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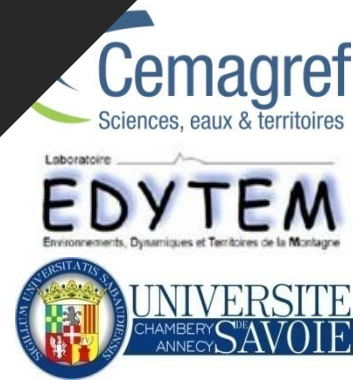
TREES AND ROCKFALLS

Use of slash as rockfall protection on forested slopes

Christophe BIGOT, Laurent ASTRADE, Frédéric BERGER and Jean-Jacques BRUN

Clermont Ferrand
November 2010

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Framework

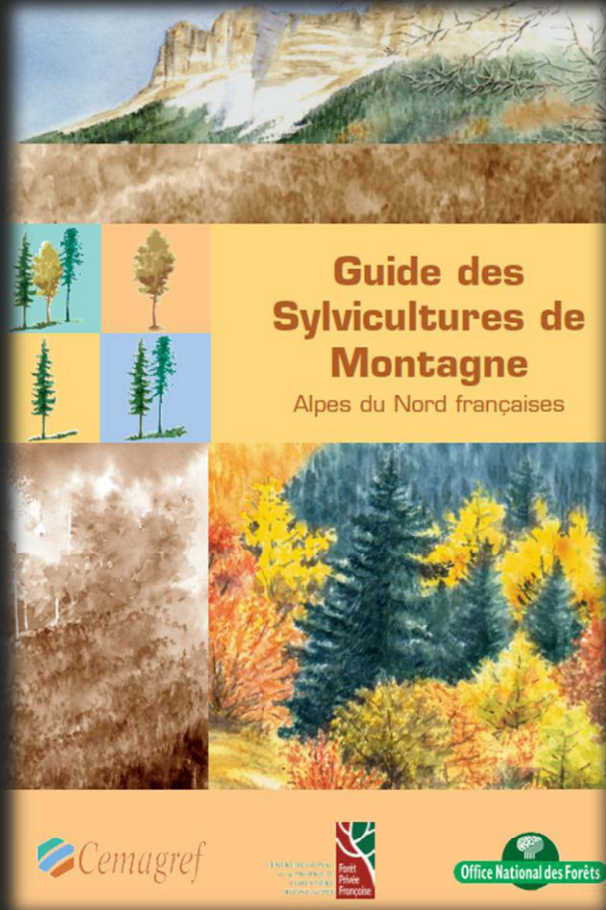
Natural hazard and rockfall activity

**CAUTION
FALLING ROCKS**



Framework

Rockfall in forest & Engineering structures



Bio Engineering



Civil Engineering



Stake

Framework

Protection structure and Civil engineering

Metallic net fences



Shelters



Reinforced embankments



Framework

Mixed engineering structures



Framework

Bioengineering structures



Framework

Bioengineering structures



Framework

Bioengineering structures



Framework

Bioengineering structures

The felling Alpi technique



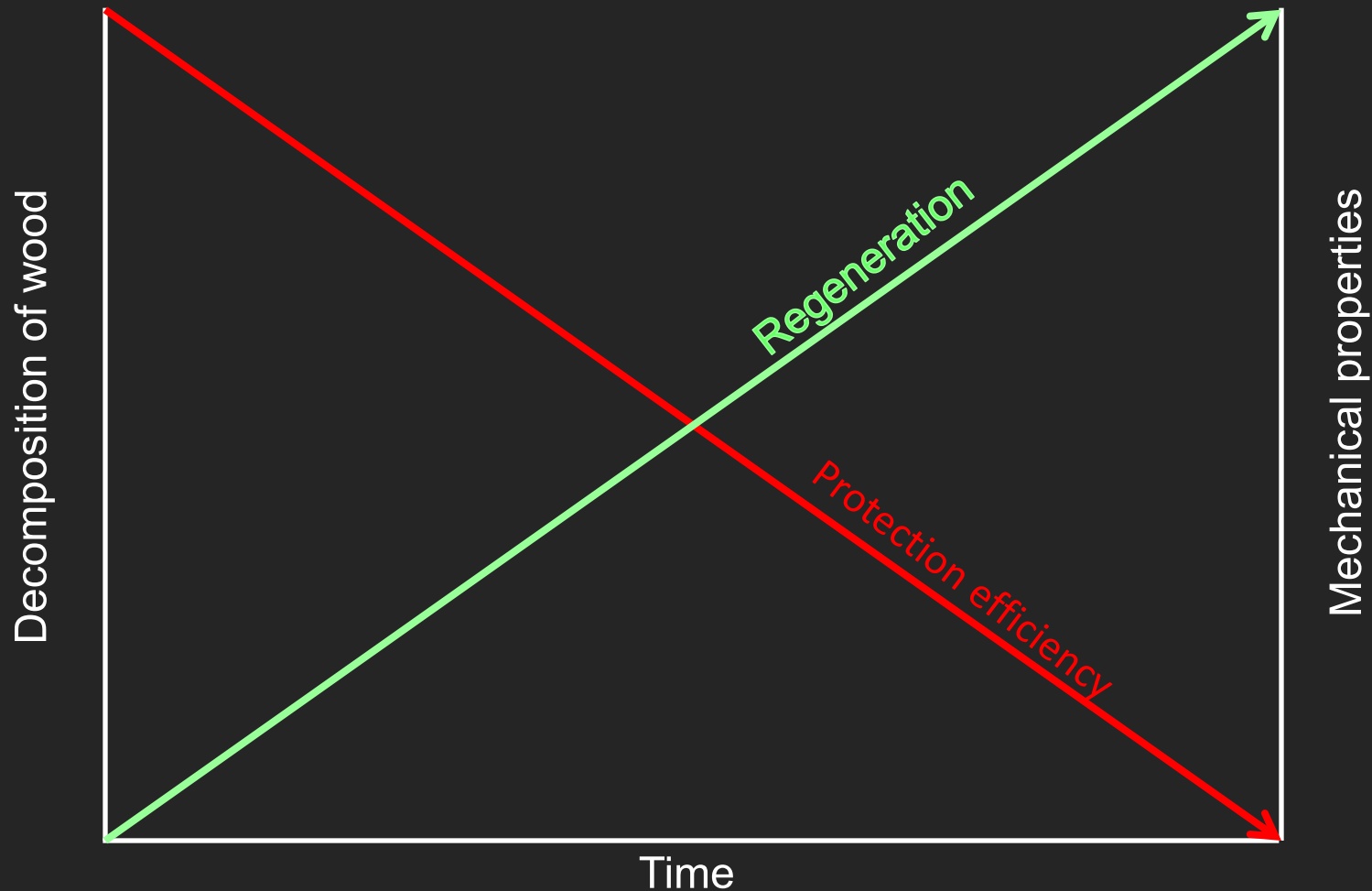
The aim objective of this research is

- To study the protective capacity of tree stumps and logs against rockfall depending on their characteristics :
 - Stump and stem density
 - Tree species
 - Diameters
 - Position on slope

Questioning

Durability

- To evaluate their protection over time
- Correlation between decomposition of wood (velocity) and mechanical resistance loss



Methods

Chronosequence approach

➤ Time since cut (0 - 10 - 20 - 30 - 50 years)

➤ Species

➤ DBH

➤ Dry density



Methods

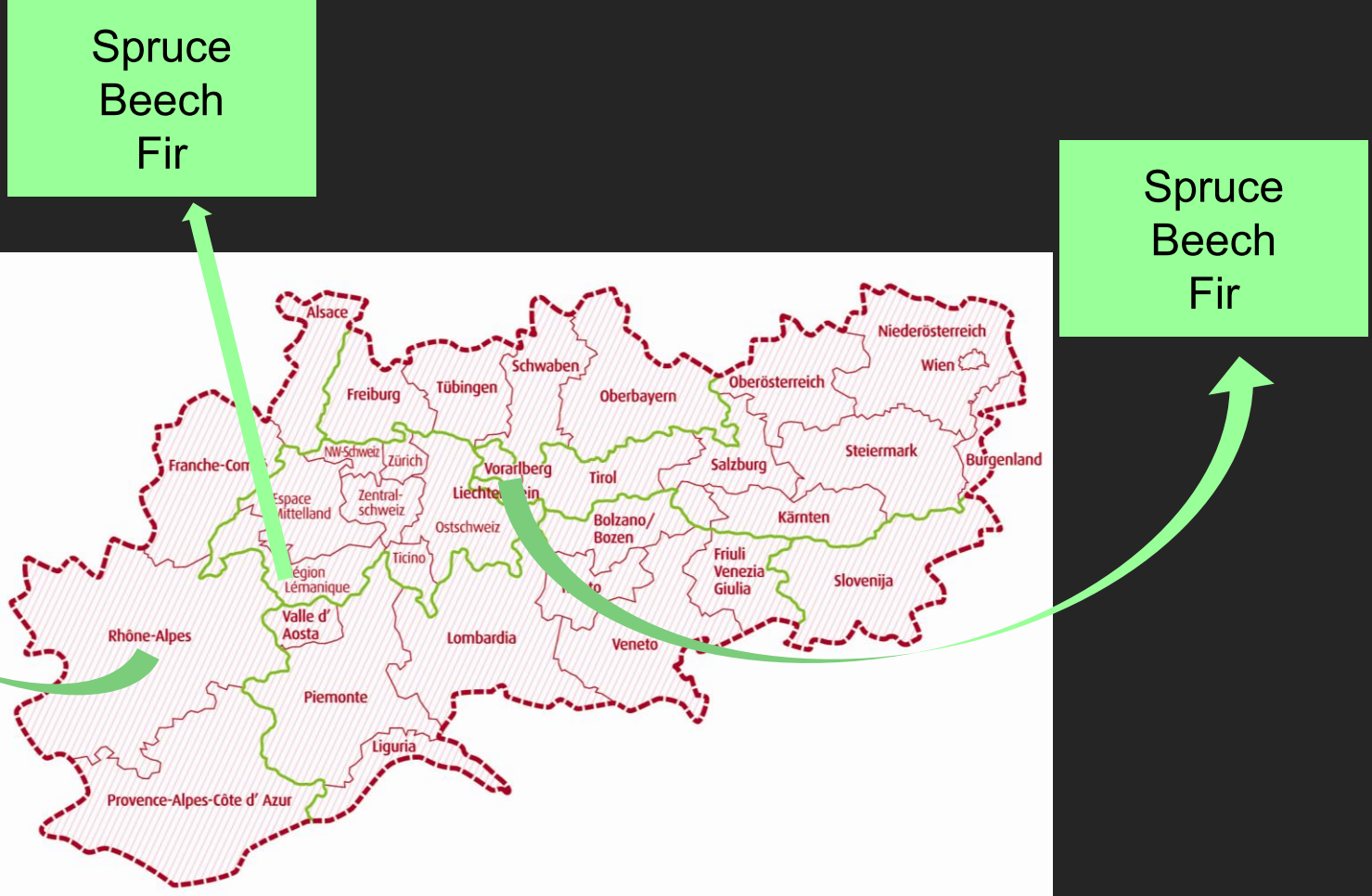
Study areas and species

Initial conditions to select study areas

- Materials: stump (high) and log
- Slope
- Time since cut (or dendrochronological application)
- Experimental capacities

Methods

Study areas and species

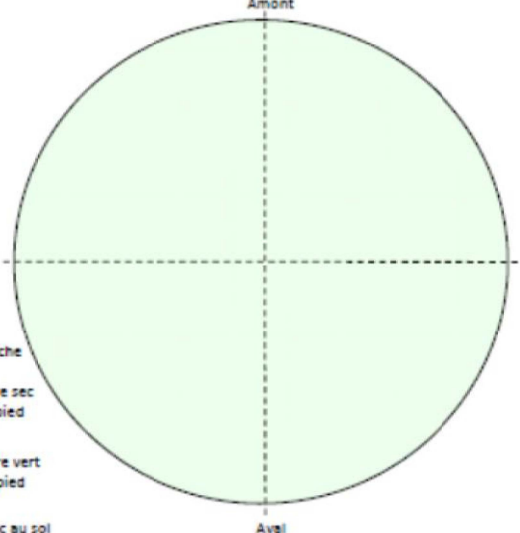






Methods

Field data sheet

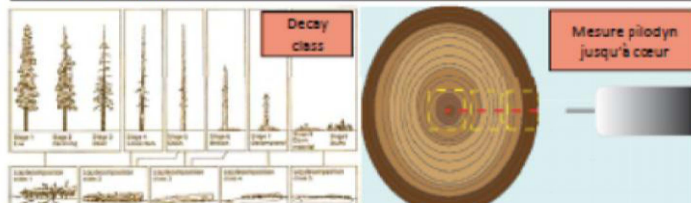
Fiche générale description du site				
Site	Date	N° placette	Localisation GPS	
Contexte forestier	Type de risque	Possibilité expérimentale	N° photo	
Contexte géographique				
Altitude (m)	Pente (°)	Exposition	Type de sol	Station forestière

Echelle :



-  Souche
-  Arbre sec sur pied
-  Arbre vert sur pied
-  Tronc au sol

Fiche individuel relevés de terrain pour rémanents						N°	
Observations							
Type de rémanent/Essence							
Classe de décomposition	1	2	3	4	5		
Présence d'écorce (%)	100	75	50	25	0		
Tronc en contact avec le sol (%)	100	75	50	25	0		
Branche (OUI/NON)							
Champignon (OUI/NON)							
Insecte (OUI/NON)							
Impacté (OUI/NON)							
Photos							
Mesures sur terrain (cm)							
Date de mort (naturel ou coupe)							
- Hauteur de souche amont aval							
- Longueur du tronc							
Circonférence/ DHP (tronc 3 points)							
Épaisseur rondelle							
Pénétration (cloueuse/Pilodyn)							
Code résistographe							



Methods

Field works and tools

Estimate wood density by different index:

- Wood dry density by weighing disc before and after oven dried
- Penetration depth
- Heart wood by drill resistance

Pilodyn



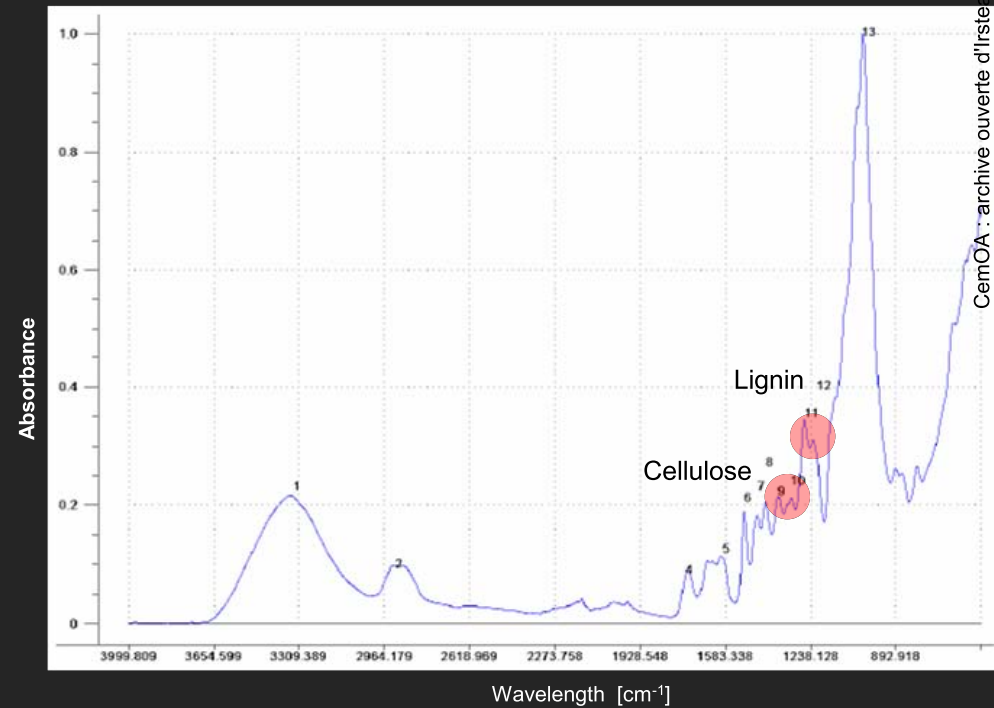
Resistograph



Methods

Lab works and tools

Relate wood resistance to wood physico-chemical properties depending on wood decay (lignin, cellulose) by Near InfraRed Spectroscopy

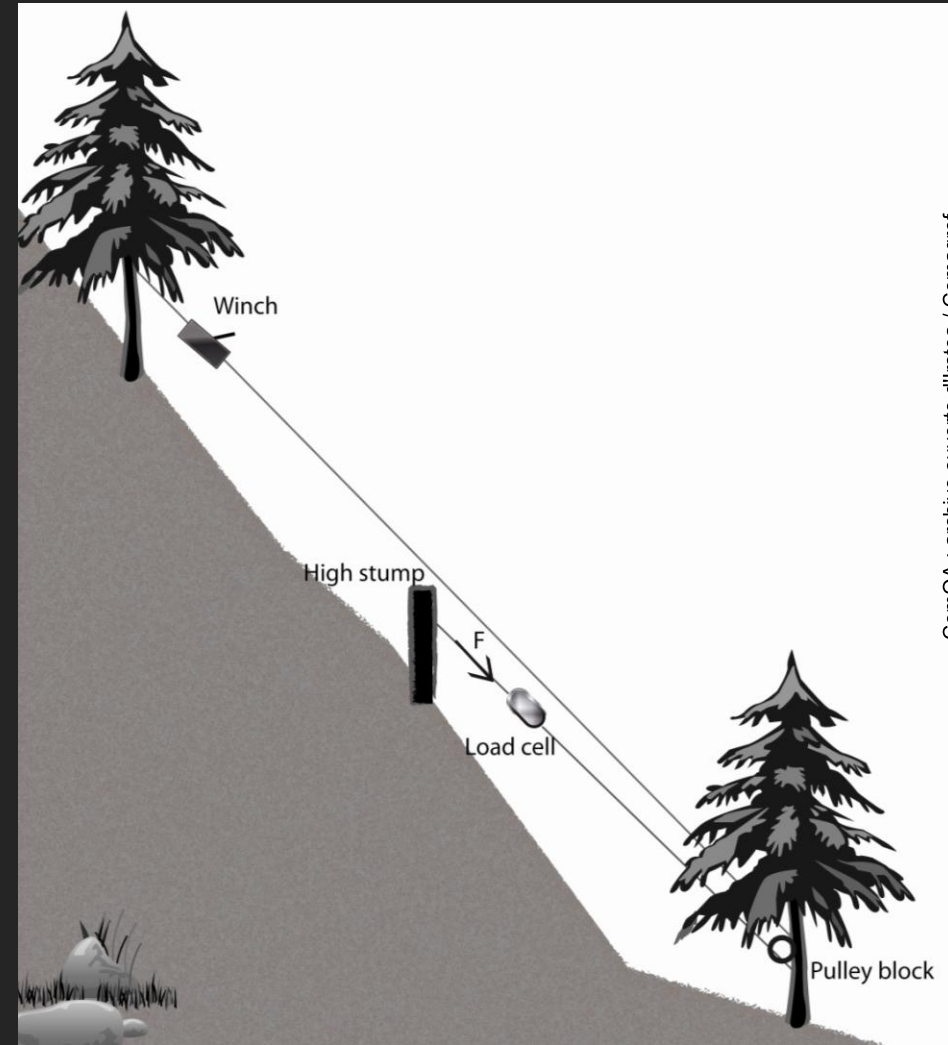


Experiments

Winching test

Quantify root anchorage resistance

by force measurement necessary to cause uprooting or stem breakage measured.



Experiments

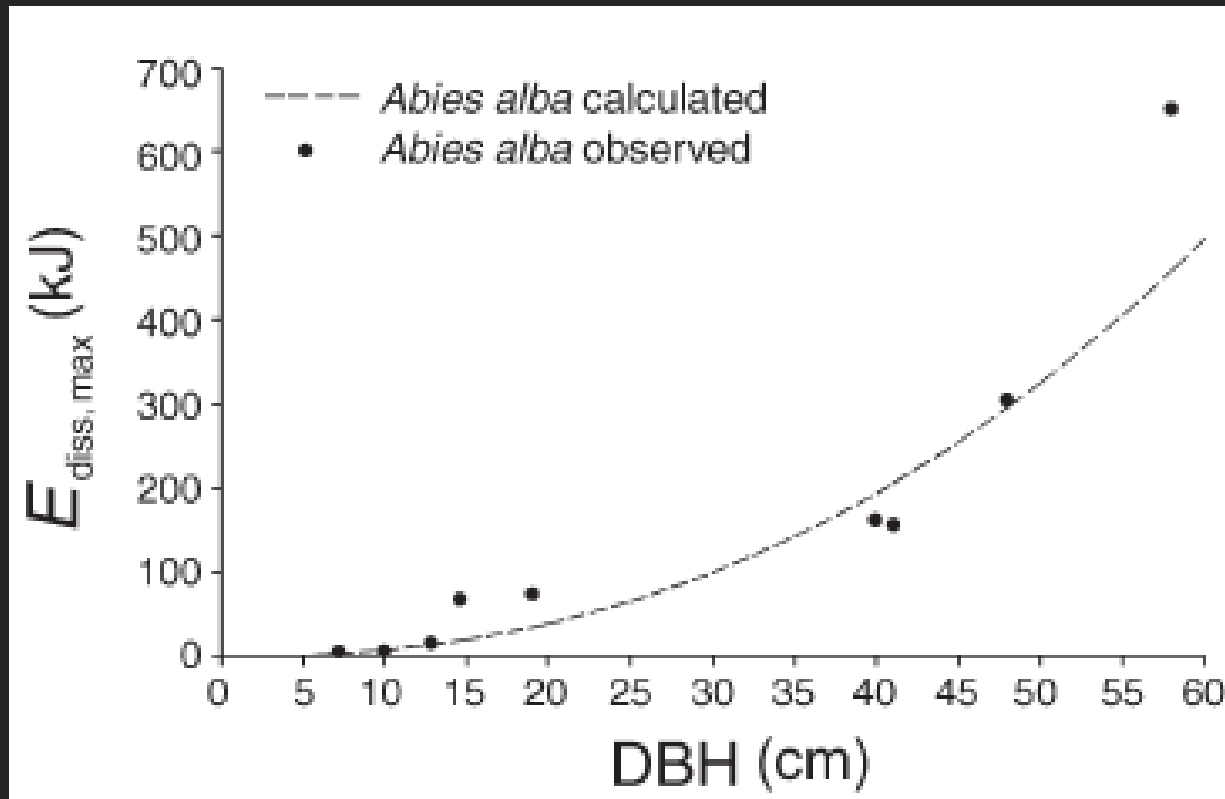
Real size experiences

To verify field works and
winching test



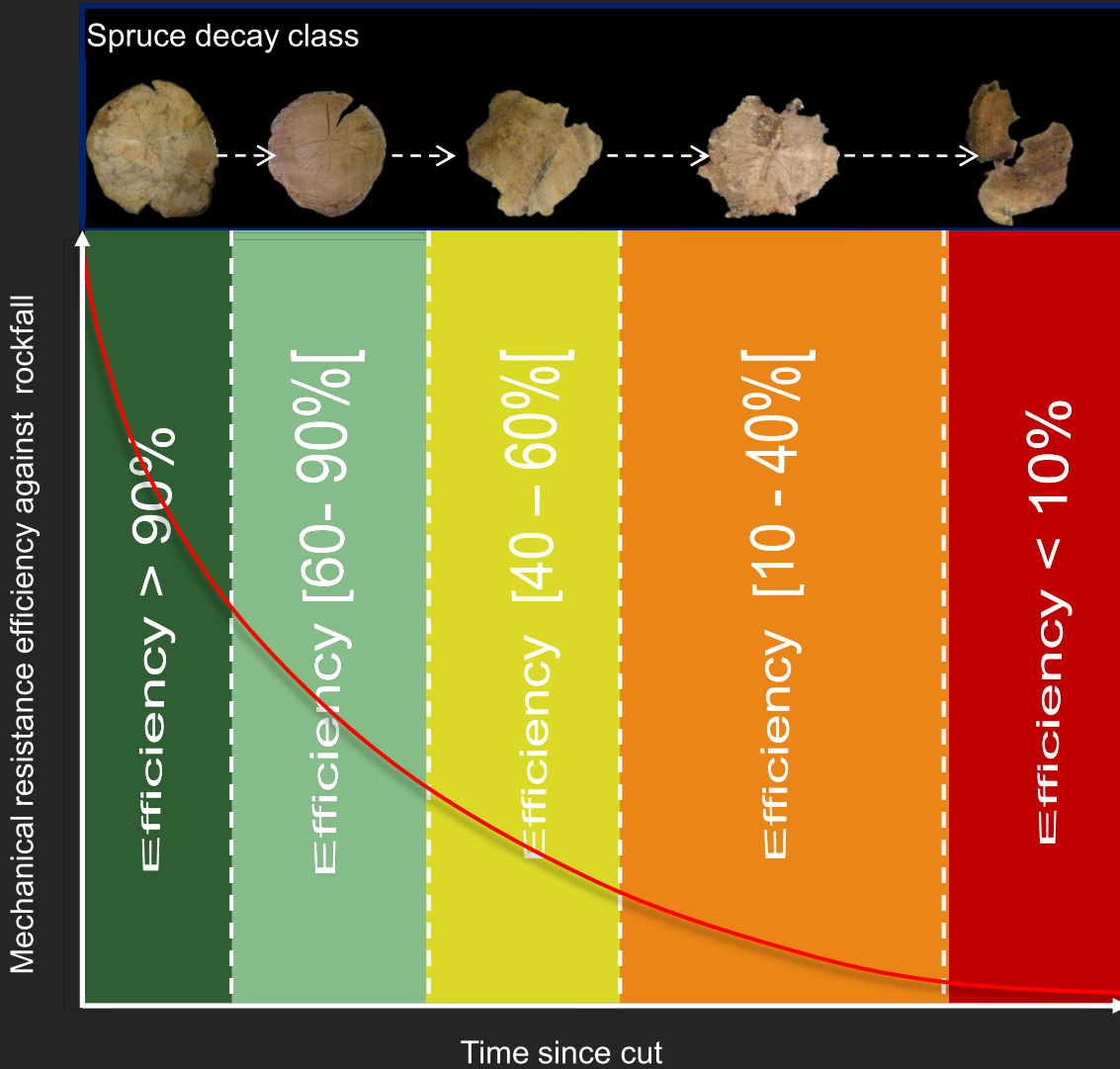
Expected results

Stem breakage of trees and energy dissipation during rockfall impacts



(Dorren and Berger 2005)

Expected results

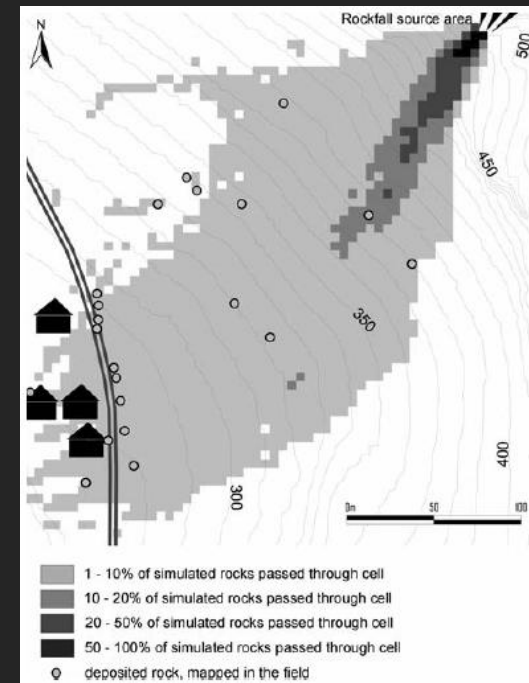


Conclusion

The final objective of this research is :

➤ To Develop models of the interaction between falling rocks and such structures that integrate lifetime of the structures

➤ These models will be integrated into the rockfall simulation code RockyFor3D



(Bigot 2009)



Thank you for your attention

For more information
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