

WHAT WILL BE THE IMPACT OF CLIMATE CHANGE TO VARIOUS ECOSYSTEM SERVICES WITHIN EUROPEAN BEECH FORESTS IN SERBIA UNDER DIFFERENT MANAGEMENT REGIMES?

Dejan STOJANOVIC¹, Martin GUTSCH², Bratislav MATOVIC¹, Vladimir DJURDJEVIC³,
Sasa ORLOVIC¹, Petra LASCH-BORN², Christopher REYER², Felicitas SUCKOW²

¹Institute of Lowland Forestry and Environment, University of Novi Sad, Antona Cehova 13d, 21000 Novi Sad, Serbia

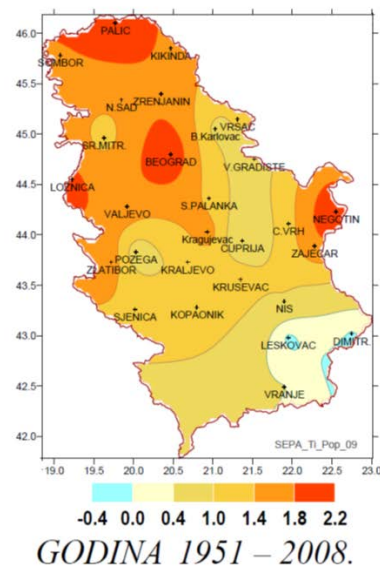
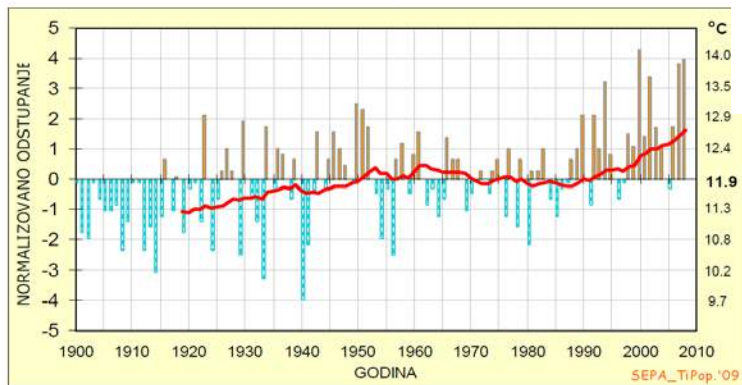
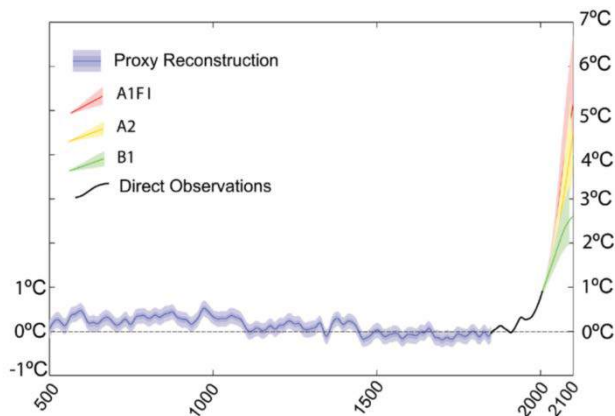
²Potsdam Institute for Climate Impact Research (PIK), P.O. Box 601203, D-14412 Potsdam, Germany

³Faculty of Physics, Institute of Meteorology, University of Belgrade, Dobracina 16, 11000 Belgrade Serbia

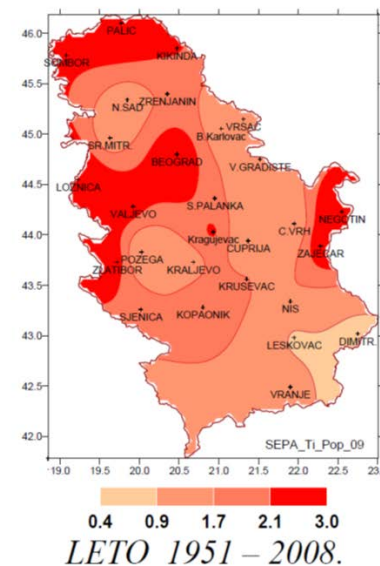
dejan.stojanovic@uns.ac.rs

- According to the IPCC SRES CO₂ emission scenarios and climate change projections on regional level, temperature in some parts of Serbia will rise for about four degrees Celsius before the end of 21st century.

Global Temperature Relative to 1800-1900 (°C)



GODINA 1951 – 2008.



LETO 1951 – 2008.

- Current forests, as well as those that are planted today, will be exposed to drastically different climate conditions.

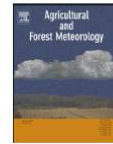
Agricultural and Forest Meteorology 176 (2013) 94–103



Contents lists available at SciVerse ScienceDirect

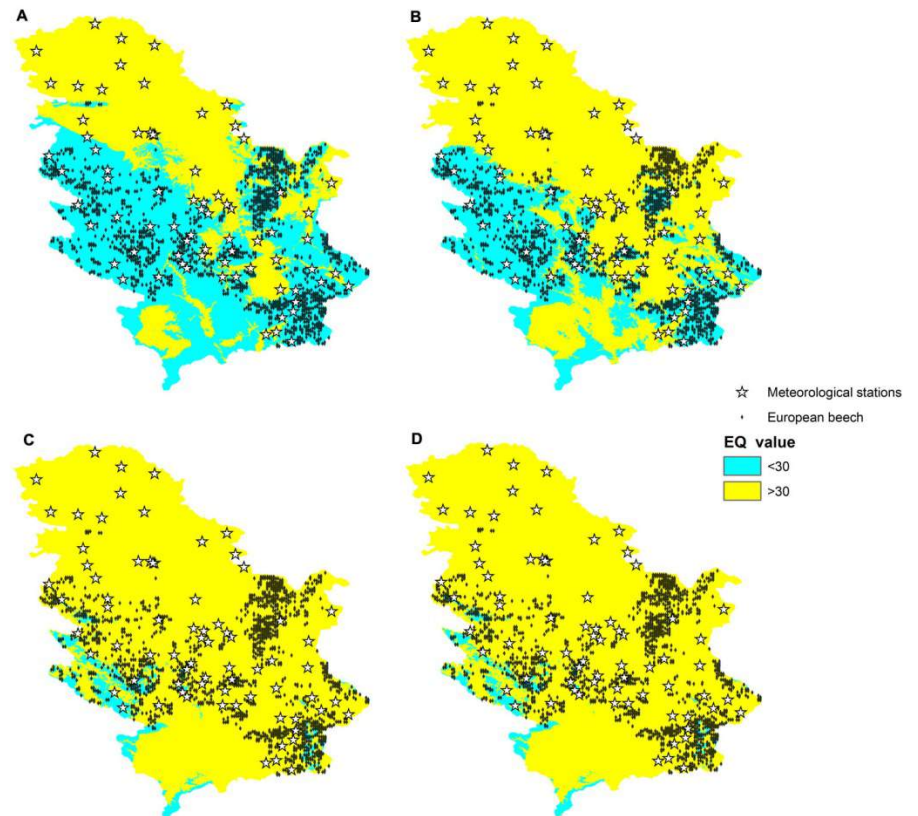
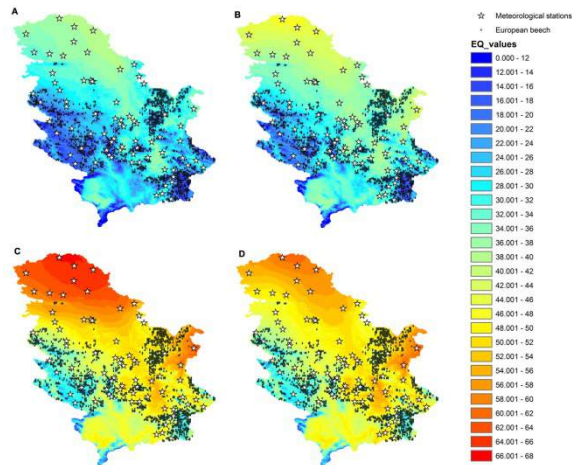
Agricultural and Forest Meteorology

journal homepage: www.elsevier.com/locate/agrformet



Prediction of the European beech (*Fagus sylvatica* L.) xeric limit using a regional climate model: An example from southeast Europe

Dejan B. Stojanović^{a,*}, Aleksandra Kržič^b, Bratislav Matović^a, Saša Orlović^a, Anne Duputic^c, Vladimir Djurdjević^{b,d}, Zoran Galić^a, Srdjan Stojnić^a



- With a forecasted rise in average global surface temperature and changes in precipitation and disturbance regimes at an unprecedented rate (Nakicenovic et al., 2000), climate change will bring forth new challenges for forest ecosystems, as well as for current management concepts, specific objectives and various ecosystem services.

- **Fires in Serbia, 2007**



- **Ice storm in Slovenia, 2014**



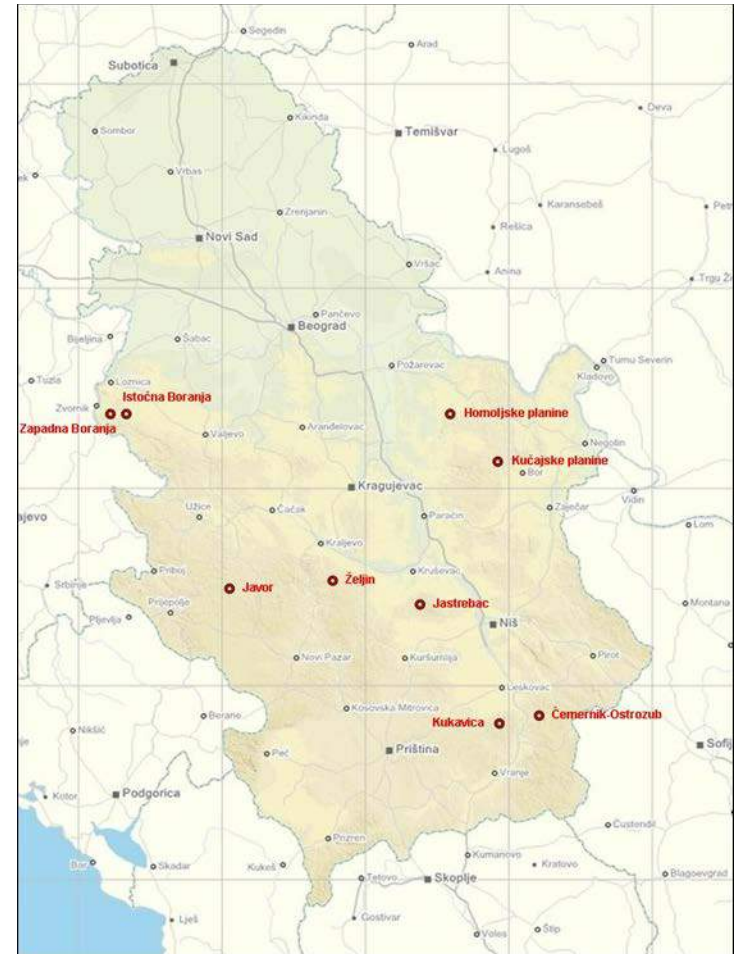
- **Wind storm in Slovakia, 2004**

- Our study targets European beech managed forests as the one of the most important ecosystems in Europe.
- This study directed focus on dynamics of originally natural beech forest ecosystems (Matović, 2012), with consideration of management intensities and trade-offs among various stakeholder preferences and ecosystem services provision.

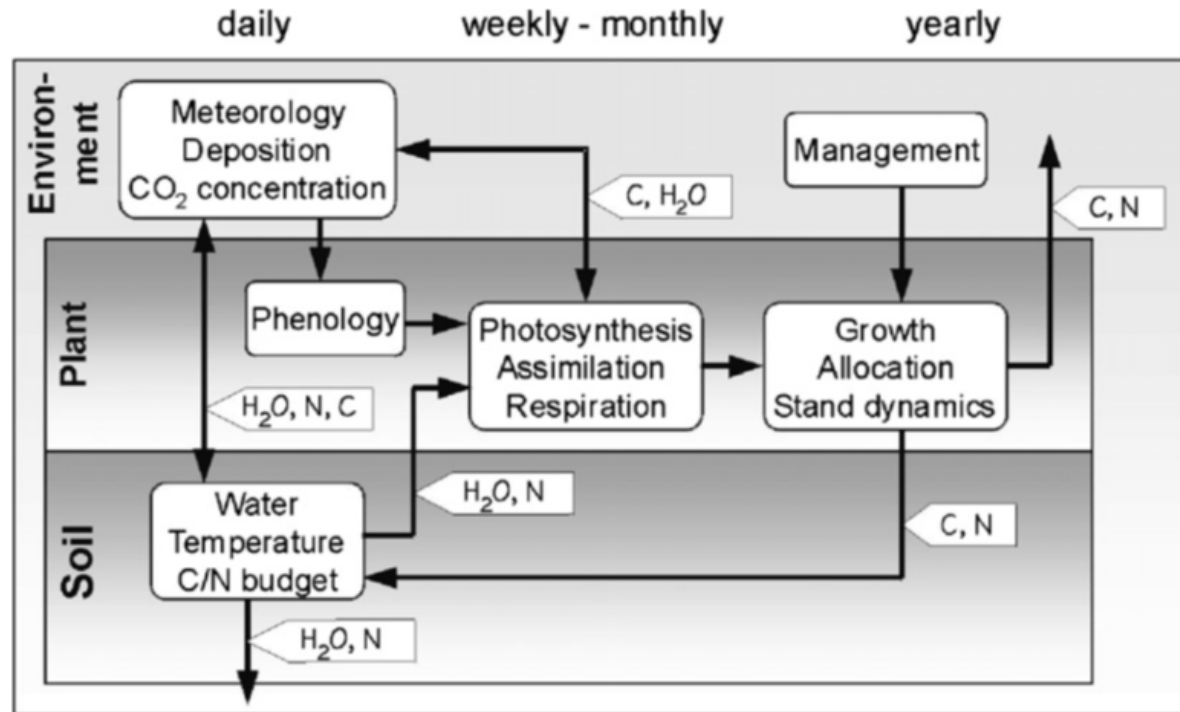


METHODS

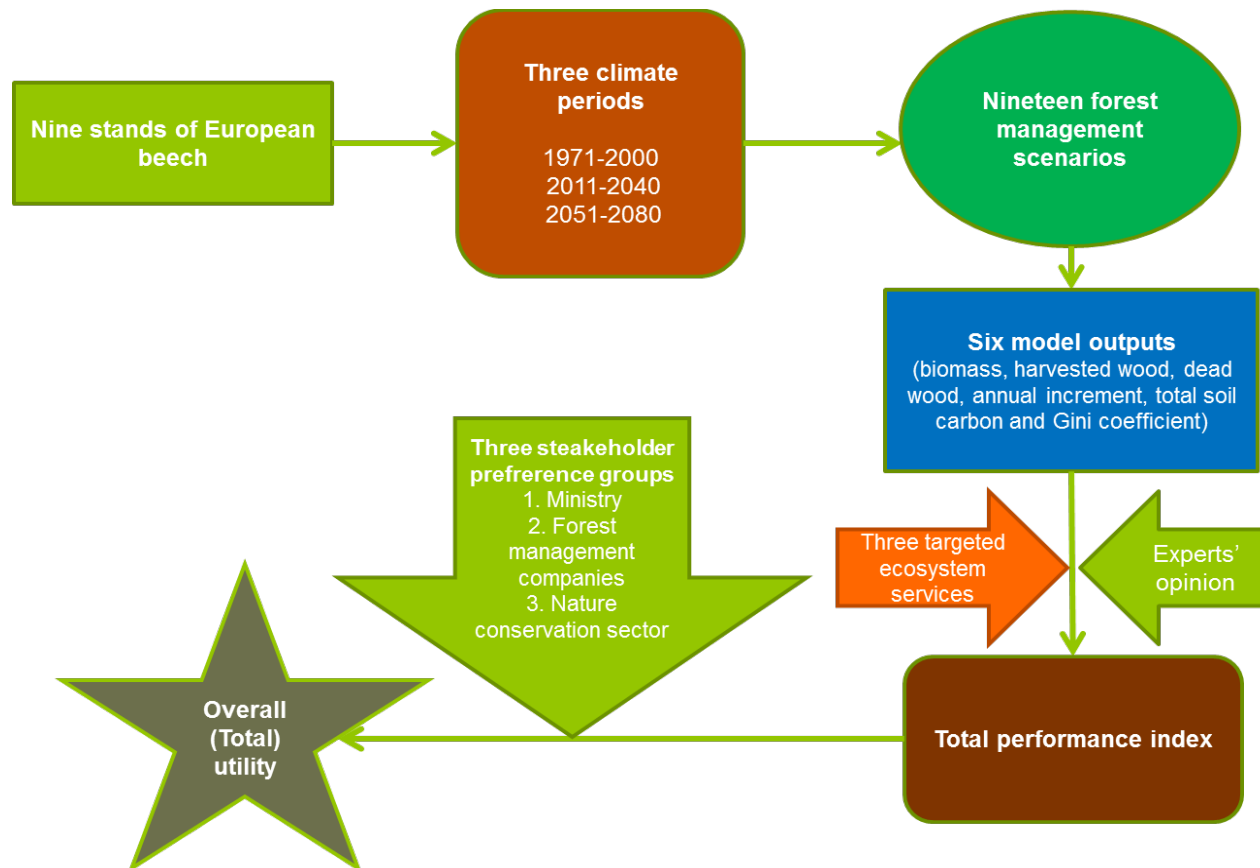
- European beech forests in Serbia are mostly uneven-aged characterized by virgin origin (Matović, 2012).
- They cover 660,400 ha or 29.3 % of forest land which makes them the most abundant tree species in Serbia.
- They are managed by public enterprise “Serbian forests” (srb. Srbijašume), and by National parks “Djerdap, “Fruška gora”, “Tara” and “Kopaonik”.
- Forest survey was conducted from 2005 to 2007 at nine publicly owned beech forest sites in Serbia.
- Nineteen different sets of silvicultural management measures were designed in a way to be close to current management practice.



Forest Growth Model 4C



Overall study flow



Description of management measures

Description of management measures

	Felling type	Felling intensity (% of growing stock)	Felling interval (years)
1	Without felling	0	0
2	Felling of higher trees	10	10
3	Felling of higher trees	20	10
4	Felling of higher trees	30	10
5	Felling of lower trees	10	10
6	Felling of lower trees	20	10
7	Felling of lower trees	30	10
8	Selective felling	10	10
9	Selective felling	20	10
10	Selective felling	30	10
11	Felling of higher trees	5	5
12	Felling of higher trees	10	5
13	Felling of higher trees	15	5
14	Felling of lower trees	5	5
15	Felling of lower trees	10	5
16	Felling of lower trees	15	5
17	Selective felling	5	5
18	Selective felling	10	5

Mean temperatures and mean annual sum of precipitation for simulated 30-years' periods

Climate periods	Javor	Zapadna Boranja	Čemernik-Ostrozub	Homoljske planine	Kucajske planine	Zeljini	Kukavica	Jastrebac	Istocna Boranja
1971-2000 20c3m	724	786	606	674	729	709	616	666	786
2011-2040 A2	802	859	697	786	839	808	712	756	859
2051-2080 A2	709	745	612	667	704	695	616	666	745

Climate periods	Javor	Zapadna Boranja	Čemernik-Ostrozub	Homoljske planine	Kucajske planine	Zeljini	Kukavica	Jastrebac	Istocna Boranja
1971-2000 20c3m	5,9	9,5	8,9	9,3	7,2	9,0	9,7	9,3	9,5
2011-2040 A2	6,2	9,8	9,2	9,5	7,5	9,3	10	9,6	9,8
2051-2080 A2	8,3	11,9	11,2	11,6	9,7	11,3	12	11,7	11,9

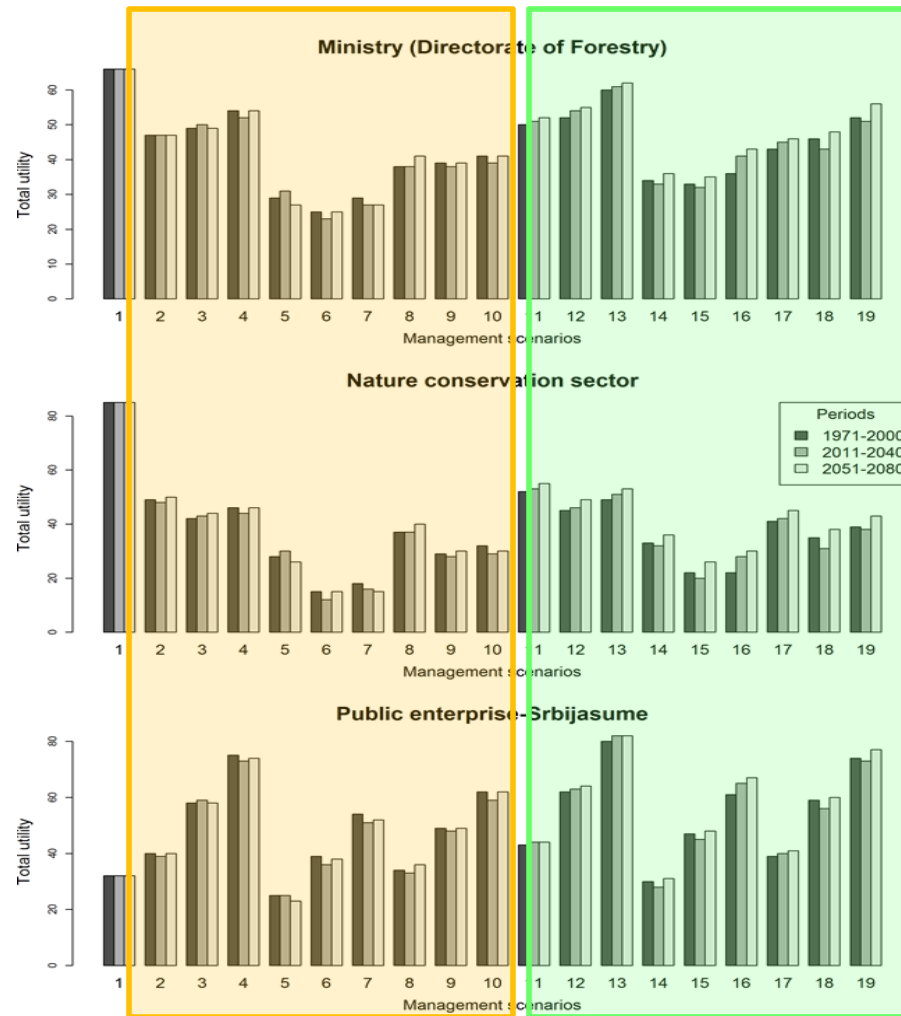
Five forest experts crossed and ranked different model outputs with three targeted ecosystem services
 Weighting factors for model outputs according to experts' opinion

Ecosystem services (or partial objectives in forest management)	Biomass	Harvest	Dead wood	Growth (Stem increment)	Total carbon in soil	Gini (structural diversity index)
Carbon sequestration on site	0.25	0.13	0.08	0.30	0.17	0.07
Provisioning of biodiversity	0.15	0.07	0.19	0.12	0.14	0.33
Timber production	0.16	0.29	0.06	0.30	0.07	0.12

Weighting factors for four scenarios and three objectives

	Stakeholder preference groups		
Ecosystem services (or partial objectives in forest management)	Lawmaker	Nature conservation sector	Forest management companies
Carbon sequestration on site	0.33	0.15	0.19
Provisioning of biodiversity	0.33	0.7	0.13
Timber production	0.33	0.15	0.68

Provision of various ecosystem services under different management and climate regimes



Conclusion

- Making the relation among the concept of multifunctionality with the ecosystem services, as well as with multiple management measures, climate conditions and stakeholder preferences is a promising approach for producing scientific evidence for forest management planners.
- Management has the larger impact on variations in ecosystem services provision than climate conditions.
- Management regimes which included more frequent felling operations provided better results in multifunctional forest management under different stakeholder preference scenarios than regimes with less frequent felling operations for the same harvested volume.

Thank you very much.

