Department of Geosciences and Natural Resource Management

The potential of forests and forestry to support a sustainable development of the Nordic and Baltic regions

- we can double forest productivity at the stand scale

Sustainable Energy Systems 2050

- final seminar, Norwegian Research Council, Lysaker, Oslo 21-22 Oct. 2015

Palle Madsen

www.ENERWOODS.dk

By Mats Hannerz; photos by Mats Hannerz and Per Bergkvist

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Key points

- Forests and forestry's role in supporting a sustainable development of World Society

- Links to global Forest Landscape Restoration efforts on forest adaptation and mitigation

- Focus at forest management and silvicultural opportunities increase supply of wood and woody biomass

- Modern transportation and logistic systems

- Optimised use of woody biomass in the energy systems

- Focus at opportunities at the stand scale

- Perspectives as well as new methods, systems and approaches (more or new tools in the toolbox)

- The potential is very large

- It is up to society to decide to what extent this potential is going to be utilized

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

- *it is about people*
- *7 billion with justified expectations for a good life for themselves and for future generations*
- *sustainability and forests are not just questions of sustainable management of the forests and e.g. their biodiversity*
- *question is how forests and forestry potentially can support a sustainable development of society?*

Mitigation - global perspective: Fossil versus renewable energy

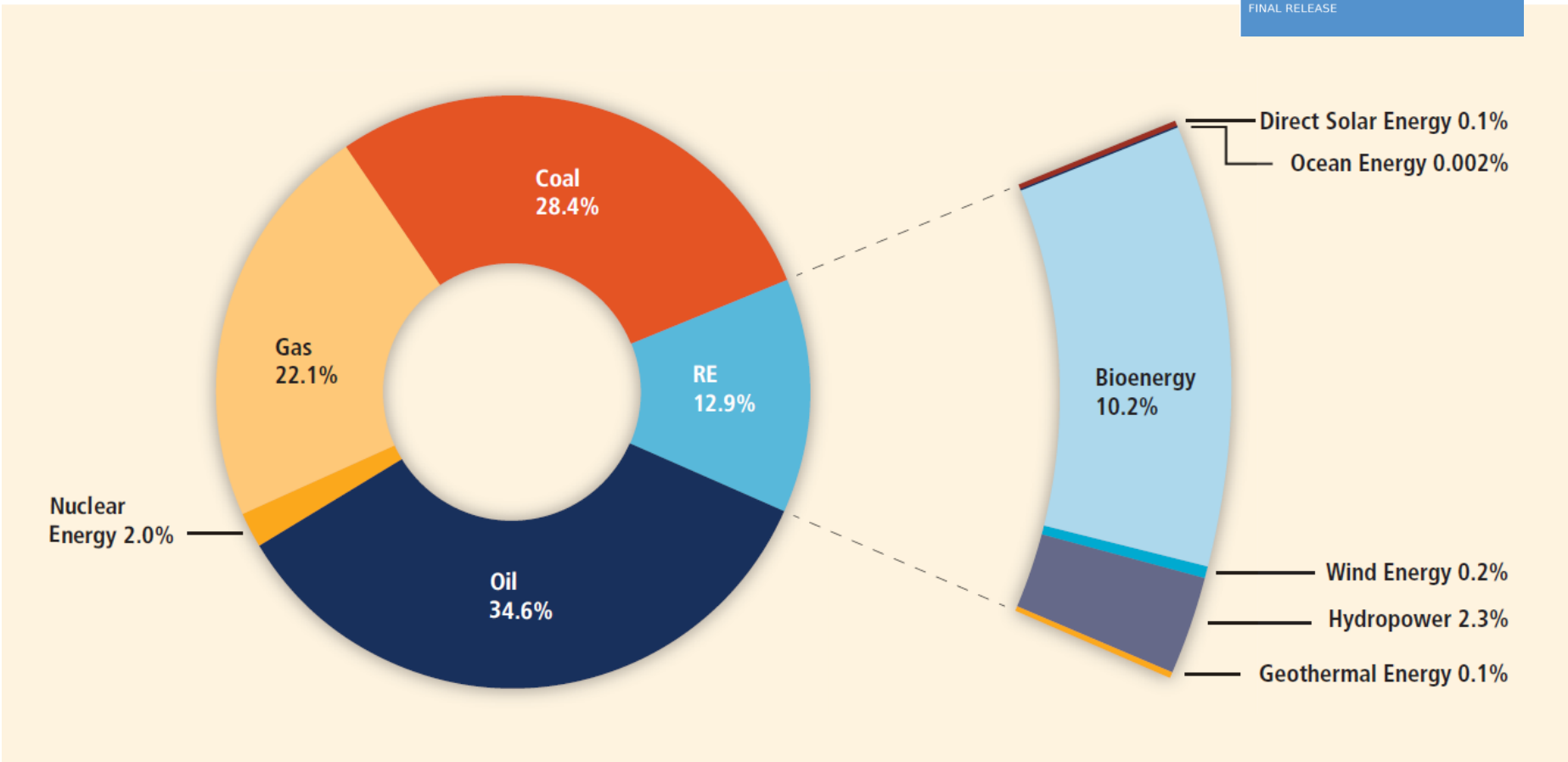
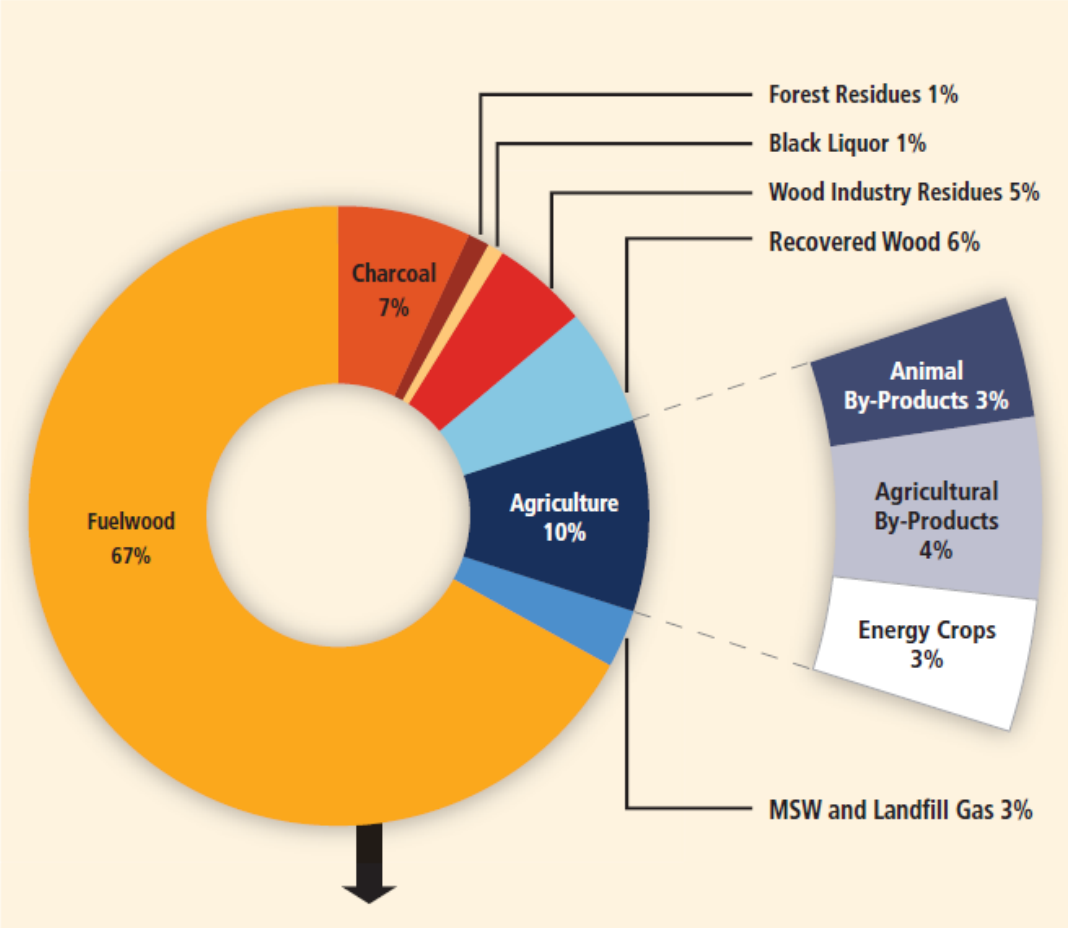


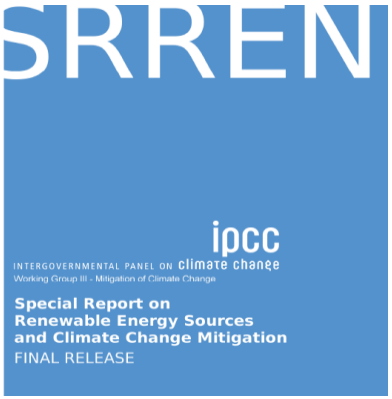
Figure 1.10 | Shares of energy sources in total global primary energy supply in 2008 (492 EJ). Modern biomass contributes 38% to the total biomass share. Data source: IEA (2010a).

Notes: Underlying data for figure have been converted to the direct equivalent method of accounting for primary energy supply (Annex II.4).

Mitigation - annual global harvest

- **3,4 billion m^3 - 50/50% industrial wood / fuelwood**
- **264 million ha planted forest produces app. 65% of the industrial wood harvest!**
- **bioenergy is by 2050 estimated to contribute 2-6 times more**

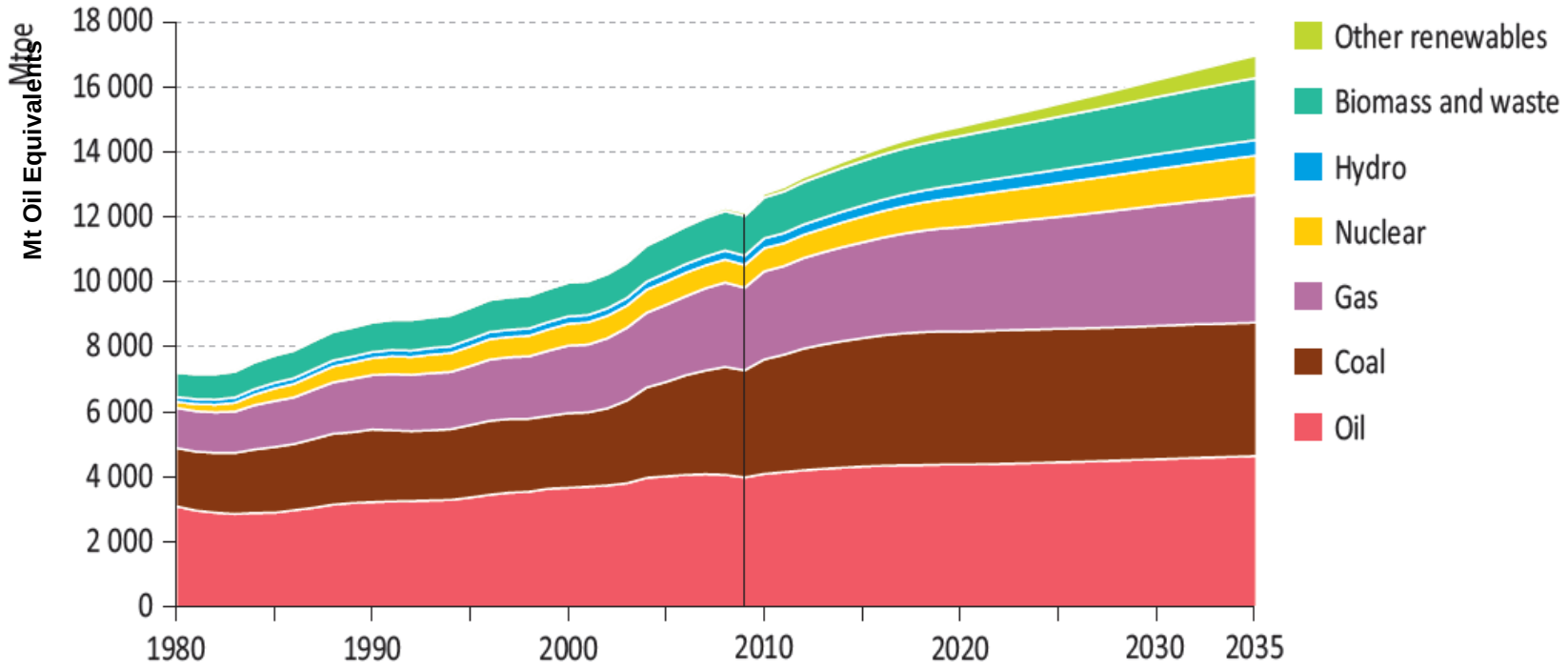


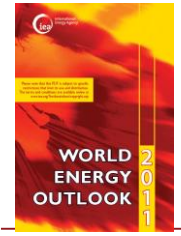


Use of fossils

- we are moving in the wrong direction with increasing speed

Figure 2.6 • World primary energy demand by fuel in the New Policies Scenario

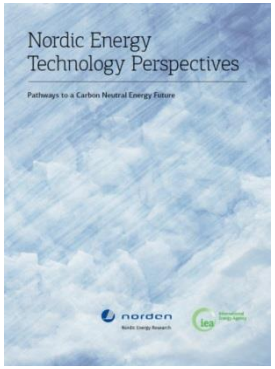




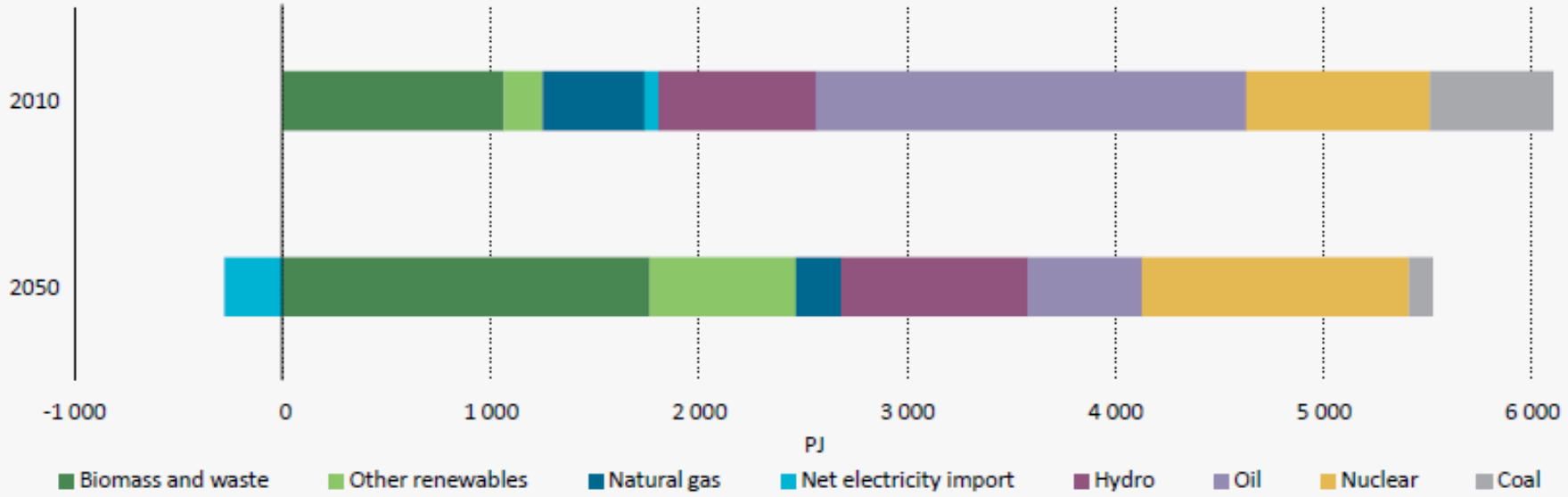
IEA – World Energy Outlook 2011

Nordic forest biomass

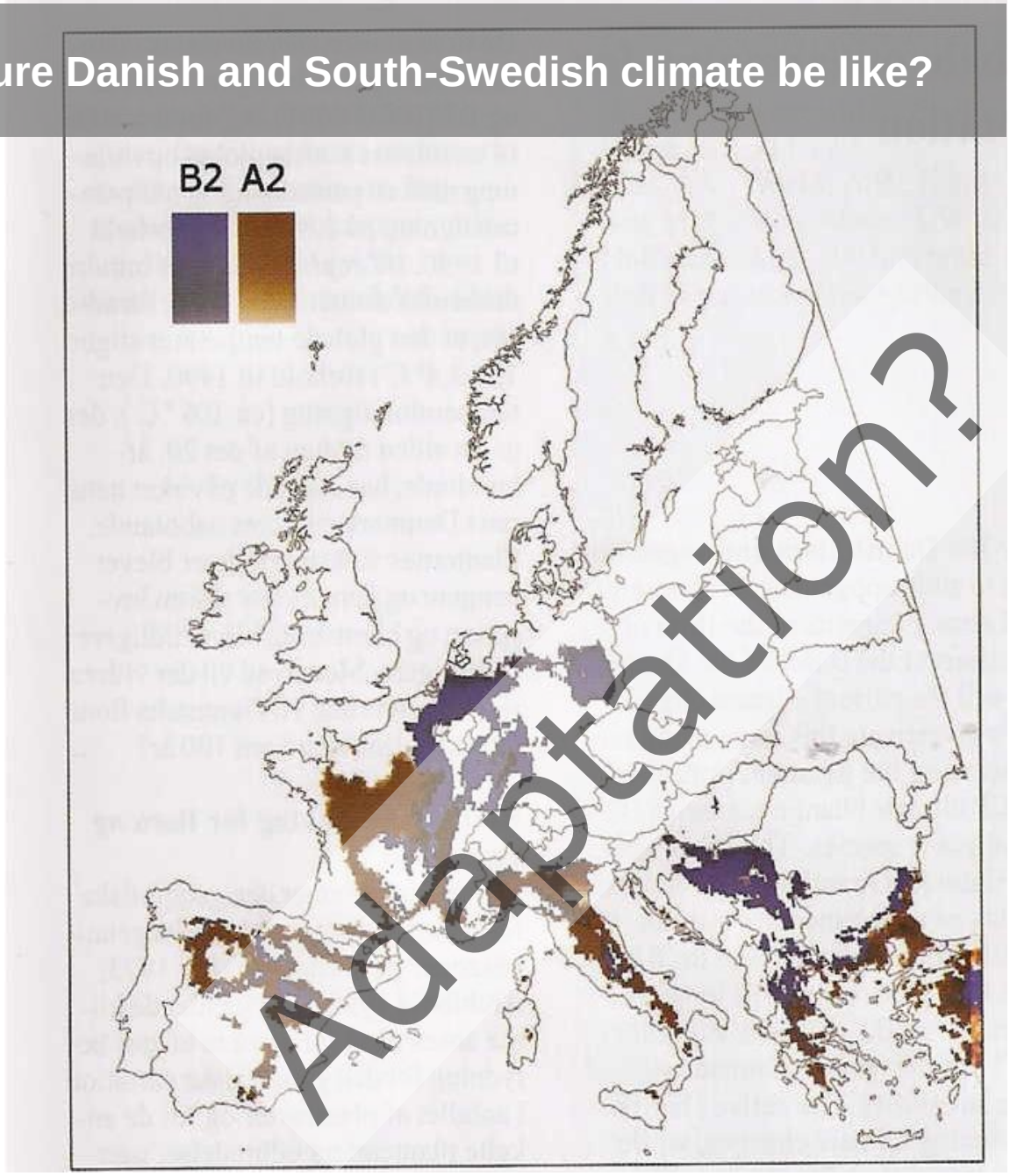
- expected/desired future importance!
- is it possible?
- may forests provide more?
- focus at the potential from 2050 and beyond



Projections Nordic total primary energy supply in the Carbon-Neutral Scenario



What will the future Danish and South-Swedish climate be like?



ADAPTATION
Changing climate increases risks of extreme weather
- pests and diseases perhaps may be an even bigger challenge…

Examples from Europe and North America
- **Dutch elm disease**
- **ash decline (*Chalara fraxinea*)**
- **emerald ash borer**
- **Mountain pine beetle**
- **oak wilt (*Ceratocystis fagacearum*)**
- **chestnut blight**
- **white pine blister rust**
- **beech bark scale**
- **hemlock wolly adelgid**
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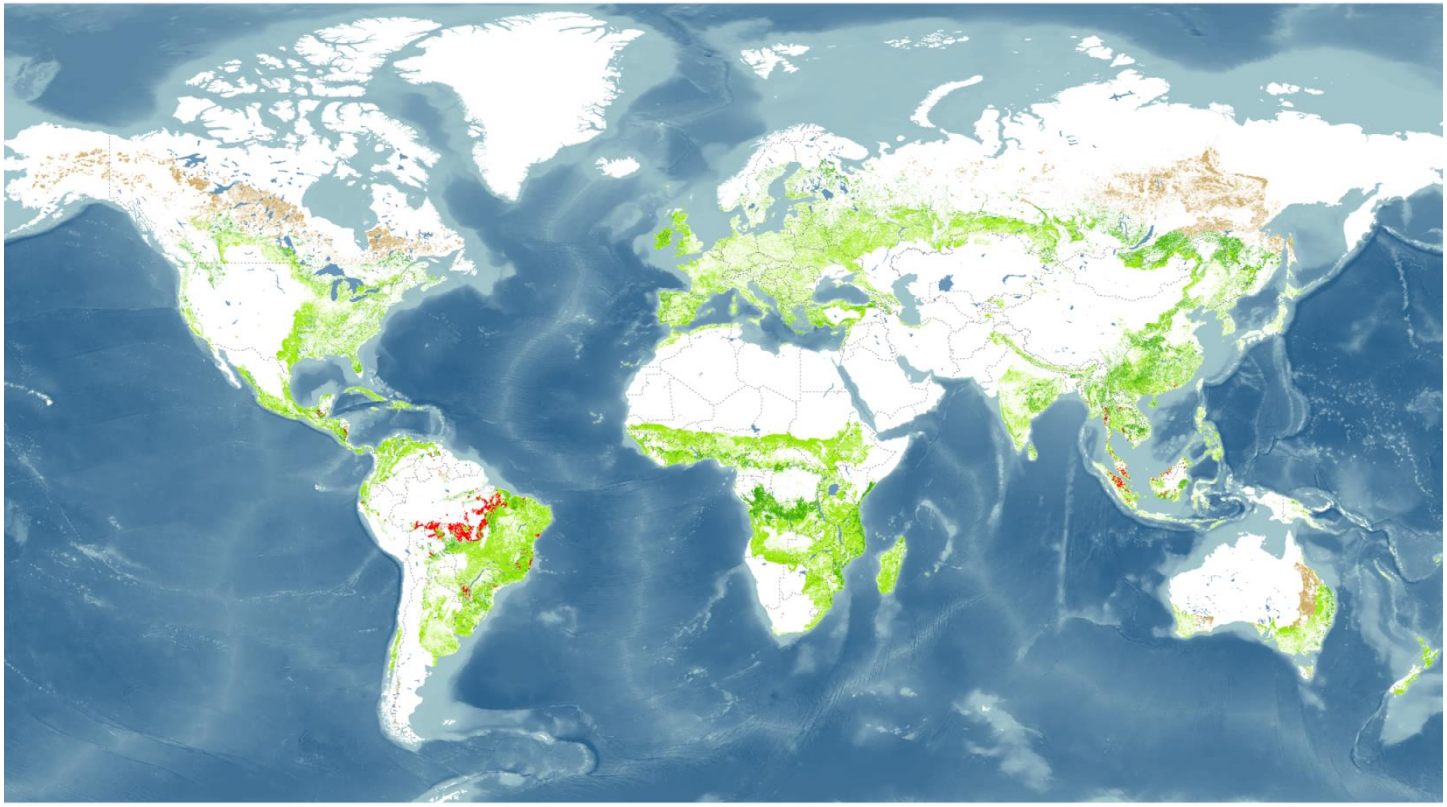
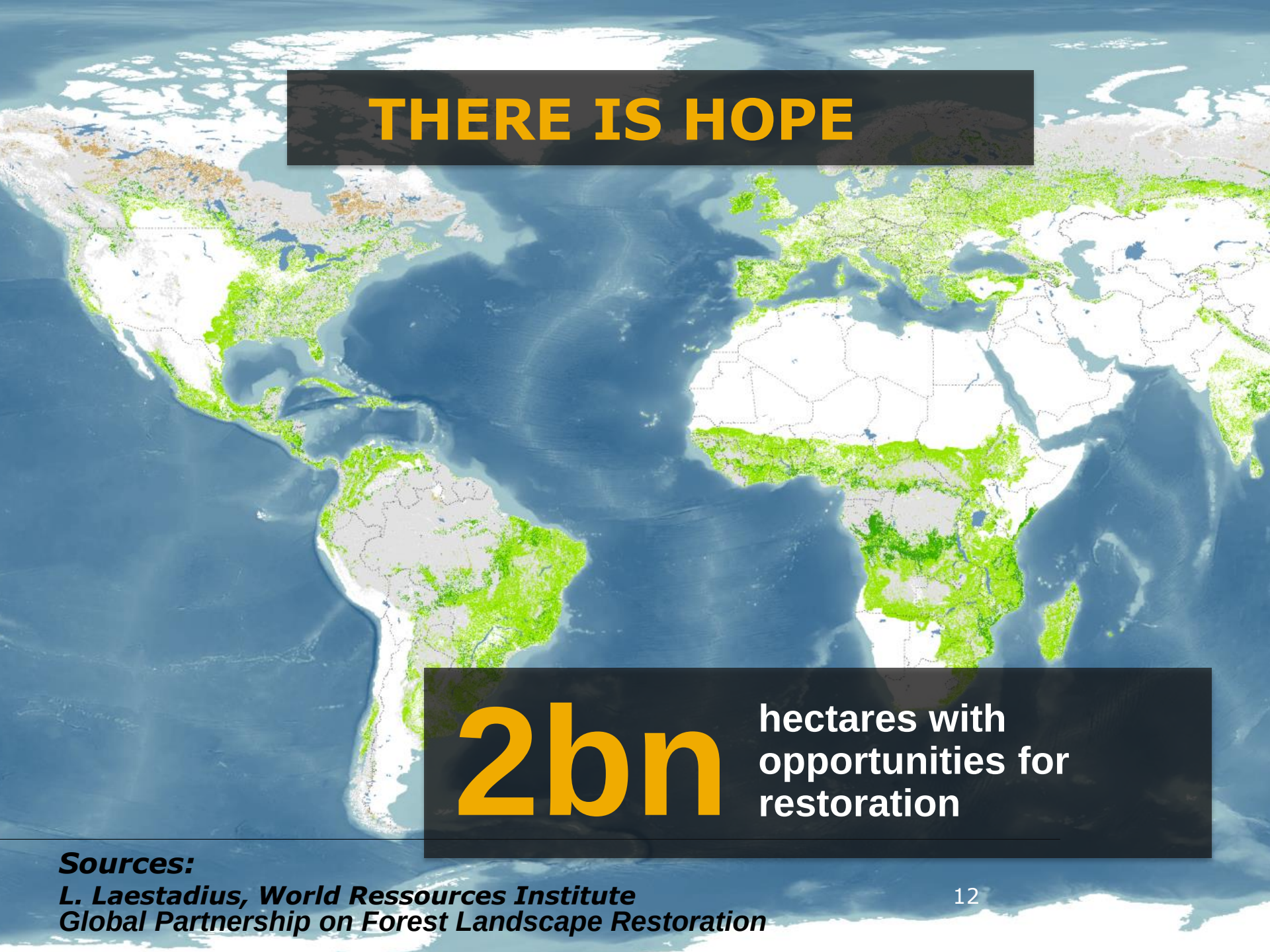
BONN CHALLENGE
on forests, climate change and biodiversity 2011

A World of Opportunity
for Forest and Landscape Restoration

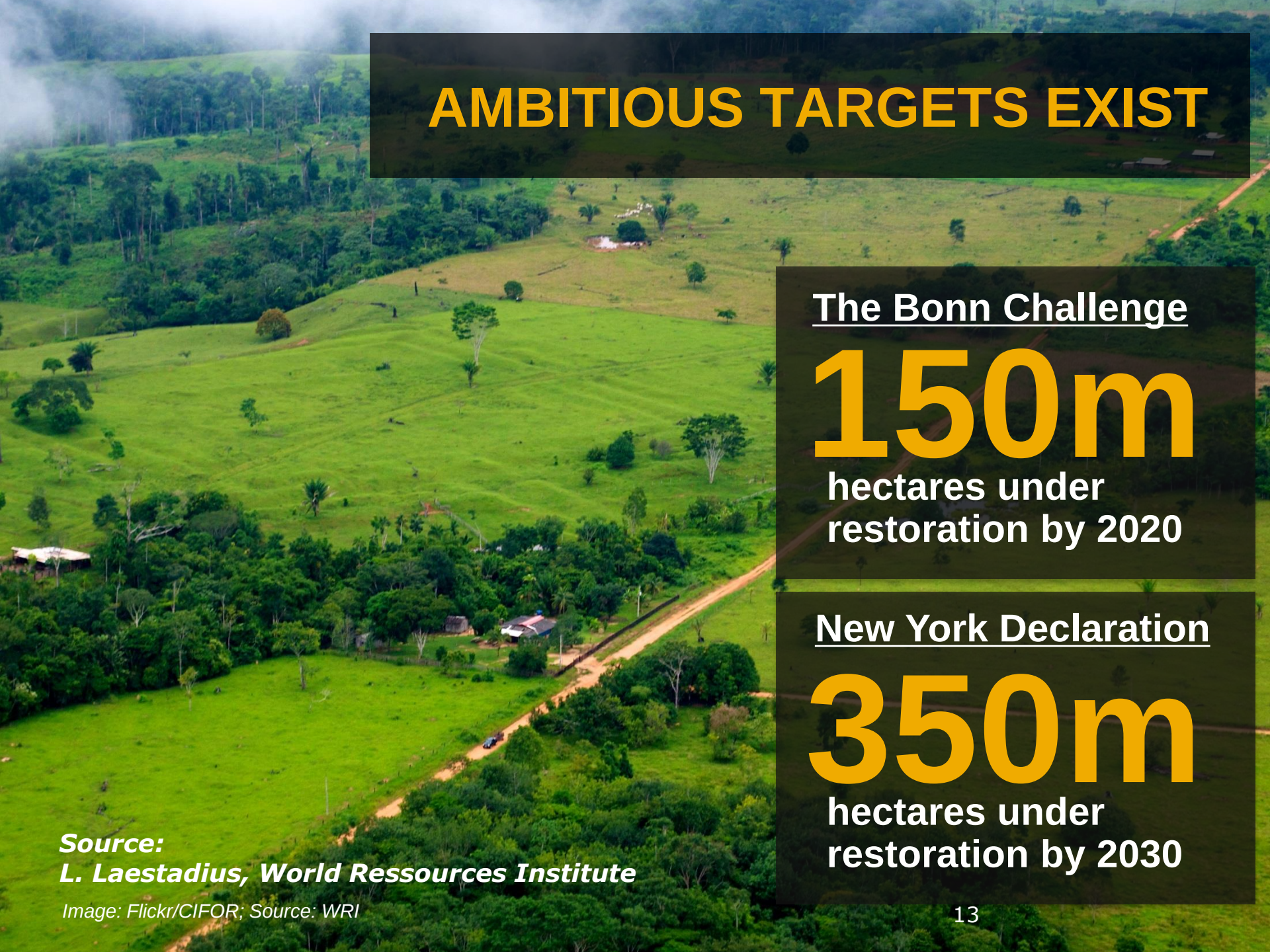


Source: L. Laestadius, World Ressources Institute



Sources:

L. Laestadius, World Ressources Institute
Global Partnership on Forest Landscape Restoration



AMBITIOUS TARGETS EXIST

The Bonn Challenge

150m

hectares under restoration by 2020

New York Declaration

350m

hectares under restoration by 2030

Source:
L. Laestadius, World Ressources Institute

Image: Flickr/CIFOR; Source: WRI

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

Forest Landscape Restoration as a Strategy for Mitigating and Adapting to Climate Change

Side Event at the XXIV IUFRO World Congress, 10 October 2014, Salt Lake City, USA
Report by John Stanturf, Palle Madsen, Promode Kant and Michael Kleine

This Congress side event jointly organized by the World Resources Institute (WRI) and IUFRO aimed at discussing forest landscape restoration (FLR) as a strategy for mitigating and adapting to climate change. To this end, a group of IUFRO scientists led by IUFRO Research Group 1.06.00 "Restoration of degraded sites" has developed a framework to demonstrate how FLR contributes to climate change mitigation and adaptation and how this contribution can be enhanced through more efficient methods and systems. This communication tool should help decision-makers to build resilient landscapes and learn how climate objectives can be addressed through FLR.
(Full report)

In his opening remarks Björn Hånell of the Swedish University of Agricultural Sciences and Coordinator of IUFRO Division 1 Silviculture (meanwhile IUFRO Vice-President) explained, "IUFRO is an active member of the Global Partnership on Forest Landscape Restoration (GPFLR). As such it supports the call to restore 150 million hectares of deforested and degraded lands by 2020 as an important component of the *Bonn Challenge Initiative on forests, climate change and biodiversity*. Research activities on FLR within IUFRO have been carried out for many years - long before FLR restoration has been placed high on the political agenda at global and national levels."

IUFRO is pleased to partner with the World Resources Institute in implementing a joint project, financed by the German Ministry of Environment, called *"Inspire, Sup-*

Restoring natural beech forests on farmland in Denmark (Photo by Palle Madsen)

Almost half of the global forest landscapes that have been deforested and/or severely degraded over the past centuries are considered as relevant target areas for FLR activities. They account for about 2 billion hectares of degraded land and, once restored, potentially support the multiple environmental benefits provided by forests and trees.

Numerous examples from around the world (e.g. Republic

Restored forest landscapes on formerly degraded land in Denmark

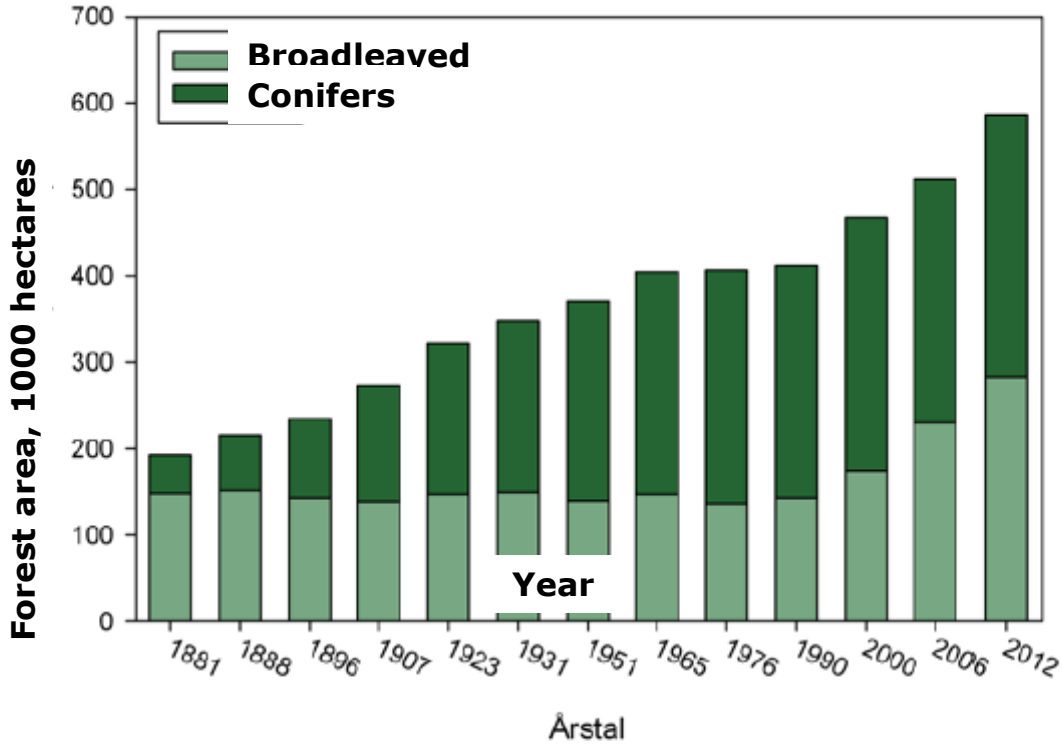
History has shown that large scale restoration efforts including non-native species can restore

- forest environmental conditions
- pave the road for reintroduction of native species

High-productive mixed Norway spruce and Douglas fir
- novel forest ecosystem with non-native tree species…….

The Danish case with a high proportion of non-native species is somehow controversial in many countries

- but it works well for us and may work well for others, too



Figur 1.2. Udviklingen i skovarealet fra de første skovtællinger til nu. Søjlerne for 2006 og 2012 er baseret på Danmarks Skovstatistik.

Figure 1.2. Forest area in Denmark since the first forest surveys and until today. Bars for 2006 and 2012 are based on the NFI.

Almost all conifers are non-native e.g.

- **Norway spruce**
- **Sitka spruce**
- **Douglas fir**
- **Grand fir**
- **Logdepole pine**
- **Japanese larch**
- **Red cedar**
- **European silver fir**
- **….**

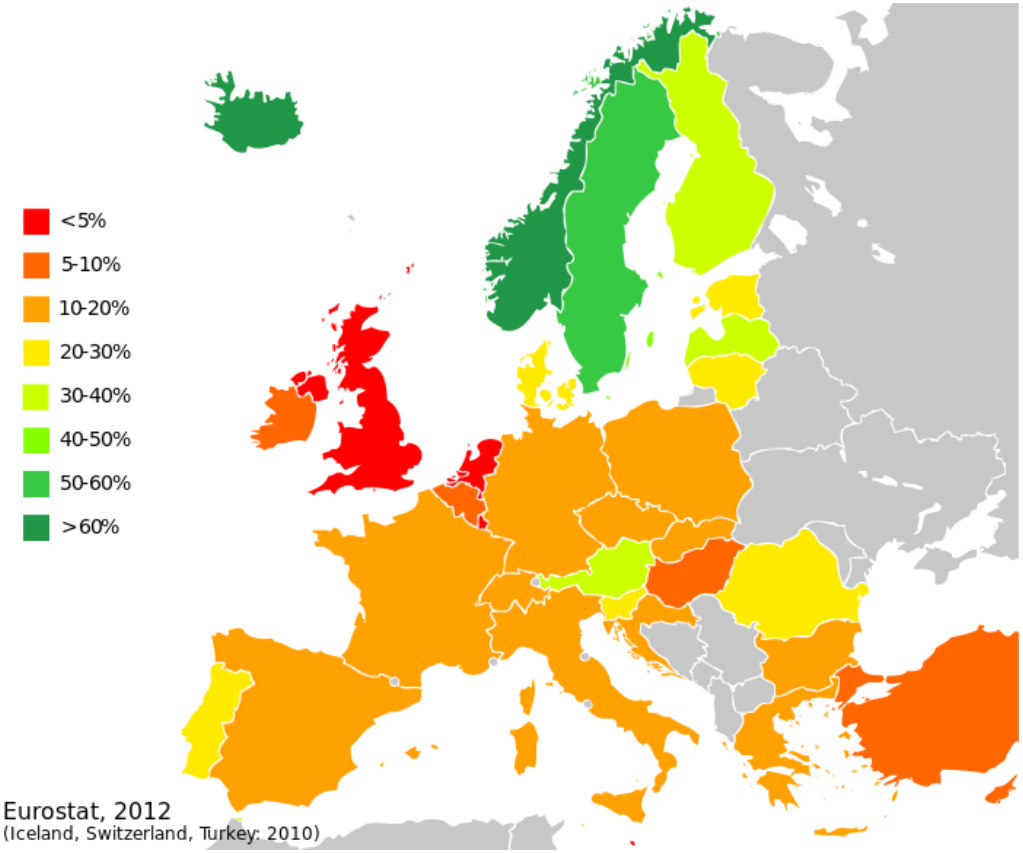
Native species e.g.

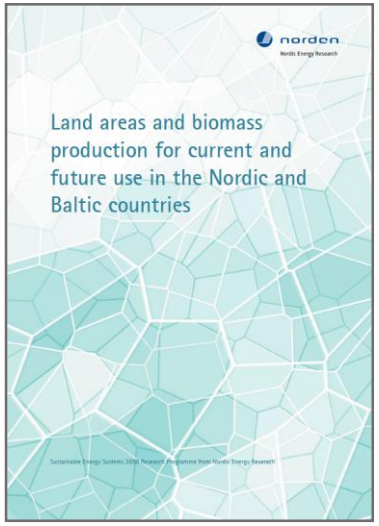
- **Beech**
- **Oak**
- **Ash**
- **Maple**
- **Lime**
- **Rowan**
- **Cherry**
- **Scots pine**
- **…..**

Johannsen et al. 2013. Skove og Plantager 2012

Annual current (2015-2050) harvest potential of forest fuels in the Nordic and Baltic countries ("ENERWOODS"-countries only)

- Large proportion of energy supply is already renewable
- 65-97 % of renewables (in EST, LVT, DK, FIN, S) are now from biomass and waste (woody biomass is the largest component)
- Wind and sun covers 2% and 0.2%, respectively
- Currently we only harvest 65% of forest growth in the region





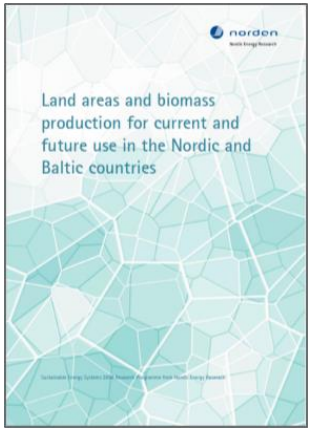
http://www.nordicenergy.net/publications/

- **a condensed version is now accepted for publication**

Annual current (2015-2050) harvest potential of forest fuels in the Nordic and Baltic countries

Country		Denmark	Finland	Norway	Sweden	Estonia	Latvia	Summary
Potential, lowest restriction level	Mton DM	2,3	35	5,11	29,33	3,2	4,52	**79,46**
	TWh	11,5	186	27,1	143,4	16,8	23,9	**409**
	PJ	41,5	670	98	522	62,2	87	**1481**
Potential, highest restriction level	Mton DM	1	22	3,84	10,89	1,7	4,52	**43,95**
	TWh	5,1	117	20,4	53,1	9,1	23,9	**229**
	PJ	18,3	420	74	194	33,4	87	**827**

The current forest fuel potential is 229 to 409 TWh yr^{-1}



Potential increases of within 50-100 years of forest growth and carbon storage are possible due to:

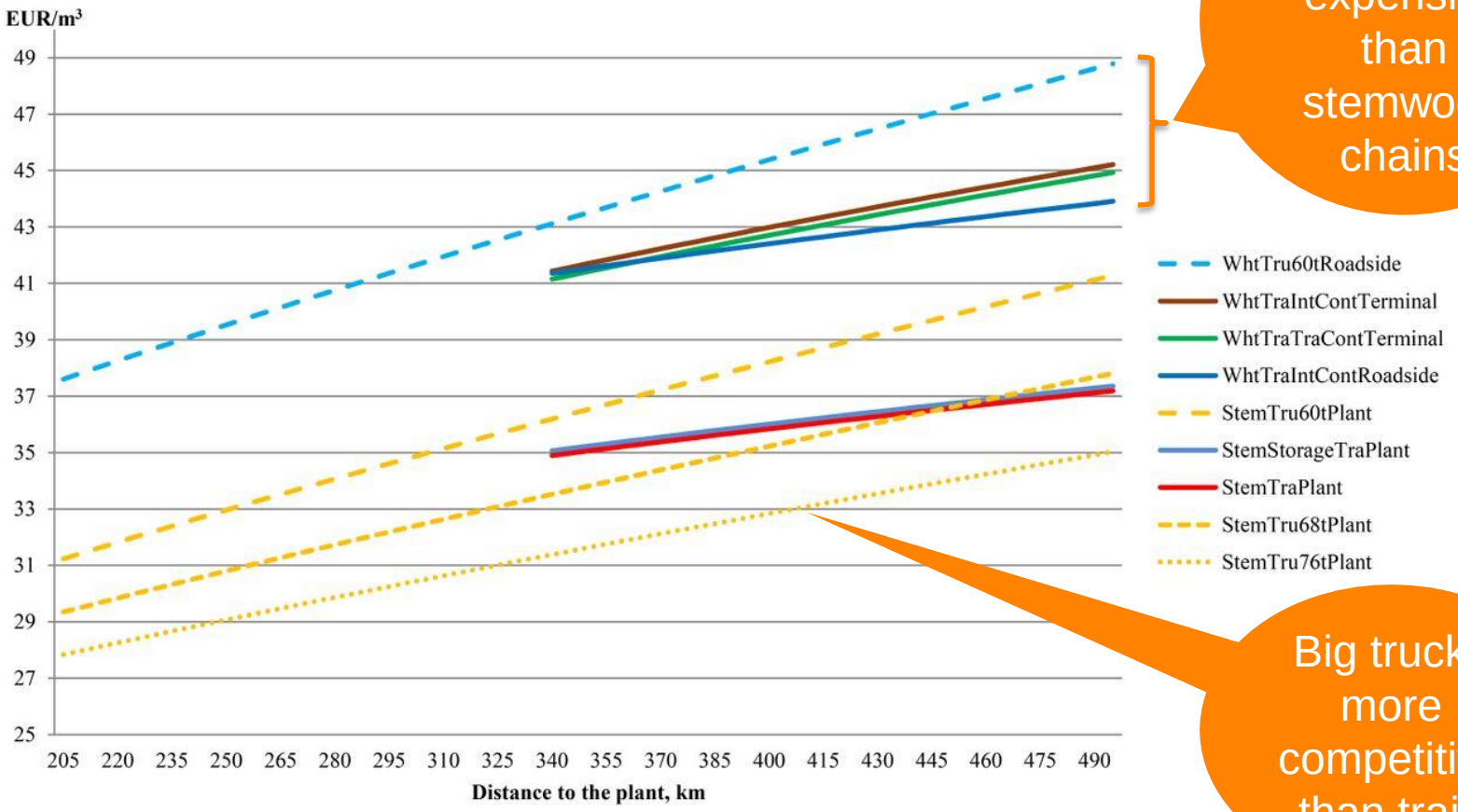
- **change tree species (+ 25 – 50%)**
- **genetic improvement (+8-50 % depending on tree species)**
- **high productive stand types with nurse crops (+ 100% or more within the first 25 years – long term productivity gain not well estimated)**
- **fertilization – 30% and more on poorest sites**
- **increased forest land area (up to additionally 2 mio ha; + 3% of area)**
- **climate change (+30%)**

A "conservative" potential of 50-100 % growth increase relative to todays practise and climate at the stand level

BUT! - large variation due to species-site interactions and what the reference is ….

Long-distance supply of energy wood in Finland

By Perttu Antilla, LUKE (METLA), Finland



Whole-tree chains more expensive than stemwood chains

Big trucks more competitive than train

Nivala et al. (2015)

Nicholas Herbert Stern (2006), British economist**:**

- Climate change presents a unique challenge for economics: it is the greatest and **widest-ranging market failure ever seen**

Greenhouse-gas emissions can be cut in four ways:

- Reducing demand for emissions-intensive goods and services *(… use e.g. wood instead (ed.))*
- Increased efficiency, which can save both money and emissions
- Action on non-energy emissions, such as avoiding **deforestation**
- Switching to **lower-carbon technologies** for power, heat and transport

Challenge:

Will society meet the challenge of market failure

- **and price renewables according to their value for a sustainable future?**

Challenges:

- **are we willing to utilize the potentials of planted forests and use the tools available?**

Strategic decisions are needed about whether functional integration must:

- **take place at the <u>stand scale</u>**
- **or to what extent it is acceptable at the landscape scale?**

New Generation

Plantations concept by WWF

Source: Luis N Silva, WWF

Conclusions:

- healthy and productive forests are essential for the forests to support a sustainable development
- high-productive forests supports nature conservation and biodiversity protection, too
- essential that the whole range of desired tree species and genetic material can be regenerated
- particularly the planted forests has a very large potential growth increase (50-100%)

Challenges:

- market failures that favour fossil energy and energy intensive materials relative to renewables
- willingness to use silvicultural potentials in planted forests
- strategic decisions needed concerning functional integration on the stand or on the landscape scale