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HETEROFOR: an individual-based and spatially-explicit model for exploring the response of structurally-complex forests to uncertain future conditions

Mathieu Jonard¹, Frédéric André¹, Nicolas Beudez², François de Coligny³, Louis de Wergifosse¹, Quentin Ponette¹, Caroline Vincke¹ ¹Université catholique de Louvain, Louvain-la-Neuve, Belgium; ²Institut National de la Recherche Agronomique, Montpellier, France; ³CIRAD, Montpellier, France (mathieu.jonard@uclouvain.be; frederic.andre@uclouvain.be; nicolas.beudez@inra.fr; coligny@cirad.fr; louis.dewergifosse@uclouvain.be; quentin.ponette@uclouvain.be; caroline.vincke@uclouvain.be)

Given the multiple abiotic and biotic stressors resulting from the global changes, management systems and practices must be adapted in order to maintain and reinforce the resilience of the forests. Among others, the transformation of monocultures into uneven-aged and mixed stands is an avenue to improve forest resilience. To explore the forest response to these new silvicultural practices and to the changing environment, one needs models combining a process-based approach with a detailed spatial organisation, which is very rare. We therefore decided to develop our own model (HETEROFOR) according to a spatially explicit approach describing individual tree growth based on resource sharing (light, water and nutrients). HETEROFOR was progressively elaborated through the integration of various modules (light interception, phenology, water cycling, photosynthesis and respiration, carbon allocation, mineral nutrition and nutrient

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cycling) within the modelling platform CAPSIS devoted to tree growth and stand dynamics. The advantage of using such a collaborative platform is to use a common development environment, model execution system, user-interface and visualization tools and to share data structures, objects, methods and libraries. The objectives of this presentation are to describe the functioning of HETEROFOR, to show its ability to estimate resource availability and to reconstruct tree growth in mixed oak and beech stands in Wallonia (Belgium). The growth dynamics in these stands was simulated according to four climate scenarios of IPCC to illustrate how the model can be used to predict climate change impacts on forest ecosystems.

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