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Research Group 4.05 Managerial economics and accounting

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Valuing Forest Genetic Resources for ecosystem services: expert-based insights for future management practices, policymaking and accounting initiatives across Europe

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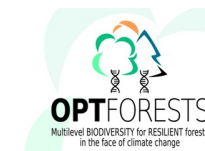


Outline



- Research Background and Motivation
- Problem Statement and Research Questions
- Methods
- Preliminary results
- Discussion
- Conclusions & Way forward

Research developed within the framework of:

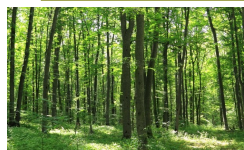


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Research Background



Forest Genetic Resources (FGR):
"the heritable material in trees & woody plants"



Forest Reproductive Material (FRM): seeds, seedlings, plant parts, propagated plants...



- Key role in forest resilience and adaptation
- Underpin forests' adaptation to forest stressors
- Support the delivery of ecosystem services (ES)

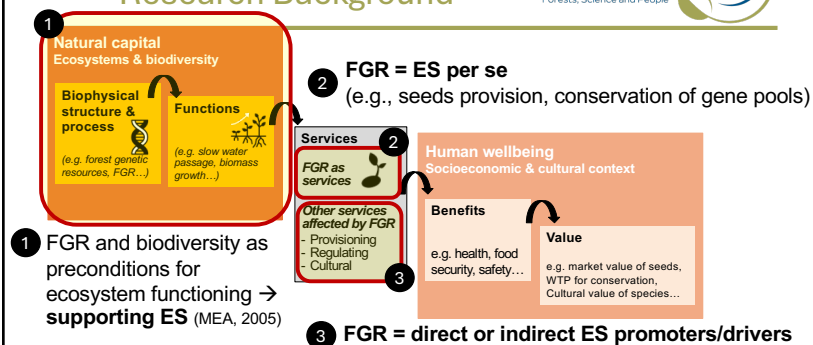
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Research Background



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Modified from Braat and de Groot (2012)

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- (Bosselmann et al., 2008; Jansson et al., 2017; Soliño et al., 2020)

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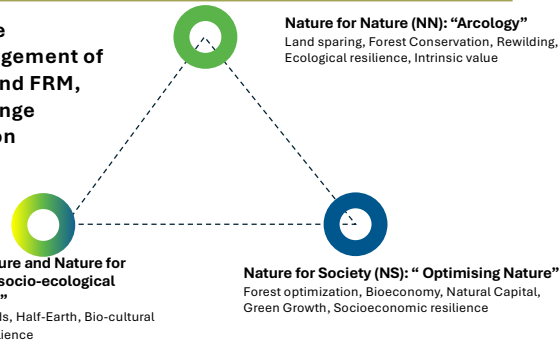
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Future Scenarios 1/2



3 scenarios on the future interpretation and management of European forests, FGR and FRM, considering climate change adaptation and mitigation potential by 2050

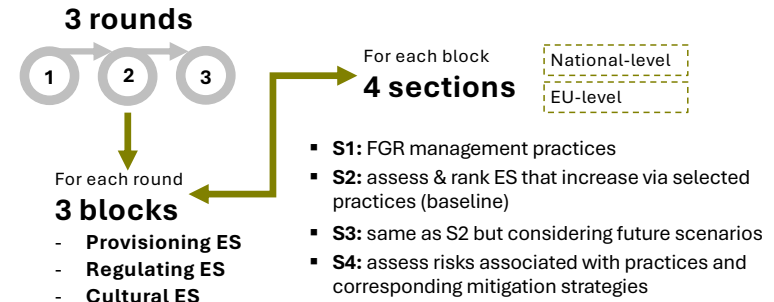


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The Delphi process & survey design



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The Delphi process & survey design



- Survey via UNIPD Lime Survey platform
- Pilot-tested by 15 experts from the OptFORESTS project

Final experts panel for Delphi (snowball sampling)

- **5 expert categories:** geneticists, ecologists, socioecologists, economists, and decision-makers with experience in FGR-ES research, management and policy
- **6 EU countries** (Finland, Denmark, Romania, France, Slovenia, and Italy) + EU level

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Expert's panel



- Approx. 200 experts contacted → 68 agreed to participate → **47 completed the first round**

Country / Category	Geneticists	Ecologists	Socioecologists	Economists	Decision makers	Total
Italy	5	8	0	3	1	17
France	4	2	2	1	2	11
Slovenia	1	0	2	0	1	4
Finland	3	3	2	0	2	10
Romania	2	0	0	1	1	4
Denmark	1	0	0	0	0	1
Total	16	13	6	5	7	47

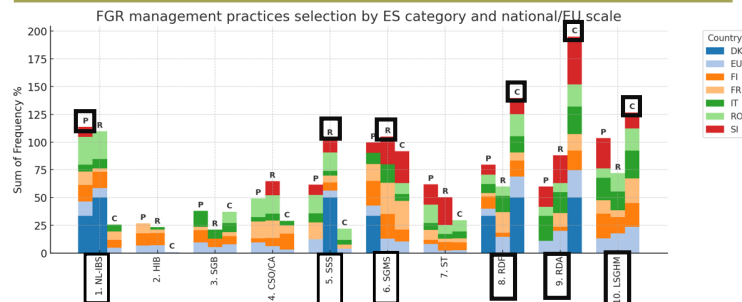
- The panel is **strongly unbalanced** both in terms of countries and expert categories (some gaps)
- IT most represented country, DK only one expert
- Geneticists most represented, Economists the least

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Results: FGR management practices (%)



1. NL-IBS: Novel low-input breeding strategies; 2. HIB: High intensity breeding; 3. SGB: Seed/Gene banks; 4. CSO/CA: Conservation seed orchards/clonal archives; 5. SSS: Selected seed stand; 6. SGMS: Silviculture of genetically mixed stands; 7. ST: Selective thinning; 8. RDF: Rescue of declining forests; 9. RDA: Restoration of devastated areas; 10. LSGHM: Landscape-scale genetic heterogeneity management

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Results: FGR management practices & specific ES supply at the EU-level



- Peculiar Trade-offs both within and between ES categories.

e.g.,: RDA is associated with provisioning of genetic materials and water, much less with noise reduction and air quality regulation.

NL-IBS: strong positive impact on education and research, but no impact on recreation and sport.

ST: positive impact on carbon storage & natural hazard protection, no impact on water and soil quality.

Provisioning ES	1. NL-IBS	2. HIB	3. SGB	4. CSO/CA	5. SSS	6. SGMS	7. ST	8. RDF	9. RDA	10. LSGHM	11. O
Genetic materials	34.68%	32.00%	48.15%	48.00%	31.48%	18.33%	21.43%	17.65%	21.43%	18.82%	50.00%
Water quality	4.08%	4.00%	14.81%	4.00%	5.56%	11.67%	14.29%	17.65%	20.00%	17.65%	0.00%
Food (wild plants)	8.56%	8.00%	18.52%	4.00%	11.11%	18.33%	14.29%	17.65%	14.29%	18.82%	0.00%
Firewood	16.33%	16.00%	0.00%	12.00%	12.96%	16.67%	21.43%	13.73%	10.00%	12.84%	0.00%
Timber	30.63%	30.00%	18.52%	28.00%	20.63%	16.67%	21.43%	17.65%	18.75%	15.29%	50.00%
Recreation and tourism	6.12%	4.00%	0.00%	4.00%	9.26%	18.33%	4.76%	15.69%	15.71%	16.47%	0.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Regulating ES	1. NL-IBS	2. HIB	3. SGB	4. CSO/CA	5. SSS	6. SGMS	7. ST	8. RDF	9. RDA	10. LSGHM	11. O
Air quality	7.02%	11.11%	4.55%	6.67%	8.51%	7.53%	0.00%	7.94%	8.40%	9.73%	0.00%
Carbon storage	19.38%	22.22%	3.09%	16.67%	14.89%	17.20%	0.00%	15.79%	10.95%	11.89%	0.00%
Genetic pool protection	15.78%	3.89%	27.27%	23.33%	12.77%	12.90%	25.00%	7.94%	8.96%	11.89%	0.00%
Habitat for plants and animals	10.53%	5.56%	13.64%	3.33%	14.89%	16.13%	0.00%	13.49%	11.44%	11.89%	0.00%
Human health	8.77%	8.33%	5.09%	13.33%	5.38%	5.38%	0.00%	7.94%	9.45%	9.19%	0.00%
Natural hazard protection	15.78%	11.11%	0.00%	10.00%	12.77%	11.81%	30.00%	11.90%	11.44%	9.73%	0.00%
Noise reduction	5.26%	5.56%	4.55%	6.67%	4.36%	1.08%	0.00%	4.76%	7.40%	5.95%	0.00%
Soil quality	5.26%	8.33%	13.64%	6.67%	12.77%	11.90%	0.00%	11.90%	11.44%	10.73%	0.00%
Temperature regulation	8.77%	5.56%	4.55%	6.67%	6.38%	7.53%	10.50%	10.32%	9.95%	9.19%	0.00%
Water quality	3.52%	8.33%	4.55%	6.67%	6.38%	7.53%	0.00%	5.32%	10.45%	10.27%	0.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	0.00%
Cultural ES	1. NL-IBS	2. HIB	3. SGB	4. CSO/CA	5. SSS	6. SGMS	7. ST	8. RDF	9. RDA	10. LSGHM	11. O
Education and research	11.11%	0.00%	7.69%	12.50%	11.11%	18.75%	18.18%	16.80%	16.25%	16.57%	0.00%
Recreation and tourism	41.43%	25.00%	25.64%	25.00%	22.22%	18.57%	18.18%	16.00%	15.26%	15.38%	0.00%
Heritage/leisure activities	0.00%	0.00%	1.66%	0.25%	11.11%	11.43%	18.18%	15.20%	13.68%	14.79%	0.00%
Mushrooms/wild plants picking	22.22%	0.00%	12.82%	0.25%	11.11%	17.14%	18.18%	13.60%	14.21%	12.43%	0.00%
Hunting	0.00%	0.00%	5.13%	0.25%	5.56%	11.43%	0.00%	10.40%	12.13%	14.20%	0.00%
Spiritual value	0.00%	0.00%	20.51%	18.75%	16.67%	11.43%	18.18%	14.40%	14.21%	12.43%	0.00%
Traditional/forest culture/knowledge	22.22%	25.00%	20.51%	25.00%	22.22%	11.43%	0.00%	13.60%	14.21%	14.20%	0.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	0.00%

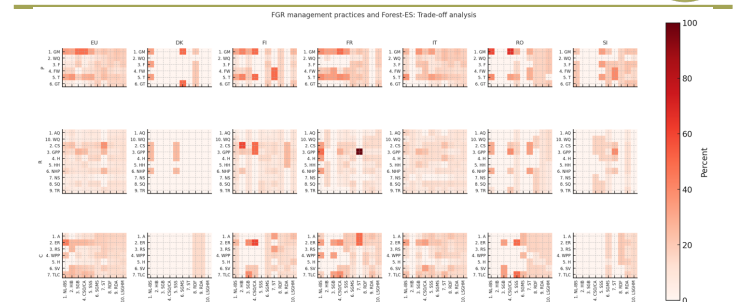
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Results: FGR management practices & ES supply: an example of cross-regional comparison



NL-IBS: Novel low-input breeding strategies; 2. HIB: High intensity breeding; 3. SGB: Seed/Gene banks; 4. CSO/CA: Conservation seed orchards/clonal archives; 5. SSS: Selected seed stand; 6. SGMS: Silviculture of genetically mixed stands; 7. ST: Selective thinning; 8. RDF: Rescue of declining forests; 9. RDA: Restoration of devastated areas; 10. LSGHM: Landscape-scale genetic heterogeneity management

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Results: Future scenarios

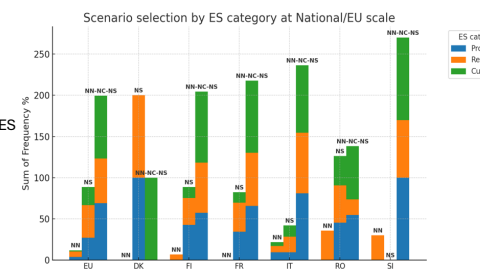


On avg. across practices:

- NN-NC-NS (65%): most functional to increase future supply of all ES categories
- NS (30%): mainly regulating ES (39%)
- NN (5%): cultural (1%) & provisioning (2%) ES

Country patterns:

- RO & SI: highest NN (10-12%) → regulating
- DK & RO: lowest NN-NC-NS, highest NS
- SI: NS (0%)



NL-IBS: Novel low-input breeding strategies; 2. HIB: High intensity breeding; 3. SGB: Seed/Gene banks; 4. CSO/CA: Conservation seed orchards/clonal archives; 5. SSS: Selected seed stand; 6. SGMS: Silviculture of genetically mixed stands; 7. ST: Selective thinning; 8. RDF: Rescue of declining forests; 9. RDA: Restoration of devastated areas; 10. LSGHM: Landscape-scale genetic heterogeneity management; 11. O: Other

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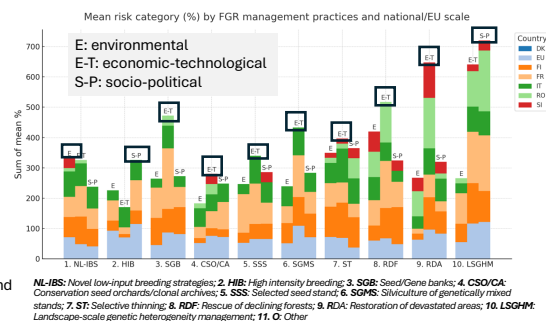
Results: Risks categories

On avg., across practices

- Highly heterogeneous risk picture
- E-T risks frequently ranked first
- S-P relevant for LSGHM and HIB
- E (slightly) higher only for NL-IBS

Countries patterns:

- FR very high share across risks
- FI particularly high on E-T
- RO high E-T and S-P for restoration and landscape levels



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Discussion

- Varying practices across countries and ES groups
- Provisioning → the most diverse, Regulating → stand and landscape level options, Cultural → large-scale restoration and management practices
- Overall need for a **multilevel approach** → links with different national/EU policies
- Country-level patterns, e.g. Italy and Slovenia (RDA) → recent common issues? (windstorms- wildfires)
- NN-NC-NS preferred scenario → multifunctional approach based on “nature’s contributions to people” vs intrinsic (NN) or utilitarian (NS) perspectives of ES
- Heterogeneous risk picture → specific traits by country and categories (E-T particularly relevant)

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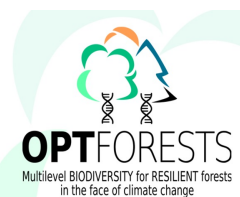
Conclusions & Way forward

- Some **key limitations** (e.g., panel composition)
- An **interdisciplinary Delphi** → insights for **bridging ecological and economic benefits** in forestry
- Land-sharing & multifunctionality**: emerging (policy) paradigms → e.g., *Biodiversity International Framework*, *EU Nature Restoration Regulation*
- Mixed practices = mixed risks → **mainly E-T (higher costs)** → **valuing co-benefits** to (reduce risks) **improve economic viability & financial stability**
- Final results can inform **future strategies** for **ecological-socioeconomic resilience linked to FGR in Europe**
- Way forward: **spatially-explicit (physical-monetary) assessment of forest-ES trade-offs** at multiple scales

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If you want to know more about OptFORESTS project, please contact us at: info@optforests.eu

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Thank for your attention!

OptFORESTS

Harnessing forest genetic resources for increasing options in the face of environmental and societal challenges.

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