



Sustainable forest biomass potentials in Austria

Limits of biomass harvest from sustainable forests

Michael Englisch

**Federal Research and Training Centre for Forests,
Natural Hazards and Landscape, Vienna**

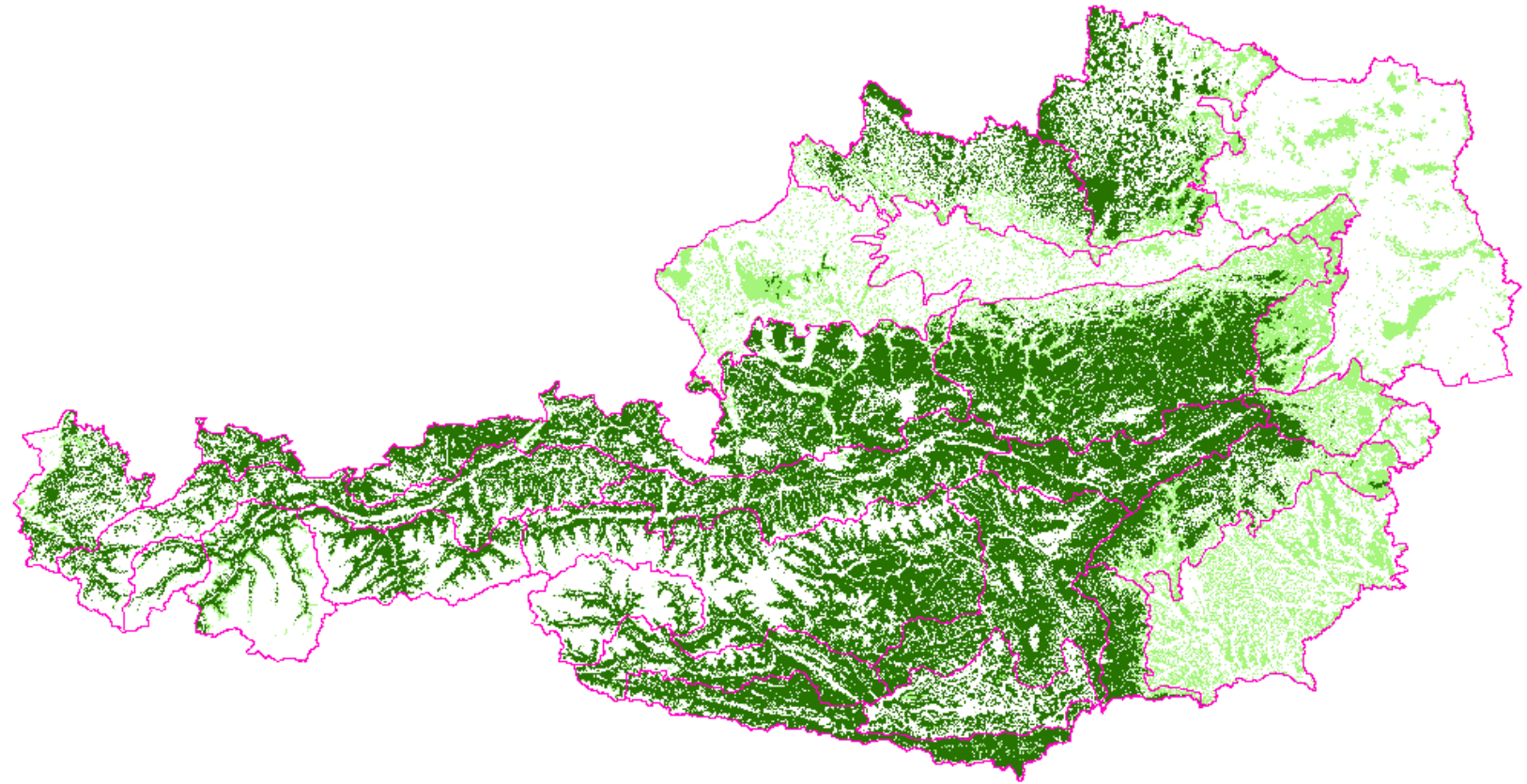
Dept. for Forest Ecology and Soil




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- Study on Sustainable Forest Biomass Potentials in Austria
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**Austria: Forest area 4.000.000 ha (47.6 %)
timber stock 1135 Mill m³,
(337 m³.ha⁻¹) [AFI 2007/09]**



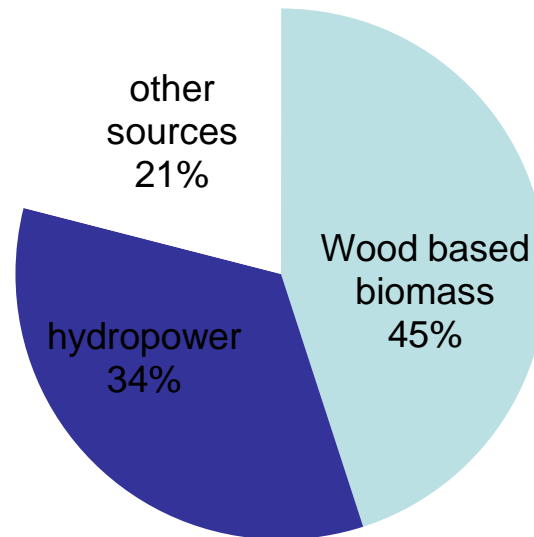
- Forstliche Wuchsgebiete
- natürliches Vorkommen der Fichte
- Waldfläche

1:2.200.000 

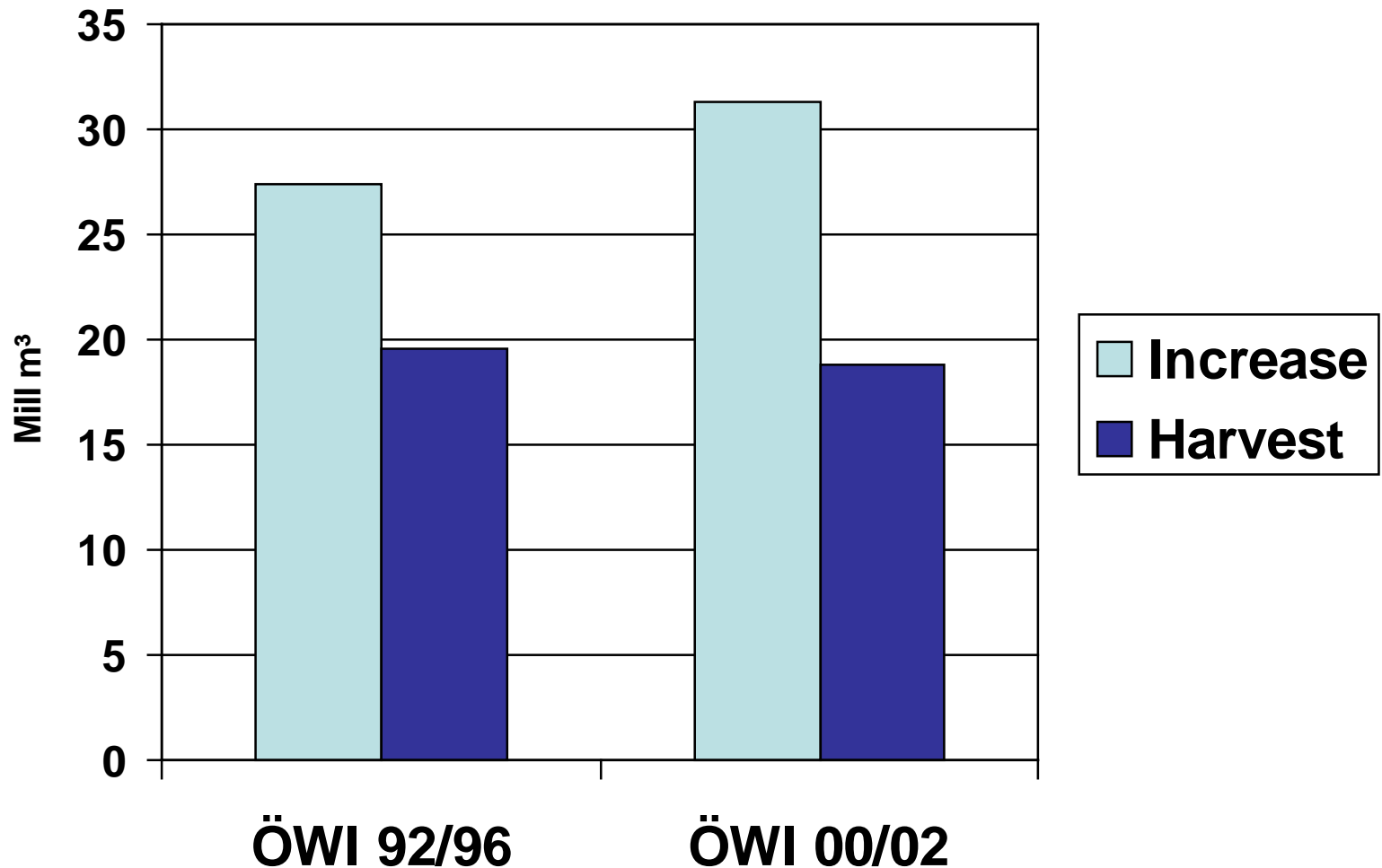
Austria: Energy gross inland consumption and renewables

- gross inland energy consumption:
1458 PJ (Statistik Austria, 2010)
30.8 % from renewable sources (411 PJ).

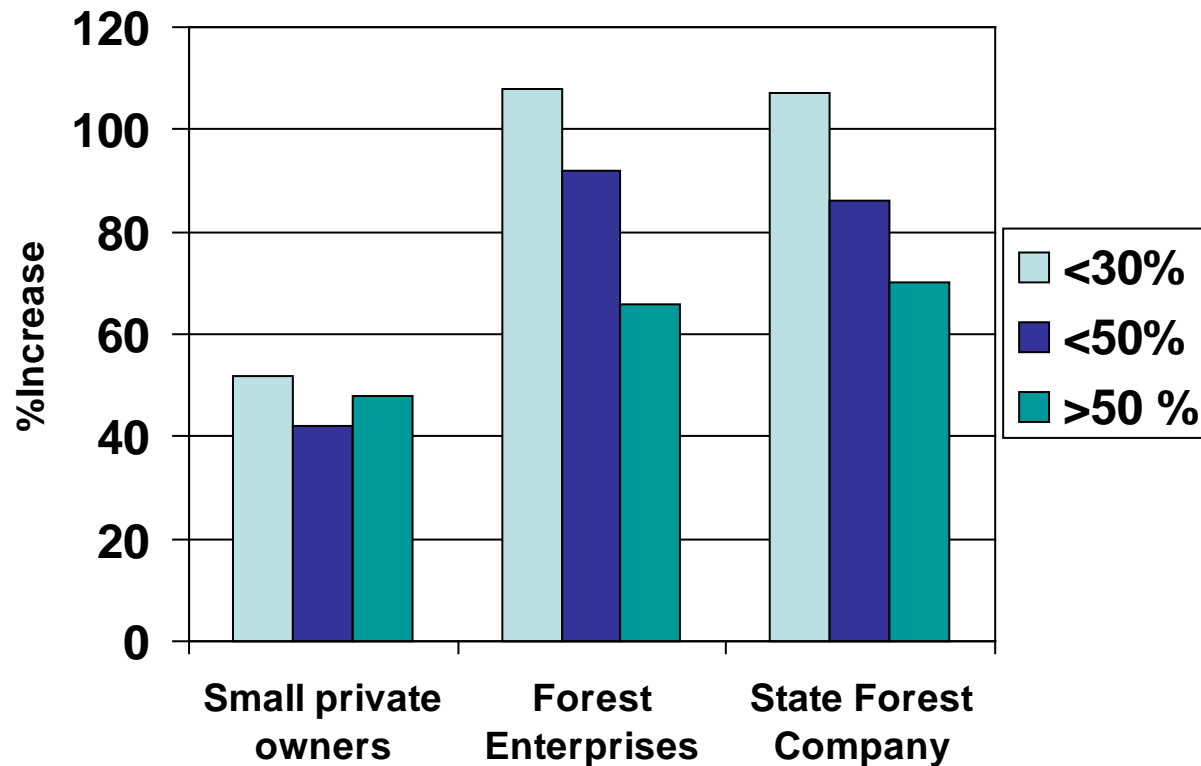
percentage of renewable energy supply



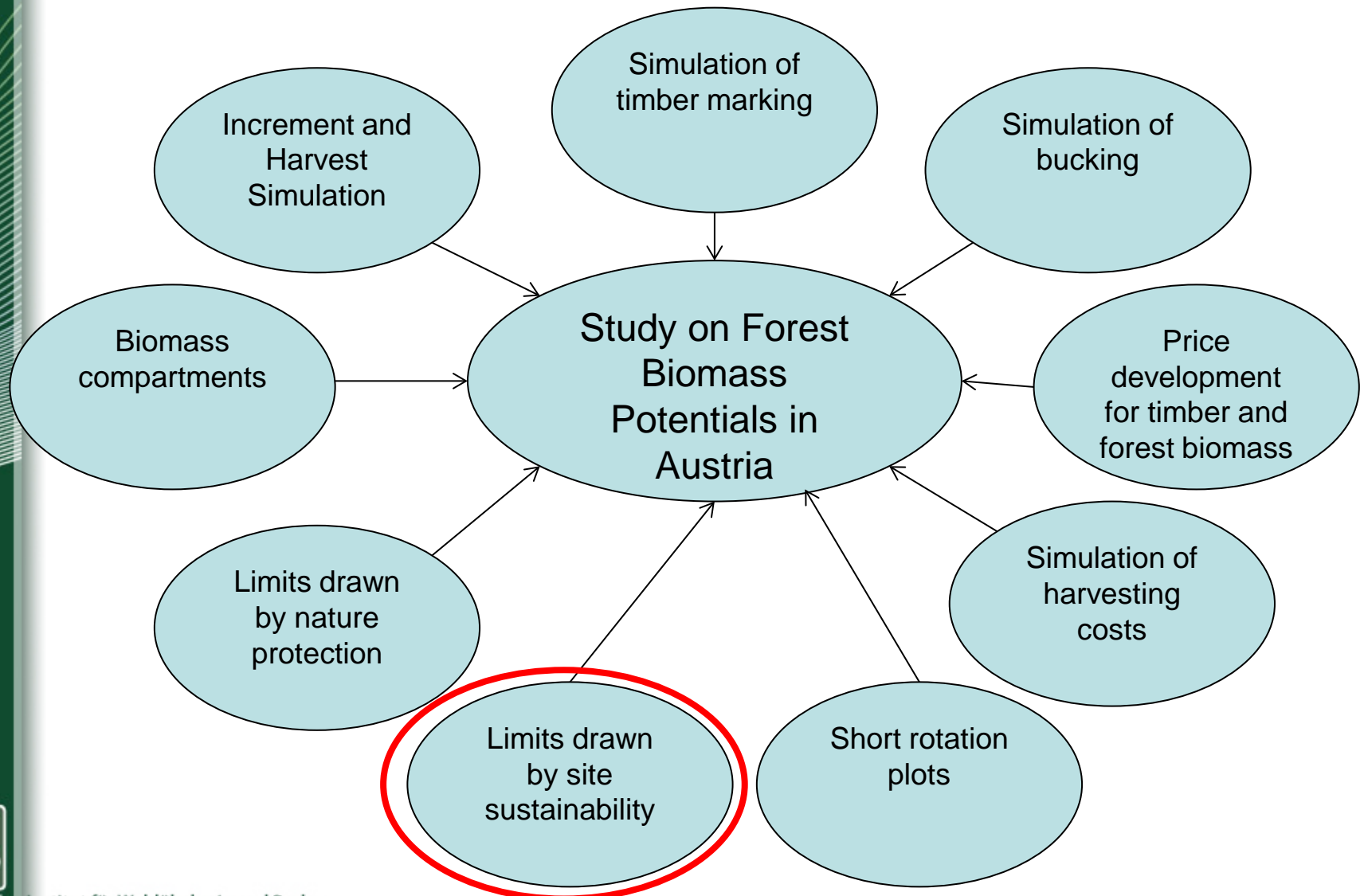
Increase surpasses Harvest (AFI 1992/96 und 2000/02, in mill. m³, SCHADAUER 2008)



Increase vs. Harvest [%], stratified by ownership and slope (SCHADAUER 2008)



Study on sustainable Forest Biomass Potentials in Austria



Study on sustainable Forest Biomass Potentials in Austria

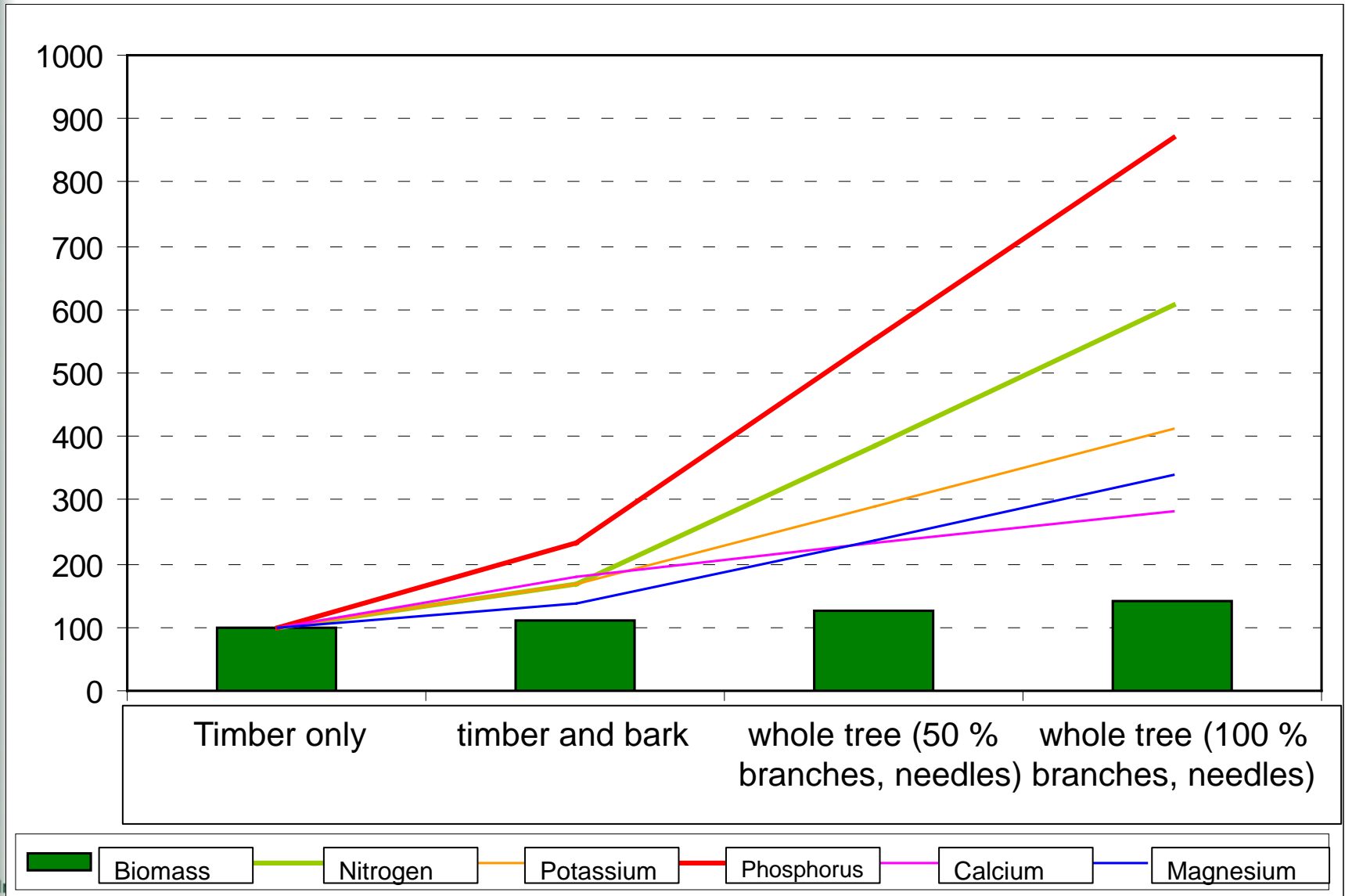
Data base:

- Forest Inventory (11.000 plots)
- Forest Soil Monitoring System (500 plots)
- Monitoring Plots Level II/ICP Forests
- Bioindicator-Grid
- Standalone studies

Sustainable Forest Biomass Potentials

- **theoretical potential**
- - Harvesting restrictions (economical, ecological)
- = **available potential**
- x mobilisation factor
- = **realisable potential**

Biomass- und element extraction, different harvesting methods and extraction intensities [%]



Nitrogen extraction [kg.ha⁻¹], different harvesting intensities

Norway spruce stand, age=106, mean annual increase: 8 m³.a⁻¹

- N-extraction, timber only: 162 kg.ha⁻¹
- N-extraction timber and bark (traditional): 231 kg.ha⁻¹
- **N-extraction whole tree (70% needles/branches): 470 kg.ha⁻¹**
- N-extraction whole tree (100% needles/branches): 573 kg.ha⁻¹

→ Whole tree harvest more than doubles N-extraction compared to traditional harvesting

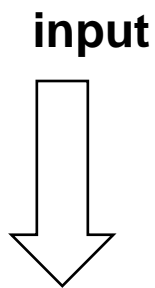
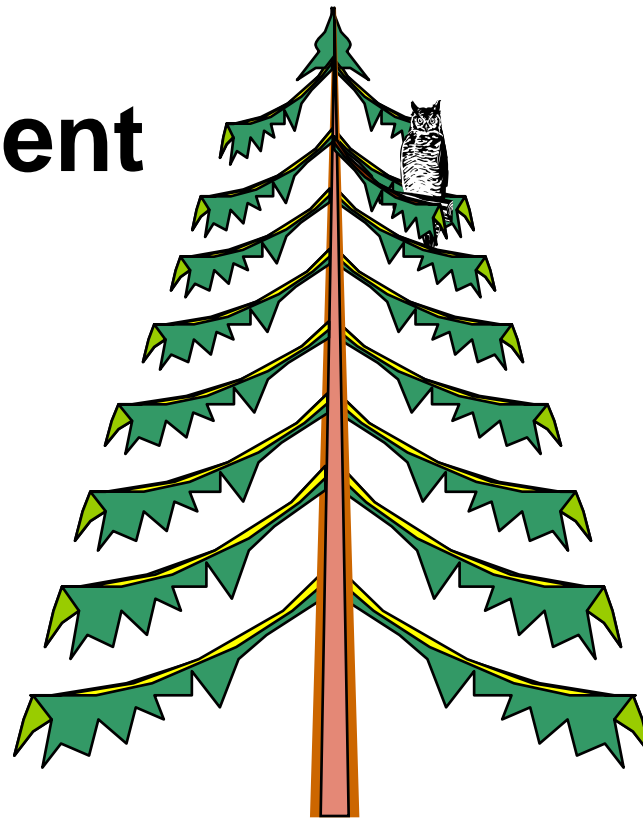
Approach to calculating ecologically sustainable biomass potentials

Comparison of
site element balance

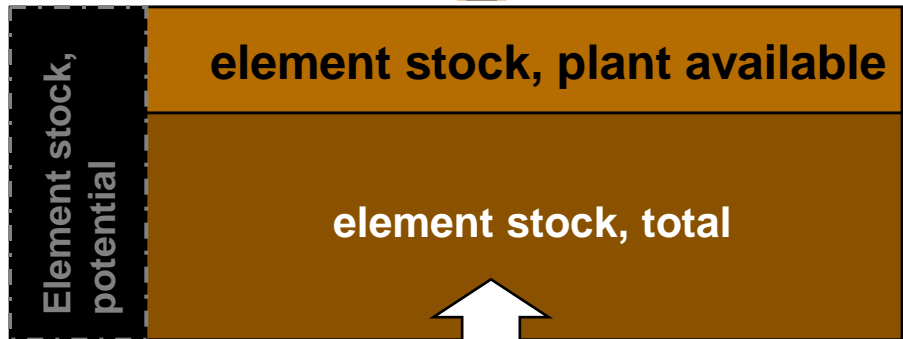
to

**element loss by biomass extraction
(different harvesting intensities)**

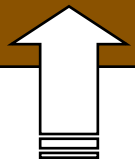
Site element balance



- immissions
- fertilization
- slope water



- output
- gaseous emissions
 - harvest
 - erosion
 - leaching



weathering (nutrient supply)

Approach

Element input = Σ (weathering, atmospheric input)

Weathering = f (soil temperature, texture, substrate, soil depth)

[Spranger et al.(Eds.) 2004]

Atmospheric input = f (precipitation, element conc._{bulk measurements})

Element output = Σ (leaching, gaseous outputs, element loss_{harvest})

leaching, gaseous outputs (literature studies)

nutrient loss_{harvest} = f (stand mass, element concentration_{biomass})

[stand mass calculation: PROGNAUS, Ledermann 2008]

Soil element stock = f (soil mass (<2mm), element concentration_{soil})

Classification

Sustainability classes based on the percentage of element mass extracted in relation to the available soil element pool (Englisch and Reiter 2009), each inventory plot

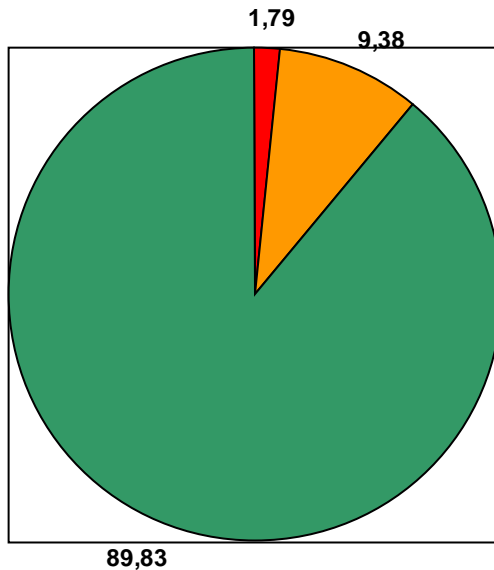
	N	P	Ca	Mg	K
Not sustainable	> 60	> 40	> 100	> 100	> 100
Problematic	30-60	25-40	50-100	50-100	50-100
Sustainable	< 30	< 25	< 50	< 50	< 50

Aggregate classification, each inventory plot

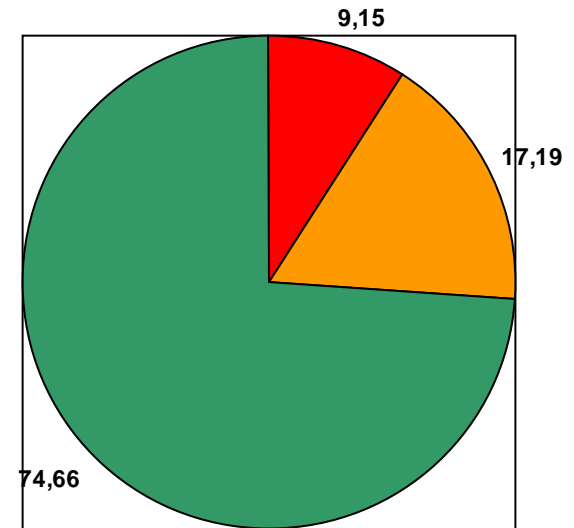
≥ 1 element „not sustainable“ – WTH „not sustainable“

≥ 1 element „problematic“ – WTH „problematic“

Percentage of Forest Inventory plots (n= 9378), where harvest of „timber only“ (left) and „timber and bark“ is „possible“ resp. „problematic“ or is „not sustainable“

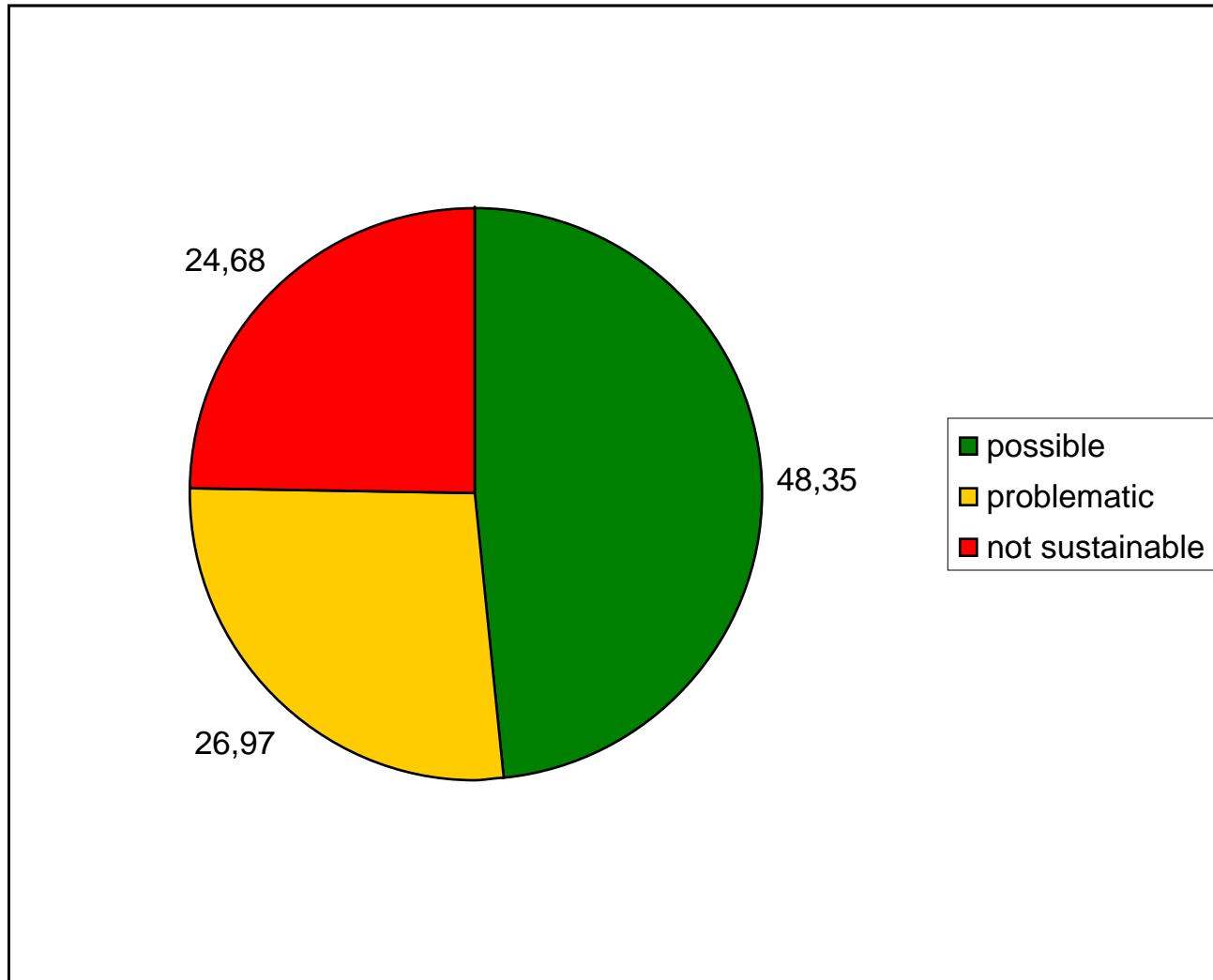


■ not sustainable ■ problematic ■ possible



■ not sustainable ■ problematic ■ possible

Percentage of Forest Inventory plots (n= 9378), where whole tree harvest is „possible“ resp. „problematic“ or is „not sustainable“ [postulated harvest loss for needles and branches: 30 % (z.B. Eriksson, 1993); deciduous species: without leaves]



Theoretic and available (ecological and economical restrictions met) biomass potentials in Austria, different scenarios [Mill m³.a⁻¹]

	„Constant stock“	„climate change“	„intensive thinning“	„stock decrease“
Price scenario 1: 81 €/m³				
Theoretic	32,7	34,0	35,7	38,4
Available	25,6	26,6	26,9	29,3
Price scenario 2: 100 €/m³				
Theoretic	32,7	34,0	35,7	38,4
Available	26,4	27,4	27,9	30,3
Price scenario 3: 162 €/m³				
Theoretic	32,7	34,0	35,7	38,4
Available	27,4	28,5	29,1	31,5

Summary and Conclusions

- Whole tree harvesting „not sustainable“ or „problematic“ at 52 % of inventory plots
- Timber and bark harvesting „not sustainable“ at 9 % of inventory plots
- Timber only harvesting „not sustainable“ at 2 % of inventory plots

- Theoretic potential in Austria depending on scenario and timber/biomass prices between 32.7 and 38.4 mill m³.a⁻¹
- Available potential in Austria depending on scenario and timber/biomass prices between 25.6 and 31.5 mill m³.a⁻¹

- Timber/biomass prices do not change forest biomass availability considerably
- Whole tree harvest only after site diagnosis

- Consideration: Potential financial gain of slash extraction versus potential future increase losses
- Consideration: Economical benefit of slash extraction

**Thanks to: Alfred Fürst, Karl
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Thank you for your attention!



Kurzumtrieb

