Climate change: impact on forest ecosystems ...

ORESTERRA FINAL CONFERENCE LISBON, November 25, 2015 Climate change: impact on forest ecosystems ...

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FORESTERRA FINAL CONFERENCE LISBON, November 25, 2015 Main research interest(s)

How did and does climate change? & How did and do ecosystems respond to such changes?

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NatureCC 2012

Science 2011

PLoSOne 2012

Coastal East Greenland near Scoresbysund



Where are the trees



What is a tree



Thin section of Rhododendron lapponicum



Signal and noise



Tree-ring parameter



Towards wood anatomy







WSL-Lab-microtome

Recent and historical tree-ring sources











Archaeological and subfossil tree-ring sources



Central EU precipitation and temperature variability over the last 2'500 years



Outline

Climate variability over Iberia

Climate effects on forest growth

Climate and non-woody forest products

Limitations

Among many other biases, examples herein provided are

highly selective and partly explorative

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Climate variability over Iberia

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Temperature increase since the 1970s followed by a recent hiatus











corr Jun-Aug averaged Iberia JJA temp index with Jun-Aug averaged E-OBS 11.0 Tmean 1950:2014 p<10%

























An Iberian perspective from the OWDA

Materials of the OWDA



Materials of the OWDA



Materials and methods of the OWDA

OWDA Domain Penman-Montheith scPDSI Map



Materials and methods of the OWDA



Materials and methods of the OWDA



Materials, methods and results of the OWDA



Reconstructed Iberian summer drought variability



Placing the recent drought in a millennium-long, pre-industrial context


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Declining pine growth in Central Spain coincides with an increasing diurnal temperature range since the 1970s

Pinar Grande - Soria



Natural distribution of *Pinus sylvestris*



Tree-ring width sample replication



Pine growth coherency



Trends and signals of Pinar Grande forest growth



Projected changes of DTR and summer drought until 2100



Spatial diversity in recent Mediterranean tree growth patterns

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Pinar Grande - Soria



Non-woody forest products



Boletus edulis



Lactarius deliciosus



Possible linkages between tree growth and mushroom yield



Büntgen et al. (2014) Fungal Ecology

Temporal changes in fungal phenology and productivity



Effects of summer precipitation on autumn fungal productivity phenology



Büntgen et al. (2014) Fungal Ecology

The role of climate and host plants on mycorrhizal and saprotrophic fungi



Büntgen et al. (2013) Global Change Biology

Périgord black truffle (*Tuber melanosporum*)



Drought-induced Périgord black truffle decline



Drought-induced Périgord black truffle decline and oak growth





Tracing putative fungi-host interaction



Büntgen et al. (2012) Frontiers in Ecology and the Environment

Breaking new ground at the interface of dendroecology and mycology



The role of climate, irrigation and host trees on truffle growth



Büntgen et al. (2015) Agriculture, Ecosystems & Environment

Warm spring and wet summer conditions (indirectly) enhance truffle harvest with medium irrigation intensity being most beneficial



Büntgen et al. (2015) Agriculture, Ecosystems & Environment

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Conclusion

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The Iberian Peninsula represents a wide range of unique ecosystems

for the assessment of different causes and consequences of

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Numerous intra and interannual tree-ring parameters

facilitate timely research at the cross-disciplinary interface of

archaeology, (paleo)climatology and ecology (including forestry / mycology),

and more generally in numerous fields of environmental science that have temporal interest.

Outlook

Temperature reconstruction



Temperature and drought reconstructions



Climate reconstructions and truffle ecology



Thanks

Key publications

Dendroecology

Galván et al. (2015) Drought-induced decline of growth-temperature association in Mediterranean forests. Global and Planetary Change 124: 95-106

> Galván et al. (2014) Spatial diversity of recent trends in Mediterranean tree growth. Environmental Research Letters 9: 084001

Büntgen *et al.* (2013) Declining pine growth in Central Spain and diurnal temperature range since the 1970s. *Global and Planetary Change* 107: 177-185

Büntgen *et al.* (2010) Diverse climate sensitivity of Mediterranean tree-ring width and density. *Trees, Structure and Function* 24: 261-273

Büntgen *et al.* (2008) Long-term summer temperature variations in the Pyrenees. *Climate Dynamics* 31: 615-631

Mycology

Büntgen *et al.* (2015) Drought-induced changes in the phenology, productivity and diversity of Spanish fungi. *Fungal Ecology* 16: 6-18

Büntgen et al. (2015) Long-term irrigation effects on Spanish holm oak growth and its black truffle symbiont. Agriculture, Ecosystems & Environment 202: 148-159

> Büntgen *et al.* (2012) Drought-induced decline in Mediterranean truffle harvest. Nature Climate Change 2: 827-829

Key authors (in alphabetical order)

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"To miss the forest for the trees"



"The whole is more than the sum of its parts"

