Climate change impact on tree architecture may contribute to forest decline and dieback

M. Vennetier, F. Girard, S. Ouarmim, A. Thaabet, C. Ripert, Maxime Cailleret, Yves Caraglio

Technical and Poster Sessions

Theme A: Forests and Climate Change

Forest managers and policy makers need the best available science, models and decision tools, and monitoring systems to support adaptation and mitigation options for fostering healthy, productive forests and for ensuring continued provision of ecosystem services in a changing climate. Contributions to this theme will include: effects of climate change on the structure and function of forest ecosystems; interactions between climate and disturbance regimes such as fire, insect and disease, or invasive species; effects of changing climate on ecosystem services; management options for facilitating adaptation of forest ecosystems; mitigation options for optimizing carbon sequestration and greenhouse gas (GHG) offsets; carbon and GHG accounting protocols; feedbacks between climate-induced changes, management options, and global warming potential; and monitoring the impacts of changing climate and of mitigation and adaptation actions.

A-01 Climate change in the boreal forest zone: impacts and interactions
A-02 Biodiversity and climate change: direct and indirect linkages in adaptation and mitigation
A-03 Can forestry and forest sector activities contribute to mitigating climate change?
A-04 Competing roles of forests in climate change mitigation
A-05 Plantation forestry under marginal conditions: water use and water use efficiency in a changing climate
A-06 Assessment of forest management strategies for facilitating adaptation and mitigation in rapidly changing forest systems
A-07 Is climate change leading to global increases in drought-induced forest die-off?
A-08 Silviculture and global change: managing forests for ecosystem resiliency and carbon storage
A-09 Dendrochronology – a useful tool in climate change research
A-10 Adapting to future wildland fire regimes
A-11 Fire and sustainable management of future forests
A-12 Adaptation of temperate and boreal forests to climate change - what experimental trial system is needed?
A-13 Climatic gradients in mountains: opportunities for studying forests facing climate change
A-14 Impacts of climate change on forest ecology, ecosystem processes, and management
A-15 Strategies for linking climate change mitigation and adaptation: securing livelihood options in tropical forestry

				Presenting Author						
Technical Session	Session time slot	Session room	abstract No.	first name	last name	email address	Abstract Title (original)	Abstract decision	Order of presentation	Poster session type
A-07	Tuesday am	Hall E1	S02371	Bernard	Dell	b.dell@murdoch.edu.au	Determining the impacts of climate change on iconic West Australian trees,..	Accepted for Oral	1-3	
A-07	Tuesday am	Hall E1	S02294	Zhen	Zhang	zhangzhen@caf.ac.cn	Chinese and global examples of drought and heat-induced forest mortality a..	Accepted for Oral	1-4	
A-07	Tuesday am	Hall E1	S00097	Alistair	Jump	a.s.jump@stir.ac.uk	Rapid mountain range retractions of forest trees and their implications fo..	Accepted for Oral	1-5	
A-07	Tuesday am	Hall E1	S00209	Haroun	Chenchouni	chenchouni@yahoo.fr	Drought-induced mass mortality of Atlas cedar forest (Cedrus atlantica) in..	Accepted for Oral	1-6	
A-07	Tuesday am	Hall E1	S01825	Lucy	Amissah	ewurakua.amissah@gmail.com	Species response curves along rainfall gradient in Ghanaian forests: what ..	Accepted for Oral	1-7	
A-07	Tuesday pm	Hall E1	S01874	Michel	Vennetier	michel.vennetier@cemagref.fr	Climate change impact on tree architecture may contribute to forest declin..	Accepted for Oral	2-1	
A-07	Tuesday pm	Hall E1	S00819	Andreas	Rigling	andreas.rigling@wsl.ch	Direct and indirect effects of drought in large-scale pine dieback in the ..	Accepted for Oral	2-2	
A-07	Tuesday pm	Hall E1	S02077	Andreas	Bolte	andreas.bolte@vti.bund.de	Critical limits of soil water availability (CL-SWA) for central European f..	Accepted for Oral	2-3	
A-07	Tuesday pm	Hall E1	S00384	Phillip	Van Mantgem	pvanmantgem@usgs.gov	Widespread Increase of Tree Mortality Rates in the Western United States	Accepted for Oral	2-4	
A-07	Tuesday pm	Hall E1	S02931	John	Shaw	jdshaw@fs.fed.us	Population-Wide Mortality in Multiple Forest Types in Western North Americ..	Accepted for Oral	2-5	
A-07	Tuesday pm	Hall E1	S00943	E.H.(Ted)	Hogg	Ted.Hogg@NRCan.gc.ca	Multi-scale approaches for assessing causes and extent of aspen (Populus t..	Accepted for Oral	2-6	
A-07	Wednesday 25 August 12:15-13:15		S00690	Junghwa	Chun	chunjh69@forest.go.kr	CHANGE DETECTION AND VEGETATION MAPPING OF KOREAN FIR STANDS AROUND THE PE..	Accepted for Poster		B
A-07	Wednesday 25 August 12:15-13:15		S00137	Toshinori	Kawaguchi	s809632008@kpu.ac.jp	Adaptation mechanism to water stress of Fagus crenata in Japan.	Accepted for Poster		B
A-07	Wednesday 25 August 12:15-13:15		S00748	Jolanda	Roux	jolanda.roux@fabi.up.ac.za	Increasing reports of unexplained die-back and death of native trees in So..	Accepted for Poster		B
A-07	Wednesday 25 August 12:15-13:15		S01875	Michel	Vennetier	mvennetier@cemagref.fr	Forest dieback and decline: what did we learn from a ten years long antici..	Accepted for Poster		B
A-08	Monday pm	308A	S03049	Juergen	Bauhus	juergen.bauhus@waldbau.uni-freiburg.de	Silviculture to achieve multiple objectives in a changing climate	Accepted for Oral	1	
A-08	Monday pm	308A	S03044	Hubert	Hasenhauer	hubert.hasenauer@boku.ac.at	A mechanistic ecosystem model to derive forest carbon, nitrogen and water ..	Accepted for Oral	2	
A-08	Monday pm	308A	S01880	Takayoshi	Koike	tkoike@for.agr.hokudai.ac.jp	Effects of elevated CO2 on the aboveground growth of sprouts of deciduous	Accepted for Oral	3	
A-08	Monday pm	308A	S01096	Bill	Mason	bill.mason@forestry.gsi.gov.uk	Mixtures as a means of adapting Sitka spruce plantations to climate change..	Accepted for Oral	4	
A-08	Monday pm	308A	S02280	Kevin	O'Hara	kohara@berkeley.edu	Stand Structures and Silvicultural Systems to Maximize Carbon Storage	Accepted for Oral	5	
A-08	Monday pm	308A	S00730	Klaus	Puettmann	klaus.puettmann@oregonstate.edu	Silviculture in times of global change and uncertainty – Achieving r..	Accepted for Oral	6	
A-08	Monday pm	308A	S01353	Ahmet	SIVACIOĞLU	ahmets1973@gmail.com	Rehabilitation Practices of Degraded Forests for Carbon Sequestration in..	Accepted for Oral	7	
A-08	Monday pm	308A	S00809	Hendrik	Stark	hendrik.stark@waldbau.uni-freiburg.de	Energy Nurse Crops: Long Term Effects on Forest Soil Nutrient and Carbon P..	Accepted for Oral	8	
A-08	Tuesday 24 August 12:15-13:15		S03006	Adrian	Ares	adrian.ares@oregonstate.edu	Effects of Pinus radiata afforestation on soil carbon sequestration and so..	Accepted for Poster		B
A-08	Tuesday 24 August 12:15-13:15		S03010	Adrian	Ares	adrian.ares@oregonstate.edu	Aboveground carbon stores in temperate coniferous stands subjected to fixe..	Accepted for Poster		B
A-08	Tuesday 24 August 12:15-13:15		S00591	Leni Diamante	Camacho	camachold@yahoo.com.ph	Carbon Sequestration Potential of Mangrove Forests in the Philippines	Accepted for Poster		B
A-08	Tuesday 24 August 12:15-13:15		S01910	Pablo	Cuenca	pcuenca@catie.ac.cr	Evaluation of productivity in volume and carbon fixation potential in mixe..	Accepted for Poster		B
A-08	Tuesday 24 August 12:15-13:15		S00558	Nancy	Grulke	ngrulke@fs.fed.us	Effect of stand density on canopyhealth and tree drought stress	Accepted for Poster		B
A-08	Tuesday 24 August 12:15-13:15		S01518	Utsugi	Hajime	utsugi@ffpri.affrc.go.jp	long-term forest biomass sequestration in deciduous broad- leaved forest.	Accepted for Poster		B
A-08	Tuesday 24 August 12:15-13:15		S02577	Wai Mun	Ho	howaimun@frim.gov.my	Carbon pool of an Acacia mangium stand established on a degraded ecosystem	Accepted for Poster		B
A-08	Tuesday 24 August 12:15-13:15		S00505	Jaeyeob	Jeong	jy668@nate.com	Soil carbon dynamics of Larix leptolepis, Pinus densiflora and Pinus rigit..	Accepted for Poster		B
A-08	Tuesday 24 August 12:15-13:15		S02055	Hyun-Kil	Jo	jhk@kangwon.ac.kr	Atmospheric CO2 reduction by forest landscapes in middle Korea	Accepted for Poster		B
A-08	Tuesday 24 August 12:15-13:15		S00504	Choonsig	Kim	ckim@jinju.ac.kr	Influence of clear-cut and thinning on soil respiration in red pine stands	Accepted for Poster		B
A-08	Tuesday 24 August 12:15-13:15		S02097	Kiwoong	Lee	woongs0718@gmail.com	Carbon storage of Acacia auriculiformis and Acacia mangium plantations in ..	Accepted for Poster		B

Climate change impact on tree architecture may contribute to forest decline and dieback

Michel VENNETIER, François GIRARD, Samira OUARMIM, Ali THABEET, Christian RIPERT, Maxime CAILLERET & Yves Caraglio

The impact of repeated droughts on tree architecture was studied in South-eastern France from 1995 to 2010. For all of six studied species, a fall occurred in branching rate, and for concerned species a reduction of polycyclism rate. The size and number of leaves were also significantly reduced. The simplified architecture limits the capacity of trees to explore available space and contributes to a low LAI and crown transparency. For evergreen species, small leaves also limit the potential maximum LAI for 3 to 8 years according to their life span. Together, light architecture and smaller leaves or needles may cut by more than 50% and for several years the potential LAI after repeated bad years. This may contribute to carbon shortage and starvation up to many years after climatic accidents. For some species, long series allowed untangling the relationship between architecture parameters and climate parameters (monthly or seasonal) from current and previous years. The models showed that crown development should be significantly reduced in the future. Architectural parameters appeared to be directly linked to tree vigour, and could be good indicators of tree health. The simplification of architecture can be considered as an early warning of potential dieback.