Soil degradation

“Soil management is sustainable if the supporting, provisioning, regulating, and cultural services provided by soil are maintained or enhanced without significantly impairing either the soil functions that enable those services or biodiversity. The balance between the supporting and provisioning services for plant production and the regulating services the soil provides for water quality and availability and for atmospheric greenhouse gas composition is a particular concern” (GSP, 2017).

PLURIFOR

Avispilla del castaño

Gorgojo del eucalipto

Chancro resinoso del pino

Nematodo de la madera del pino

Plagas y enfermedades emergentes

Incendios forestales

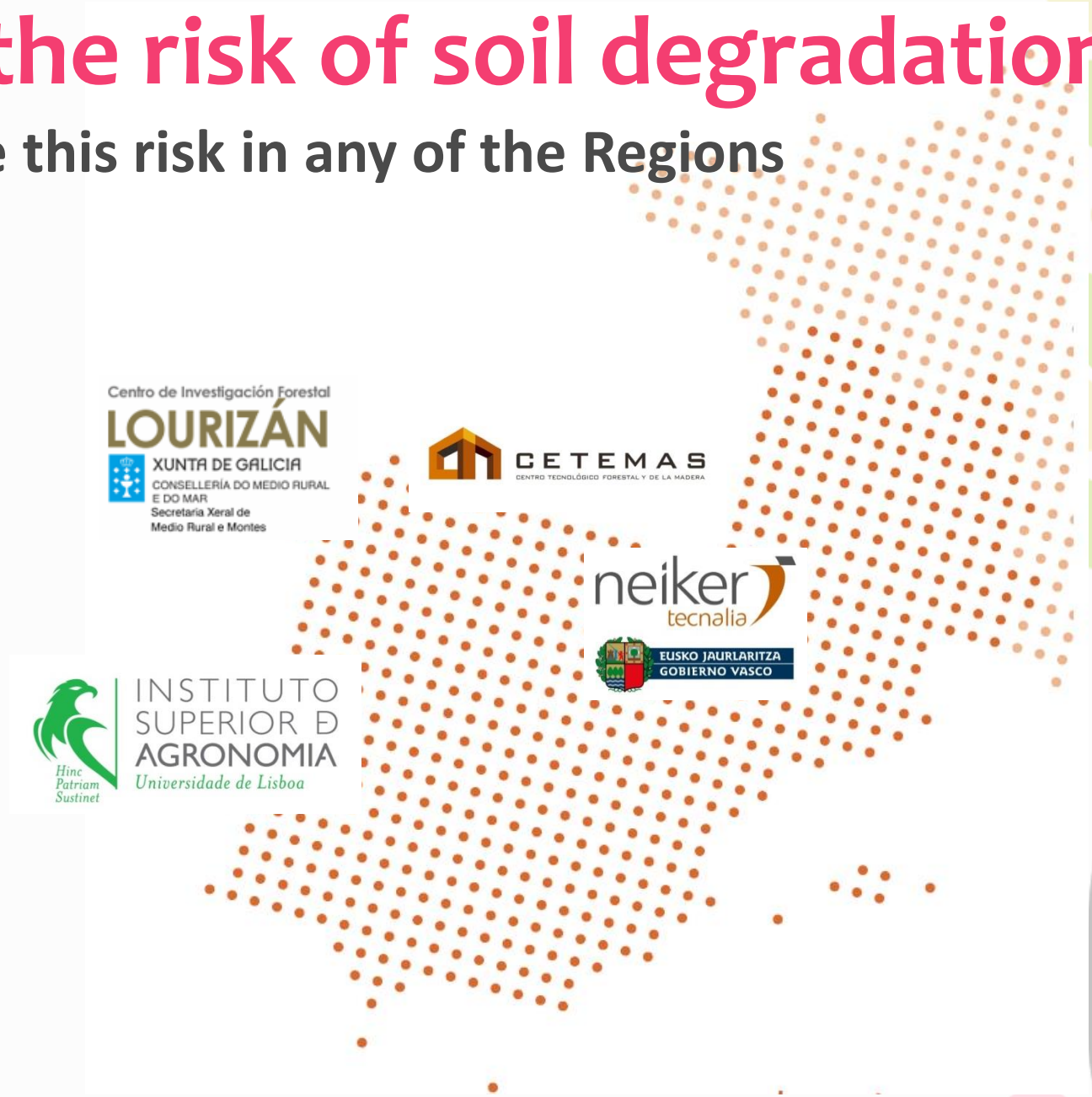
Degradación del suelo

Vendavales

Plan to manage the risk of soil degradation

There is no plan to manage this risk in any of the Regions

- Portugal
- Galicia
- Asturias
- Euskadi



Plan to manage the risk of soil degradation

Focus for the plan

- Water Erosion
- Compaction
- Landslides
- Loss of Organic Matter and Nutrient Depletion
- Biodiversity loss

Plan to manage the risk of soil degradation

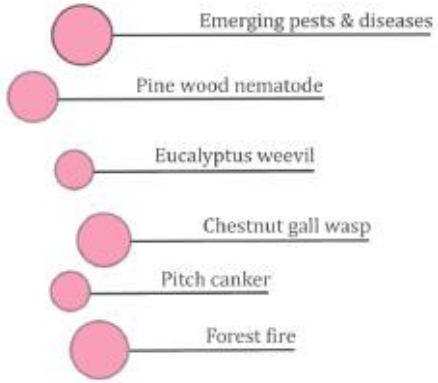
Interreg Sudoe

Transnational plans for the management of forest risks

PLURIFOR

AFG Asociación Forestal de Galicia

Plan de gestió
degradación de suelos



Asociación de Propietarios Forestales de Asturias

June 2018

ARABAKO BASOGINTZA ELKARTEA

BIZKAIKO BASOGINTZA ELKARTEA

GIPUZKOAKO BASO ELKARTEA

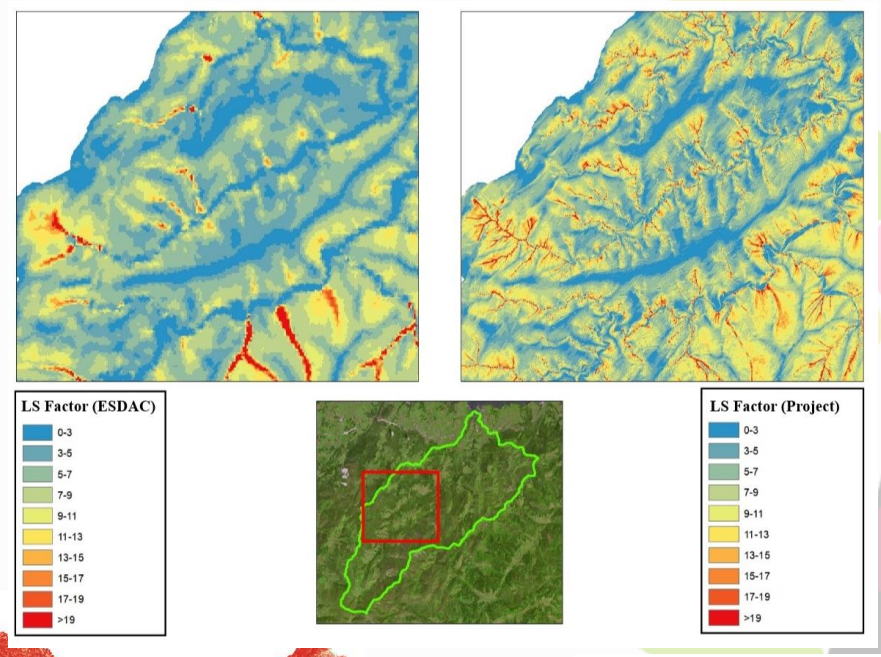
IDARN INSTITUTO PARA O DESENVOLVIMENTO AGRÁRIO DA REGIÃO NORTE

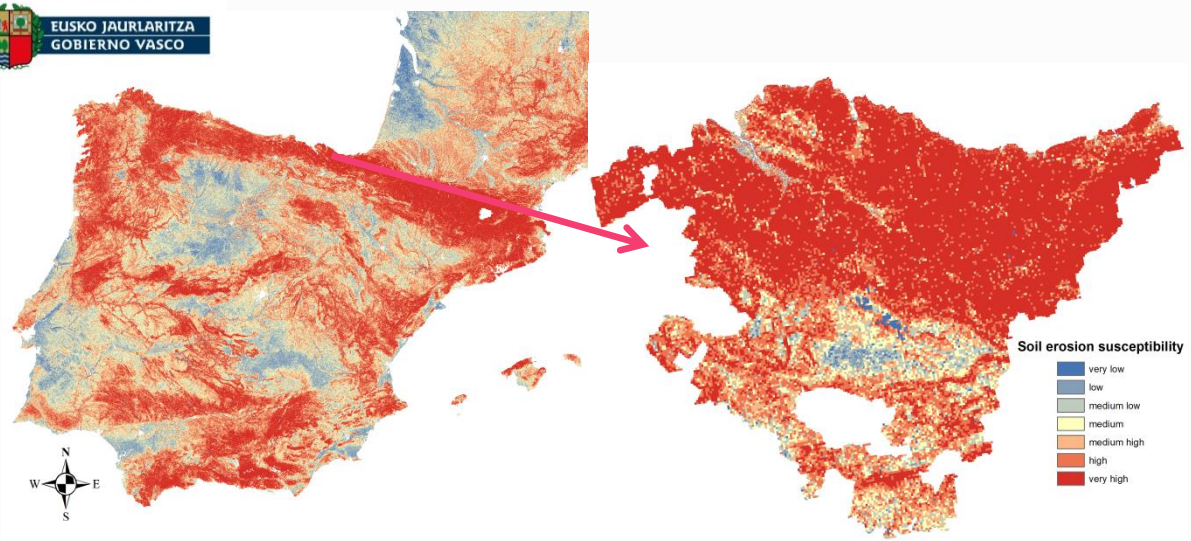
1. Detection and Identification:
   - Prevention
   - nce and Monitoring
   - Crisis Management
   - Rehabilitation

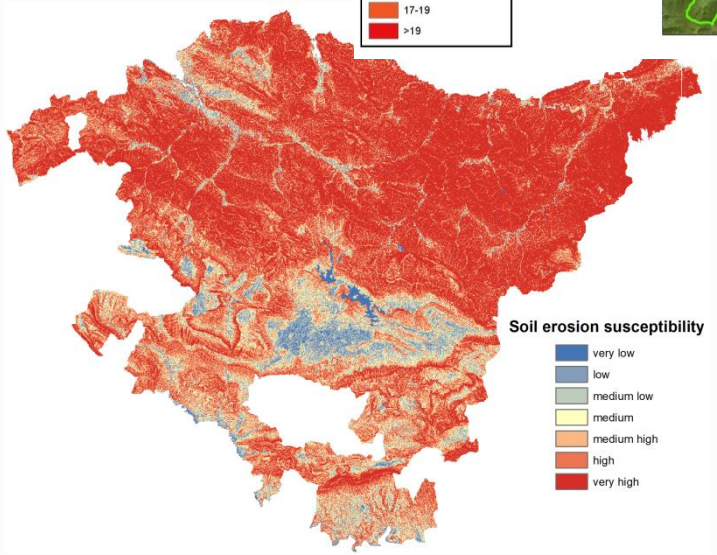
Risk assessment

Detection and Identification: Vulnerability

Water Erosion from JRC developed maps.







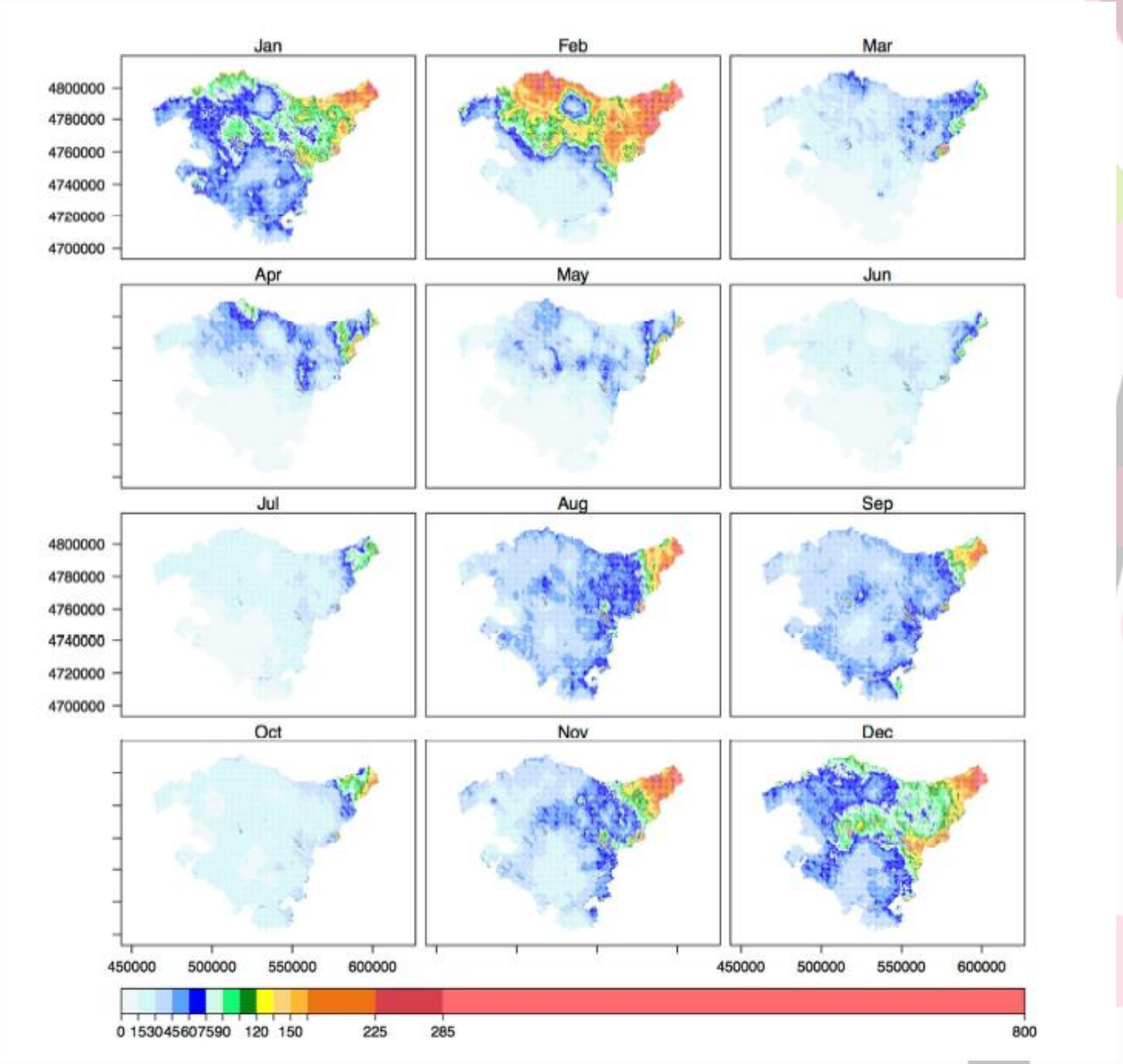
Asturias and Basque Country have developed higher resolution .

Risk assessment

Detection and Identification:

Vulnerability

Monthly Rainfall Erosivity Maps.



Contingency plan

Prevention

Centro de Investigación Forestal LOURIZÁN
XUNTA DE GALICIA
CONSELLERÍA DO MEDIO RURAL E DO MAR
Secretaría Xeral de Medio Rural e Montes

CETEMAS
CENTRO TECNOLÓGICO FORESTAL Y DE LA MADERA

INSTITUTO SUPERIOR D AGRONOMIA
Hinc Patriam Sustinet
Universidade de Lisboa

neiker tecnalia
EUSKO JAURLARITZA GOBIERNO VASCO

Voluntary Guidelines for Sustainable Soil Management

GLOBAL SOIL PARTNERSHIP

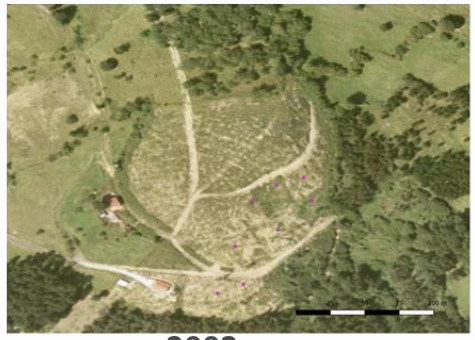
Contingency plan

Monitoring

Soil damage risk

Contingency plan

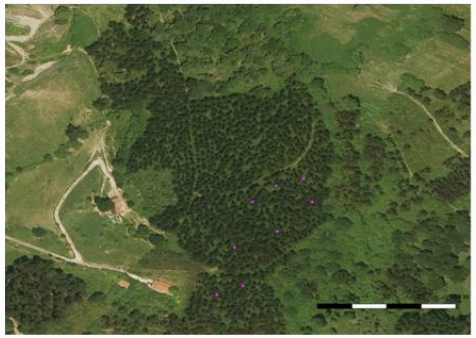
Monitoring



2002

2008

2013

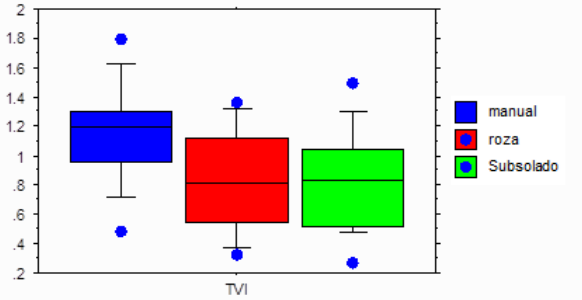


2016

	Bulk density (Mg m^{-3})	Soil Penetration Resistance (Mpa)	Available water content (%)	Saturated hydraulic conductivity (cm h^{-1})
Manual	1.25 (0.0)^{a*}	1.63 (1.48)^{a}	17.9 (0.44)^{a}	3.79 (0.14)^{a}
Scalping	1.50 (0.0)^{b}	3.73 (0.89)^{b}	16.9 (0.11)^{b}	0.46 (0.17)^{b}
Ripping	1.49 (0.81)^{b}	3.23 (0.51)^{b}	15.4 (0.13)^{c}	0.98 (0.36)^{b}

2002

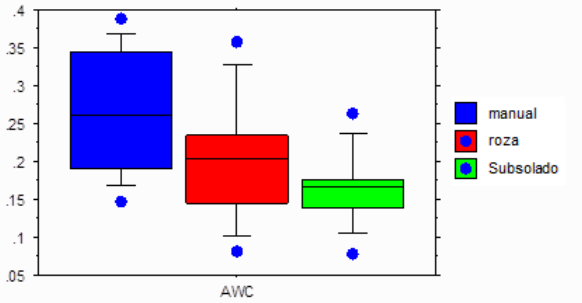
Productivity: Tree Volume Index



F-value= 3.69

p<0.05

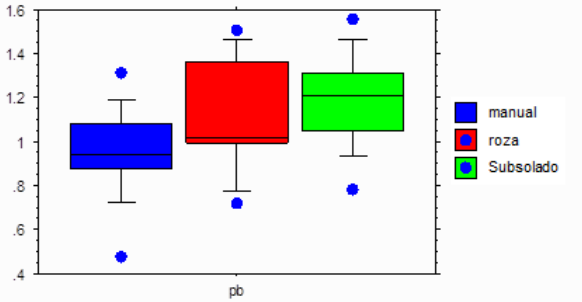
Available water content



F-value= 6.04

p<0.01

Bulk density



F-value= 3.92

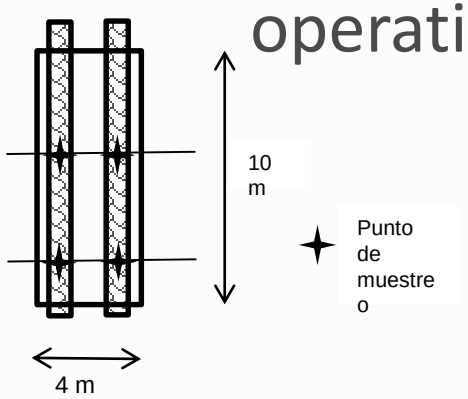
p<0.05

2018

Contingency plan

Prevention

- Effects of forwarding on soil hydrological properties in thinning operation in northern Spain



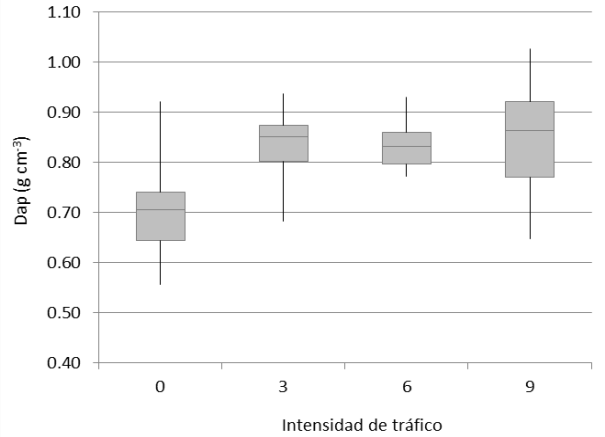
- The aim of this study was to evaluate the effects of forwarding on the hydrological properties of a high compaction-risk soil with a moisture content of almost 62%.
- A single-factor factorial design with three replications was used involving three traffic intensities of a Dingo AD6-24 forwarder (3, 6 and 9 passes).
- Four undisturbed soil samples were taken in each treatment plot and specific soil properties were measured in the laboratory: bulk density, porosity, saturated hydraulic conductivity and gravimetric water content -10 kPa (field capacity).

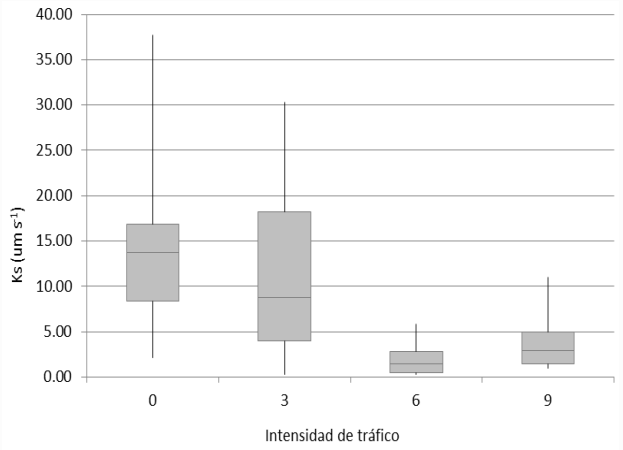
Contingency plan

Prevention

- Effects of forwarding on soil hydrological properties in thinning operation in northern Spain

- The results demonstrated that 3 passes of the forest machine are enough to significantly increase bulk density with successive passes having no additional effect.
- However, additional passes (6 or 9) significantly reduced the saturated hydraulic conductivity of soils, increasing soil erosion risk.
- These results indicate that in a soil with a high compaction risk, forwarding alters its physical properties and recovery from the disturbance should be followed up.





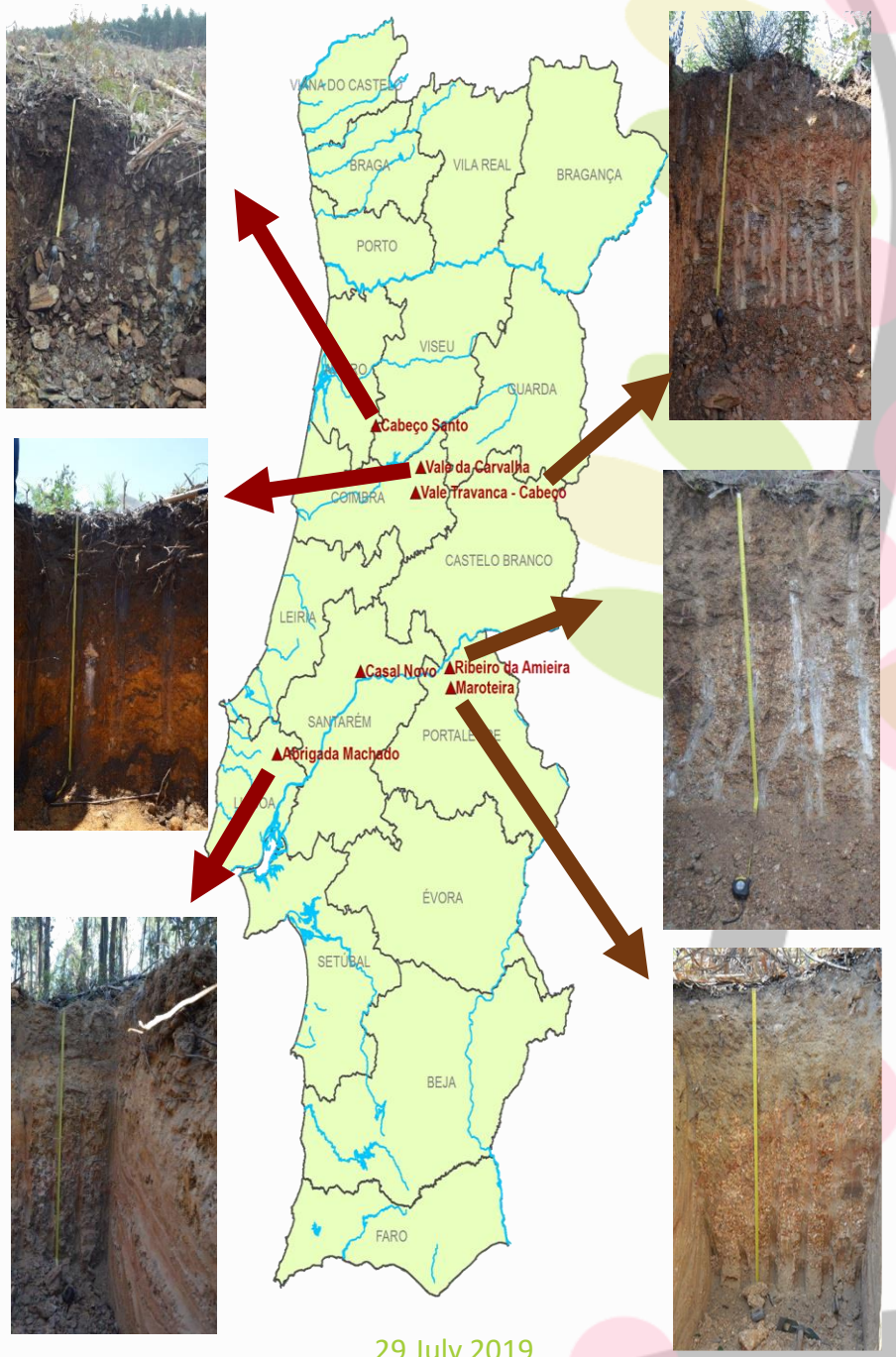
Contingency plan

Surveillance and Monitoring

- System for soil quality monitoring in Forest Plantations.
- Establish soil reference sites representative from biogeoclimatic conditions.
- Indicators for soil conditioning at referencevalues and after different silvicultural treatments.

Maroteira: soil indicators before and after perbubation

Depth	MV	pH	C_{org}	Ca^{2+}	Al^{3+}	P	K
cm	g cm^{-3}	H_2O	g kg^{-1}	$cmol_c$ kg^{-1}		mg kg^{-1}	
Reference (Before perturbation)							
0-10	1,37	5,46	30,4	0,35	1,62	3,4	81
10-20	1,50	5,68	11, 6	0,14	1,84	2,5	57
6 months after perturbation							
0-10	1,35	5,26	25,1	0,48	1,24	2,1	76
10-20	1,46	5,37	20,6	0,23	1,22	1,7	73



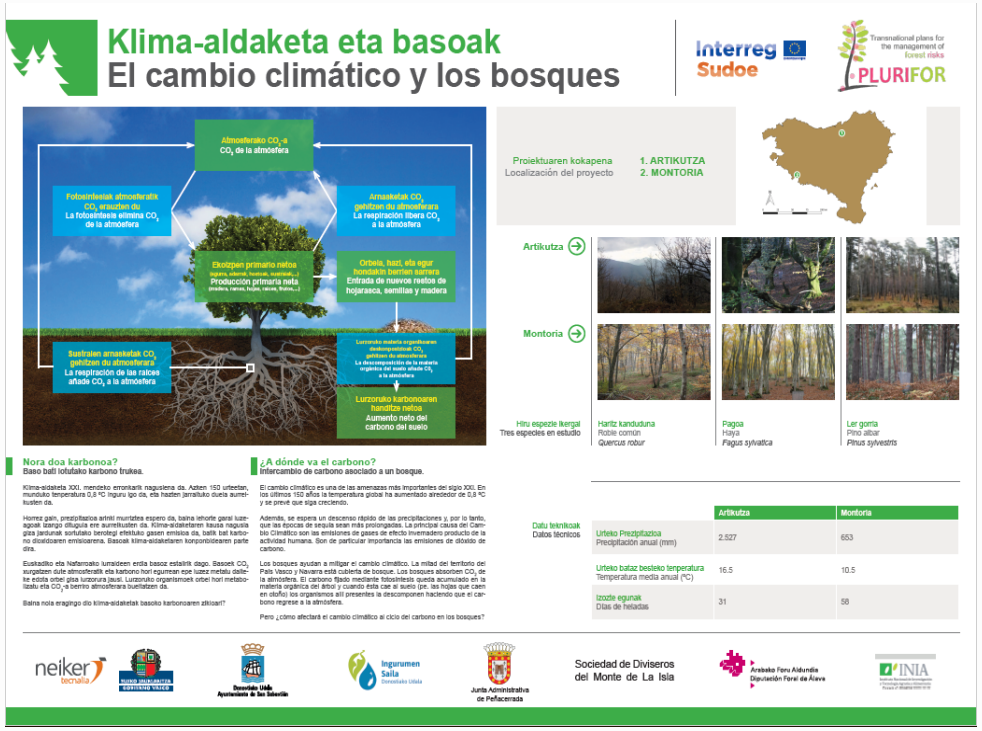
Contingency plan

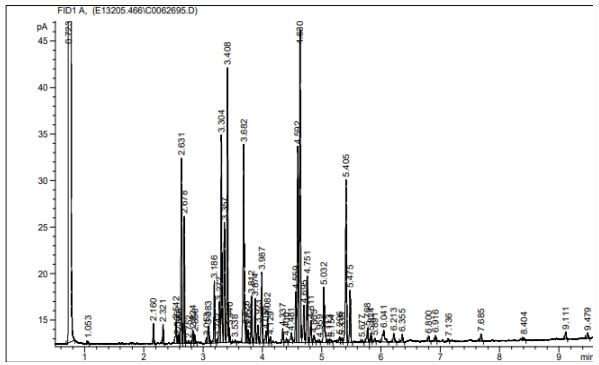
Surveillance and Monitoroing

- Reference values for soil biodiversity: available knowledge on soil biodiversity is recognised as being very limited, little is known about the degree of biodiversity required to maintain core soil functions.

Phospholipid fatty acids determination (PLFA)

PLFA analysis is an efficient way to rapidly screen whether the fungal or bacterial part of the soil community has been affected by a treatment.





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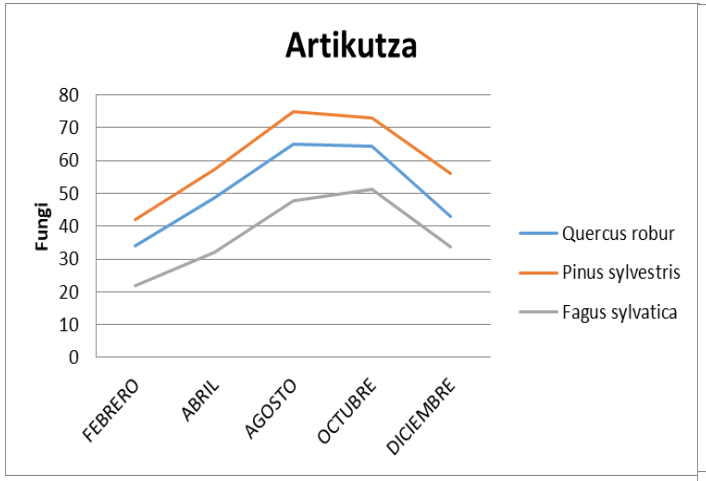
Contingency plan

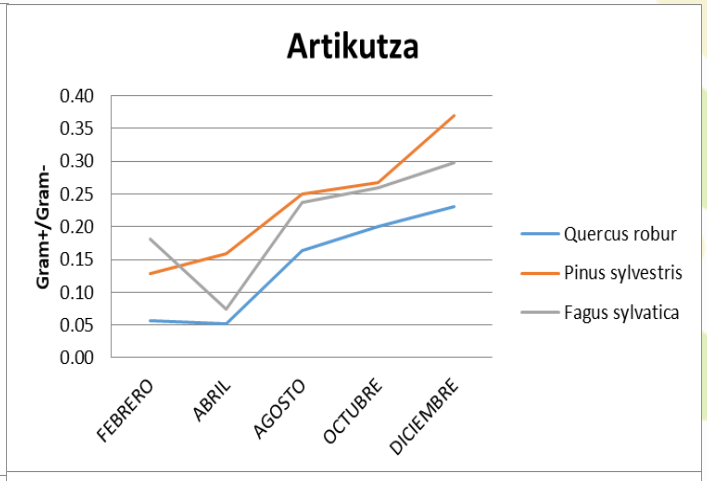
Surveillance and Monitoring

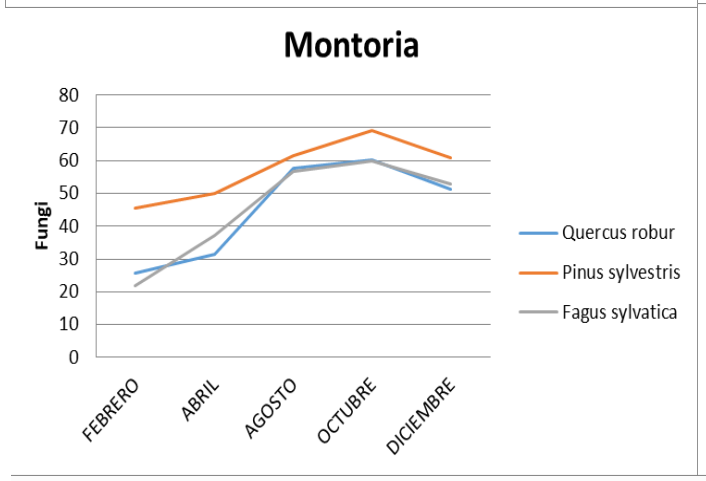
Quercus robus	ARTIKUTZA					MONTORIA				
	FEBRERO	ABRIL	AGOSTO	OCTUBRE	DICIEMBRE	FEBRERO	ABRIL	AGOSTO	OCTUBRE	DICIEMBRE
Biomasa total	592	698	840	1159	708	1131	728	902	1284	1262
Fungi	34	49	65	64	43	26	32	58	60	51
Gram -	60	46	27	26	41	70	63	36	31	36
Gram +	2.74	2.08	3.14	3.92	6.85	1.43	1.72	2.30	3.62	4.39
Eucariotas	3.23	3.04	3.40	3.76	5.03	3.02	3.13	3.38	3.53	7.16
Actinomicetes	0.59	0.29	1.27	1.40	2.67	0.22	0.33	0.34	0.75	0.80
Fungi/Bacteria	0.58	1.06	2.21	2.22	0.92	0.37	0.50	1.52	1.77	1.33
Depredador/Presa	0.05	0.07	0.12	0.13	0.11	0.04	0.05	0.09	0.10	0.18
Gram +/-	0.06	0.05	0.16	0.20	0.23	0.02	0.03	0.07	0.14	0.15
Sat/unsat	1.81	2.10	1.15	1.07	1.03	1.06	1.19	1.06	0.86	0.72

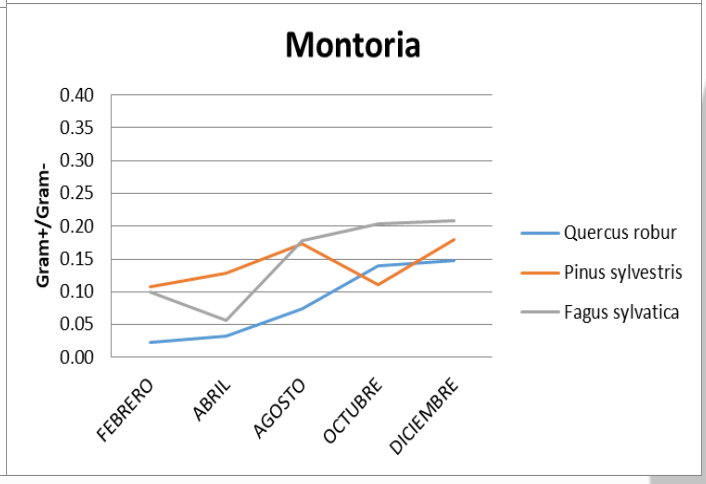
Pinus yslvestris	ARTIKUTZA					MONTORIA				
	FEBRERO	ABRIL	AGOSTO	OCTUBRE	DICIEMBRE	FEBRERO	ABRIL	AGOSTO	OCTUBRE	DICIEMBRE
Biomasa total	631	555	1291	1522	1658	532	442	757	1039	1109
Fungi	42	57	75	73	56	46	50	62	69	61
Gram -	48	34	17	17	25	45	43	29	25	29
Gram +	5.66	5.05	3.68	3.90	8.04	4.47	4.78	4.39	2.54	4.44
Eucariotas	3.71	3.22	2.89	4.37	8.44	3.92	3.94	3.73	2.67	4.78
Actinomicetes	0.37	0.32	0.63	0.65	1.14	0.41	0.39	0.67	0.23	0.65
Fungi/Bacteria	0.83	1.59	3.72	3.67	2.02	0.93	1.14	1.88	2.53	1.93
Depredador/Presa	0.07	0.08	0.14	0.21	0.31	0.08	0.09	0.11	0.10	0.15
Gram +/-	0.13	0.16	0.25	0.27	0.37	0.11	0.13	0.17	0.11	0.18
Sat/unsat	1.66	1.51	0.96	0.84	0.76	1.26	1.21	0.91	0.78	0.75

Fagus sylvatica	ARTIKUTZA					MONTORIA				
	FEBRERO	ABRIL	AGOSTO	OCTUBRE	DICIEMBRE	FEBRERO	ABRIL	AGOSTO	OCTUBRE	DICIEMBRE
Biomasa total	811	957	905	1037	776	933	806	814	969	1058
Fungi	22	32	48	51	34	22	37	57	60	53
Gram -	61	60	35	31	43	64	58	34	30	32
Gram +	8.75	3.97	6.27	5.97	9.62	5.79	3.05	4.65	4.93	5.81
Eucariotas	5.81	2.55	8.11	9.21	9.08	7.53	1.73	2.53	3.51	7.03
Actinomicetes	1.72	0.57	1.88	1.89	3.14	0.51	0.19	1.37	1.09	0.92
Fungi/Bacteria	0.36	0.53	1.31	1.47	0.69	0.33	0.63	1.52	1.80	1.47
Depredador/Presa	0.09	0.04	0.22	0.26	0.18	0.11	0.03	0.07	0.10	0.18
Gram +/-	0.18	0.07	0.24	0.26	0.30	0.10	0.06	0.18	0.20	0.21
Sat/unsat	0.96	1.18	0.97	0.76	1.01	0.80	0.89	0.89	0.73	0.64









Contingency plan

Crisis Management/eradication/control

Gestión de la crisis /respuesta/erradicación/control

Medidas de la primera fase

Estudiar el impacto del evento catastrófico, detectar responsabilidades, habilitar ayudas para la rehabilitación y decidir cuáles y donde se aplicarán las medidas de restauración para evitar que la degradación del suelo sea continua.

Los órganos competentes en la gestión forestal y en la vigilancia serán los responsables de activar la mesa de crisis que decidirá las medidas oportunas.

Medidas de la segunda fase

Se evaluará la efectividad de las medidas aplicadas y si se demuestra que no han sido efectivas se estudiará el por qué y se propondrán unas nuevas medidas.

Contingency plan

Rehabilitation

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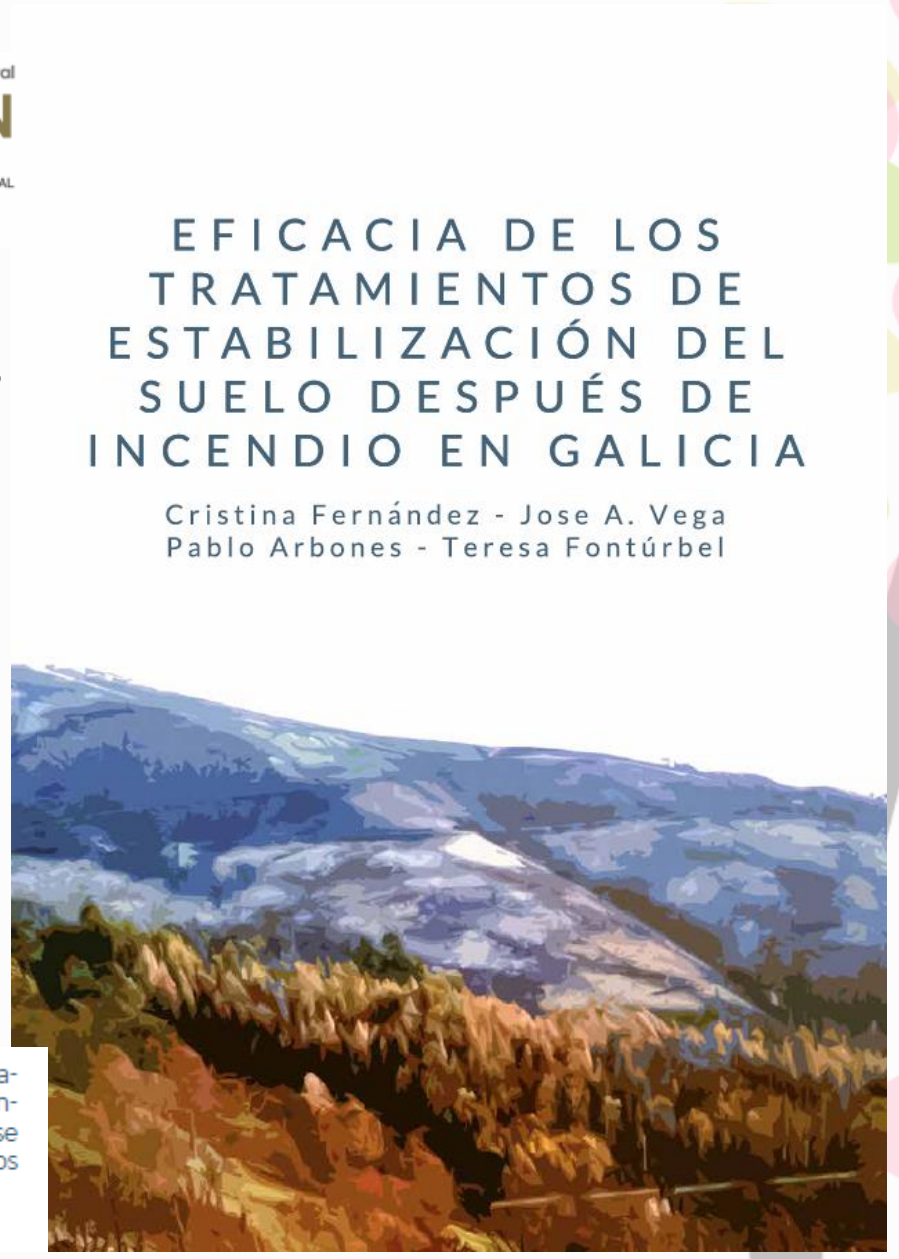
Secretaría Xeral de Medio Rural e Montes

- Effectiveness of different treatments for post-fire soil losses reduction.

Soil erosion is a major consequences of forest fires in the North of the Iberian Peninsula.

This guide summarizes the results in terms of soil erosion reduction of different treatments carried out in Galicia (NW Spain).

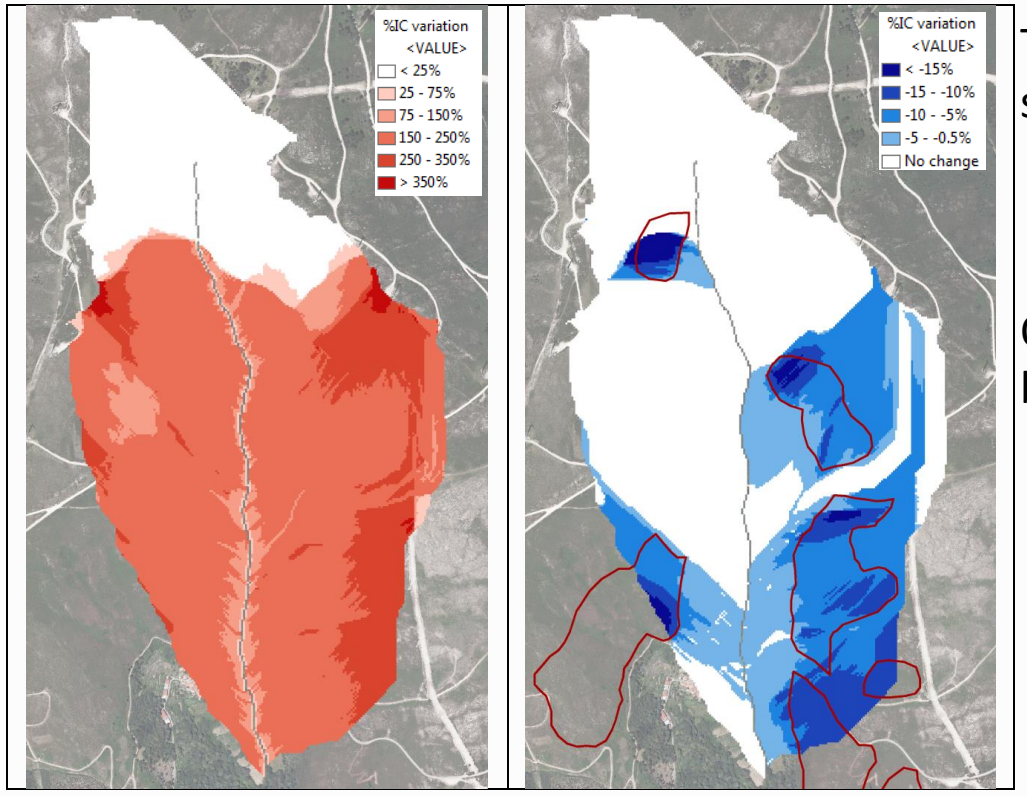


Cristina Fernández, y Teresa Fontúrbel son investigadoras del Centro de Investigación Forestal de Lourizán. Axencia Galega de Calidade Alimentaria (AGACAL). Consellería do Medio Rural. Xunta de Galicia. José A. Vega ha sido investigador en ese centro. Pablo Arbones es el Director-Gerente de la Empresa Pública de Servicios Agrarios Galegos, S.A. (SEAGA).

Contingency plan

Rehabilitation

- Connectivity index in the planning for post-fire erosion reduction



The selection of the areas to be treated is a key step in the soil stabilization protocol after fire.

One of the most important aspects for that selection is the level of soil burn severity in the affected area.

The computation of a connectivity index in catchment burned in 2016 helps to prioritize the areas to be treated. It is also possible to see how mulch application reduces catchment connectivity.

Contingency plan

Rehabilitation

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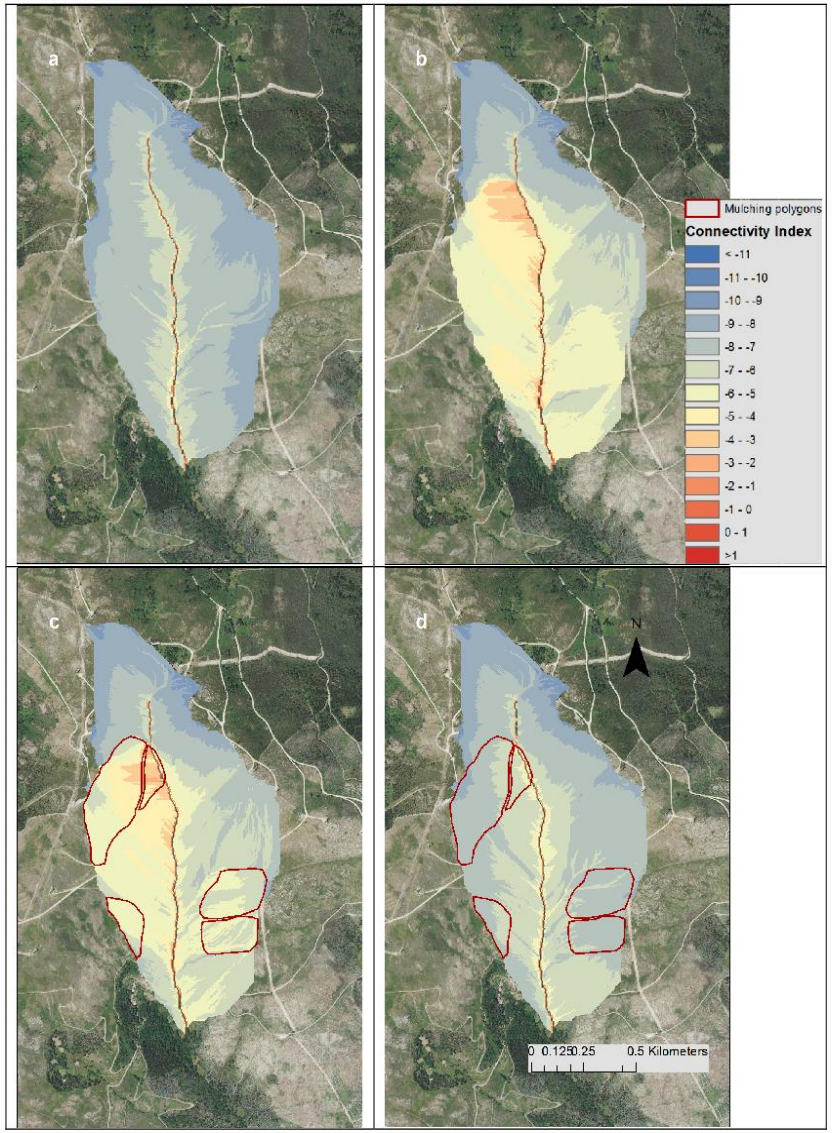
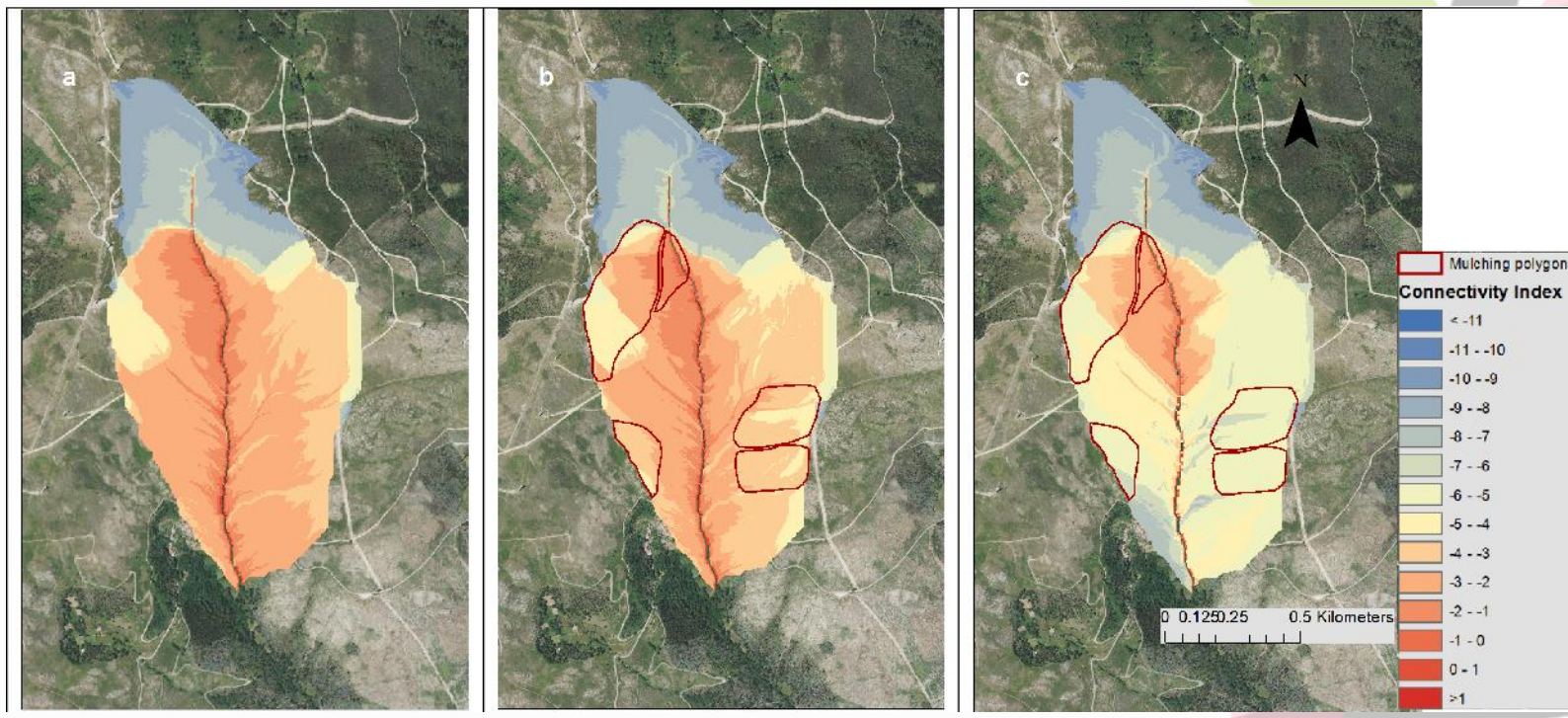
Connectivity index computed following Borselli et al. (2008)



The modification of Borselli's connectivity index based on soil burn severity improves the original formulation and it is related with sediment delivery



Contingency plan

Rehabilitation

- Pine residues chipping effects on soil compaction and erosion

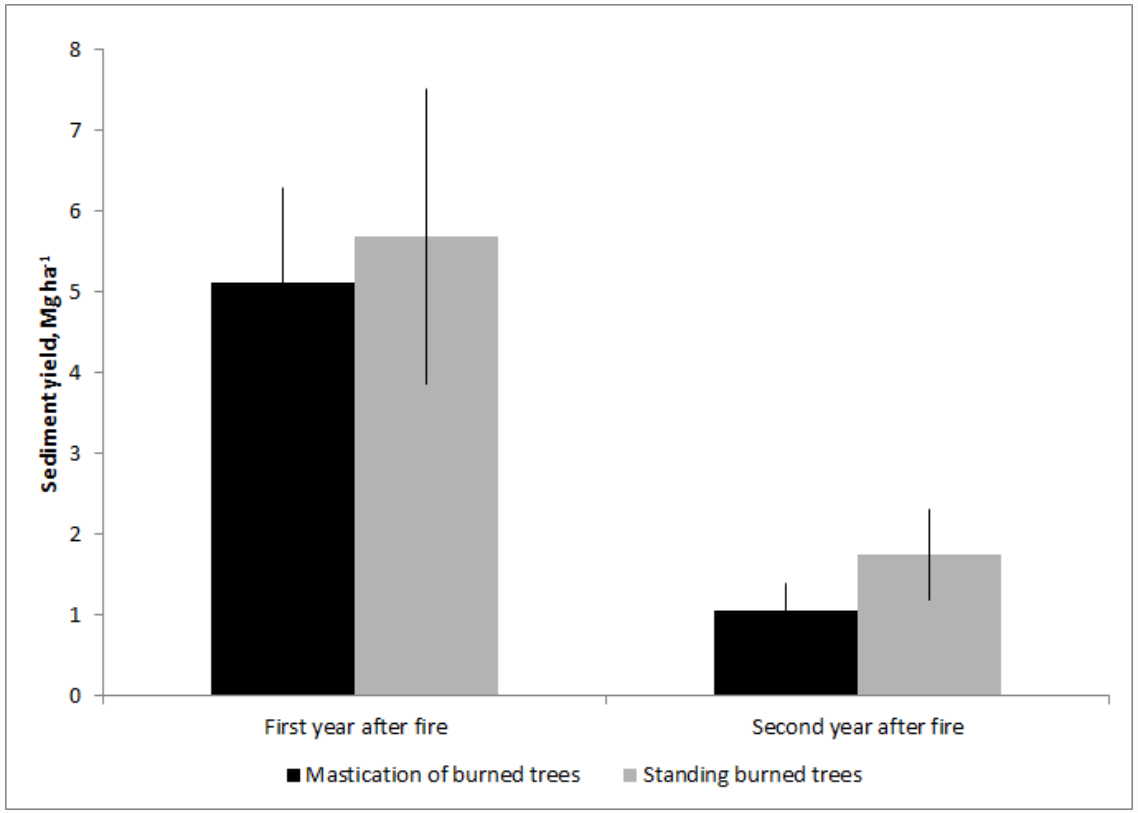
Thousands of hectares of non-commercial burned pine trees are being mechanically shredded every year.

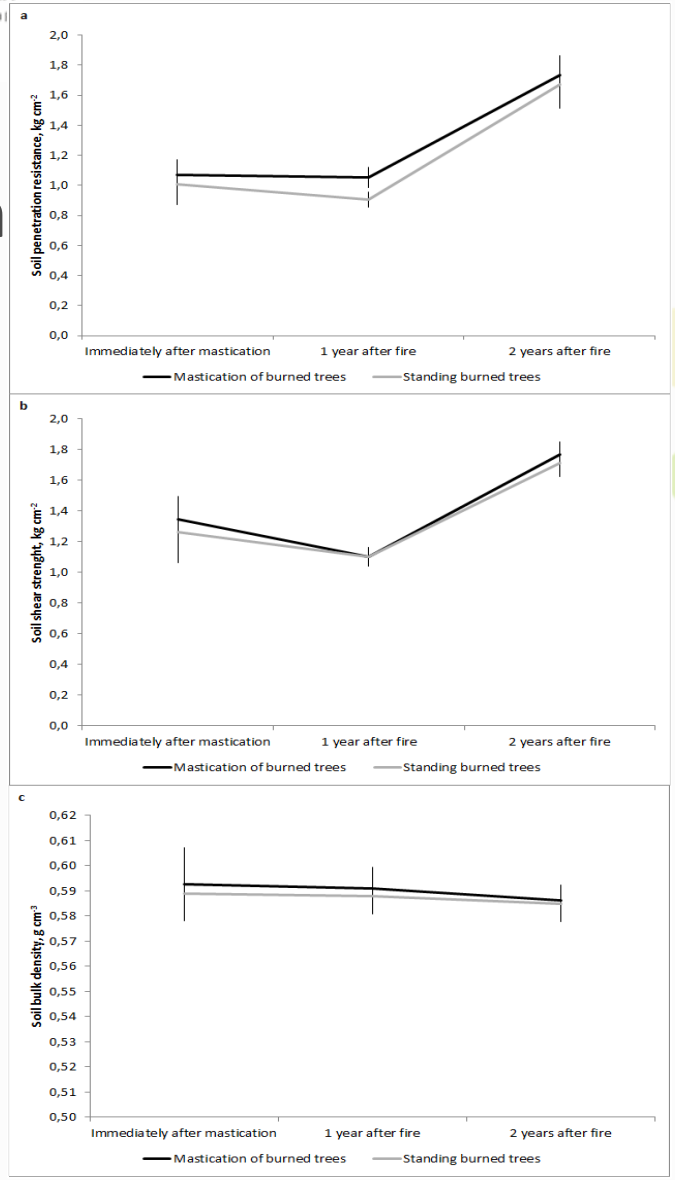
The case of study provides cuantitative information on the effect of mechanical shredding on soil coverage, soil compaction and soil erosion.

Contingency plan

Rehabilitation

- Pine residues chipping effects on soil com





Contingency plan

Rehabilitation

- Pine residues chipping effects on soil compaction and erosion

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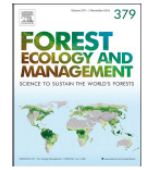

Mastication of burned non-commercial *P. sylvestris* L. stands: Effects on soil erosion and vegetation recovery

Cristina Fernández*, Teresa Fontúrbel, José A. Vega

Centro de Investigación Forestal-Lourizán, Xunta de Galicia, P.O. Box. 127, 36080 Pontevedra, Spain

ARTICLE INFO

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Wildfire
Mastication
Erosion
Soil compaction
Vegetation diversity

ABSTRACT

Forest mastication is frequently used as a fuel reduction treatment aimed at minimising severe wildfires in fire prone areas worldwide. In recent years, mastication of non-commercial burned trees has become common practice in NW Spain, as a way of providing cover on the burned soil and preventing erosion. However, little is known about the possible effects on soil conservation and vegetation recovery. In this study, 20 experimental plots were established in a *Pinus sylvestris* L. plantation affected by a crown fire that caused moderate-high soil burn severity in the summer of 2016. Immediately after the fire, burned trees were masticated in half of the plots, while burned trees were left standing in the other half of the plots during the first two years after the fire. The objectives of the study were to determine how mastication affected soil erosion, soil physical properties (soil penetration resistance, soil shear strength, soil bulk density) and vegetation recovery. The masticated material covered 43% of the burned soil. During the first year after wildfire + mastication, precipitation was lower than the annual mean level in the area, and the mean soil loss in the untreated burned soils (5.7 Mg ha^{-1}) was not significantly different from that in the masticated plots (5.0 Mg ha^{-1}). Mastication did not have any detrimental effects on either the soil physical properties analysed or on the regeneration of natural vegetation. The results indicated that in addition to mastication of severely burned non-commercial trees, extra mulch should be applied to reduce the risk of soil erosion. Mastication after wildfire is not detrimental to soil conservation. No advantage was obtained by leaving the standing burned trees on site, in relation to reducing soil erosion or enhancing vegetation recovery.

Eskerrik asko!
¡Muchas gracias!
Gracies!
Grazas!
Obrigado!
Thanks a lot!