



Understanding and directing small-scale private forest owner behaviour towards climate change adaptation

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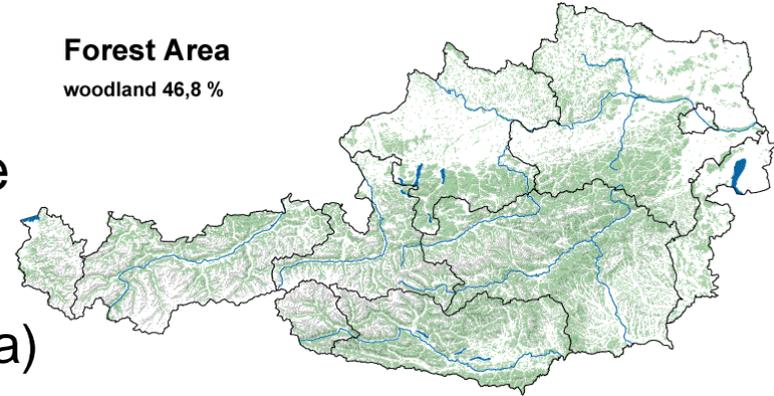


Background:

Forest ownership and climate change



Forest Area
woodland 46,8 %



- 80% is privately owned
 - Percentage increases across Europe
 - Size of properties is decreasing (20% of forest units are smaller than 5 ha)
 - Climate change will effect productive forest stands **directly** and **indirectly** (economic loss, influence on protective function, increased risks and damages from natural hazards, effects on non-forest sectors)
 - Adaptation and mitigation strategies have been developed by forest research
 - **Costs of in-action in Austria:**
2014 - 2039: 150 Mio.€/year
2040 - 2070: 230 Mio.€/year
-

The trends in forest ownership



■ Forest owner in the past



■ Forest owner in the future



- Forest ownership is part of land use
- Significant units remain
- Forest responsibility and ownership begins in their 40s at the latest
- Forest owners are involved in forest management over decades
- Forestry skills
- Forests have a relevant economic function

- Forest ownership not part of land use
- Forests are scattered and divided between children
- Forest responsibility and ownerships start late (in their 60s)
- Little experience and few forest related skills
- Forests have no economic function
- **Under - researched**

Research goal



Investigate small-scale private forest owners' management decision making in the context of climate change

Not clear **how they approach emerging challenges** of climate change and **whether or not they are aware of the required activities** of sustainable forest management



- 0 - 20 ha
- No ties to agriculture
- No exchange with chamber (despite required membership) or ministry
- Not reached through usual information channels
- Left out in census

Method

- Online questionnaire
 - 27 open- and closed-ended questions
 - description of forest
 - forest owner's perception of climate change
 - motivation for forest ownership
 - sociodemographic questions
 - discrete choice experiment
 - raffle



Mit Wald gewinnen!

Wir suchen Personen, die Wald besitzen!

Wenn Sie also jede noch so kleine Waldfläche Ihr Eigentum nennen, dann können Sie mit dem Ausfüllen dieses Fragebogens ein Wellness-Weekend und weitere Sachpreise gewinnen.

Sie benötigen für diesen Online-Fragebogen rund 15 Minuten. Bitte verwenden Sie im Fragebogen zum Blättern nur das Feld „Weiter“. Alle Antworten werden anonym behandelt.

Für Rückfragen und bei Interesse an den Ergebnisse, wenden Sie sich bitte an nina.mostegl@boku.ac.at

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Projekt-Hintergrund

START

Gewinnspiel



Sampling Method



- Online questionnaire
 - 919 questionnaires in total

Pre-Test:	N = 21	2.3%
Ministry ¹ :	N = 490	53.3%
Tyrol:	N = 142	15.5%
Styria:	N = 94	10.2%
BOKU:	N = 131	14.3%
UBA:	N = 33	3.6%
Others:	N = 8	0.9%

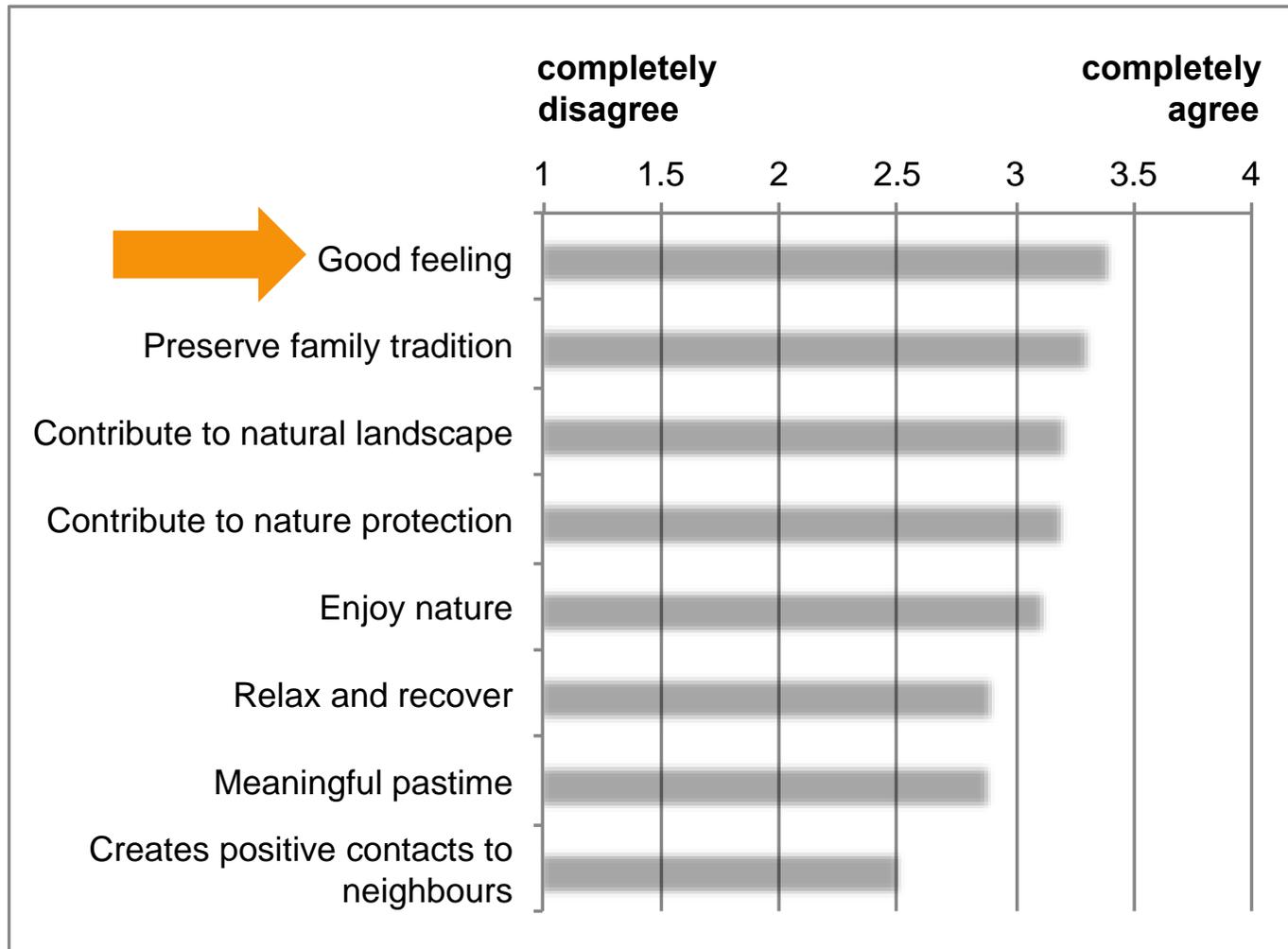
¹ The Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management

Overall description of respondents

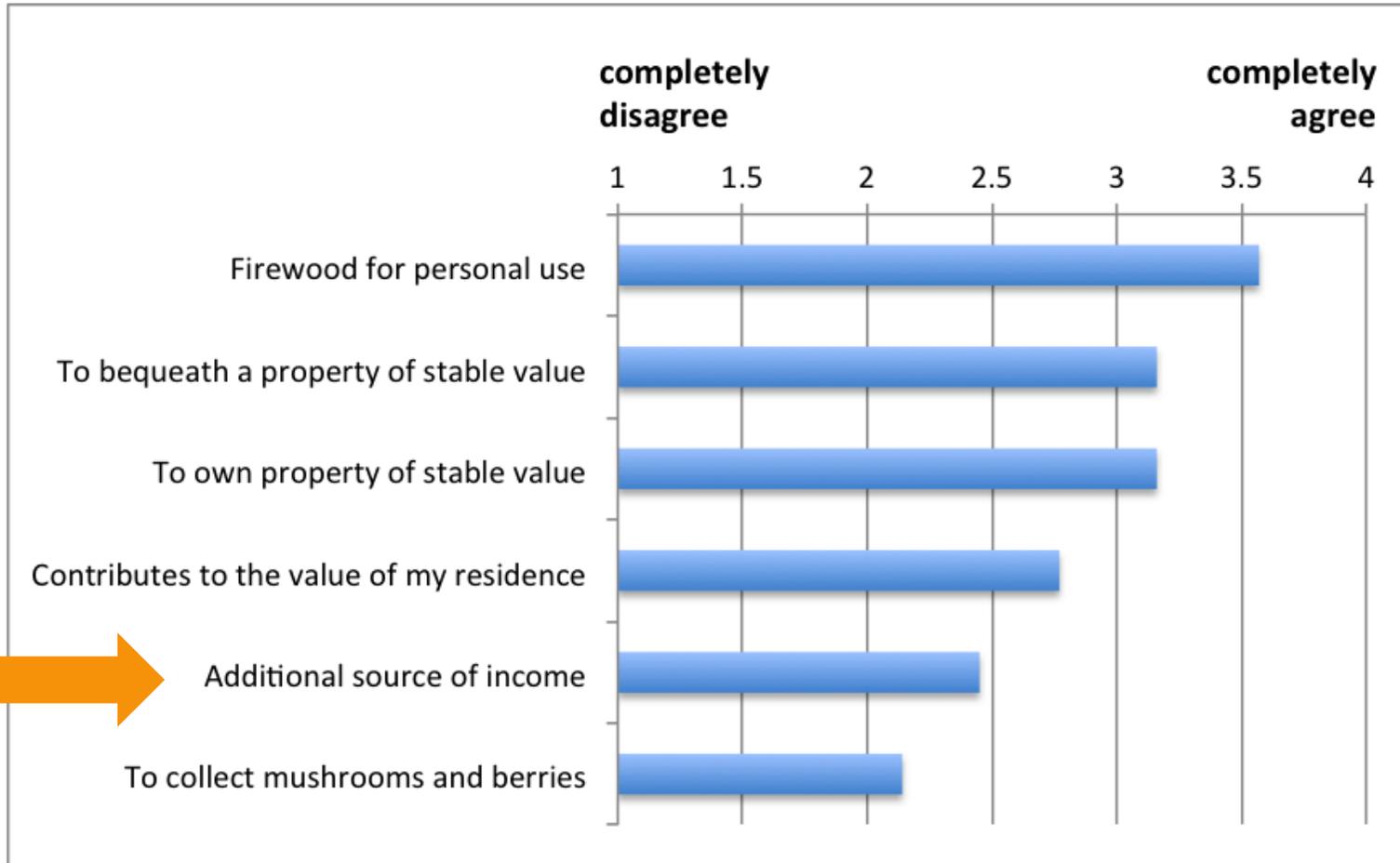


- Good spatial distribution across Austrian regions
 - **80% male**
 - One third (33.1%) member of a forest owner association
 - Lives in **rural areas** (77%)
 - **High level** of education (40.8% college/university)
 - Lives **less than 5 km away** from the forest (71%)
 - **Inherited** forest
 - Average duration of ownership **13.3 years** → **4 lots**
 - 69.1% owned the forest alone
 - Majority owned between **0.1 ha and 5 ha** (66%)
-

Main emotional motives for ownership



Main economic motives for ownership



Climate change perception



- 57% recognise effects of climate change
 - 21% effects later-on
 - 16% undecided
 - **3%** do not believe in climate change

 - 50% expect effects on their forests
(e.g. reduction of Norway spruce, forest decline, augmented bark-beetle infestation, droughts, biotic damages, and storm damage)
 - **21%** do not expect climate change to impact their forests

 - 52% require measures within 20 years
 - **23%** believe that no measures are necessary
-

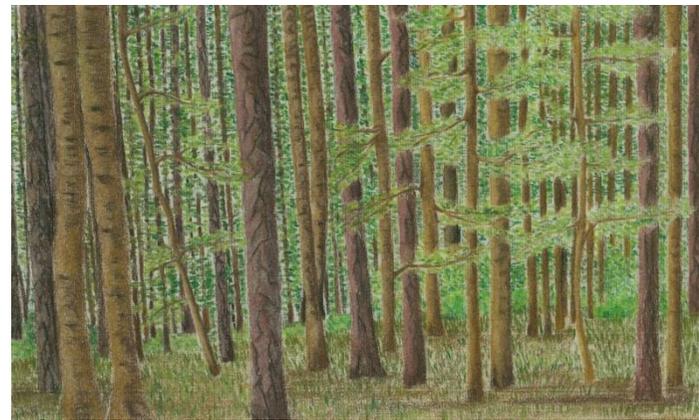
Discrete Choice Experiment



- understanding of the salient factors influencing the decision making of private forest owners
 - Stated preference method – behavioural model
 - Assumes utility maximization (economic, environmental, and social factors simultaneously)
 - Investigates willingness to make trade-offs
-

Choice Experiment

Imagine, you are the owner of **1 ha (10 000 m²)** of a **40 year old forest** dominated by coniferous trees with **a few deciduous trees (10%)**.



Since climate change may lead to negative impacts on your forest (such as draught stress, bark beetle) the forest administration suggests to increase the amount of deciduous trees. **Your task will be to select one out of three management alternatives you would prefer for the future of your forest.**

EXAMPLE

Current Decision

Situation in 50 years

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Significance of the impact	Low With natural regeneration mainly	High With artificial regeneration mainly	No impact
Balance after management	+ 500 €	+ 1.000 €	---
Funding	1.000 €	2.000 €	---
Management Type	Tractor	harvester	---
Commissioned by	Service Team or Austrian Forest Service	Local enterprise or forest enterprise	---
Probability of climate change related impacts	Very low	low	high
Expected Value change (estimated baseline 40.000 €)	0 %	+ 10 %	- 20 %
Amount of deciduous trees	10 % deciduous trees	20 % deciduous trees	0 % deciduous trees
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I choose

Now, imagine that a number of conditions have changed, such as funding, balance after management or the outcome. Which alternative you would choose now?

Please choose the alternative, you apply under the given information and circumstances .



Mixed stand 1 ha, about 40 years old, mainly coniferous trees (10% deciduous trees)

Current decision

Condition in 50 years

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Intensity of procedure	Soft procedure predominantly natural regeneration	Strong procedure predominantly regeneration through planting	No procedure
Balance after procedure	+ 500 €	+ 1.000 €	---
Funding	1.000 €	2.000 €	---
Management type	Tractor	Harvester	---
Commissioned by	Service Team or Austrian Forest Service	Regional or local forest enterprise	---
Probability of climate change induced damages	Very low	Low	High
Potential change in value (estimated baseline 40.000 €)	0 %	+ 10 %	- 20 %
Amount of deciduous trees	10 % deciduous trees	20 % deciduous trees	0 % deciduous trees

I choose

Choice Experiment: Attribute und Levels – Overview not included in the SURVEY

Intensity of procedure	Soft procedure predominantly natural regeneration	Strong procedure predominantly regeneration through planting	No procedure
Balance after procedure	- 500 € +/- 0 € + 500 €	- 1.000 € +/- 0 € + 1.000 €	---
Funding	1.000 € 2.000 € 5.000 €	1.000 € 2.000 € 5.000 €	---
Type of procedure	<ul style="list-style-type: none"> • Harvester • Tractor • Manual operation 	<ul style="list-style-type: none"> • Harvester • Tractor 	---
Commissioned by	<ul style="list-style-type: none"> • Regional or local forest enterprise • Environmental organization • Forest management units • Service Team or Austrian Forest Service 	<ul style="list-style-type: none"> • Regional or local forest enterprise • Environmental organization • Forest management units • Service Team or Austrian Forest Service 	---
Probability of climate change induced damages	Very low	Low	High
Potential change in value (estimate baseline 40.000 €)	+ 10 % 0 % - 5 %	+ 10 % 0 % - 10 %	+/- 0 % - 10 % - 20 %
Amount of deciduous trees	10 % 10 % 20 %	20 % 30 % 40 %	0 % 1 % 3 %

Choice experiment results

Latent Class analyses: 3 class model



	The utility oriented forest owner / lover	The recreation oriented forest owner	The tradition-conscious forest owner
Size of class	59.2%	30.1%	8.7%
Forest visits	Frequent visitors	Frequent visitors	Few visits
Size of forest	Average size of forest is larger than in other segments	High amount of small scaled forest units	Small scaled forest units
Type of forest	Highest amount of more productive spruce forests	High amount of deciduous forest	High amount of deciduous forest
Emotional motives	Social contacts are important (neighbourhood)	Conservation interested and forests are important for recreation and a meaningful leisure time	Family tradition is the most important motive
Economic motives	Additional income is somewhat relevant	Inheritance of valuable units	Inheritance of valuable units
Residency		Mainly from larger cities	
Climate change			Don't believe in effects of climate change or impacts on forests
Respondents			High amount of female respondents
Education			Less educated

The role of the outcome in 50 years:

- Deciduous trees matter**
- Money can't buy you love**

Choice experiment results



- Current decision:
 - Generated income
 - Funding
 - Soft management
- Future situation
 - No losses
 - Highest amount of broadleaf trees



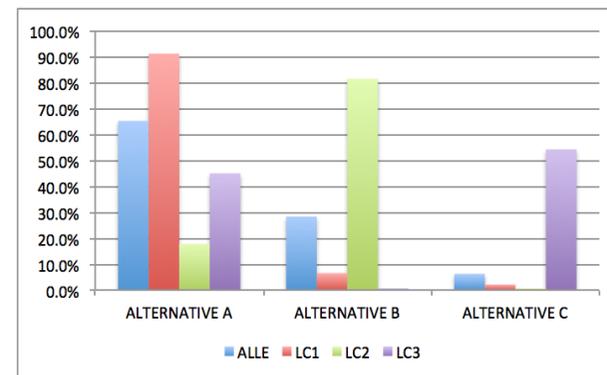
Soft impact preferred by LC1 and partially LC3
Significant impact preferred by LC 2 because of the high amount of deciduous trees
 LC3 54% **no procedure** preferred



Current decision

Condition in 50 years

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Intensity of procedure	Soft procedure predominantly natural regeneration	Strong procedure predominantly regeneration through planting	No procedure
Balance after procedure	500 €	1,000 €	---
Funding	5,000 €	5,000 €	---
Type of procedure	Tractor	Tractor	---
Commissioned by	Regional or local forest enterprise	Regional or local forest enterprise	---
Probability of climate change induced damages	Very low	Low	High
Potential change in value (estimate baseline 40.000 €)	0%	0%	0%
Amount of deciduous trees	20% deciduous trees	40% deciduous trees	3% deciduous trees



	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	65.3%	28.4%	6.3%
LC1	91.3%	6.5%	2.1%
LC2	17.8%	81.6%	0.6%
LC3	45.1%	0.5%	54.4%

The utility oriented forest owner / lover
 The recreation oriented forest owner
 The tradition conscious forest owner

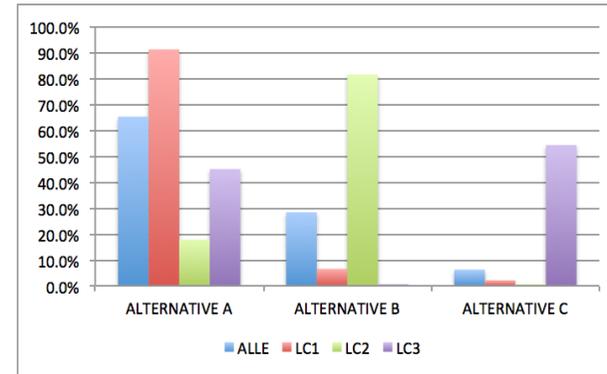
Deciduous trees matter...



Current decision

Condition in 50 years

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Intensity of procedure	Soft procedure predominately natural regeneration	Strong procedure predominately regeneration through planting	No procedure
Balance after procedure	500 €	1,000 €	---
Funding	5,000 €	5,000 €	---
Type of procedure	Tractor	Tractor	---
Commissioned by	Regional or local forest enterprise	Regional or local forest enterprise	---
Probability of climate change induced damages	Very low	Low	High
Potential change in value (estimate baseline 40.000 €)	0%	0%	0%
Amount of deciduous trees	20% deciduous trees	40% deciduous trees	3% deciduous trees



B: 40%

B: 20%

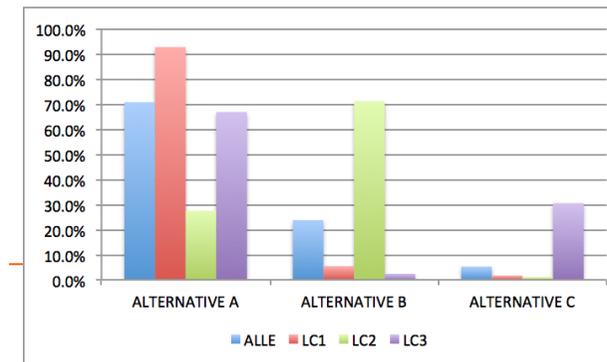
B: 20%
C: 0%

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	65.3%	28.4%	6.3%
LC1	91.3%	6.5%	2.1%
LC2	17.8%	81.6%	0.6%
LC3	45.1%	0.5%	54.4%

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	68.8%	24.6%	6.6%
LC1	88.8%	9.2%	2.1%
LC2	34.0%	64.9%	1.1%
LC3	45.0%	0.7%	54.3%

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	70.9%	23.8%	5.3%
LC1	92.9%	5.4%	1.7%
LC2	27.5%	71.3%	1.1%
LC3	67.0%	2.4%	30.6%

The utility oriented forest owner / lover
The recreation oriented forest owner
The tradition conscious forest owner



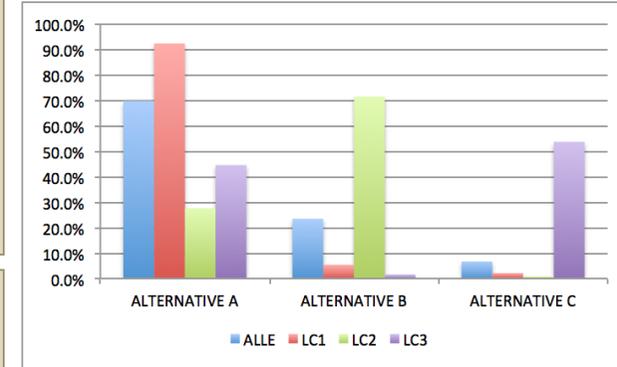
The situation in 50 years: the influence of deciduous trees



Current decision

Condition in 50 years

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Intensity of procedure	Soft procedure predominantly natural regeneration	Strong procedure predominantly regeneration through planting	No procedure
Balance after procedure	500 €	1,000 €	---
Funding	5,000 €	5,000 €	---
Type of procedure	Tractor	Tractor	---
Commissioned by	Regional or local forest enterprise	Regional or local forest enterprise	---
Probability of climate change induced damages	Very low	Low	High
Potential change in value (estimate baseline 40.000 €)	0%	-10%	0%
Amount of deciduous trees	20% deciduous trees	40% deciduous trees	3% deciduous trees



A: 20%

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	69.8%	23.5%	6.7%
LC1	92.5%	5.4%	2.1%
LC2	27.6%	71.5%	0.9%
LC3	44.6%	1.6%	53.8%

A: 10%

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	65.4%	26.9%	7.7%
LC1	91.4%	6.2%	2.5%
LC2	17.8%	81.2%	1.0%
LC3	42.9%	1.7%	55.5%

The utility oriented forest owner / lover
 The recreation oriented forest owner
 The tradition conscious forest owner

Significant impact preferred by LC 2 → high amount of deciduous trees, **even if they may lose money in the future, the acceptance increases further if A has only 10% deciduous trees (81%)**

Money can't buy you love



- Current decision:
 - Generated income
 - Funding
 - Soft management
- Future situation
 - Losses for A, B, C
 - Outcome 20% broadleaf trees in A and 40% in B
 - Any broadleaf trees in C



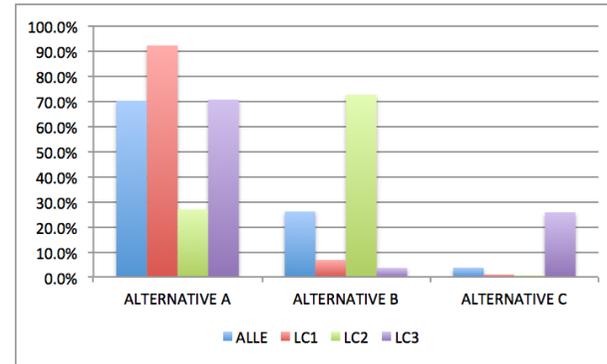
Negative outcome in 50 Years
LC 1 and LC 2 with high losses (outcome in € is not relevant)
LC3 now prefers soft impact (70.7%), some deciduous trees seem to be necessary and losses are too high



Current decision

Condition in 50 years

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Intensity of procedure	Soft procedure predominantly natural regeneration	Strong procedure predominantly regeneration through planting	No procedure
Balance after procedure	500 €	1,000 €	---
Funding	5,000 €	5,000 €	---
Type of procedure	Tractor	Tractor	---
Commissioned by	Regional or local forest enterprise	Regional or local forest enterprise	---
Probability of climate change induced damages	Very low	Low	High
Potential change in value (estimate baseline 40.000 €)	-5%	-10%	-20%
Amount of deciduous trees	20% deciduous trees	40% deciduous trees	0% deciduous trees



	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	70.2%	26.1%	3.7%
LC1	92.3%	6.8%	1.0%
LC2	26.9%	72.7%	0.4%
LC3	70.7%	3.6%	25.7%

The utility oriented forest owner / lover
 The recreation oriented forest owner
 The tradition conscious forest owner

Influences on current decisions:

→ Funding and gains

→ Harvesting methods and forest enterprises:

... the devil is in the detail

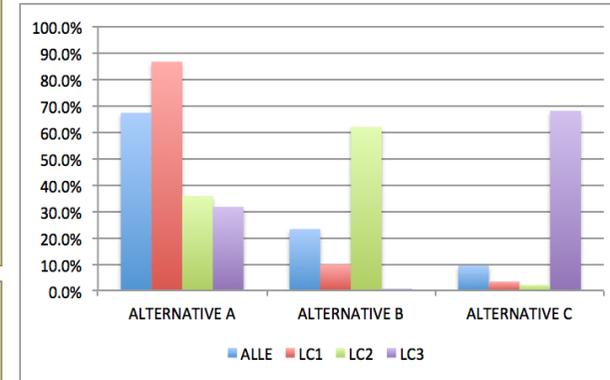
No gains by felling and reduced funding



Current decision

Condition in 50 years

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Intensity of procedure	Soft procedure predominantly natural regeneration	Strong procedure predominantly regeneration through planting	No procedure
Balance after procedure	-500 €	-1,000 €	---
Funding	1,000 €	5,000 €	---
Type of procedure	Tractor	Tractor	---
Commissioned by	Regional or local forest enterprise	Regional or local forest enterprise	---
Probability of climate change induced damages	Very low	Low	High
Potential change in value (estimate baseline 40.000 €)	0%	0%	0%
Amount of deciduous trees	20% deciduous trees	20% deciduous trees	3% deciduous trees



	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	67.4%	23.3%	9.4%
LC1	86.7%	9.9%	3.4%
LC2	35.8%	62.0%	2.2%
LC3	31.7%	0.2%	68.1%

The utility oriented forest owner / lover
 The recreation oriented forest owner
 The tradition conscious forest owner

A, B
 Funding:
 1000€

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	63.8%	25.3%	10.9%
LC1	91.0%	5.0%	4.1%
LC2	15.8%	82.5%	1.7%
LC3	30.2%	0.1%	69.7%

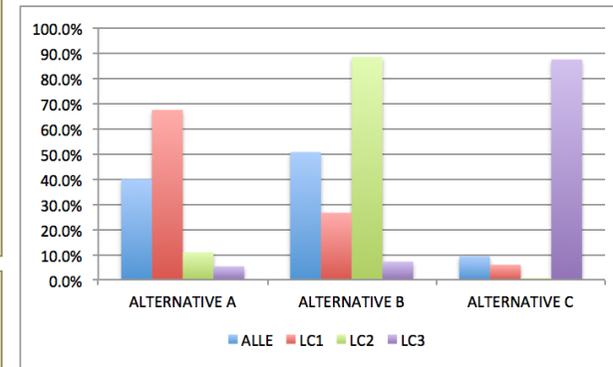
Influence of forest companies and harvesting methods (compared with preferred management action and outcomes)



Current decision

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Intensity of procedure	Soft procedure predominantly natural regeneration	Strong procedure predominantly regeneration through planting	No procedure
Balance after procedure	500 €	1,000 €	---
Funding	5,000 €	5,000 €	---
Type of procedure	Harvester	Tractor	---
Commissioned by	Service team or Austrian Forest Service	Regional or local forest enterprise	---
Probability of climate change induced damages	Very low	Low	High
Potential change in value (estimate baseline 40.000 €)	10%	10%	0%
Amount of deciduous trees	20% deciduous trees	40% deciduous trees	3% deciduous trees

Condition in 50 years



The utility oriented forest owner / lover
The recreation oriented forest owner
The tradition conscious forest owner

A with harvester and coordinated by the forest service

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	40.0%	50.7%	9.3%
LC1	67.5%	26.6%	5.9%
LC2	10.8%	88.6%	0.6%
LC3	5.3%	7.2%	87.5%

A with soft management and regional forest enterprise

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
ALLE	64.6%	30.0%	5.5%
LC1	89.5%	8.6%	1.9%
LC2	22.7%	76.8%	0.5%
LC3	39.5%	4.6%	55.9%

➔ Shift to significant impact because of disliked harvesting methods and services

Conclusions



- **The utility oriented forest owner / lover**
 - No significant forest management actions
 - Very sensitive concerning harvesting methods and the selected enterprises

 - **The recreation oriented forest owner**
 - Significantly influenced by enhanced deciduous trees
 - Financial incentives and funding are less relevant

 - **The tradition conscious forest owner**
 - Does not believe in climate change
 - About 25% are not changing their behaviour even if there is a negative prognosis of 20% losses and no deciduous trees left
-

Arguments to convince small scaled forest owners to participate in adaptation measures



- Highlight challenge of climate change and adaptation
- Talk about a bright future with a diverse forest including deciduous trees
- Underline that forest management will do the best not to harm the remaining forest stand
- Talk about **soft management** implemented by **skilled local firms**
- Highlight the **avoidance of harvesters** for forest management
- *Don't mention the state forest service*
- *Don't talk about money – it is irrelevant*
- *Don't invest in funding programs*



Influence on decision making



Workshop at the Chamber for Agriculture and Forestry

Participants doubted that the study covered the „**appropriate clientele**“. In their opinion, funding should remain the most important instrument to steer sustainable forest management.

Workshop at the Ministry of Environment, Forest Department

In the past, this target group was not considered carefully enough. The results are **contrary to existing concepts**. There is a need to inform the forest service and to change information, funding and involvement strategy.

Workshop with Forest managers in Tyrol and Styria

Forest managers **confirmed the existence of the three segments**. Several participants described their cooperation with private forest owners as frustrating. They suggested other forms of involvement such as “Apps”, “brochures” or “women forest walks”.

Decision by the Ministry of Environment; Forest Department

Based on these findings, the ministry plans to start a new project to develop new tools and processes addressing the different segments of private forest owners. The ministry is aware that this decision may have an influence on current power structures.



Thank you for your attention!



Austrian Research Center for forests

