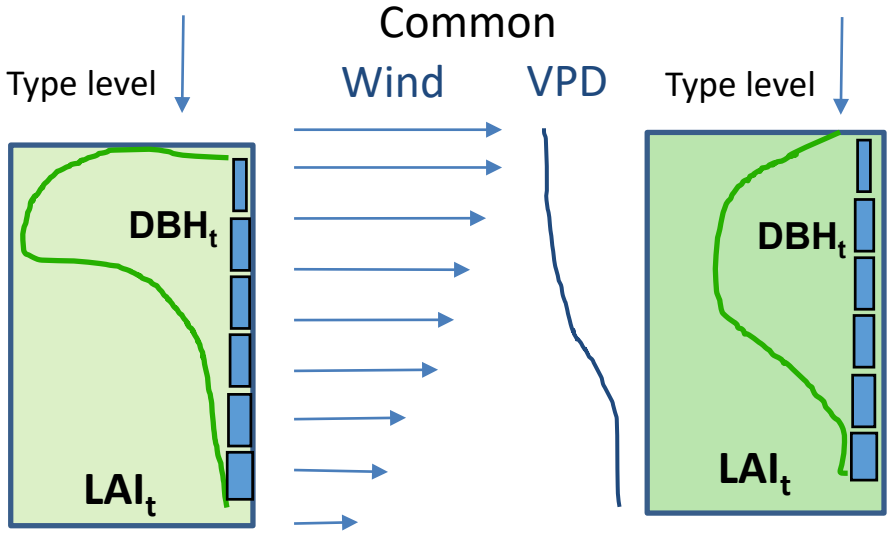
LAI$_p$=4

Alternative virtual canopy spaces

Wind; U*; VPD; Temp



LAI$_p$=4



Plot-level LAI = sum(Species specific LAI)

LAI_p LAI_{sp} Sd_{sp} CA_{sp} LAI_t

Species specific LAI = Specific stand density x Average crown Area x Tree level LAI

$Area_{sp} = Sd_{sp} \times CA_{sp} \times$ Total Plot Area

FX_t = Tree level flux [flow/xylem area] = $f(LAI_t)$ **What hydrodynamic models solve**

FX_{sp} = Type level flux [flow/ground area under tree] = $FX_t \times (\text{basal xylem area})_t / CA_{sp}$

FX_p = Total plot flux [flow/ground area] = sum($FX_{sp} \times Area_{sp}$)/ Total Plot Area

What we ultimately need!!