Understanding Mixed Forests in Europe – Findings from the COST Action EuMIXFOR

Bill Mason, Andres Bravo-Oviedo, Hans Pretzsch, Quentin Ponette, Maciej Pach and Jerzy Lesinski.

Structure of presentation

1. Overview of COST;
2. Introduction to EuMIXFOR;
3. Achievements to date;
4. Future challenges

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EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

European COoperation in Science and Technology

1. Founded 1971
2. Seeks to achieve Pan-European NETWORKING of NATIONAL research activities
3. Does NOT fund research directly.

COST Mechanisms = ACTIONS

1. Bottom-up Science & Technology Networks open both to researchers and stakeholders
2. Normally last 4 years
3. Must have participation from a minimum of 5 EU member states.

COST ACTIONS – Participation and activities

1. Open to all EU member states and to near-neighbour countries;
2. Open to International Partners (29 countries) including Canada, China, USA.
3. Main networking methods include: meetings, workshops, conferences, training schools, short-term scientific missions, etc.

COST Association

EUMIXFOR Cost Action

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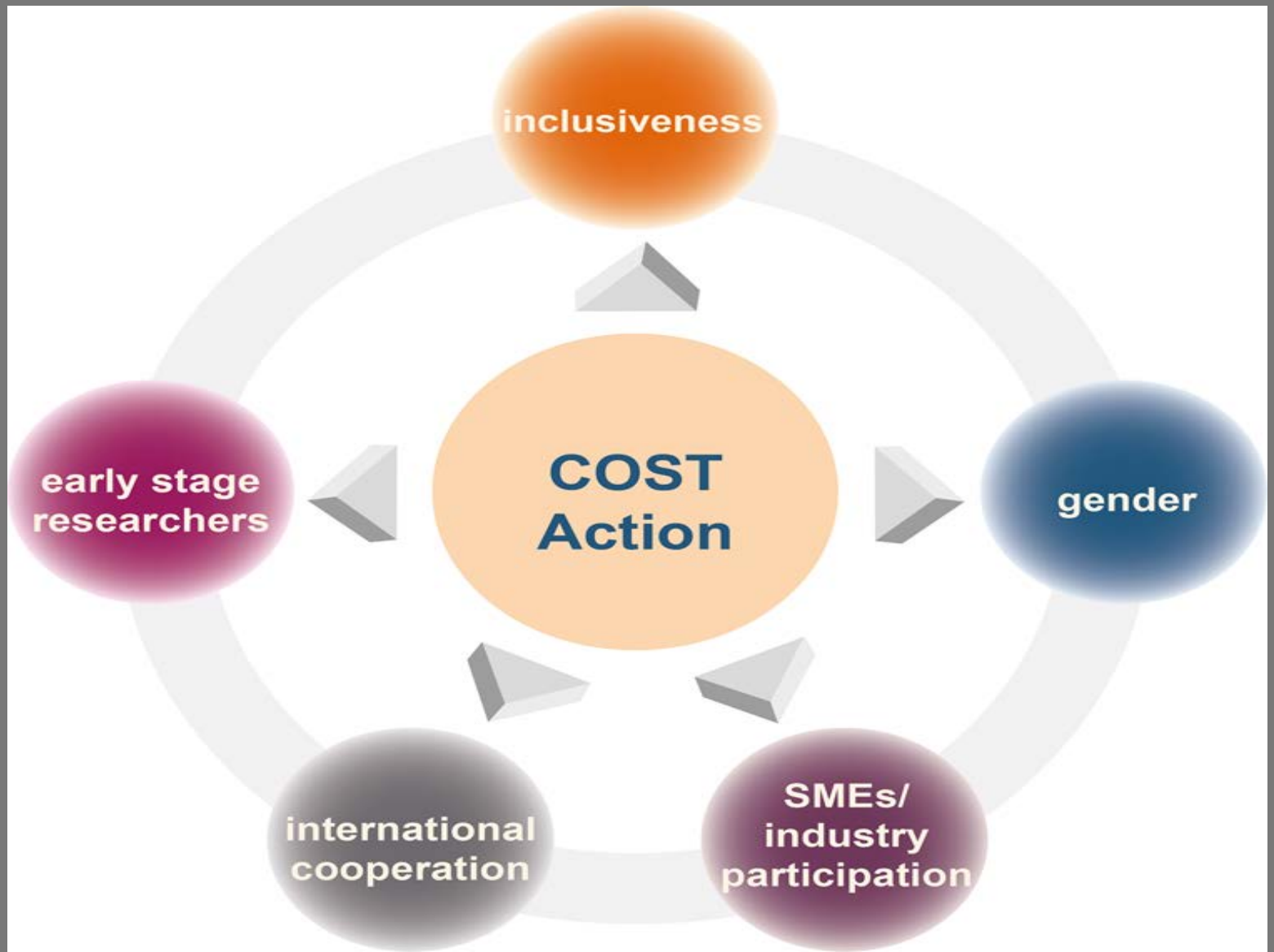


EuMIXFOR-introduction

Seeking to address the increasing policy interest in Europe in promoting mixed forests (e.g. EU Forestry Strategy);

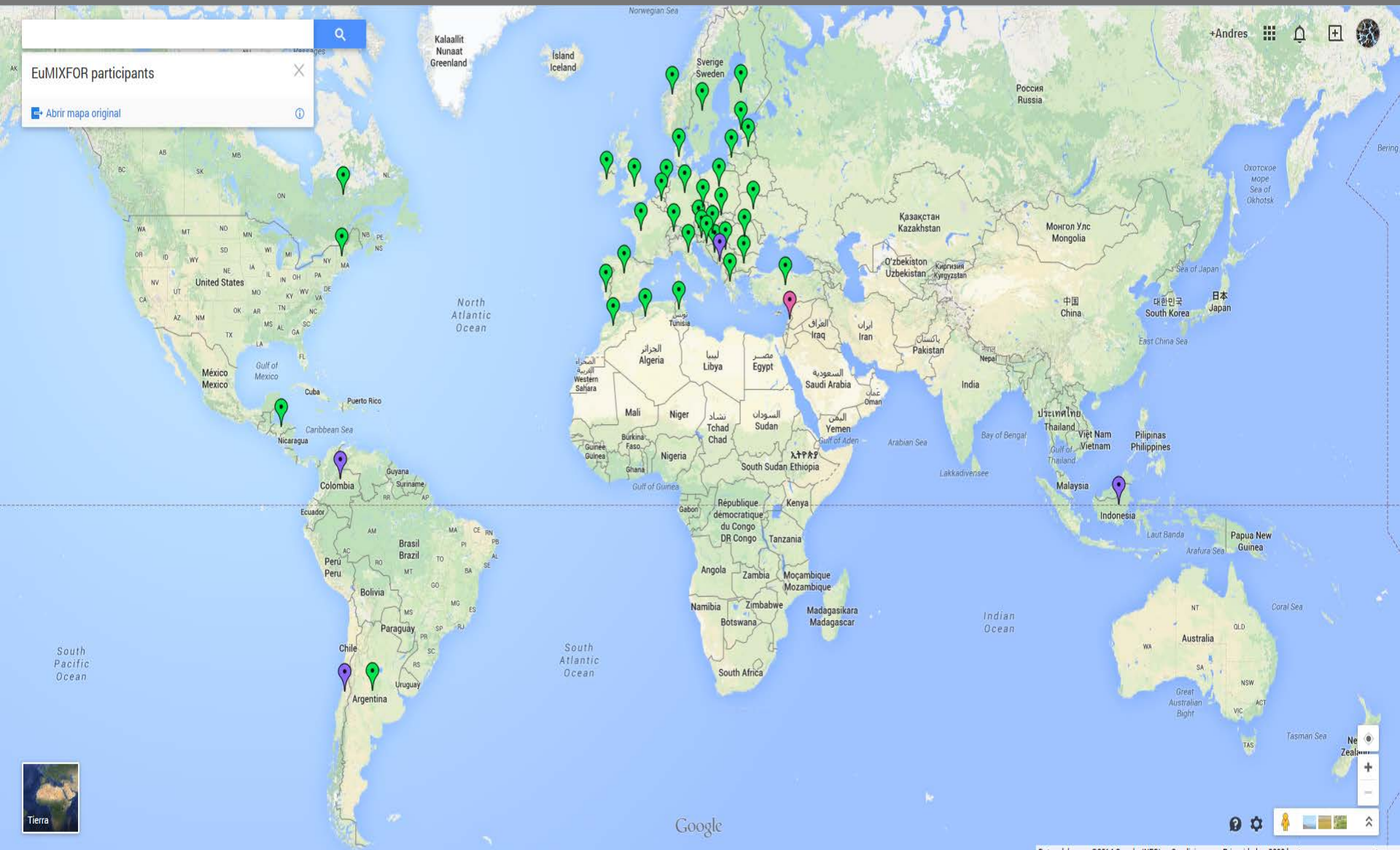
Policy is hampered by the comparatively limited knowledge base about mixed forests in Europe.

EuMIXFOR started in 2013 and is funded until 2017;

Participants from 30 EU member states and near neighbour countries;

Also participants from a number of international partner countries including Canada and USA

Distribution of participants in EuMIXFOR



EuMIXFOR - Aims

- To establish a long-lasting European network of researchers investigating all aspects of mixed forests;
- Participants will share knowledge about mixed forests to enable the sustainable management of these forests;
- Thus to enhance future conservation of mixed forests, their expansion, and their contribution to society.

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Objectives

- To improve knowledge about the role of mixed forests in providing environmental and economic services
- To understand the dynamics and functioning of mixed forests in relation to future environmental challenges including climate change
- Identifying appropriate silvicultural practices for the management of mixed forests
- Implementing measures to create a network of information about mixed forests accesible to all stakeholders

EuMIXFOR in brief

A. Bravo-Oviedo
ChairPerson

MC

H. Pretzsch
ViceChairperson

Steering Committee

WG 1. Mixed Forest Functioning and Dynamics

WG 2. Adaptive Management of mixed forests

WG 3. Policy and Social Impact of mixed Forests

STSM manager

Q. Ponette
Leader

M. Pach
Leader

J. Lesinski
Leader

S. Barreiro

K. Strelcova
Dep. Leader

M. Löf
Dep. Leader

L. Valsta
Dep. Leader

- **Working Group 1: Mixed forest dynamics and functioning**

- Analysis of impacts of the different components of global change on mixed forests (stability, biodiversity and environmental services)
- Identify knowledge gaps and research opportunties

- **Working Group 2: Adaptive Management of Mixed Forests**

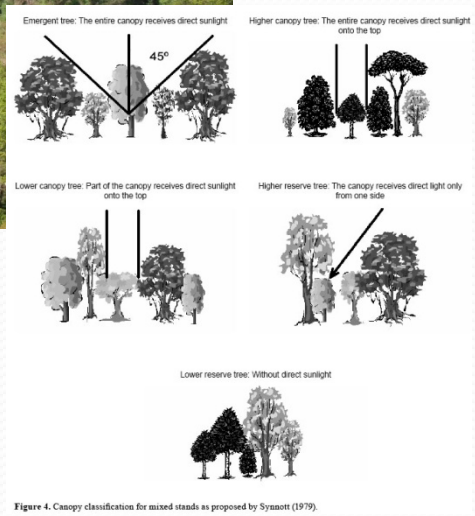
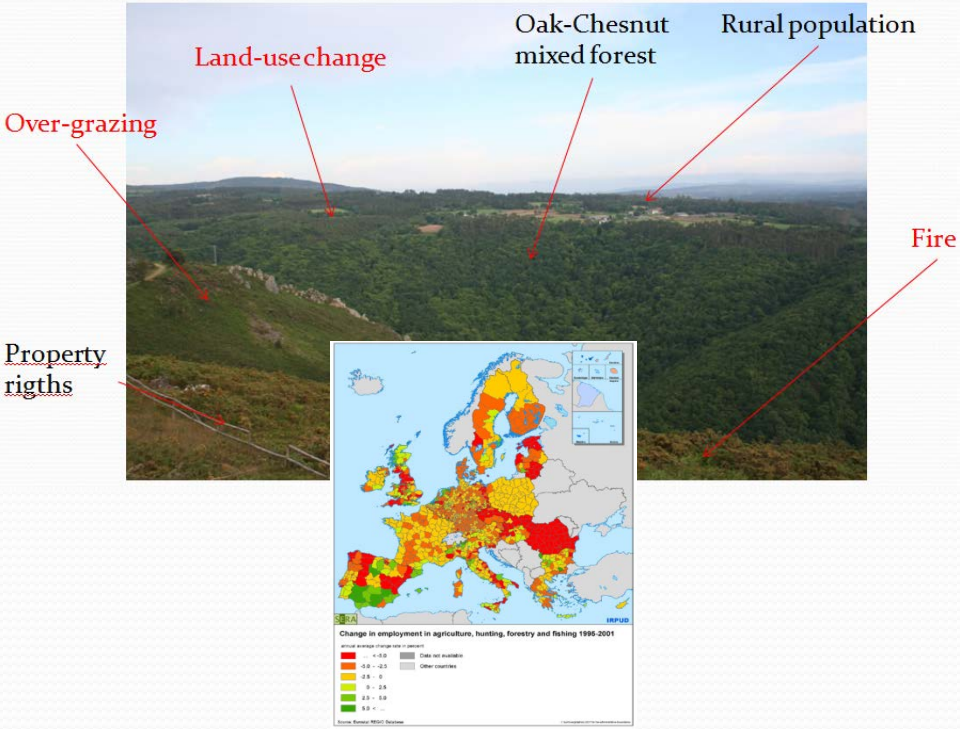


Figure 4. Canopy classification for mixed stands as proposed by Synnott (1979).

- Analysis of current forest management practices in mixed forests
- Review models and DSS that can be used to promote and maintain mixed forests
- Identify 'good silvicultural practices'

- **Working Group 3: Policy and Social Impact of mixed forests**



- Identify social impact of mixed forests
- Identify policy measures for enhancing the socio-economic benefits of mixed forests
- Economic valuation of mixed forests

SOME OF THE ISSUES

Issues to Overcome - 1

How much mixed forest is there within Europe?

No consistent definition of mixed forest between countries. Approaches in National Forest Inventories include:

1. **No definition** – simply a list of species and allocated to forest type (Poland, Italy);
2. **Estimates based on percentage canopy cover** (Austria, Ireland, France, etc.);
3. **Other measures** including basal area, volume, number of stems (Bulgaria, Finland, Slovakia, etc.)

However, no consistency within categories (e.g. for category 2 there is variation between countries in plot size, while minimum proportion of canopy cover varies from 15-30 %)

A Reference Definition of Mixed Forests

"A mixed forest is a forest unit […] where at least two tree species coexist any developmental stage, sharing common resources […].The presence of each of the component species is normally quantified as a proportion of the number of stems or of basal area, although [other measures] may be used for specific objectives. A variety of structures and patterns of mixture can occur, and the interactions between component species […] may change over time."

Bravo-Oviedo et al., *Forest Systems*, 2014, 23(3), 518-533.

Estimated area of mixed forests

- EU28 forest area – 180.2 M ha or 42% of land surface.
- 23% mixed based on 2011 FAO figures (but includes Russia)
- These figures only identify conifer: broadleaved forests as mixed, excluding conifer: conifer or broadleaved: broadleaved mixtures
- Preliminary analysis indicates that a likely figure is around 25-30 per cent mixed;
- Commonest mixture types involve Norway spruce (*Picea abies*) and Scots pine (*Pinus sylvestris*)

Main knowledge gaps about mixtures:

from 300 questions

- Climate change;
- Timber production/quality;
- Functional ecology of mixtures;
- Spatial patterns and stand structure;
- Resistance and resilience to hazards;
- Stand management;
- Stand dynamics;
- Ecosystem services;
- Economics
- Site factors;
- Policy and planning.

SOME OF THE OUTPUTS

Outputs: 2013-2015

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nature COMMUNICATIONS

ARTICLE

Received 7 Mar 2014 | Accepted 12 Aug 2014 | Published 12 Sep 2014 DOI: 10.1038/ncomms5967 OPEN

Forest stand growth dynamics in Central Europe have accelerated since 1870

Hans Pretzsch[1], Peter Biber[1], Gerhard Schütze[1], Enno Uhl[1,2] & Thomas Rötzer[1]

Eur J Forest Res
DOI 10.1007/s10342-015-0900-4

CrossMark

ORIGINAL PAPER

Growth and yield of mixed versus pure stands of Scots pine (*Pinus sylvestris* L.) and European beech (*Fagus sylvatica* L.) analysed along a productivity gradient through Europe

H. Pretzsch[1] · M. del Río[2] · Ch. Ammer[3] · A. Avdagic[4] · I. Barbeito[5] · K. Bielak[6] · G. Brazaitis[7] · L. Coll[8] · G. Dirnberger[9] · L. Drössler[10] · M. Fabrika[11] · D. I. Forrester[12] · K. Godvod[7] · M. Heym[1] · V. Hurt[13] · V. Kurylyak[14] · M. Löf[10] · F. Lombardi[15] · B. Matović[16] · F. Mohren[17] · R. Motta[18] · J. den Ouden[17] · M. Pach[19] · Q. Ponette[20] · G. Schütze[1] · J. Schweig[1] · J. Skrzyszewski[19] · V. Sramek[21] · H. Sterba[9] · D. Stojanović[16] · M. Svoboda[22] · M. Vanhellemont[23] · K. Verheyen[23] · K. Wellhausen[1] · T. Zlatanov[24] · A. Bravo-Oviedo[2]

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http://dx.doi.org/10.5424/fs/2014233-06256

Forest Systems 2014 23(3): 518-533
ISSN: 2171-5068
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OPEN ACCESS

European Mixed Forests: definition and research perspectives

Andres Bravo-Oviedo[1, 2, *], Hans Pretzsch[3], Christian Ammer[4], Ernesto Andenmatten[5], Anna Barbati[6], Susana Barreiro[7], Peter Brang[8], Felipe Bravo[9, 2], Lluis Coll[10, 11], Piermaria Corona[12], Jan den Ouden[13], Mark J. Ducey[14], David I. Forrester[15], Marek Giergiczny[16], Jette B. Jacobsen[17], Jerzy Lesinski[18], Magnus Löf[19], Bill Mason[20], Bratislav Matovic[21], Marek Metslaid[22], François Morneau[23], Jurga Motiejunaite[24], Conor O'Reilly[25], Maciej Pach[18], Quentin Ponette[26], Miren del Rio[1, 2], Ian Short[27], Jens Peter Skovsgaard[19], Mario Soliño[1, 2], Peter Spathelf[28], Hubert Sterba[29], Dejan Stojanovic[21], Katarina Strelcova[30], Miroslav Svoboda[31], Kris Verheyen[32], Nikolas von Lüpke[33] and Tzvetan Zlatanov[34]

Miškininkystė

EUMIXFOR Cost Action

Nuo monokultūrų prie mišrių miškų.

COST Veikla FP1206 EuMixFor: Europos mišrieji miškai. Mokslo žinių integracija tvariai miškininkystei

JURGA MOTIEJŪNAITĖ
Gamtos tyrimų centro Botanikos institutas
GEDIMINAS BRAZAITIS
Aleksandro Stulginskio universitetas

Miško, susidedančio iš įvairių me-

2. Nustatyti, kaip mišrus miškai reaguo-

Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA)
http://dx.doi.org/10.5424/fs/2014233-06084

OPEN ACCESS

Long-term development of nursing mixtures of Sitka spruce and larch species in an experiment in northern Scotland

William L. Mason

Forest Ecology and Management 325 (2014) 90–98

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

ELSEVIER

Analyzing size-symmetric vs. size-asymmetric and intra- vs. inter-specific competition in beech (*Fagus sylvatica* L.) mixed stands

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Miren del Río[a,b,*], Sonia Condés[c], Hans Pretzsch[d]

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SYLWAN 159 (1): 22-35, 2015

KAMIL BIELAK, MAŁGORZATA DUDZIŃSKA, HANS PRETZSCH

Przyrost miąższości drzewostanów mieszanych i litych: wyniki z wybranych stałych powierzchni badawczych w Europie Środkowej

Volume growth of mixed-species *versus* pure stands: results from selected long-term experimental plots in Central Europe

Eur J Forest Res (2015) 134:927–947
DOI 10.1007/s10342-015-0900-4

ORIGINAL PAPER

Growth and yield of mixed versus pure stands of Scots pine (*Pinus sylvestris* L.) and European beech (*Fagus sylvatica* L.) analysed along a productivity gradient through Europe

H. Pretzsch[1] · M. del Río[2] · Ch. Ammer[3] · A. Avdagic[4] · I. Barbeito[5] · K. Bielak[6] · G. Brazaitis[7] · L. Coll[8] · G. Dirnberger[9] · L. Drössler[10] · M. Fabrika[11] · D. I. Forrester[12] · K. Godvod[7] · M. Heym[1] · V. Hurt[13] · V. Kurylyak[14] · M. Löf[10] · F. Lombardi[15] · B. Matović[16] · F. Mohren[17] · R. Motta[18] · J. den Ouden[17] · M. Pach[19] · Q. Ponette[20] · G. Schütze[1] · J. Schweig[1] · J. Skrzyszewski[19] · V. Sramek[21] · H. Sterba[9] · D. Stojanović[16] · M. Svoboda[22] · M. Vanhellemont[23] · K. Verheyen[23] · K. Wellhausen[1] · T. Zlatanov[24] · A. Bravo-Oviedo[2]

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Abstract Mixing of complementary tree species may increase stand productivity, mitigate the effects of drought and other risks, and pave the way to forest production systems which may be more resource-use efficient and stable in the face of climate change. However, systematic empirical studies on mixing effects are still missing for many commercially important and widespread species combinations. Here we studied the growth of Scots pine (*Pinus sylvestris* L.) and European beech (*Fagus sylvatica* L.) in mixed versus pure stands on 32 triplets located along a productivity gradient through Europe, reaching from Sweden to Bulgaria and from Spain to the Ukraine. Stand inventory and taking increment cores on the mainly 60–80 year-old trees and 0.02–1.55 ha sized, fully stocked plots provided insight how species mixing modifies the structure, dynamics and productivity compared with neighbouring pure stands. In mixture standing volume (+12 %), stand density (+20 %), basal area growth (+12 %), and stand volume growth (+8 %) were higher

Communicated by Peter Biber.

Electronic supplementary material The online version of this article (doi:10.1007/s10342-015-0900-4) contains supplementary material, which is available to authorized users.

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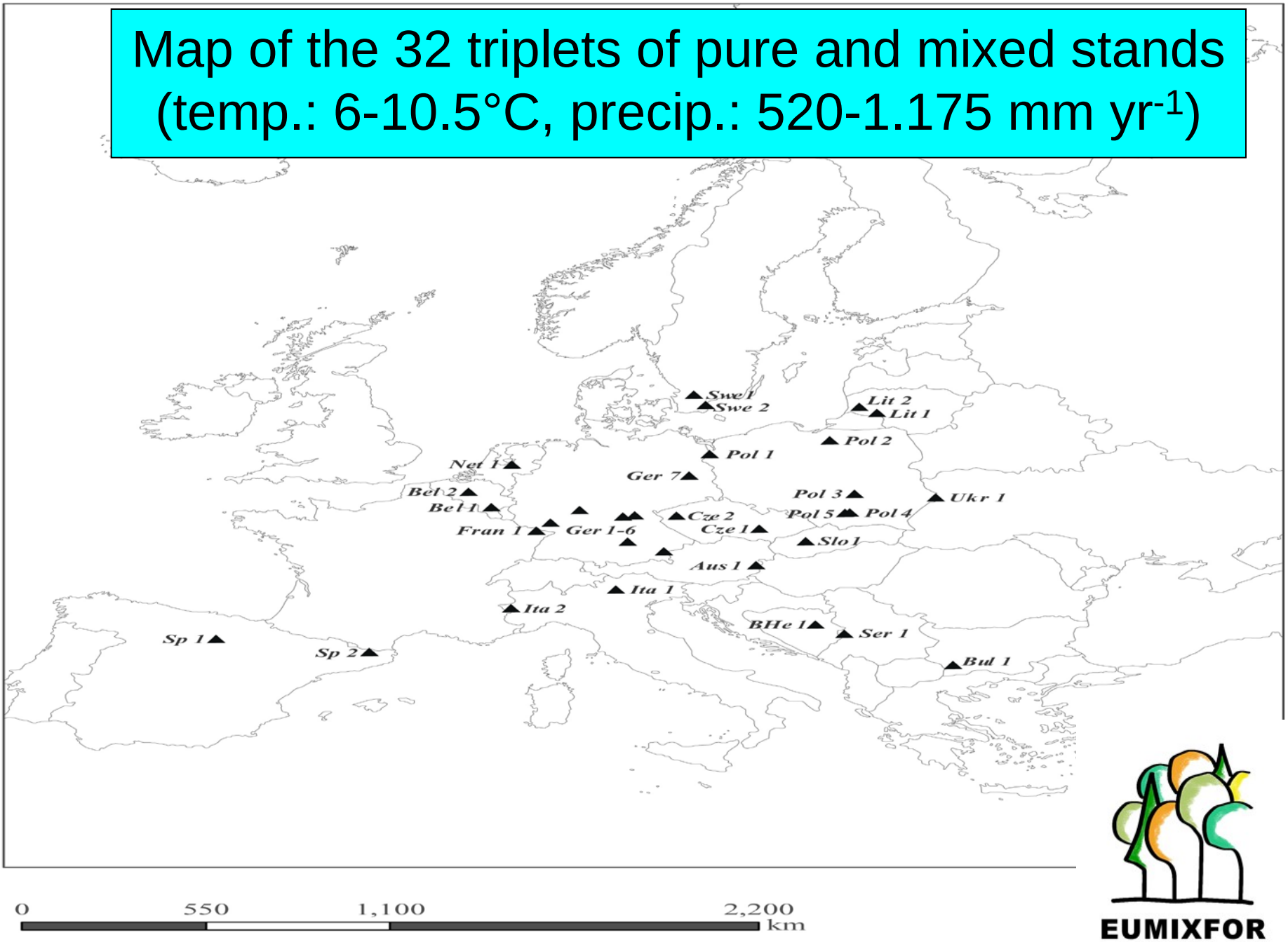
Map of the 32 triplets of pure and mixed stands (temp.: 6-10.5°C, precip.: 520-1.175 mm yr^{-1})



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OTHER outputs – workshops, training schools

IUFRO News

International Union of Forest Research Organizations

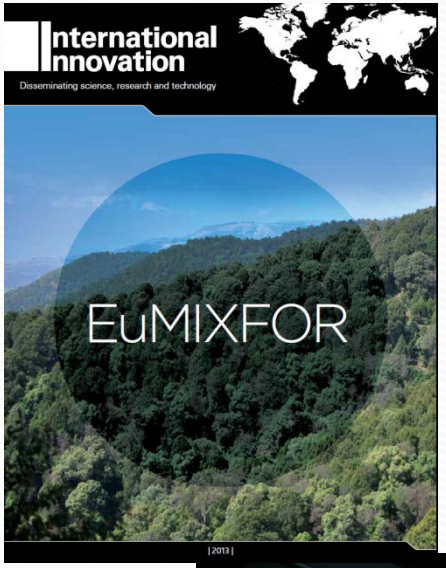
Union Internationale des Instituts de Recherches Forestières | Unión Internacional de Organizaciones de Investigación Forestal | Internationaler Verband Forstlicher Forschungsanstalten

Silviculture of Mixed Forests in Europe

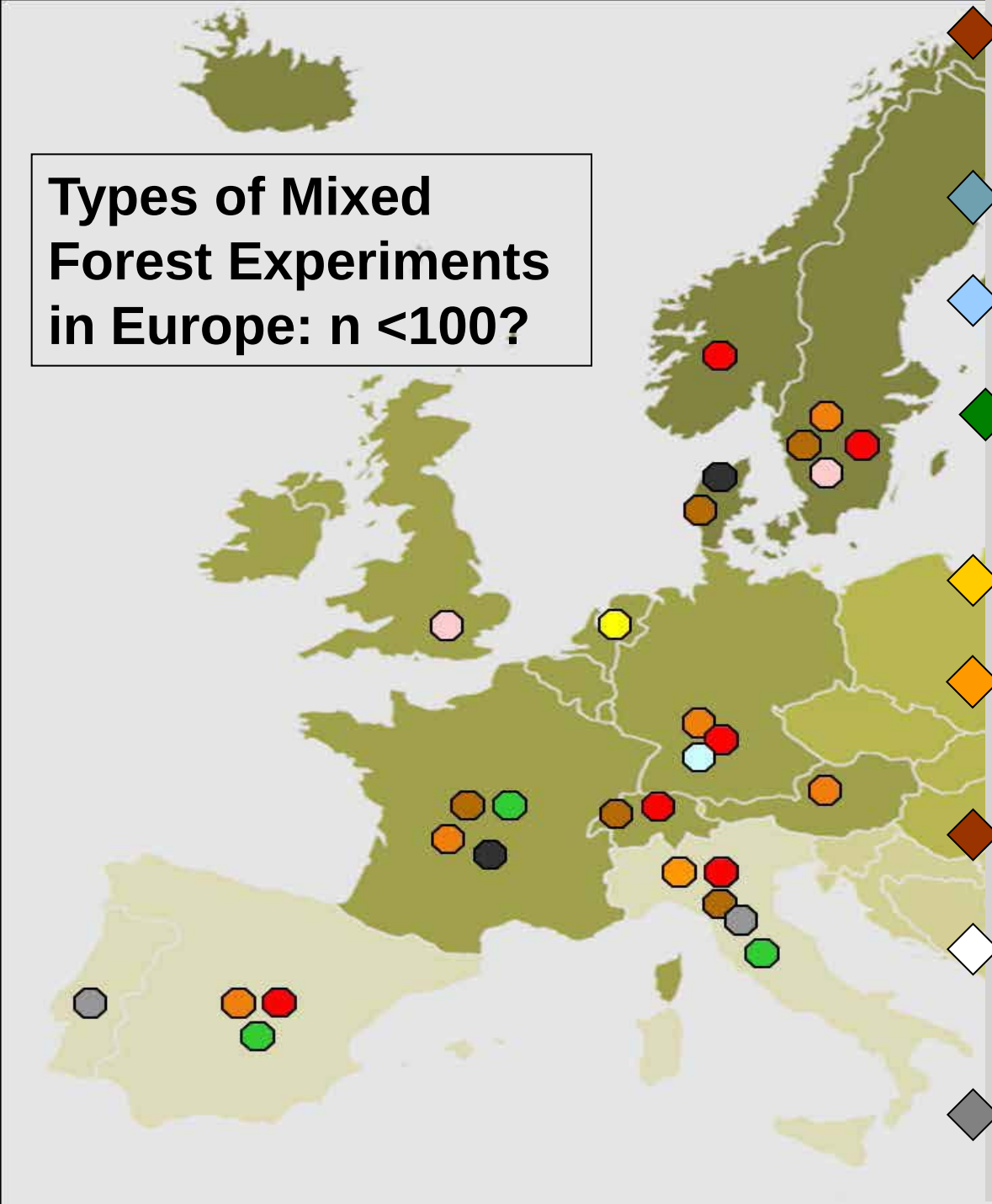
Report from a workshop related to COST Action FP1206, European mixed forests - Integrating Scientific Knowledge in Sustainable Forest Management. (EuMIXFOR), held in Arezzo, Italy, on 28-29 May 2015 (Meeting website)
By Piermaria Corona, past Coordinator of IUFRO 4.02.06

This workshop was carried out in the framework of the activities of the EuMIXFOR Cost Action. It gave participants direct insight into and experience of the practice and potential of the silviculture of mixed species forests. Particular, though not exclusive emphasis was placed on Europe, evaluating the ecosystem services and the forest functions, from boreal Canadian forests to Mediterranean coppice stands, and from natural forests to plantations.

Presentations addressed the multifaceted perspectives of



Types of Mixed Forest Experiments in Europe: n <100?



- Improving mixed stands by tending and thinning operations
- Converting pure to mixed high forest stands,
- Establishing and tending of new mixed forest stands
- Transition from coppice stands to mixed high forest stands
- Retransformation from former coppice forests
- Tending of mixed stands from natural afforestation of old fields
- How to cope with climate change adaptation
- Growth comparison between pure and mixed forest on the same site
- Permanent plots established in mixed stands

Main knowledge gaps about spruce mixtures (EST, FI, SE, UK)

- Use of mixtures to even out biological risks;
- Managing low value broadleaves admixed with spruce;
- Economic outturn from mixtures including wood quality;
- Minimum proportion of mixture needed to achieve ecological benefits;
- Mixtures and browsing presure;
- Methods of establishing spruce/pine mixtures;
- Silvicultural guidelines at different stages ;
- Incidence of pathogens in mixtures;
- Prediction of outturn from mixtures;
- Lack of experiments and too much reliance on modelling;

.

CONCLUSIONS

1. Increasing evidence of a widespread overyielding effect from growing (Norway) spruce in mixture (see Bielak, Pretzsch, Drossler, and others);
2. Recognised range of environmental benefits from growing spruce in mixture;
3. There is widespread policy support for use of mixtures but support measures are often ineffective;
4. A considerable range of practical/operational issues that need to be overcome and a lack of well documented demonstrations.

Sitka spruce: larch mixture in central Scotland

Conifer and broadleaved mosaic in northern Greece

Thanks for your attention