ALTERFOR

VYTAUTAS MAGNUS UNIVERSITY

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Kuriame Lietuvos ateitį
2014–2020 metų Europos Sąjungos fondų investicijų veiksmų programa

SPATIAL PATTERN OF CLIMATE CHANGE EFFECTS ON LITHUANIAN FORESTRY

#C4e Decision Support Approaches for Forestry of the 21th Century

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Curitiba · Brazil
SEPT 29 - OCT 5

ALTERNATIVE MODELS AND ROBUST DECISION-MAKING FOR FUTURE FOREST MANAGEMENT - ALTERFOR

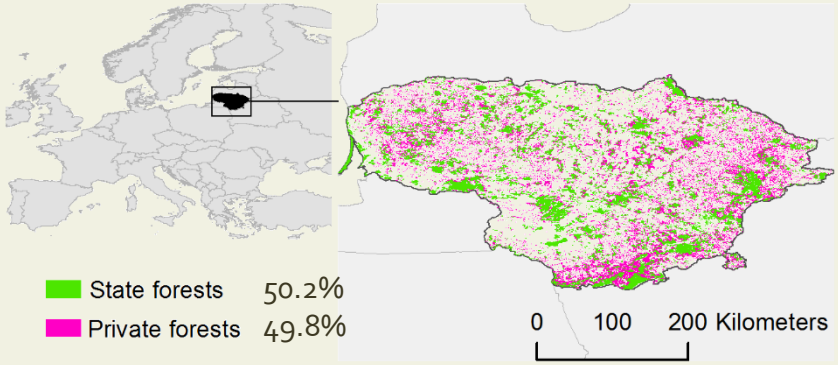
ALTERFOR is a Horizon 2020 project,
https://alterfor-project.eu/

Side Event titled "**Adapting Europe's forests to global challenges: Lessons from ALTERFOR**"

October 1st from 12:00-13:50 at Venue R8 – wing 2

"*What alternative forest management models will enable to provide the desired ecosystem services under changing climate and societal conditions over the coming century?*"

SOME FACTS ABOUT LITHUANIAN FORESTRY AND THE ROLE DECISION SUPPORT SYSTEMS



Country area	-	6.53 mill. ha
Population	-	2.79 mill.
Forest land area	-	2.2 mill. ha
Forest coverage	-	33.6%
Growing stock volume:		
total	-	546.9 mill. m^3
average	-	257 m^3/ha
Annual increment	-	20.5 mill. m^3
Annual harvest (stem volume)		
	-	~11.0 mill. m^3

Since the 1990s - struggle between the traditional silvicultural focus on **maximizing sustainable timber production** and **increasing attention on environmental and social** values

- Timber - one of the few domestically available raw materials
- Modernization of forestry technologies
- Liberalization of international trade
- Privatization, including forestland restitution to pre-war landowners and their heirs

Doubled the forest harvesting

- Acceptance of international environmental standards
- Joining the EU
- “Greening” of society

Introducing or increasing environmental regulations, implemented through segregation management and integrative measures

SOME FACTS ABOUT LITHUANIAN FORESTRY AND THE ROLE DECISION SUPPORT SYSTEMS

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Forest management environment in brief:

- **Forest management system** in Lithuania – ideological base in the classical theory of **normal forests**:
  - Objective – productive stands that by the end of the (sufficiently long) rotation can deliver the **highest possible amount of timber of sawlog dimensions**
  - **Even forest age class distribution** to ensure the evenness of timber flow
  - **Strict rotation ages and area control of age classes**, rotation age not associated with the productivity
  - Segregative forest management through forestland zoning with 4 so-called **forest groups**
- Strong **dominance of state forest institutions**, including the forest management requirements which are identical to state and private forest owners
- **Public opinion** on forests and forestry – **negative**
- **Command-and-Control forest governance** with detailed planning, legal prescriptions and scrupulous control. The **involvement of public** in taking forest management decisions – **low**

Rather common understanding – do we need any decision support system at all, assuming that forest management is thoroughly described in numerous legal acts (which may not be argued) and there are "forestry champions", who know "everything" (no questions...)

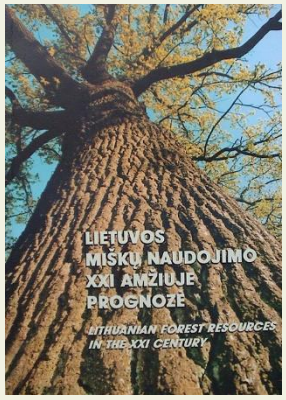
SOME FACTS ABOUT LITHUANIAN FORESTRY AND THE ROLE DECISION SUPPORT SYSTEMS

So, the development of original decision support approaches in Lithuania has been very limited, resulting practically in one operational solution – **simulator Kupolis**:

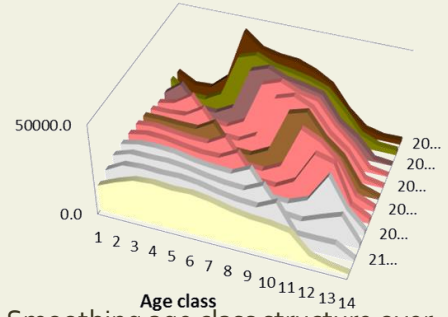
- Developed in the **last decade of 20th** century
- Primary aim - to illustrate most reliable **forest resource development** assuming the **continuation of current economic and environmental forestry conditions** at the country or regional state forest enterprise levels
- The basic unit of simulation – a **forest stand**, tree level simulations not included yet
- Designed to work using the data structure of database system "L", originally developed in Lithuania and used a decade ago to process stand-wise inventory and forest management planning data. Growth models adopted for Lithuania. DOS required…

KUPOLIS ***(Melamphyrum silvestris)***

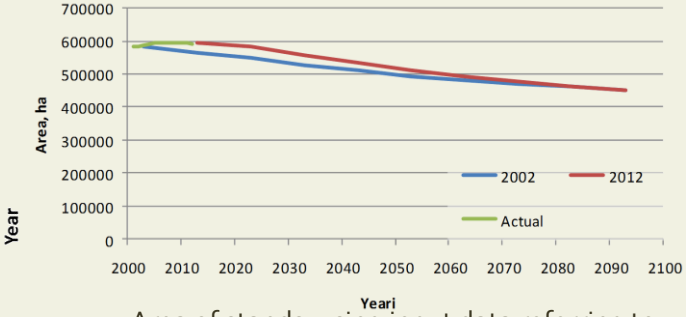
KUPOLIS



Potential development of pine forests in Lithuania, assuming continuation of current forest management approaches



Smoothing age class structure over time



Area of stands, using input data referring to different dates

SOME FACTS ABOUT LITHUANIAN FORESTRY AND THE ROLE DECISION SUPPORT SYSTEMS

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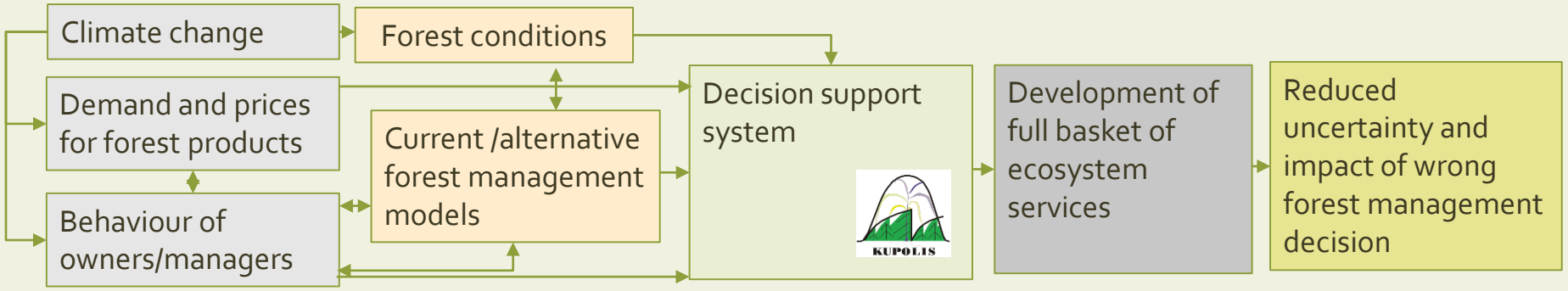
Modifications of simulator Kupolis to meet the requirements of ALTERFOR project

Required functionality	Originally implemented functionality	Upgraded functionality
Wood assortments	Key available functionality	Key available functionality
Prices	Could be handled modifying original code	Estimated using output data on wood assortments
Climate modelling	Could be handled modifying original code	Growth models adjusted depending on climate change scenario
Spatial specificity	Not considered	Available outside the system using standard GIS
Behaviour models	Not considered	Available through mapping forest owners/managers
Alternative forest mngt.	Could be used after modification of original code	Simulator modified to specify alternative forest management
Ecosystem services	Not considered	External module for ES assessment developed

Available | Available using external tools | Implemented partially | Not available

So, we got a system to validate alternative forest management, based on rather old-fashioned DSS



OBJECTIVES AND METHODOLOGY

Objectives:

- To **validate decision support system-driven solution** to include global climate change, timber demand and price scenarios in simulating future trends of forest ecosystem services as a support for forest policies at local level
- To determine the **effects of climate change on Lithuanian forests and forestry**, and its sustainability in terms of the deliveries of some ecosystem services in the future, assuming that **current forest management practices are continued**
- To discuss the effects of **alternative forest management practices** on Lithuanian forests and forestry under conditions of different climate change mitigation efforts

The study was conducted within the frames of two projects:

- H2020 "Alternative models and robust decision-making for future forest management" (**ALTERFOR**) – methodological framework, enhancement of DSS, modelling, interpretation of the results
- National research program "Integrated effect of climate and other environmental stresses on forest capacity to adapt to and mitigate the main threats of global changes" (**FOREstRESS**) – impacts of climate change on the growth of forest trees, mapping the climate change impacts

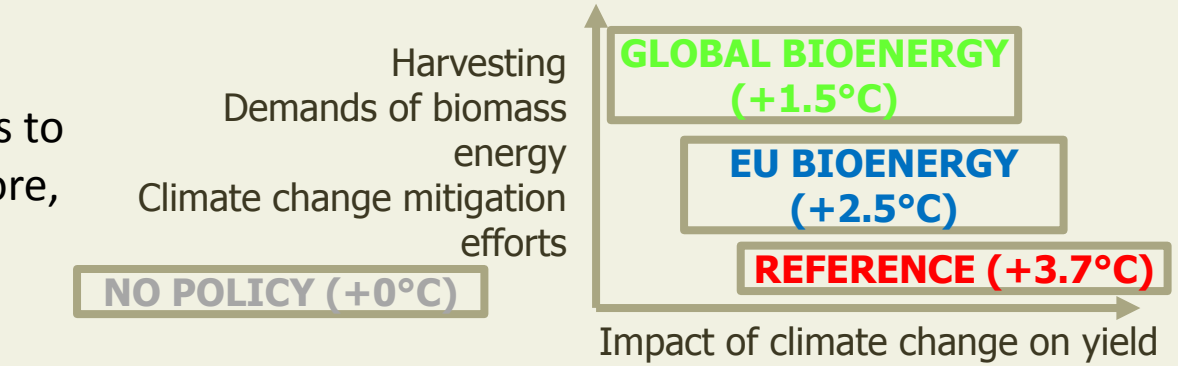
OBJECTIVES AND METHODOLOGY

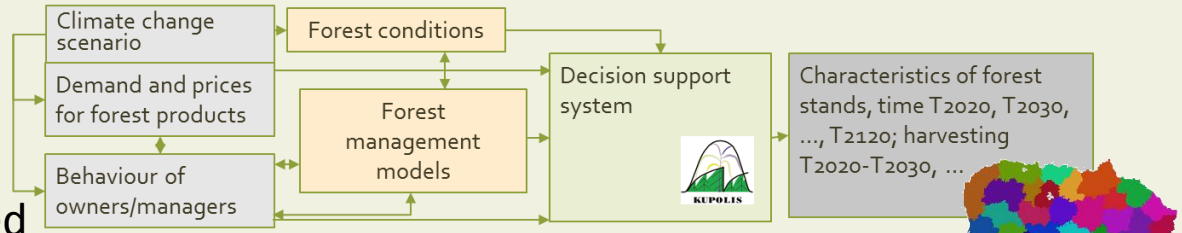
Analytical steps of our study include (1):

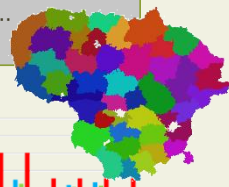
1. Specifying **alternative future scenarios**, considering human efforts to mitigate climate change and, therefore, different forest growth, timber demand, and price trends

2. Modelling **forest resource development and forest use** under alternative future scenarios and assuming that **current forest management practices** are continued (whole country)

3. Modelling forest resource development and forest use under alternative future scenarios and assuming that **alternative forest management practices are introduced** (case area, ~90000 ha)

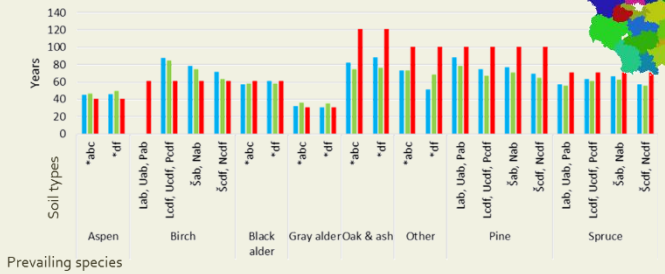






Adaptive rotation ages: Economic rotation (forest rent)

Adaptive rotation ages: Financial rotation (present net value 2%)



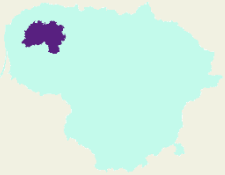
▪ Current

Care for deciduous

Potential EU habitats

Deciduous tree species prioritized in reforestation and less avoided in thinnings

No management in suggested new potential EU habitats (~10% extra)



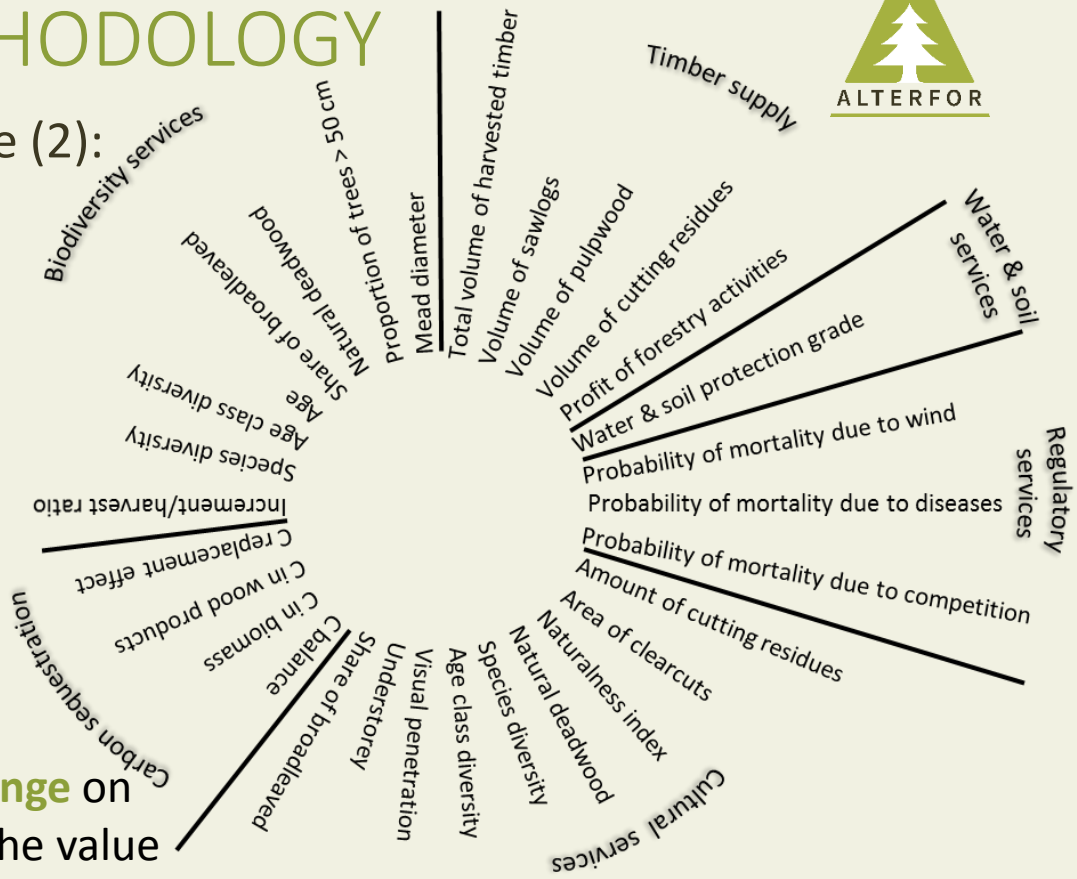
OBJECTIVES AND METHODOLOGY

Analytical steps of our study include (2):

4. Quantifying selected **ecosystem services** and analysing their **spatial** and **temporal** development at the regional branch level of the state forest enterprise

5. Quantifying the **impact of climate change** on specific forest attributes by subtracting the value achieved in the NO POLICY scenario from the corresponding values of other scenarios for each time point

6. To detect the presence of a monotonic increasing or decreasing **trend in the differences** during the certain period, nonparametric Mann–Kendall test was used and the slope of a linear trend was estimated with the nonparametric Sen's method

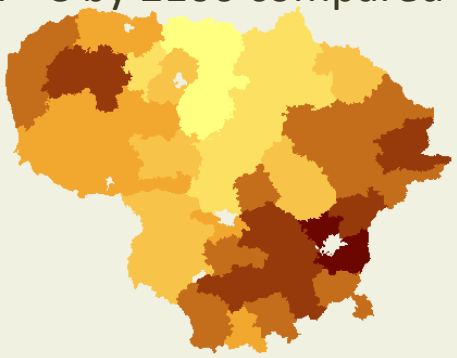


7. Quantifying the impact of **alternative forest management model** on specific forest attributes - the percentage of achieved value, assuming the value under current FMM as 100%, then estimating linear trend of the differences over certain period

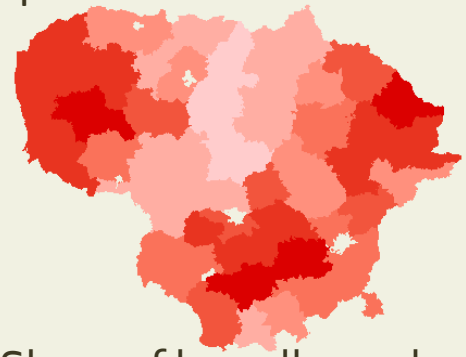
SOME RESULTS

Climate change effects on selected attributes of forests & forestry during 100 years, expecting that **current forest management** practices are continued

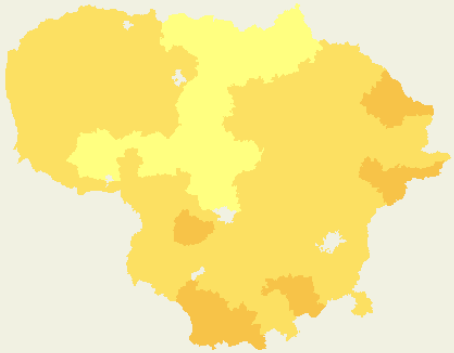
REFERENCE: Current climate change mitigation efforts — temperature increase of ca. 3.7 °C by 2100 compared to pre-industrial values



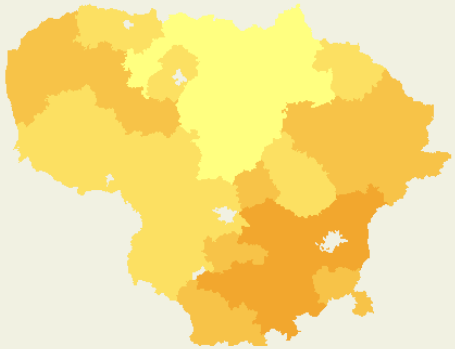
Volume increment

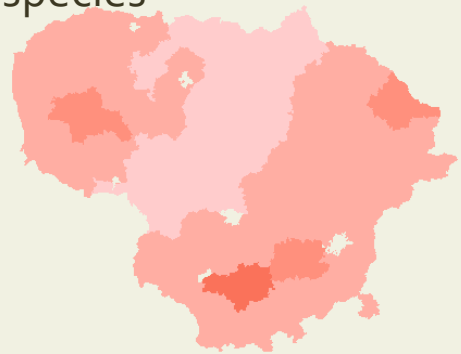


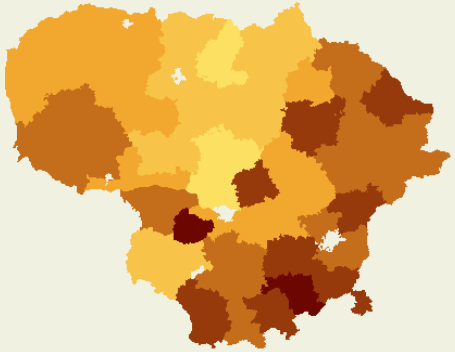
Share of broadleaved species



Profit from forestry activities



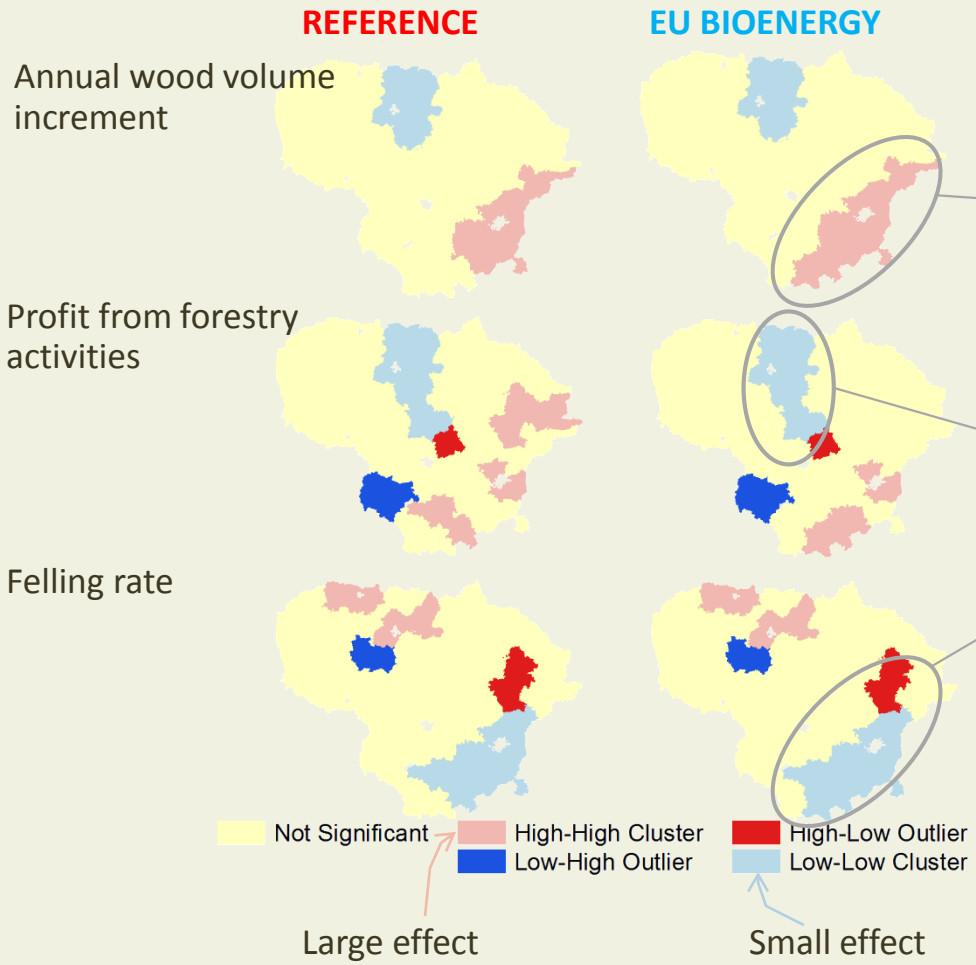




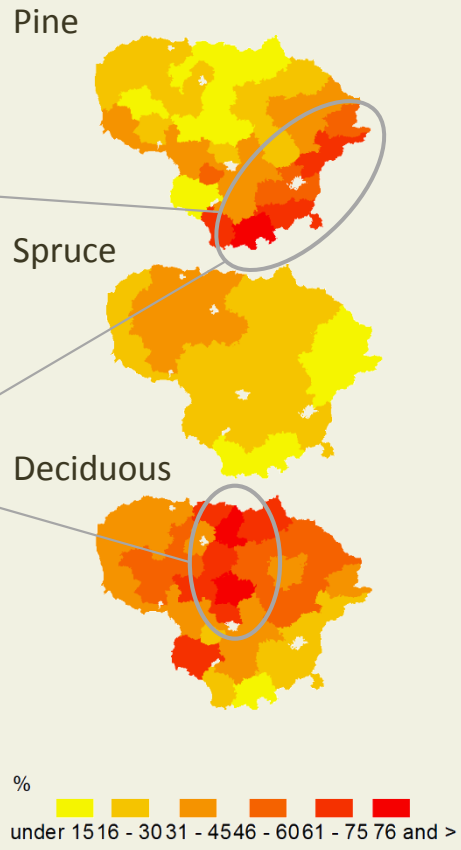
EU BIOENERGY: Strong EU policies in climate change mitigation — temperature increase of ca. 2.5 °C by 2100 compared to pre-industrial values

SOME RESULTS

Hot spots, cold spots, and spatial outliers of climate change effects on selected key forestry attributes in Lithuanian forests during the next 100 years from 2020 to 2120, **current forest management approaches**



Volume proportions of major tree species now



SOME RESULTS

So, **decision support system-driven solution without originally inbuilt climate models** was tested for the potential to include global climate change, timber demand and price scenarios in simulating future trends of forest ecosystem services as a support for formulating long-term forest policies:

- Both **opportunities and risks** of climate change and mitigation efforts for Lithuanian forestry

Positive:

Increasing volume of growing stock and harvested assortments

Higher profits of forestry activities

Lower felling rate

Negative:

Decreasing share of broadleaved tree species

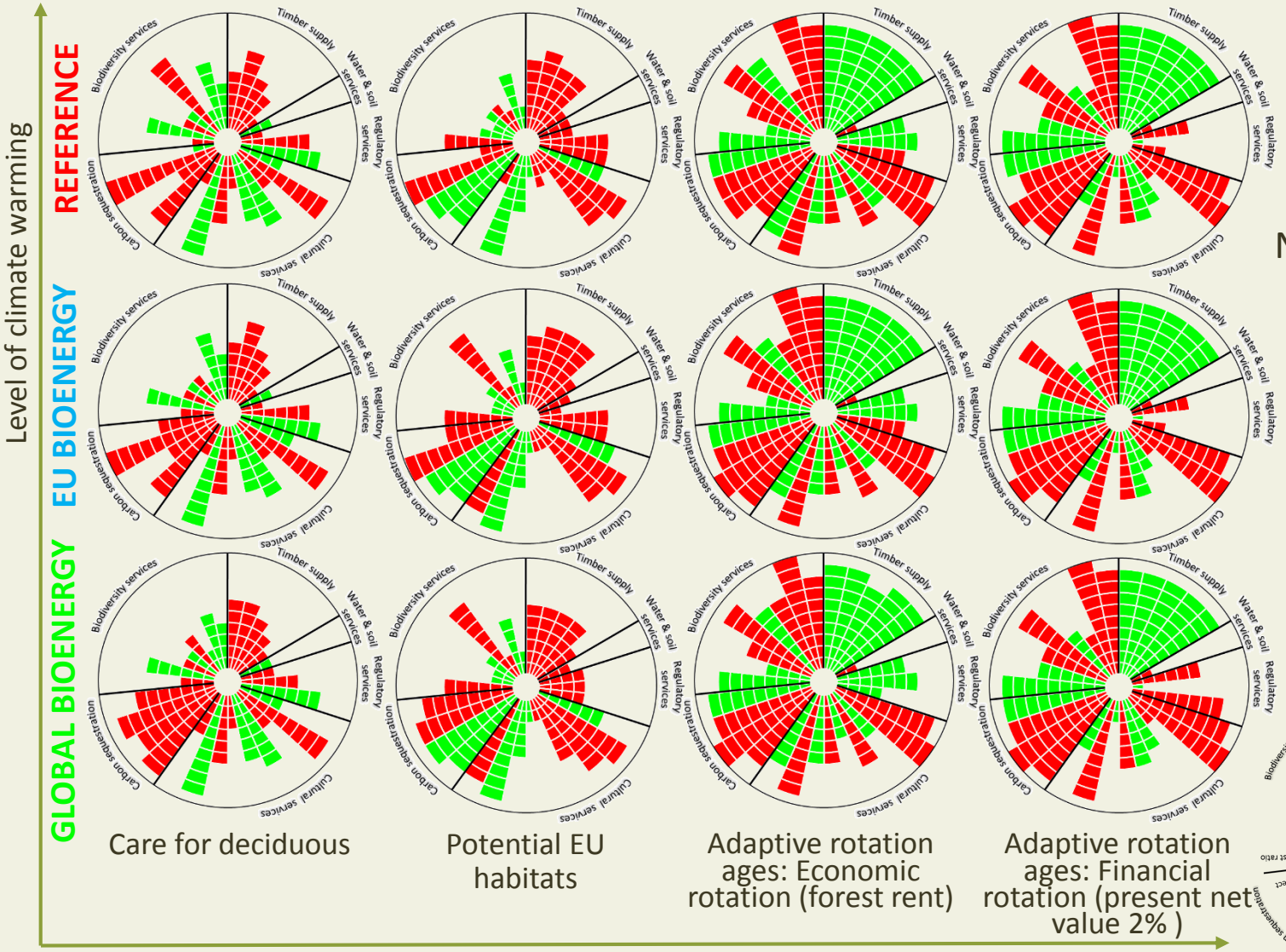
Decreasing tree species diversity

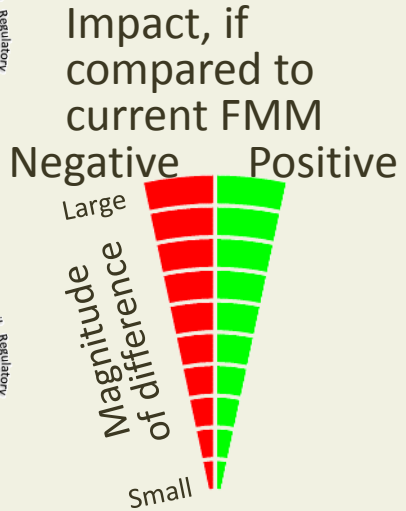
Clustered pattern of climate change effects for a relatively small country like Lithuania - increases in stand productivity and amount of harvested timber are concentrated in the **regions with dominating coniferous species**, while the same areas are exposed to stronger negative impacts on dynamics of biodiversity-related attributes

However – the above findings are based on assumption that current forest management practices are continued during next century… So, "*will **alternative forest management models** enable to provide the desired ecosystem services under changing climate and societal conditions over the coming century?*" (overarching ALTERFOR question)

SOME RESULTS

Impact of **alternative forest management models** on delivery of forest ecosystem services in the period 2020-2060





SOME RESULTS

Impact of **alternative forest management models** on delivery of forest ecosystem services

The impact of **forest management** model on delivery of ecosystem services seems to be **larger than** the one of **climate change**

So, acknowledging global human efforts to mitigate the climate change, forest management at local level has a deciding role in reducing negative and benefiting from the positive climate change impacts on forests and forestry

The overall picture of future forests without the above-mentioned considerations would be biased, consequently, leading to higher uncertainty in forest management decisions

The key question is **how use decision support systems** effectively under **conditions of command and control forest governance**…

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THANKS FOR YOUR ATTENTION

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See you in Stockholm

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