IMC Innsbruck 2025
International Mountain Conference

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BF UNIVERZA V LJUBLJANI Biotehniška fakulteta

Zavod za gozdove Slovenije
Slovenia Forest Service

Capacity building to support forest management in protective forests of Slovenia

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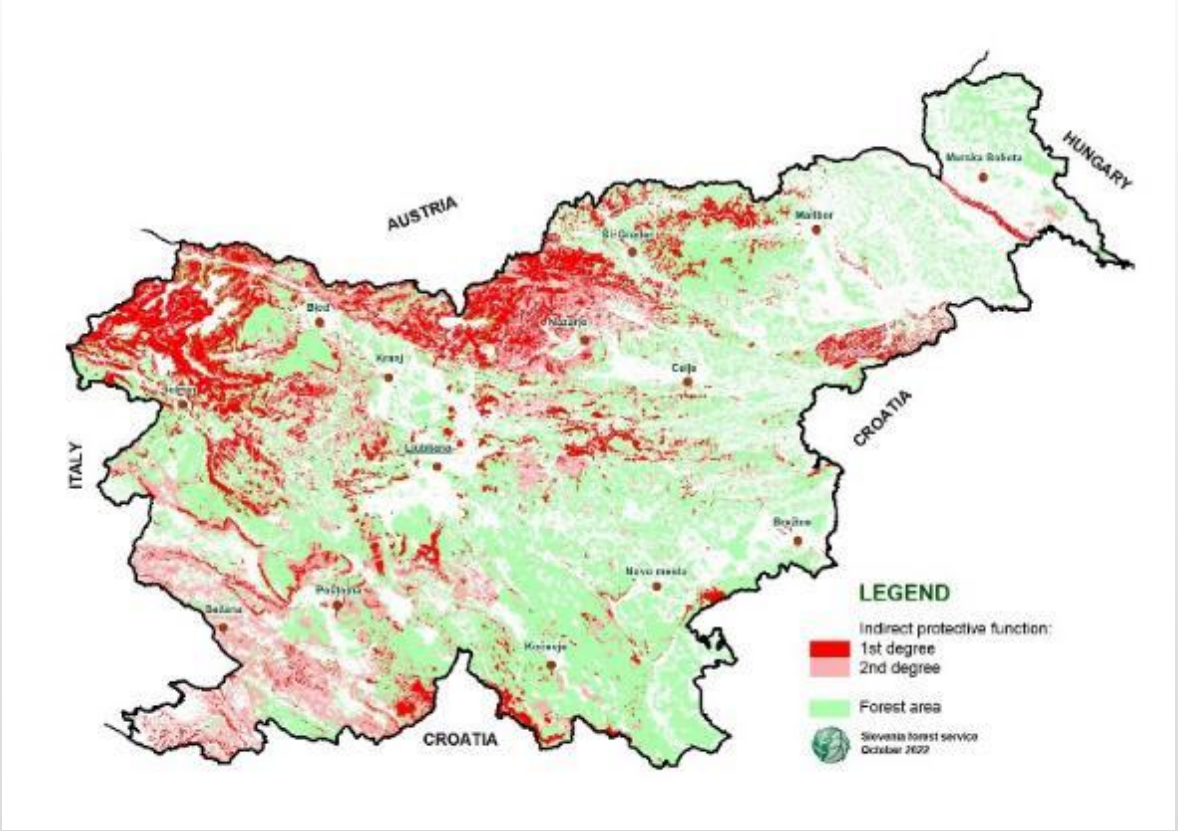
THE PROTECTIVE FUNCTION IS KEY ECOSYSTEM SERVICE IN MOUNTAIN FORESTS

IN SLOVENIA: 21% OF FOREST WITH AN EMPHASIZED PROTECTIVE FUNCITON

NATURE-BASED SOLUTION AGAINST SLOPE-RELATED and EXTREME WEATHER EVENTS

EXTREME WEATHER COMPOUND EVENTS REDUCED STAND STABILITY AND PROVISION OF ESS

SOCIAL CHANGES: INCREASED DEMANDS ON FORESTS



ADDRESSING CLIMATE AND SOCIAL CHANGES REQUIRES ACTIVE MANAGEMENT

LOW INTENSITY OF FOREST MANAGEMENT

CONFLICTS AMONG ESS

INCREASING INTENSITY AND FREQUENCY OF NATURAL DISTURBANCES

LACK OF KNOWLEDGE

CHALENGING WORKING CONDITIONS

LOW ECONOMIC RETURNS

CHANGING CONDITIONS FOR FOREST MANAGEMENT

CHALLENGES

in protective forest management

REDUCED STAND STABILITY and OVER-AGED STRUCTURE

CAPACITY BUILDING IS ESSENTIAL TO ENHANCE FOREST MANAGEMENT IN PROTECTIVE FORESTS

NEW APPROACHES TO STRENGTHEN THE PROTECTIVE FUNCTION

CAPACITY BUILDING:

EDUCATION AND TRAINING

COLLABORATION AND NETWORKING

PROVIDING TOOLS AND METHODS

INSTITUTIONAL SUPPORT

LIVING LAB AS A CAPACITY BUILDING TOOL

USER-CENTERED

REAL-LIFE ENVIRONMENT

ITERATIVE FEEDBACK PROCESSES

FULL INOVATION LIFECYCLE

STAKEHOLDER COLLABORATION

EXPERIMENTAL LEARNING

SUSTAINABLE IMPACT

OPENNESS AND FLEXIBILITY

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FOREST LIVING LAB SOTESKA

MUNICIPALITY OF
BOHINJ – Soteska gorge

PROTECTIVE FOREST on steep slopes, protecting road, railway, bicycle path

MAIN RISKS:
Rockfall
Land slides
Torrential waters
Wind
Barkbeetle

FOREST LIVING LAB SOTESKA

ACTIVITIES:

Research, casee studies

Workshops, excursions, trainings

TARGET GROUPS AND STAKEHOLDERS:

FORESTRY EXPERTS

FOREST OWNERS

CONTRACTORS FOR FOREST WORKS

TRIGLAV NATIONAL PARK

RAILROAD AND ROAD STATE COMPANY

MUNICIPALITIES AND LOCAL PUBLIC

TRAINING FORESTRY PROFFESSIONALS TO ENHANCE PROTECTIVE FUNCTION

MARTELOSCOPE and I+ TRAINER FOR VIRTUAL TRAINING of silvicultural measures

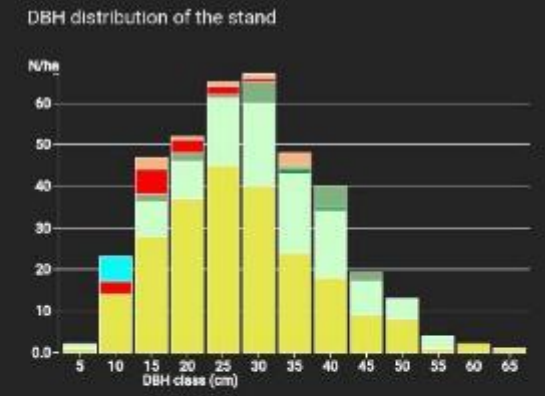
1 HA BIG PLOT

I+ TRAINER ON TABLET COMPUTERS

tool for conducting silvicultural trainings – education and knowledge transfer

Silvicultural measures in protective forests: STABILITY and SLOPE PROCESSES PREVENTION

Scots pine Pinus sylvestris	2	0.2	2.3	113	3	1	0.78	0
black pine Pinus nigra	9	1.2	14.6	817	82	15	4.85	0
common beech Fagus sylvatica	203	16.3	181.6	11435	5898	393	109.6	0
larch Larix decidua	3	0.3	3.8	294	28	4	1.32	0
sycamore maple Acer pseudoplatanus	15	0.5	3.8	231	110	9	1.83	0
Total	**309**	**27.3**	**306.8**	**21175**	**7092**	**498**	**154.1**	**0**
Dead wood								
Standing	74	0	31.7	0	0			
Lying			0	0	0			



UPGRADING I+ TRAINER WITH PROTECTIVE MODULE

PROTECTIVE MODULE: the results will show how our measures affect protective function

15 PROTECTIVE INDICATORS:

- STAND STABILITY AND SLOPE PROCESSESS PREVENTION
- DEFINED
- EVALUATED BY FORESTRY EXPERTS
- ANALYZED
- RANKED
- INTEGRATED INTO THE I+ TRAINER

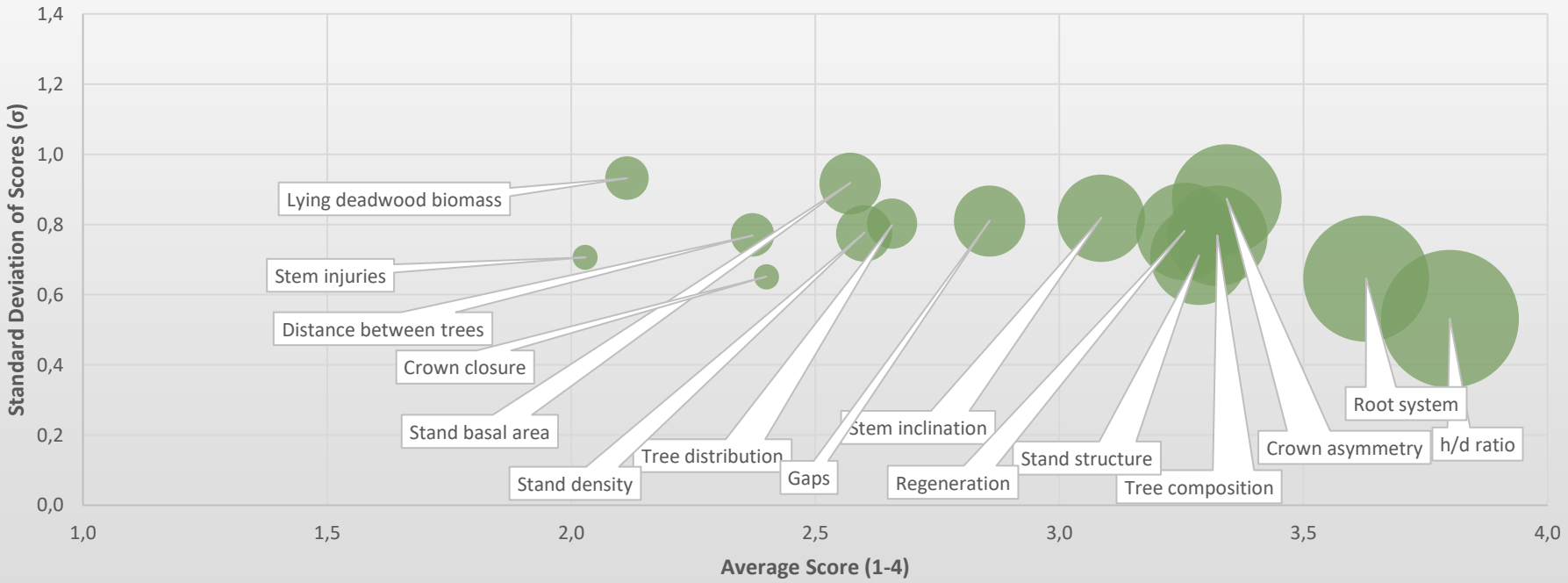
Rate each indicator with a score from 1 to 4 (1 - not important, 4 - very important) according to i

Indicators	Input	Indicator descri
h/d ratio (slenderness) 	height, diameter	The height-to-diameter ratio (H/D ratio) forestry used to assess the stability o H/D = tree height (m) / diameter at bre Trees with a high H/D ratio are genera prone to breaking or uprooting, especia the other hand, trees with a lower H/D height but a larger diameter at breast h stable, resilient and resistant to natura
Crown asymmetry 	Crown asymmetry Symmetrical / asymmetrical crown Suggestion - 3 classes: 0 = none (symmetrical crown) 1 = slightly asymmetrical crown 2 = highly asymmetrical crown	Crown symmetry is important for the especially in forests on steep slopes. reduces the risk of overturning or brea or storms. Asymmetrical crowns caus stress, which increases instability, esp terrain.
Stem inclination 	Stem inclination Suggestion - 3 classes: 0 = none – straight stem 1 = slightly inclined 2 = highly inclined	Stem inclination strongly affects tree significantly inclined stems have their outside the vertical axis, which causes distribution of forces in the root syste Key impacts of stem inclination on st * Increased risk of tree uprooting * Asymmetrical mass distribution: Du storms, the mass is greater and one-s trees more susceptible to mechanical In a stable protective stand, it is there have upright stems with minimal inclin their static properties and increases re

PROTECTIVE FOREST INDICATORS FOR STABILITY

35 participants

RATE	INDICATORS
1	h/d ratio
2	Root system
3	Crown asymmetry
4	Tree compositon
5	Stand structure
6	Regeneration
7	Stem inclination
8	Gaps
9	Tree distribution
10	Stand density
11	Stand basal area
12	Crown closure
13	Distance between trees
14	Lying deadwood biomass
15	Stem injuries

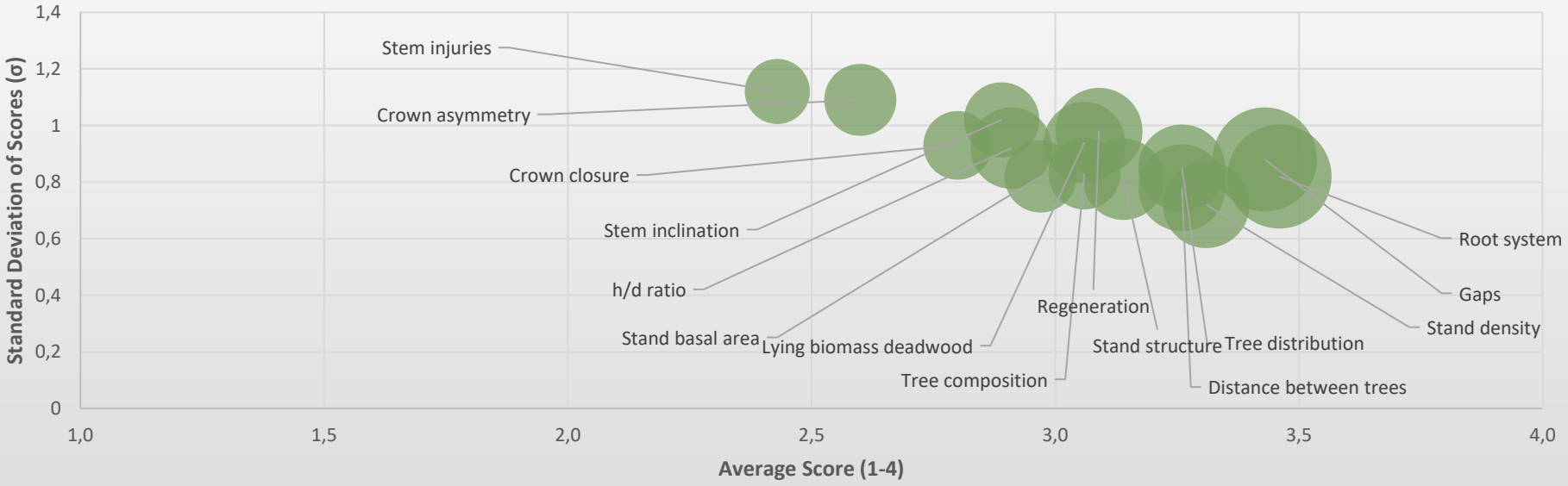


**Size of the bubble is based on frequency distribution of the highest score (score "4")*

RANKING PROTECTIVE FOREST INDICATORS FOR SLOPE PROCESSES PREVENTION

RATE	INDICATORS
1	Root system
2	Gaps
3	Stand density
4	Tree distribution
5	Distance between trees
6	Stand structure
7	Regeneration
8	Tree composition
9	Lying dead wood biomass
10	Stand basal area
11	h/d ration
12	Stem inclination
13	Crown closure
14	Crown asymmetry
15	Stem injuries

35 participants



**Size of the bubble is based on frequency distribution of the highest score (score "4")*

NEXT STEPS

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UPGRADING THE I+ TRAINER WITH PROTECTIVE MODULE

CONDUCT SILVICULTURAL TRAININGS IN PROTECTIVE FORESTS WITH THE UPGRADED VERSION OF THE I+ TRAINER

DEVELOP AN EDUCATIONAL CONCEPT FOR SILVICULTURAL TRAINING IN PROTECTIVE FORESTS TO SUPPORT THE ORGANIZATION OF TRAINING SESSIONS

CREATE PRACTICAL ILLUSTRATIVE GUIDELINES TO SUPPORT PROTECTIVE FOREST MANAGAMENT

HIGHLIGHTS

1. **ACTIVE FOREST MANAGEMENT IS A KEY TOOL FOR MITIGATING NATURAL HAZARDS**

2. **CAPACITY BUILDING IS ESSENTIAL FOR IMPROVING MANAGEMENT IN PROTECTIVE FORESTS**

3. **COLLABORATION WITH STAKEHOLDERS: FOREST LIVING LAB**

4. **CONTINUOUS LEARNING: MARTELOSCOPE and I+ TRAINER**

5. **EVIDENCE-BASED DECISION-MAKING**

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