EGU General Assembly 2022

Session NH3.6

Space and time forecasting of landslides

Sub-session: Mapping, Monitoring, and Modelling

Regional slope stability simulations: recent advances in root reinforcement modelling

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Dealing with integrating the root reinforcement into a distributed slope stability model for a few years…

geosciences
MDPI

Review

Root Reinforcement in Slope Stability Models: A Review

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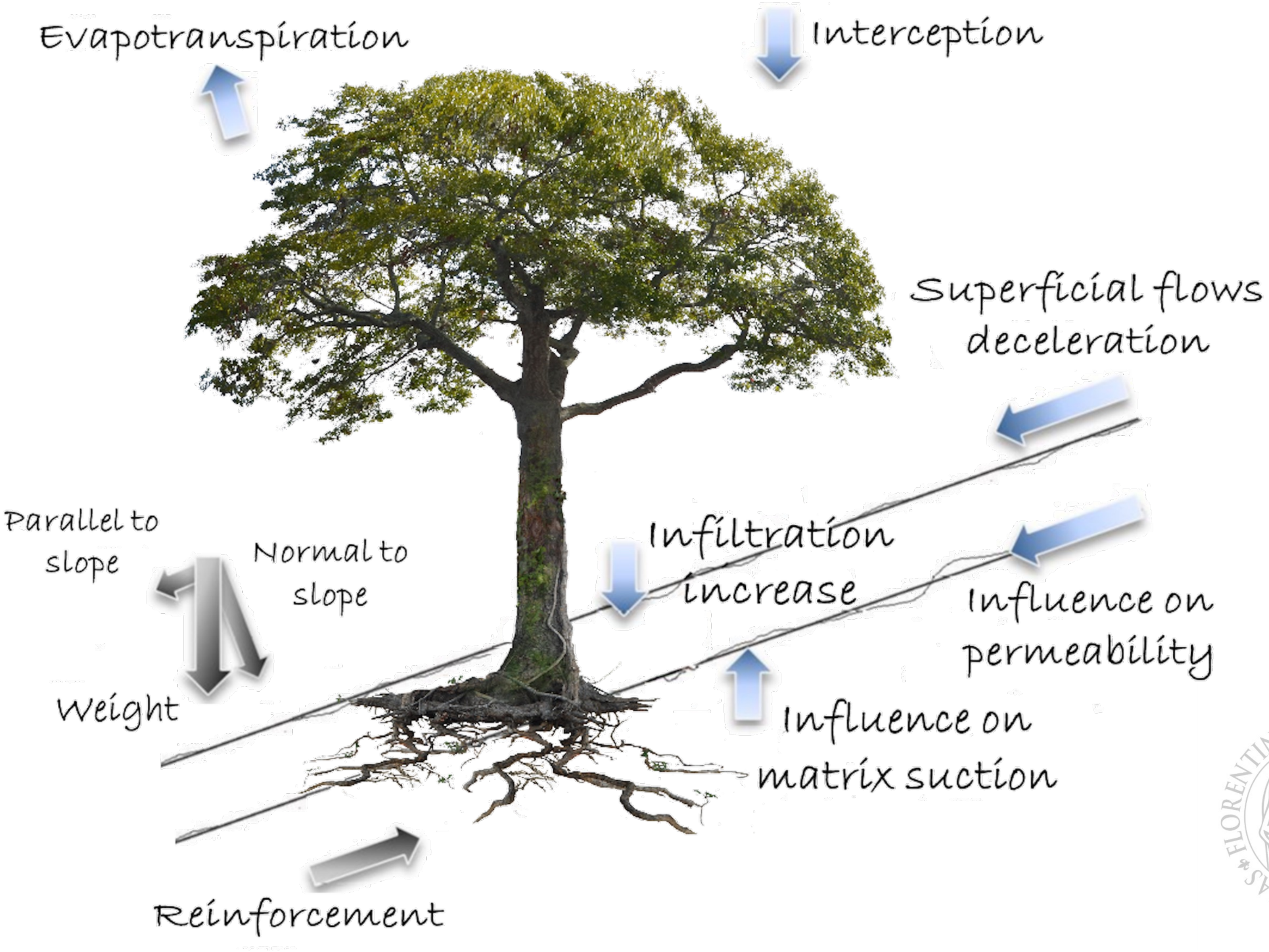

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ROOT REINFORCEMENT

Mohr-Coulomb failure criterion for unsaturated soils

$$\tau = c' + (\mu_a - \mu_w)\tan\varphi^b + (\sigma - \mu_a)\tan\varphi' + \Delta S$$

Root reinforcement (root cohesion)

ΔS (or C_r)$=kT_r\,(A_r/A)$

Where T_r = tensile strength of roots per unit of soil, A_r/A = Root Area Ratio RAR, k = coefficient commonly assumed equal to 1.2

ASSESSING ROOT DENSITY SPATIAL VARIATIONS…

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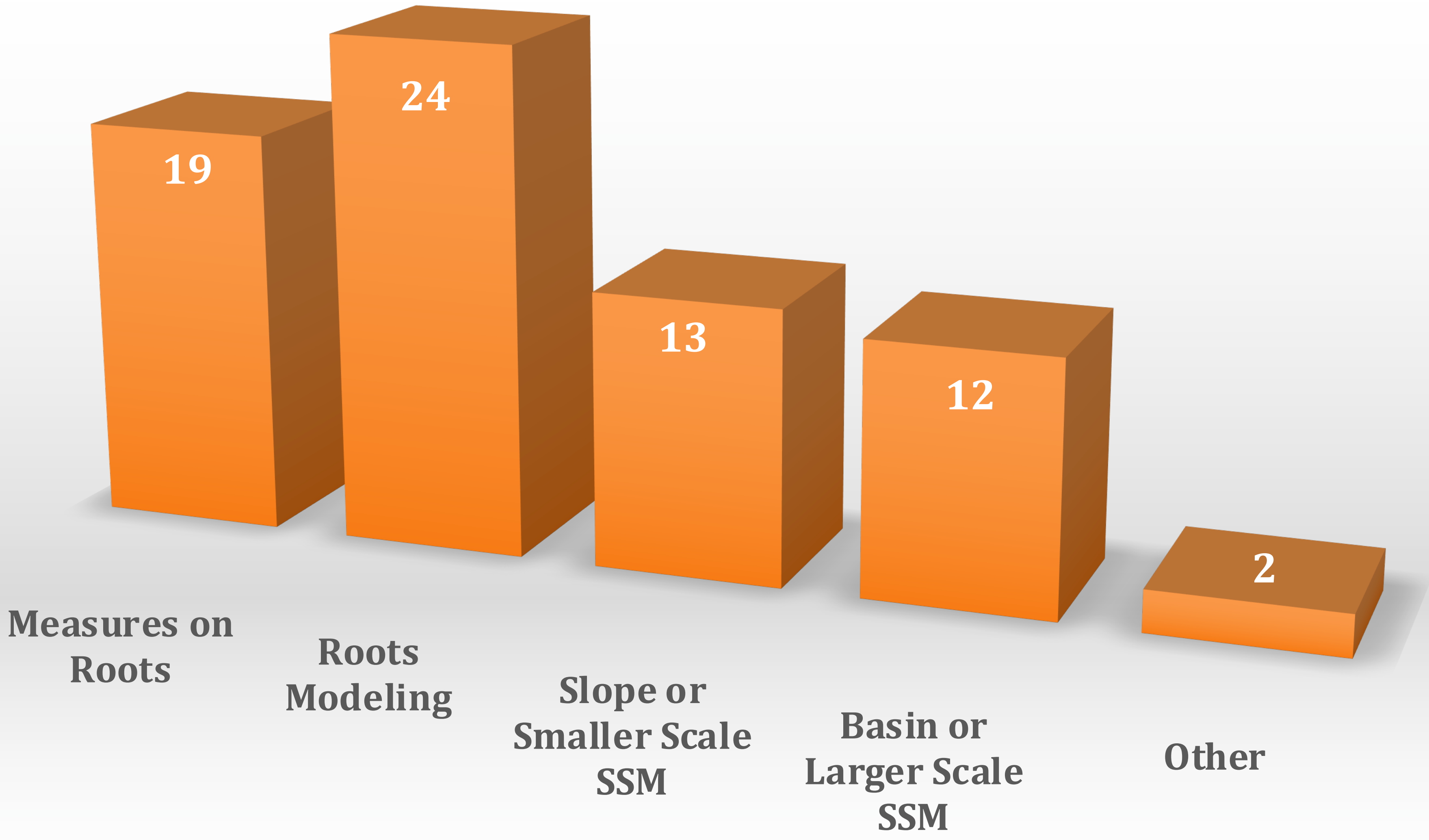
ROOT REINFORCEMENT MODELLING: RECENT APPLICATIONS AND RESEARCH DIRECTIONS

- Approaches for Estimating the Root Reinforcement Distribution at a Regional Scale
- New Slope Stability Models Including Root Reinforcement
- Influence of Particular Plant Species on Slope Stability
- Influence of Forest Structure, Wildfires, and Soil Moisture Gradient

Authors	Measures on Roots	Roots Modeling	Slope or Smaller Scale SSM	Basin or Larger Scale SSM	Other
Abdi et al. 2018	x				
Arnone et al. 2016		x	x		
Bordoni et al. 2020	x	x		x	
Bordoni et al. 2016	x	x			
Chiaradia et al. 2016	x	x	x		
Chok et al. 2015		x	x		
Cislaghi et al. 2017	x	x			
Cislaghi et al. 2017	x	x		x	
Cislaghi et al. 2018				x	
Cislaghi et al. 2019	x	x		x	
Cuomo et al. 2020				x	
Dazio et al. 2018	x	x			
Gehring et al. 2019	x	x			
Giadrossich et al. 2017	x				
Gonzalez-Ollauri 2017	x	x		x	
Hales et al. 2018		x		x	
Hales and Miniat 2017	x	x	x		
Hwang et al. 2015	x	x		x	
Kokutse et al. 2016		x	x		
Likitlersuang et al. 2017			x		
Masi et al. 2020	x				
Moos et al. 2016	x	x	x		
...					
...					
Total Papers: 36	Count: 19	24	13	12	2


19
24
13
12
2
Measures on Roots
Roots Modeling
Slope or Smaller Scale SSM
Basin or Larger Scale SSM
Other


36
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11%
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8%
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8%
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6%
Others
14%

CONCLUSIONS

- ☞ The **vast spatial and temporal variability** characterizing the root reinforcement still represents an **open challenge** for research in distributed slope stability **modelling**
- ☞ **High species-specific** character of the **root reinforcement** highlights the importance to pursue the study of **new plant species** or different **environmental conditions**
- ☞ The impact of forest structure **disturbances** due to **sylviculture** or **wildfires** on root reinforcement emerged as **significative**, further studies needed
- ☞ **Soil moisture** has a **significant control** on root tensile strength, further studies highly beneficial for a thorough integration of root reinforcement into slope stability models.