

PLURIFOR contribution to improving transboundary preparedness

EFI PLANTED FORESTS FACILITY & IEFC 2018 ANNUAL MEETING

“Global Change and Associated Risks”

27 June 2018, Porto (Portugal)

PLURIFOR



EFIATLANTIC

European Forest Institute
– Atlantic European
Regional Office



Institut National de la
Recherche Agronomique



Instituto Superior de
Agronomia



Instituto Nacional de
Investigaçao Agraria e
Veterinaria, I.P.



NEIKER-Instituto Vasco de
Investigación y Desarrollo
Agrario, S.A.



Fundación Hazi
Fundazioa



Unión de
Selvicultores del Sur
de Europa, AEIE.



Instituto Galego de
Calidade Alimentaria



Technologías y
Servicios Agrarios,
S.A.



Universidad de
Valladolid



Fundación Centro
Tecnológico Forestal
y de la Madera

PLURIFOR

WP1: Analysis of organisations, plans and management



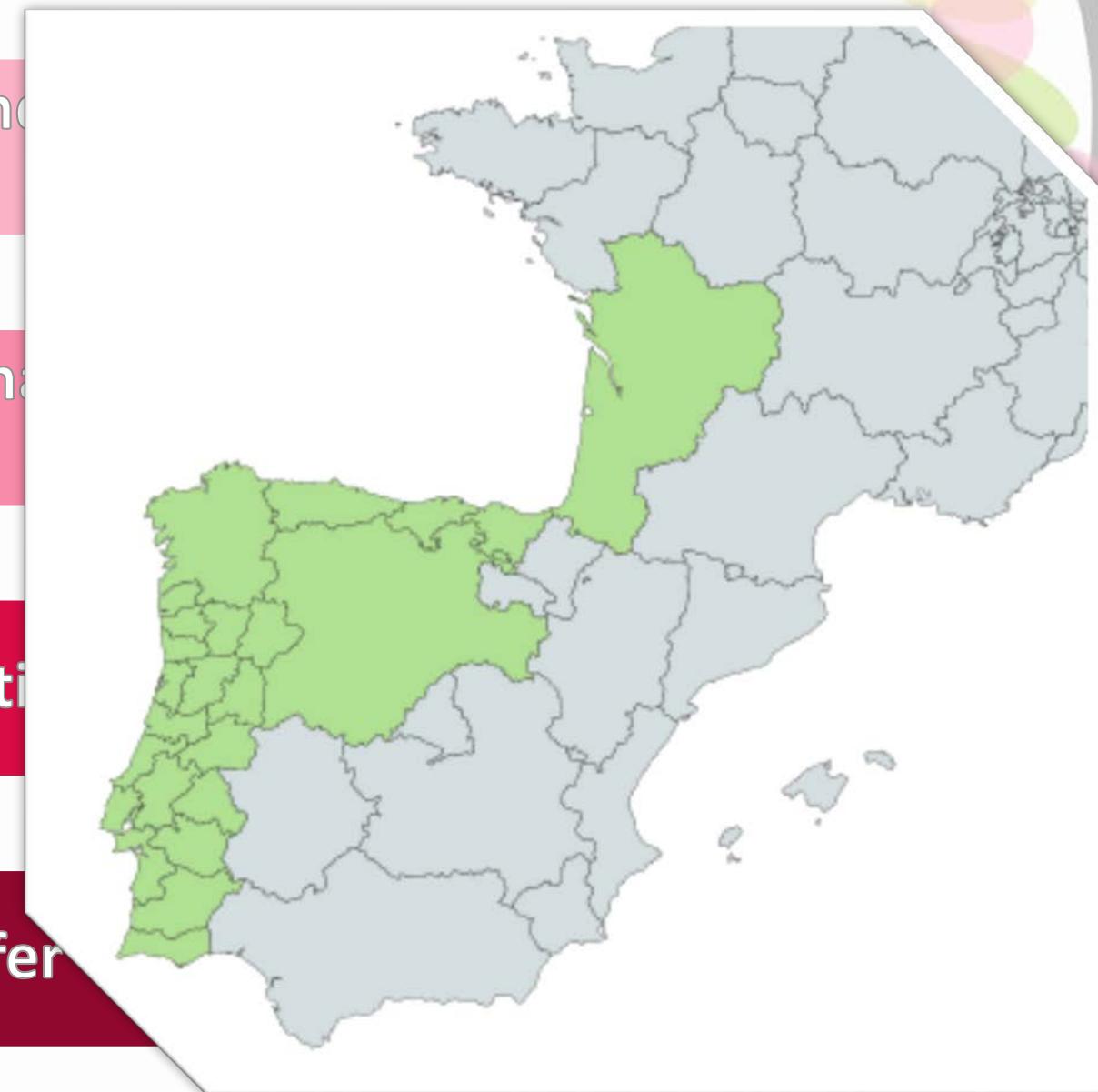
WP2: Creation/improvement of risk management tools



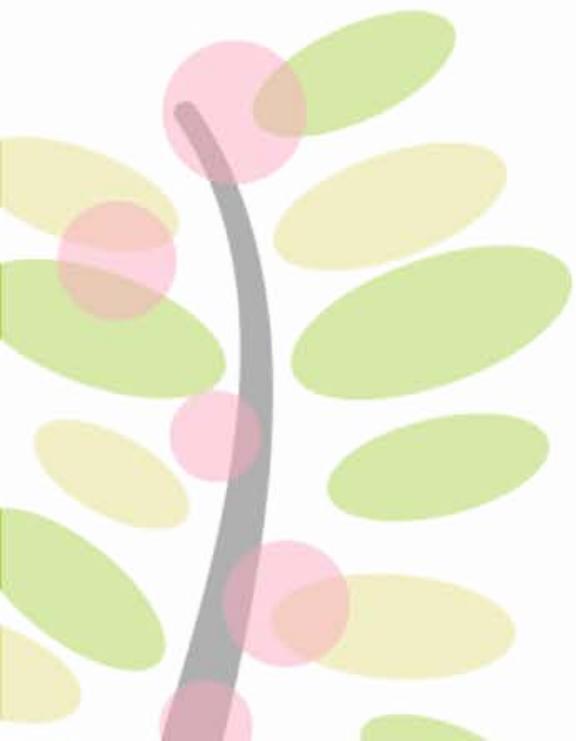
WP3: Plans and tools evaluation



WP4 : Validation and transfer



Outputs developed from January 2017 to June 2018



An overview

Eduard Mauri (EFI)

Workshops

Present proposed tools and gather associated partners opinions

Workshop	Title	Date	Place	Attendees
Forest fire	Fire behaviour software: a good tool for enhancing forest fire management plans	22-23 May 17	Lisbon, PORTUGAL	17
Soil degradation	Practical guidance for developing Plans to Manage Soil Degradation Risk in Forestry	28 Jun 17	Extremadura, SPAIN	16
Wind	1) <i>Basaize</i> , a wind risk model for Euskadi 2) Forest management adapted to wind	11-12 Sept 17	Euskadi, SPAIN	18
Pine pitch canker	Tools for quick disease diagnosis	3 Oct 17	Aveiro, PORTUGAL	18
Eucalyptus weevil	Tools for monitoring defoliation	4 Oct 17	Aveiro, PORTUGAL	34
Chestnut gall wasp	State-of-the-art knowledge, prevention, and monitoring and control systems	19 Oct 17	Vila Real, PORTUGAL	57
Emerging pest and diseases	Towards early warning detection methods	25 Jan 18	Lisbon, PORTUGAL	47
Pinewood nematode	Towards early warning detection methods	26 Jan 18	Lisbon, PORTUGAL	48

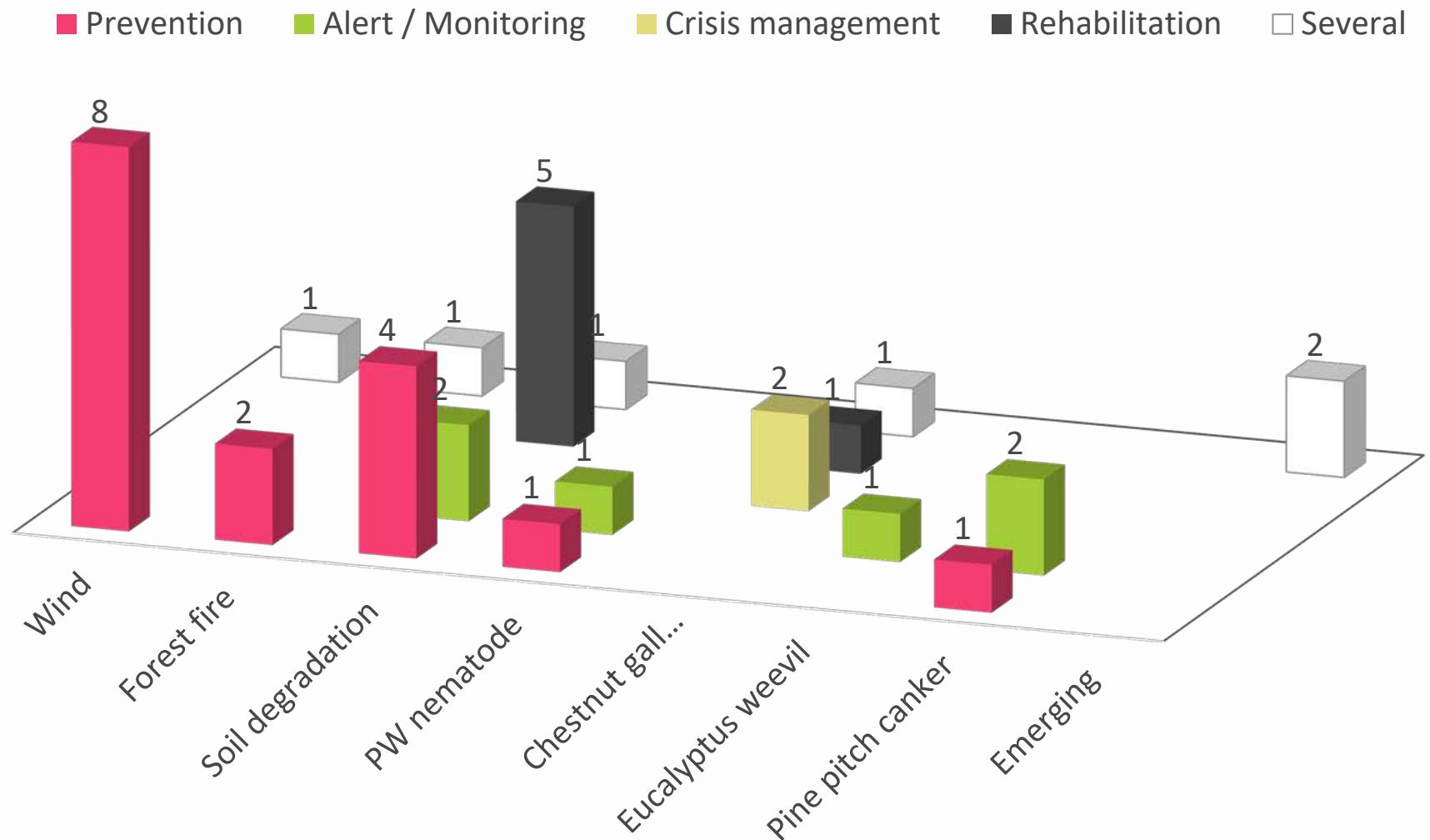
Tools

Specifically developed for the forest risk management plans

Risk	Tools (37)	Regions
Wind	9	Nouvelle-Aquitaine, Euskadi
Forest fire	3	Euskadi, Asturias, Galicia, Portugal
Soil degradation	12	Euskadi, Asturias, Galicia, Portugal
Pinewood nematode	2	Nouvelle-Aquitaine, Castilla y Léon, Portugal
Chestnut gall wasp	4	Castilla y Léon, Portugal
Eucalyptus weevil	2	Asturias, Cantabria, Portugal
Pine pitch canker	3	Cantabria, Portugal
Emerging pest and diseases	2	Nouvelle-Aquitaine, Euskadi, Portugal

Tools

Specifically developed for the forest risk management plans



Plans

Improve or create transboundary forest risk management plans

Risk	Plans
Wind	Nouvelle-Aquitaine: update Euskadi: new
Forest fire	Global: language and technical harmonization
Soil degradation	Global: update
Pinewood nematode	Global: update
Chestnut gall wasp	Global: update
Eucalyptus weevil	Global: update
Pine pitch canker	Global: update
Emerging pest and diseases	Global: update



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1. Wind

2. Forest fire

3. Soil degradation

4. Pinewood nematode

5. Chestnut gall wasp

6. Eucalyptus weevil

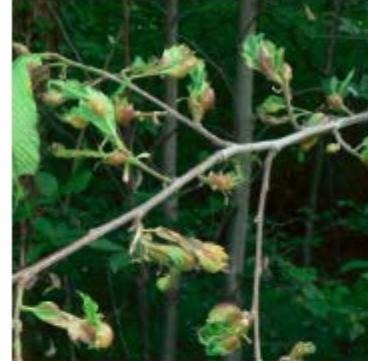
7. Pine pitch canker

8. Emerging pests & diseases

9. SilvAlert phone app

10. Conclusion and closure

Chestnut gall wasp



Eucalyptus weevil



Fusarium



Pinewood Nematode



Emerging pests and diseases



Forest fire



Soil degradation



Storms



Wind Risk

Nouvelle-Aquitaine and Euskadi

Barry Gardiner, Alejandro Cantero, Eduard Mauri, Hernan Serrano
León, Tommaso Locatelli, Christopher Poette and Dorain Cablat



European Forest Institute
– Atlantic European
Regional Office



Fundación Hazi
Fundazioa

Gestión del riesgo vendaval

Euskadi: herramientas

Two new tools are developed:
Wind Plans Synthesis and Local
Winds Maps (by WindNinja
software)

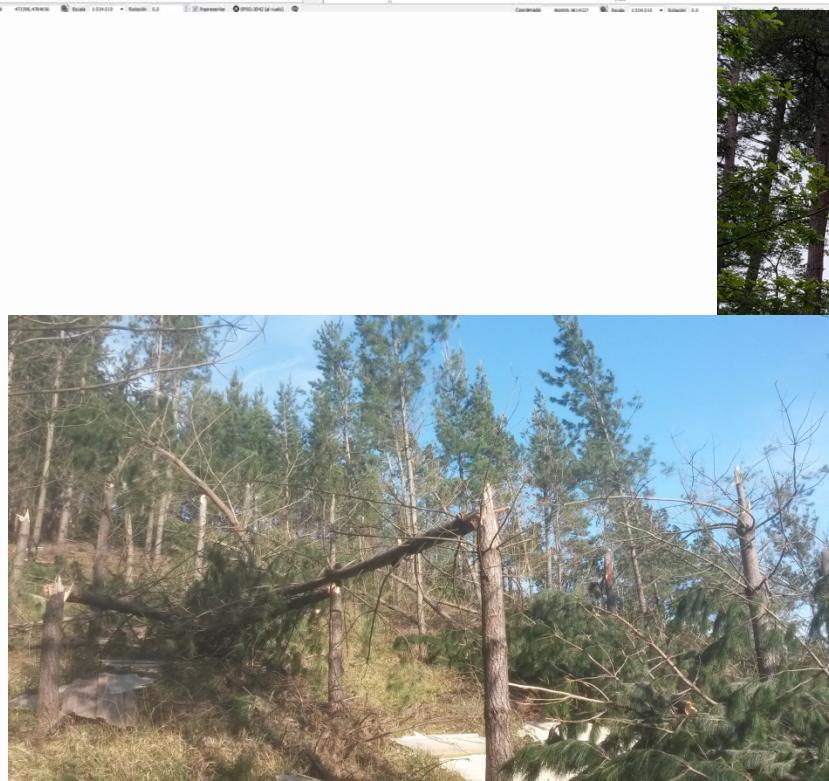
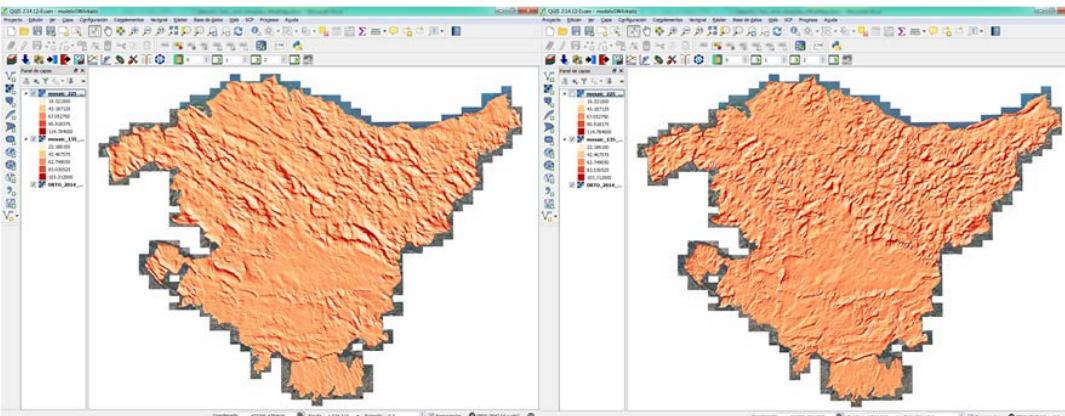


Síntesis de planes atlánticos de gestión del
riesgo de vendaval

EFI
Eduard Mauri

HAZI
Alejandro Cantero

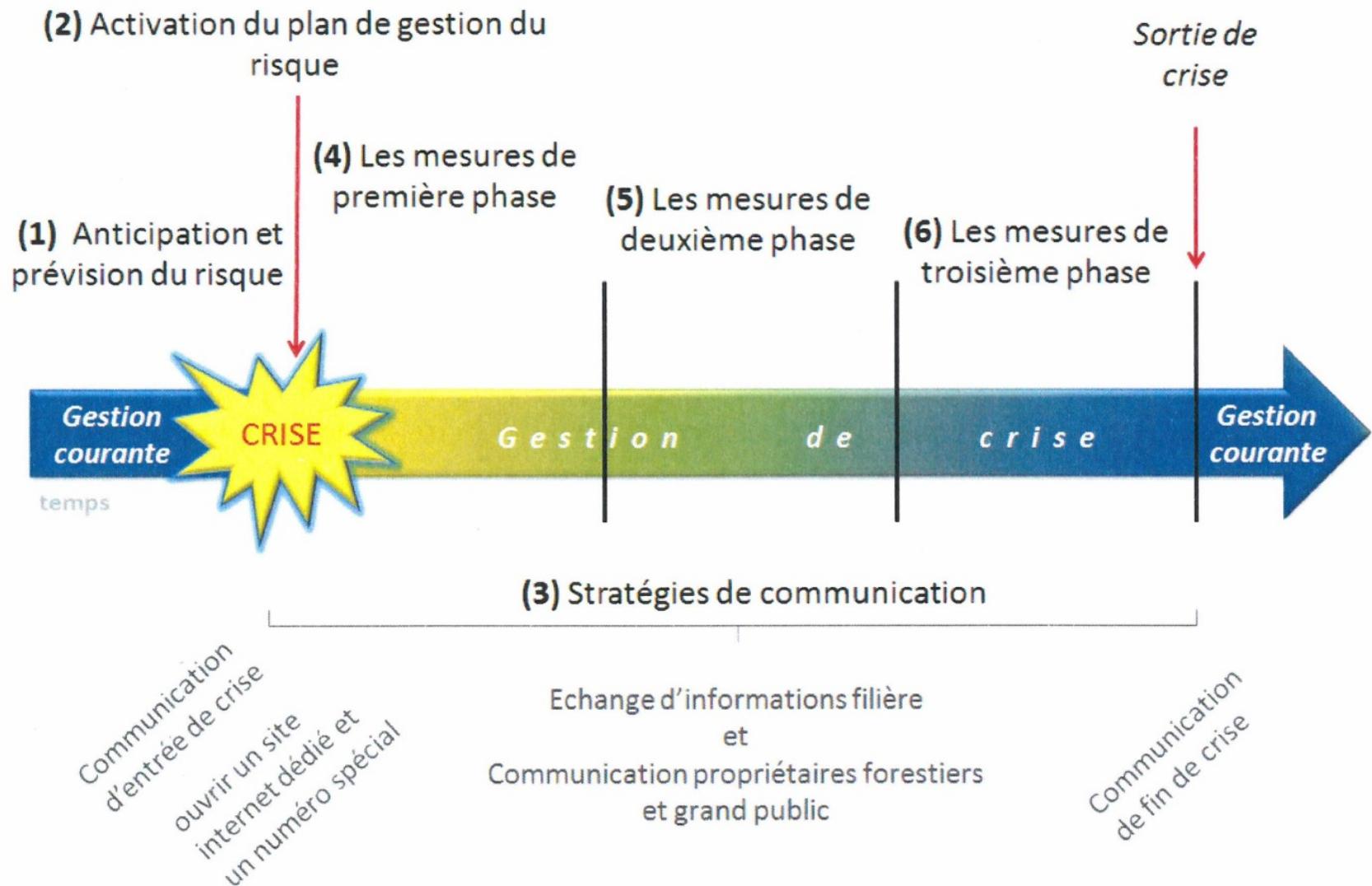
Mayo 2018



As a final result of the collaboration, it is expected to be able to use Basaize's results in the drafting of forest management plans

Gestión del riesgo vendaval

Euskadi: nuevo plan



Gestión del riesgo vendaval

Euskadi: nuevo plan

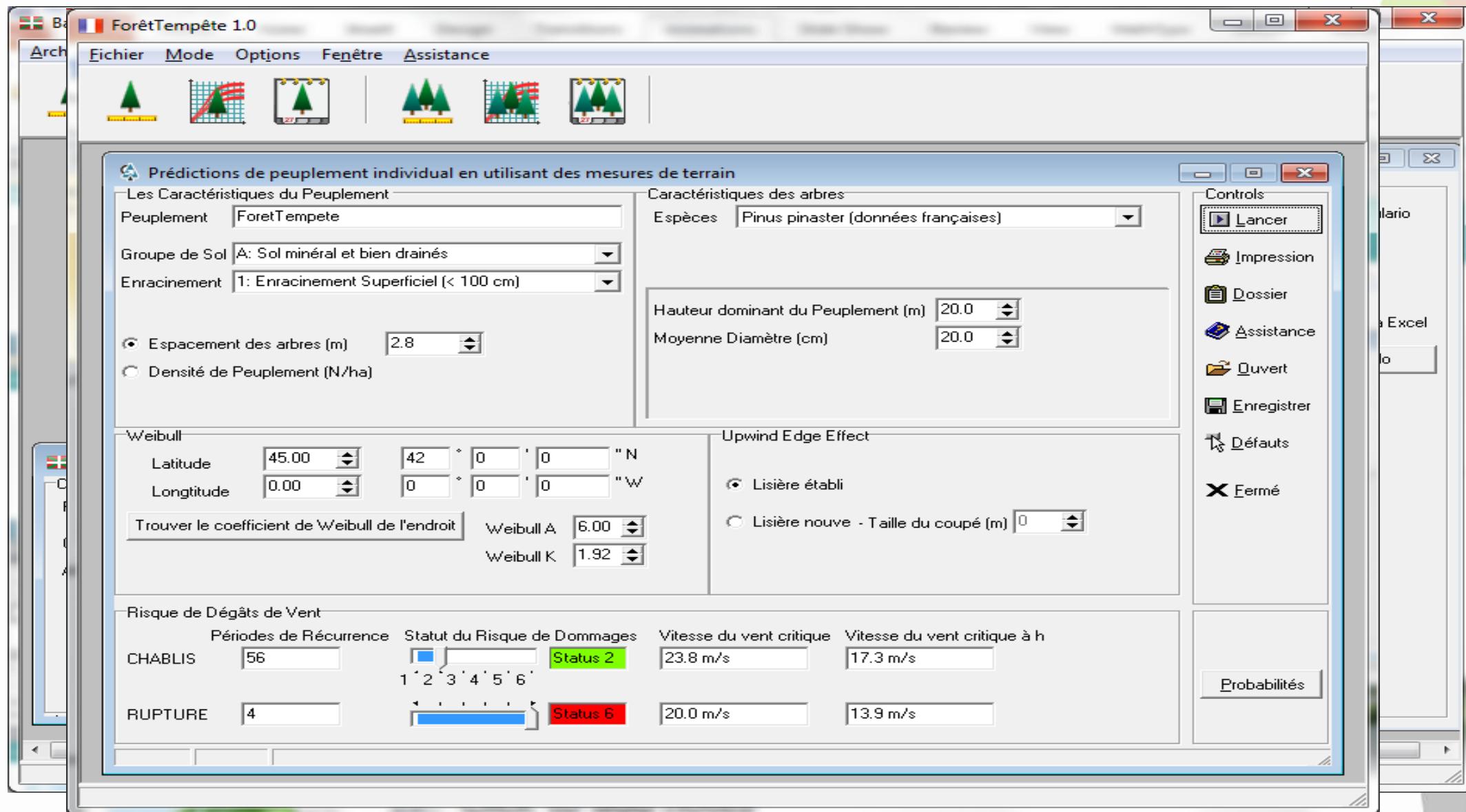
(4) **Medidas de primera fase:** evaluación del evento y ejecución de acciones de urgencia operacionales: desde justo después de la tormenta hasta que la población está segura y se restablecen los suministros básicos.

(5) **Medidas de segunda fase:** ejecución de medidas para salir rápidamente de la crisis y para reducir los riesgos secundarios derivados del vendaval tanto en el bosque como en la industria del sector forestal y de la madera.

(6) **Medidas de tercera fase:** ejecución de medidas para el retorno a la normalidad tanto del bosque como de la industrial del sector forestal y de la madera (rehabilitación).

Fin de la crisis: anuncio del fin de la crisis y evaluación de la experiencia.

ForêtTempête 1.1 and Basaize 1.1



ForêtTempête 1.1 and Basaize 1.1 in Excel

File Menus Home Insert Page Layout Formulas Data Review View Developer Add-Ins EasyER OffCAT Acrobat

All File Edit View Insert Format Tools Data Window Help

Calibri 12 B I U General % , .00 .00 A A

Toolbars

A1 fx Only enter data in the white cells. Leave other cells alone. Soil, Rooting, New Edge, Main Species, Species use Drop Down Menus (see Drop_Down_Values Worksheet for explanation). If you want more rows please copy all cells from Column A to DQ downwards. Make sure Enable Iterative Calculations is selected in Excel Options. Stand results

1 alone. Soil, Rooting, New Edge, Main Species, Species use Drop Down Menus (see Drop_Down_Values Worksheet for explanation). If you want more rows please copy all cells from Column A to DQ downwards. Make sure Enable Iterative Calculations is selected in Excel Options.

STAND													INDIVIDUAL TREE				STAND		
New Edge (0/1)	Gap Size	Main Species	Mean He	Mean Diam	N/ha	Thinning N/ha	Years from Thinning	Previous N/ha	Current Spacing	Previous Spacing	Species	Height	Diameter	Distance from Edge	uhBreak	uhOverturn	CWSBreak	CWSOver	
1	100	MP	7.4	10.1	2000	0	5	2000	2.24	2.24	MP	7.4	10.1	100	17.56	16.84	31.12		
1	100	SS	20	20	2000	0	0	2000	2.24	2.24	SS	25	25	100	9.71	11.35	19.22		
0	100	SS	13.4	20	3000	1500	5	4500	1.83	1.49	SS	13.4	20	100	34.99	32.72	76.51		
0	100	MP	16.1	25	2000	0	5	2000	2.24	2.24	MP	16.1	25	100	36.43	31.00	60.34		
0	100	MP	18.5	25	2000	0	5	2000	2.24	2.24	MP	18.5	25	100	31.37	28.99	49.43		
0	100	MP	21.5	28	2000	0	5	2000	2.24	2.24	MP	21.5	28	100	31.14	29.08	47.84		
0	100	MP	23.9	28	2000	0	5	2000	2.24	2.24	MP	23.9	28	100	26.68	26.49	39.44		
0	100	MP	25.7	30	2000	0	5	2000	2.24	2.24	MP	25.7	30	100	26.91	26.58	38.94		
0	100	MP	27.2	30	2000	0	5	2000	2.24	2.24	MP	27.2	30	100	24.15	24.64	34.48		
0	100	MP	27.8	30	2000	0	5	2000	2.24	2.24	MP	27.2	30	100	23.02	23.79	32.96		
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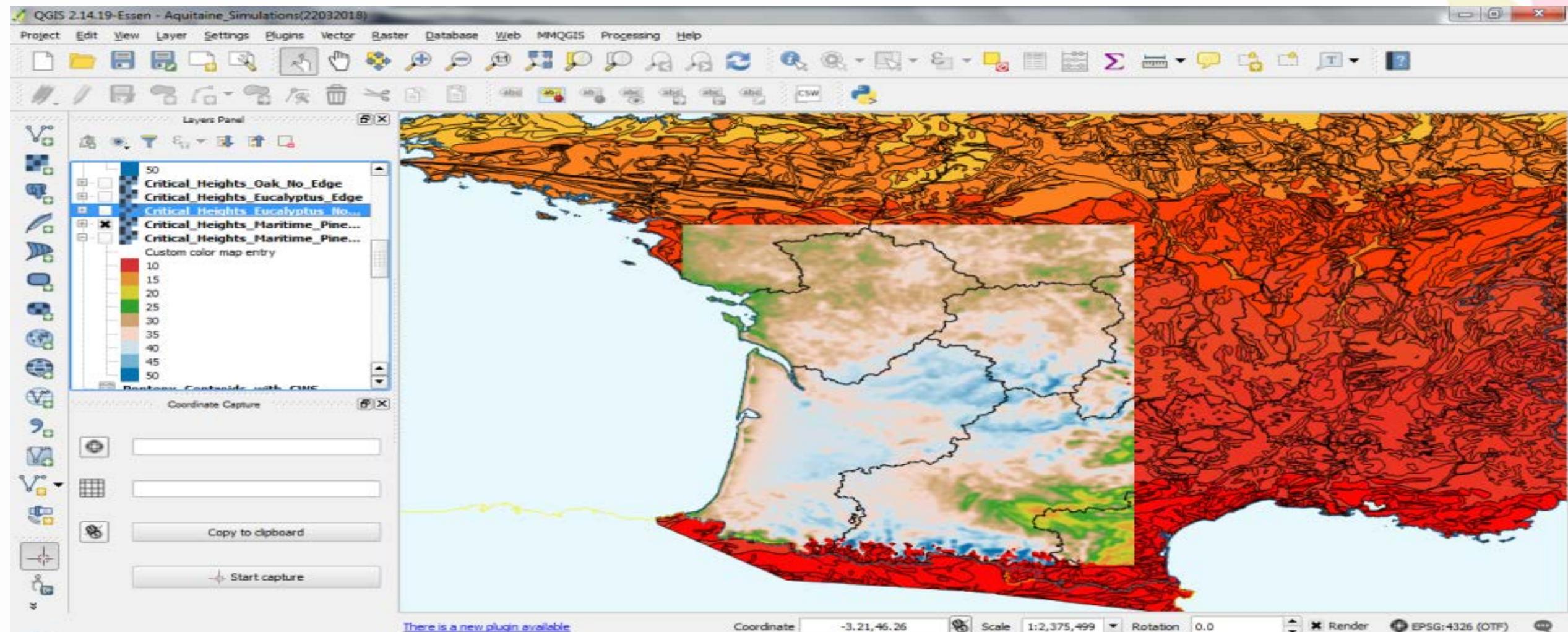
ForestGALES Tree_Parameters Drop_Down_Values

Ready Calculate

75% 09:04

Storm Risk Maps in GIS based on Wind Risk Model

Critical height and wind speed



ForêtTempête 1.1 and Basaize 1.1

Where we started

- Wind risk model for UK (ForestGALES) and Basaize 1.0 (FORRISK project)
- Single age, monospecific, stand level model

What is New?

- New tree pulling data added
- New species added
- New wind climate data included
- Model now works both for single trees and stands (allows complex silviculture)
- Models incorporated in GIS (still needs to be fully automated)

What will it be used for?

- Forest management support
- Regional planning

Storm Risk Workshops

Euskadi:
Nouvelle-Aquitaine:



Gestion du Risque Tempête

Nouvelle Aquitaine and next Euskadi

Principes généraux sur le risque tempête et la résistance des peuplements au vent

Recommandation à l'échelle des peuplements

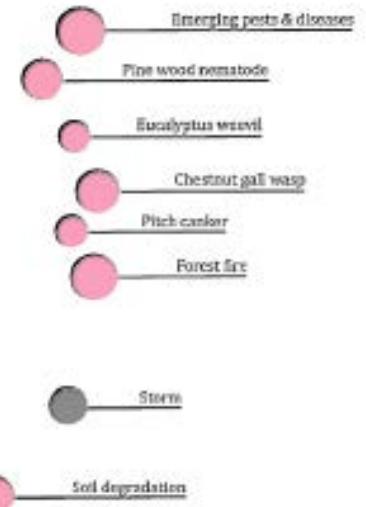
- Gestion forestière traditionnelle des principales essences
 - i Pin maritime
 - ii Douglas
 - iii Chêne
 - iv Peuplier
 - v Châtaignier
- Impact des différents choix de gestion
 - i Choix des espèces
 - ii Préparation du site
 - iii Qualité du drainage
 - iv Lisières
 - v Eclaircies
 - vi Coupes rases et durée des révolutions
 - vii Implantation des peuplements



Gestion du risque tempête en Nouvelle Aquitaine

Guide technique

Pour les aménageurs du territoire et les Aménagistes forestiers



Juin 2018

Version française

Plan de gestion du risque tempête Nouvelle-Aquitaine

Recommandations au plan (sections ajoutées, non publié)

- 1.1.0 Les outils de prévention par l'aménagement forestier
 - Modèles informatiques
 - ForêtTempête
 - ForêtTempête pour Excel
 - Guides techniques:
 - Guide technique pour la gestion du risque tempête en Nouvelle-Aquitaine
- 1.1.1 Prévisions météorologiques
 - Cartes de vulnérabilité des peuplements forestiers aux forts vents
 - ForêtTempête : carte des hauteurs critiques
 - ForêtTempête : carte des risques de dégâts

NEW!

IMPROVED!

Plan de gestion du risque tempête Nouvelle-Aquitaine

Recommandations au plan (sections ajoutées, non publié)

- 2.2 Cellule de crise
 - Création d'un comité international
 - Liste de contacts au Pays Basque espagnol
- 2.3 Communication
 - Communication à destination des pays frontaliers ou impliqués dans la mobilisation des bois

IMPROVED!

IMPROVED!



Forest Fire Risk Group

What has been done
& why we did it



What has been done & Why we did it

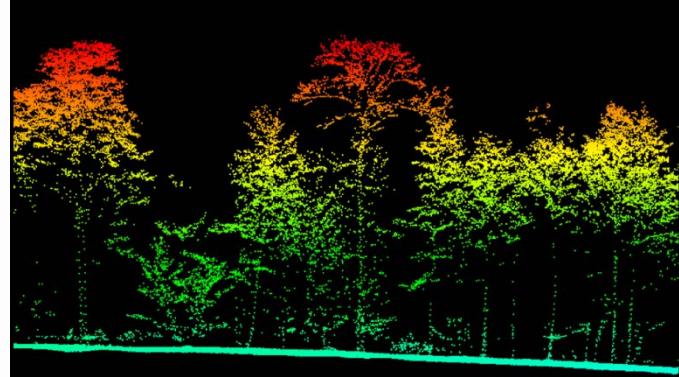
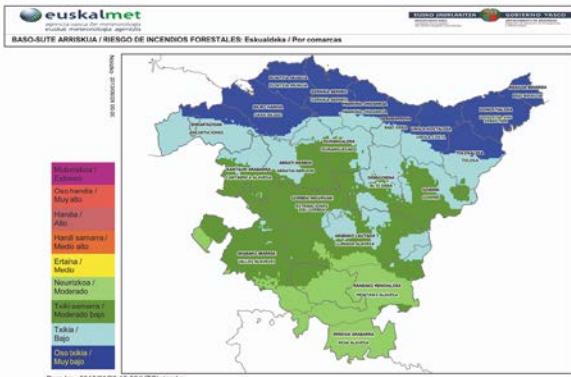
- Technical workshop “Fire behaviour software: a good tool for enhancing forest fire management plans”
 - Presentation of the different tools that each partner started to work with;
 - Presentation of the simulator TIGER (Italy);
 - Discussion about the potentialities of FARSITE and FLAMMAP;
 - Field Visit to Coruche (Portugal)



20 August 2018

What has been done & Why we did it

- “Plan de riesgo de incendio forestal en Galicia, Asturias, País Vasco y Portugal: Análisis y sugerencia de mejoras”
 - Leaded by Asturias team that developed a Plan for the Region;
 - Complemented by Galicia, Basque Country and Portugal;
 - Suggestions for transnational and transregional cooperation improvement.
 - Stakeholders Fire Simulators Inquiry.



20 August 2018

What has been done & Why we did it

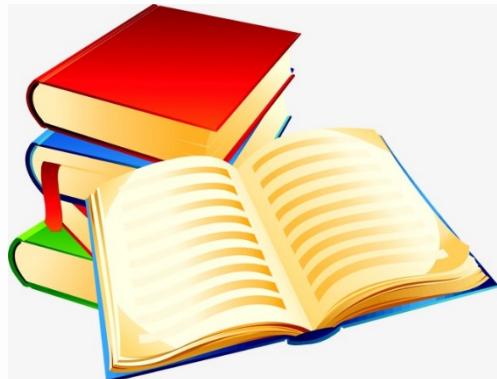
- Development of new tools

Best practice guidelines: *Fire risk plans – a common language for Iberian Peninsula*

Small Book with best practices concerning the risk components that should be taken in consideration when preparing a wildfire risk plan.

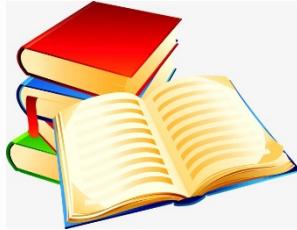
The book contents are:

- Introduction;
- Typology of past fires using historical records;
- Meteorology;
- Fuel Maps;
- Simulation tools;
- Environmental education and fire risk awareness;
- 4 case studies; Final remarks.

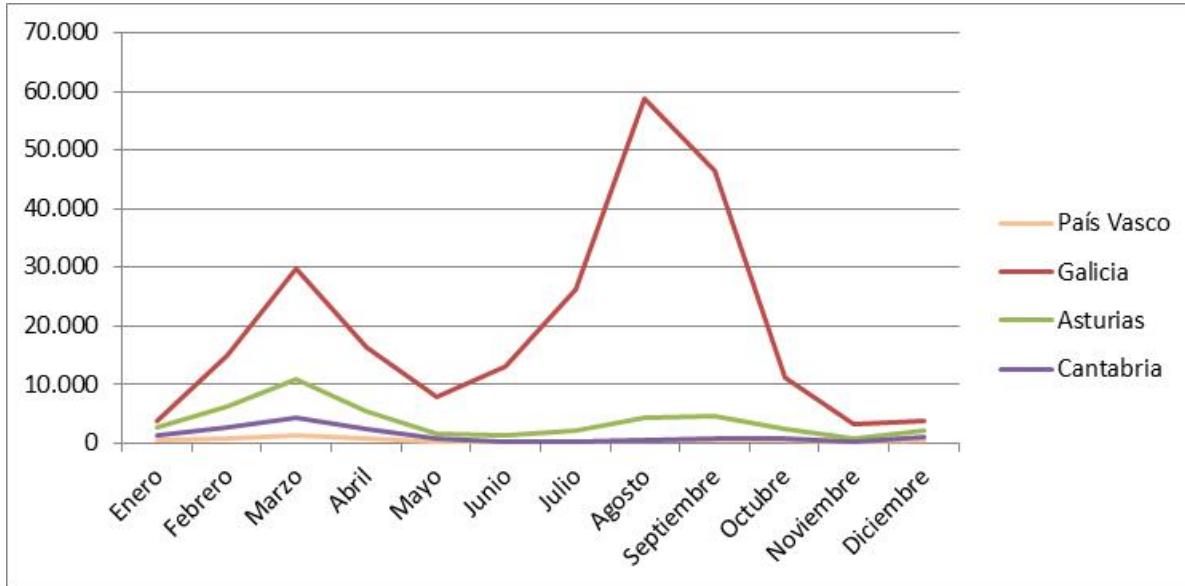


What has been done & Why we did it

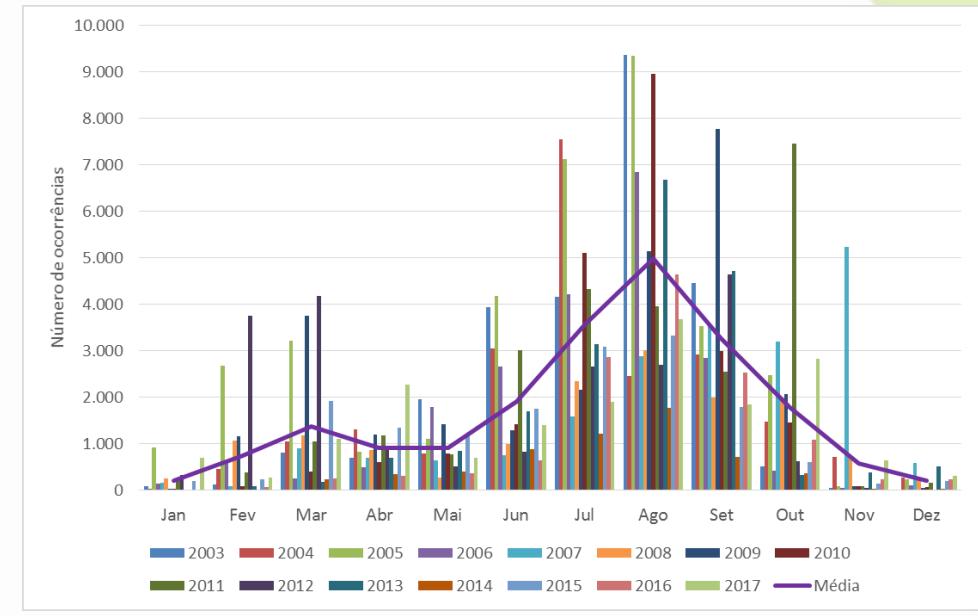
- Development of new tools



Best practice guidelines: *Fire risk plans – a common language for Iberian Peninsula*



Número total de incendios registrados según mes

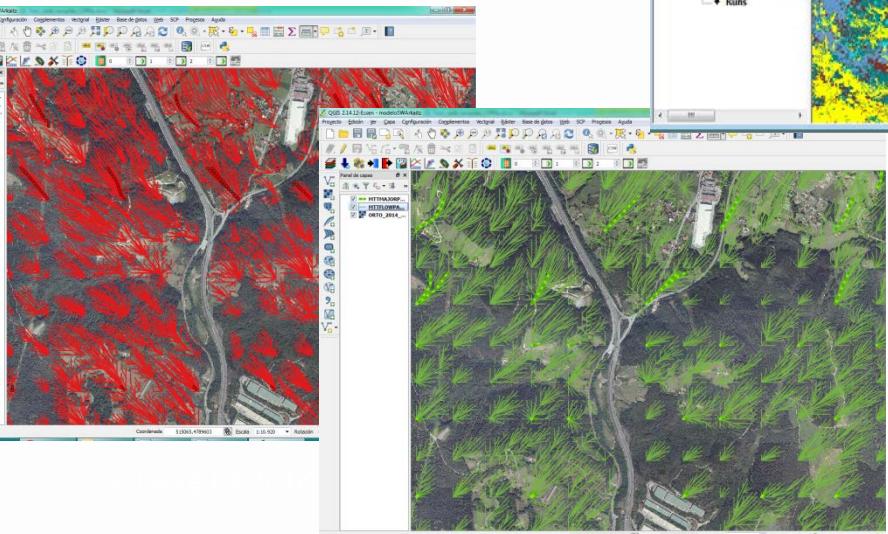


Número de ignições por mês (barras) para o período de 2002-2012 e a média mensal (linha).

Wildfire Risk Management

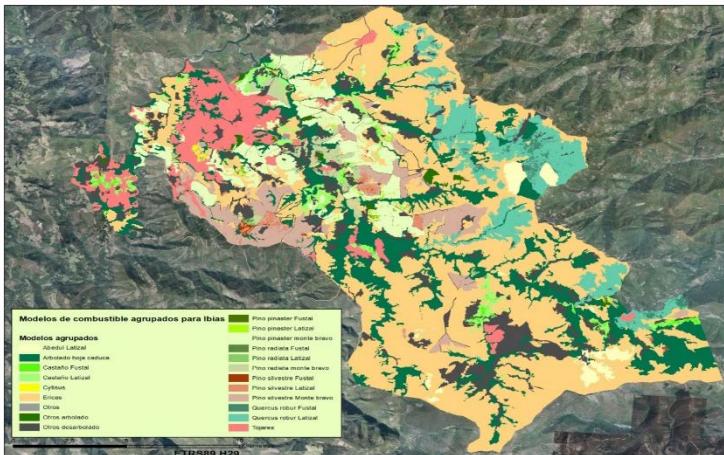
Euskadi

Two new tools are developed to facilitate the use of fire simulators: *Landscape Maps* by LiDAR flight 2012 (LCP file) and *Maps of areas of high fire risk in the Basque Country* (by WindNinja software)



As a final result of the collaboration, it is expected to be able to use fire simulators in the drafting of forest management plans and in the fight against forest fires

Thank you for your attention



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ssanchez@cetemas.es

acantero@hazi.eus

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).



Plan to manage the risk of soil degradation

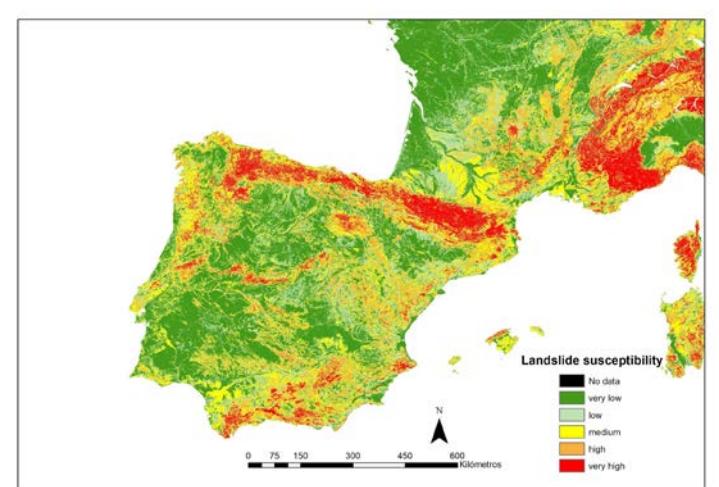
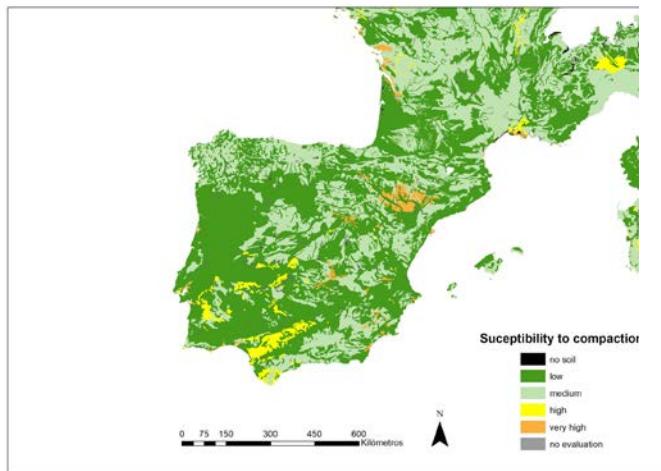
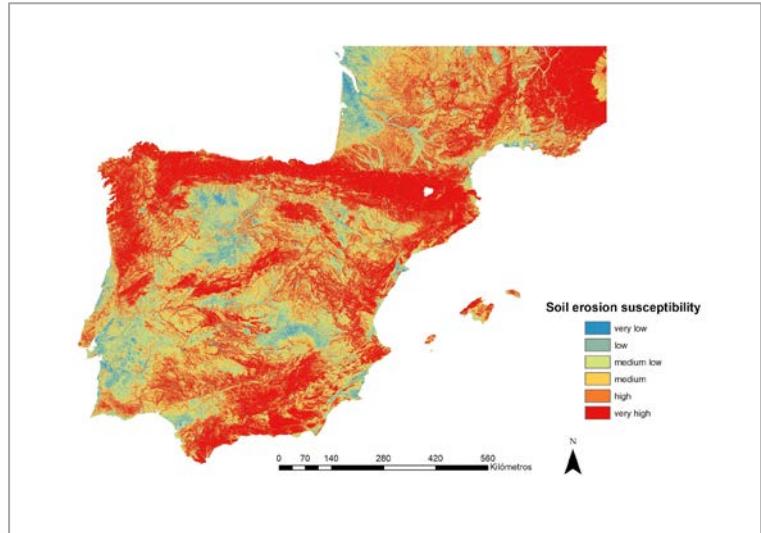
Focus for the plan

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

Risk assessment

Detection and Identification: Vulnerability

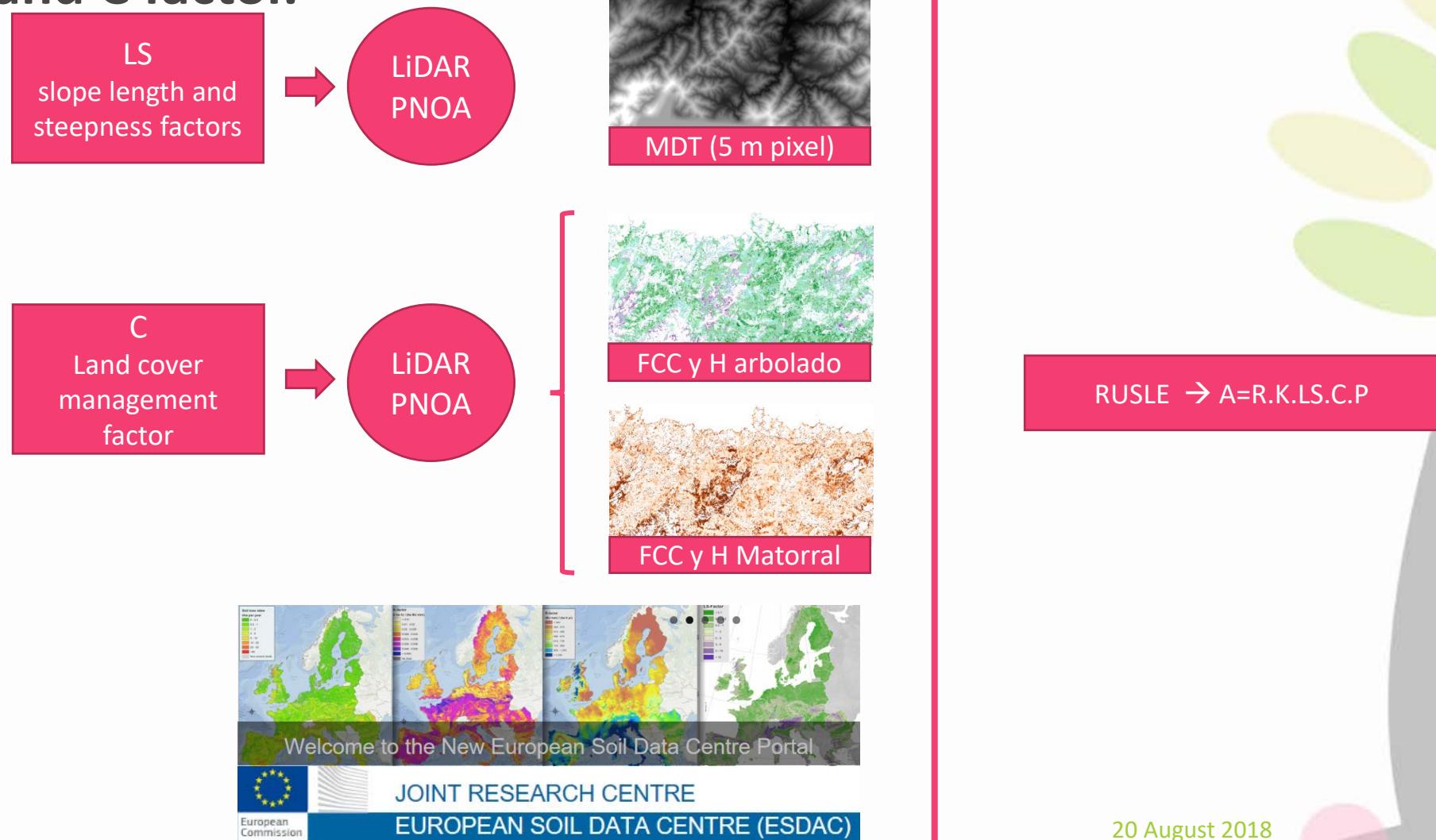
Water Erosion, Compaction and Landslides Susceptibility from JRC developed maps. Multi-Risk Assessment



Asturias and Basque Country are developing new tools with higher resolution .

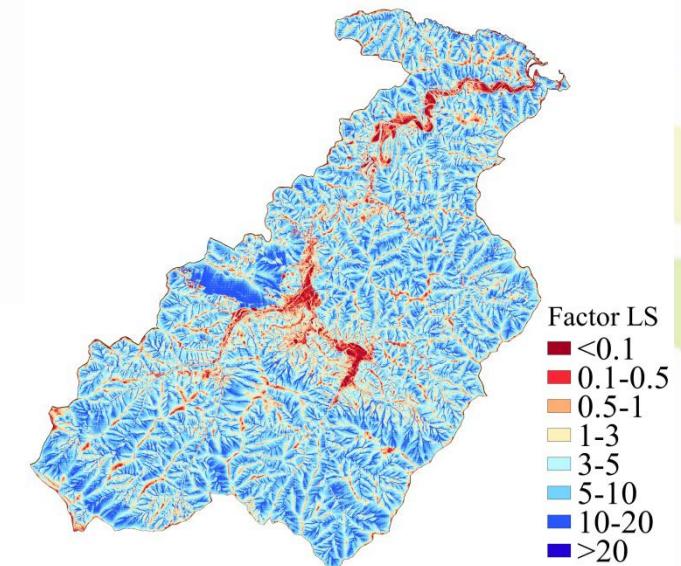
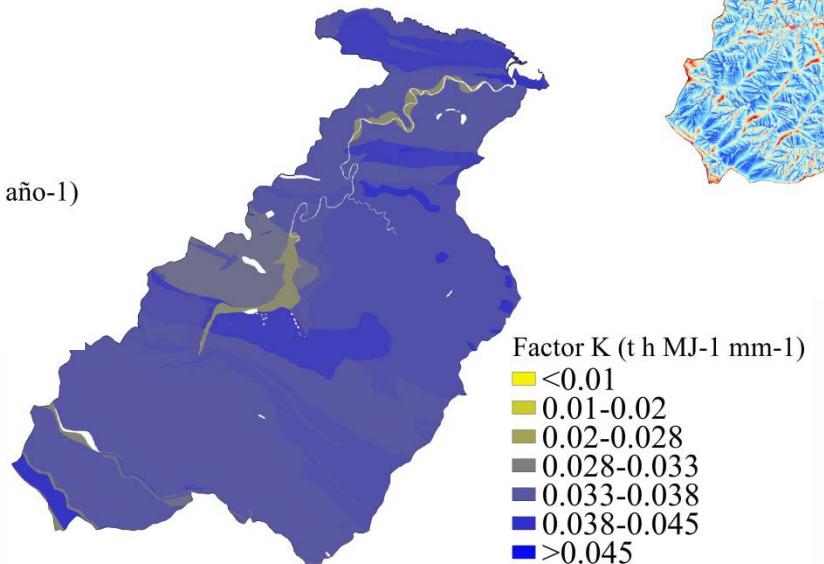
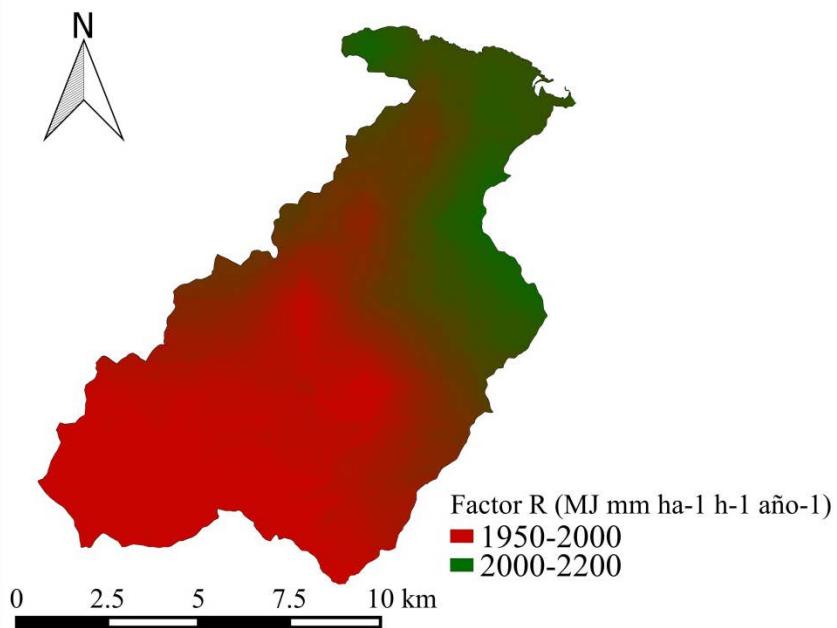
Risk assessment

Asturias: Development of soil erosion map. Use of LiDAR data to improve LS and C factor.



Risk assessment

Basque Country: Monthly rainfall erosivity and soil erodibility. Soil Compaction



Contingency plan

Prevention



Voluntary Guidelines
for Sustainable Soil
Management

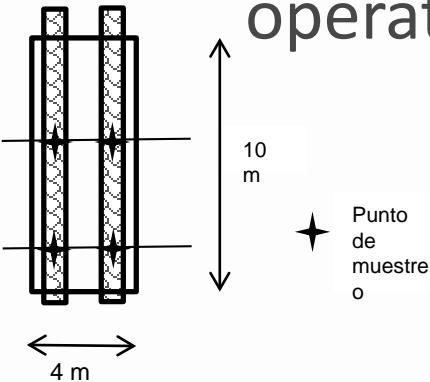


**GLOBAL SOIL
PARTNERSHIP**

Contingency plan

Prevention

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



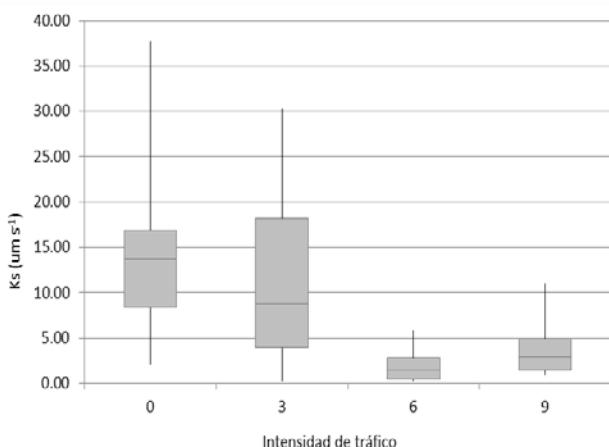
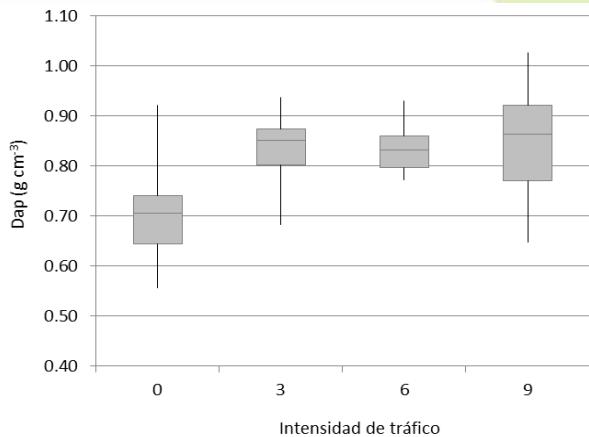
- The aim of this study was to evaluate the effects of forwarding on the hydrological properties of a high compaction-risk soil with a moisture content of almost 62%.
- A single-factor factorial design with three replications was used involving three traffic intensities of a Dingo AD6-24 forwarder (3, 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

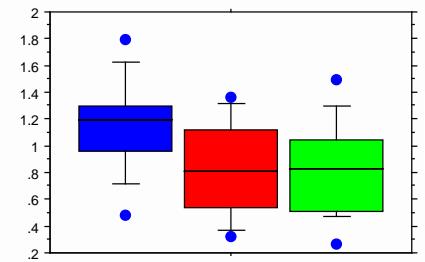
- Effects of forwarding on soil hydrological properties in thinning operation in northern Spain
- The results demonstrated that 3 passes of the forest machine are enough to significantly increase bulk density with successive passes having no additional effect.
- However, additional passes (6 or 9) significantly 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.



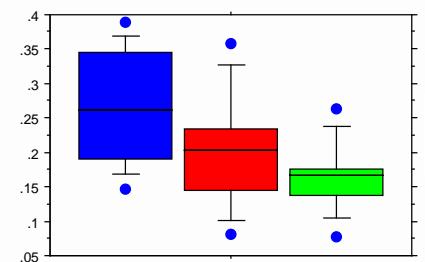
Contingency plan

Prevention

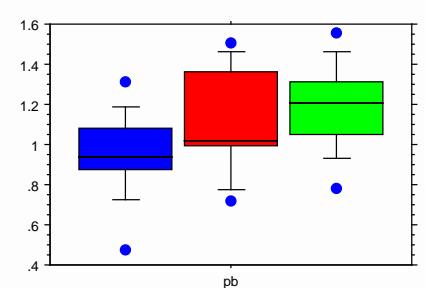
- Soil compaction and recovery after 15 years of mechanized final felling and site preparation



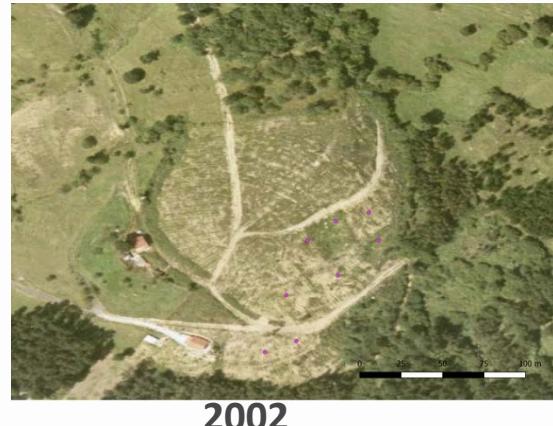
F-value= 3.69
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p<0.01



F-value= 3.92
p<0.05



2002



2008



2013



2016

Contingency plan

Surveillance

- Forest soil disturbance monitoring protocol. App to gather information easily.

Evaluación de transectos					
Evaluador Nahia	Fecha evaluación 06/08/2003	Código identificación Xaibikolanda2	prescripción Manual		
Superficie Plantación (ha) ,454	Distancia entre transectos (m) 12	Punto de comienzo 20 %	pendiente máxima permida de subsolado <30 %		
distancia entre puntos (m) 5					
pendientes medidas grados	prescripción Manual	plantada	suroos con pendientes todas		
Perturbaciones total de puntos porcentaje perturbación Limite inferior Limite superior	22 55 40 33,2 46,8	Compactación total de puntos porcentaje compactación Limite inferior Limite superior	2 55 4 1,0 7,0	Suelos desplazados total de puntos porcentaje desplazamiento Limite inferior Limite superior	15 55 27 20,8 33,2
remoción del mantillo total de puntos porcentaje mantillo Limite inferior Limite superior	17 55 31 24,5 37,5	Huellas de maquinaria total de puntos porcentaje huellas Limite inferior Limite superior	4 55 7 3,2 10,8	Zonas amplias sin MO total de puntos porcentaje zonas sin MO Limite inferior Limite superior	1 55 2 2,0 2,0
suroos totales suroos no permitidos suroos todas		pendiente media (%)		Decapados total de puntos porcentaje decapado Limite inferior Limite superior	0 55 0 0,0 0,0
				media de pendientes	



Contingency plan

Surveillance

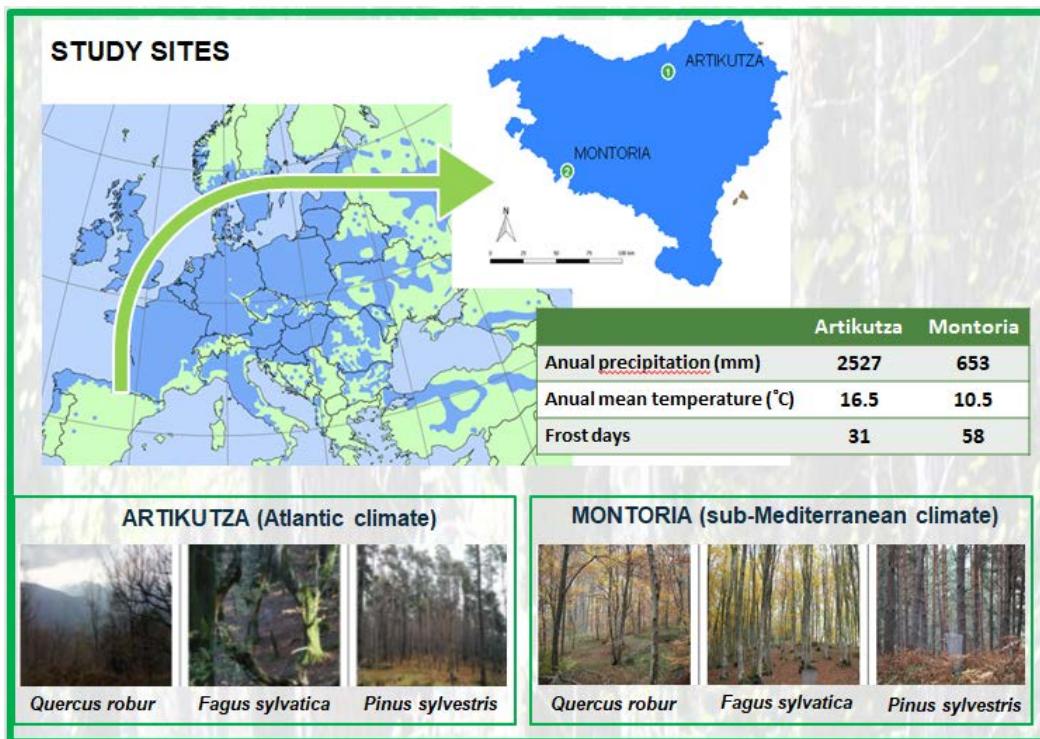
- System for soil quality monitoring in Forest Plantations.
- Establish soil reference sites representative from biogeoclimatic conditions.
- Indicators for soil conditioning at reference values and after different silvicultural treatments.
- In situ assessment of disturbances associated with compaction and erosion



Contingency plan

Surveillance

- 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.

Contingency plan

Rehabilitation

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



Straw mulch: 66-95%



Bark brands: 86%



Log barriers: 26%



Seeding, 0-19%

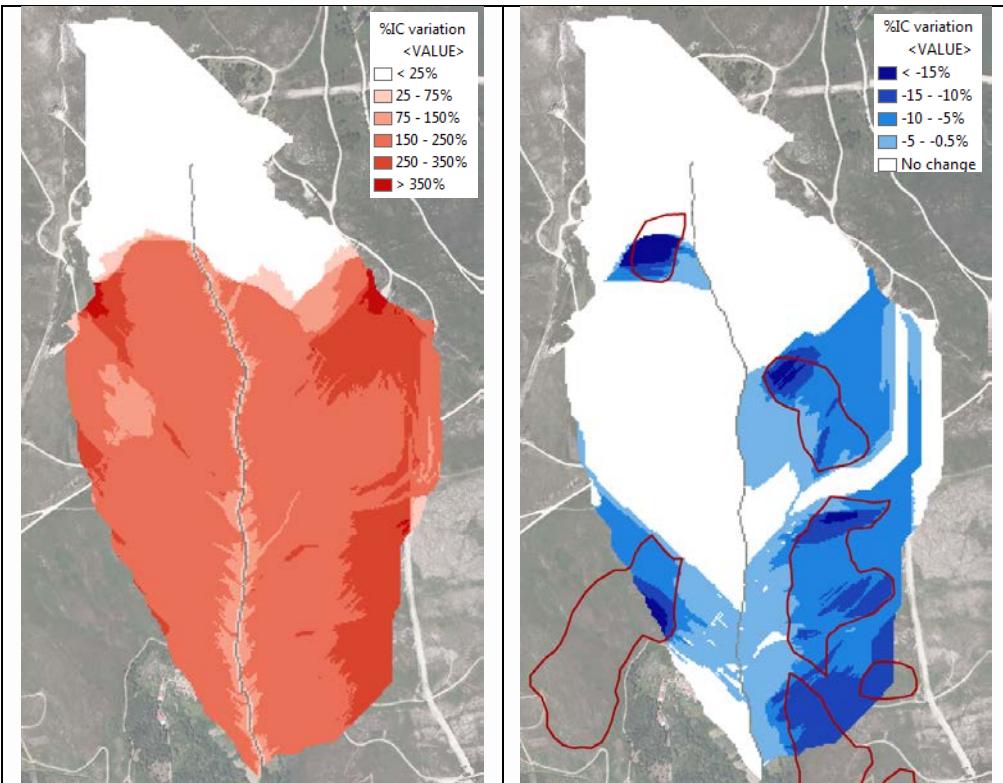
Soil erosion is a major consequence of forest fires in the North of the Iberian Peninsula.

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

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

- 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 quantitative information on the effect of mechanical shredding on soil coverage, soil compaction and soil erosion.





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



Pine wood nematode

PWN

Bursaphelunchus xylophilus

Insect vector

Pine sawyer beetle (PSB)

Monochamus galloprovincialis



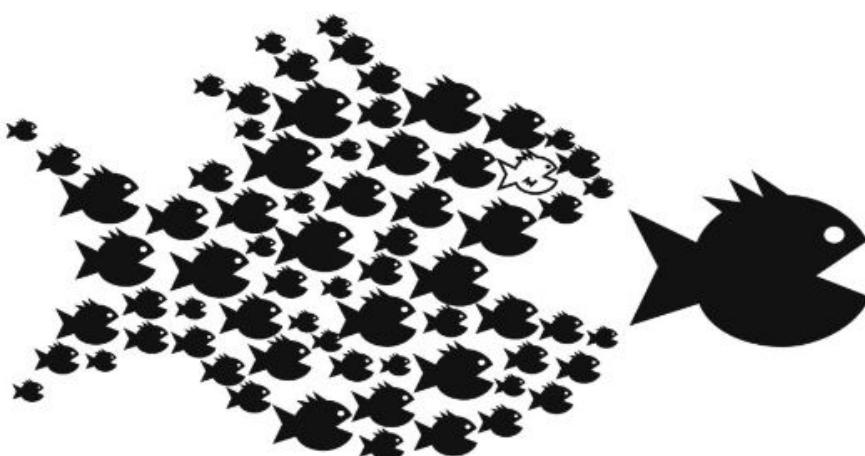
E. Sousa, P. Naves, L. Bonifacio, J. Casado, J.C. Samalens, T. Ferreira
E. Mauri, C. Orazio, H. Jactel



Process of collective action

- **Objective:** Defining research priorities to improve PWN risk management
- **Method:** Dialogue between scientists and tree health managers
 - Stakeholders' needs and expectations
 - Scientist's knowledge and vision
 - Transboundary cooperation

through interviews and workshops



Research priority for PWN risk management

- Early warning detection in areas at risk
- 2 methods to be improved:
 1. Field detection of symptomatic trees
 - Official method (EU regulation)
 - Often few and isolated
 - Non-specific symptoms
 2. Pheromone trapping of insect vectors
 - Recommended by EU regulation
 - Where ? Defining priority areas of deployment
 - How many (cost)? Optimizing the density of traps

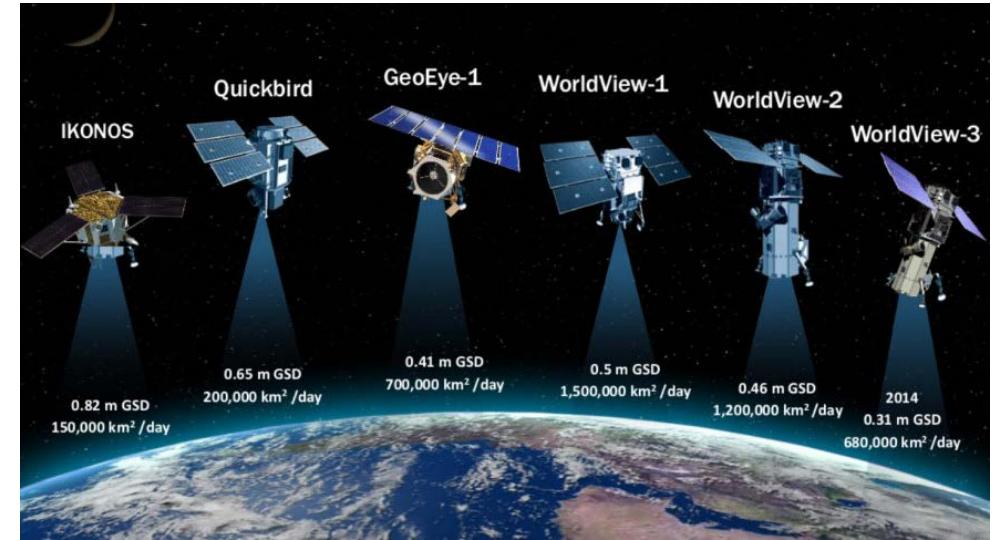
WHEN YOU
PRIORITIZE,
ALL THE
IMPORTANT STUFF
GETS DONE.

1. Aerial survey of pine forests for early warming detection of PWN infected trees

1.1. Use of satellite images

Pros

- Cover large areas
- Easy to program and obtain
- Large array of satellites
w. various image resolution and colors



Cons

- Size of the pixel > individual tree crown area
- Weather conditions
- Image cost

1. Aerial survey of pine forests for early warming detection of PWN infected trees

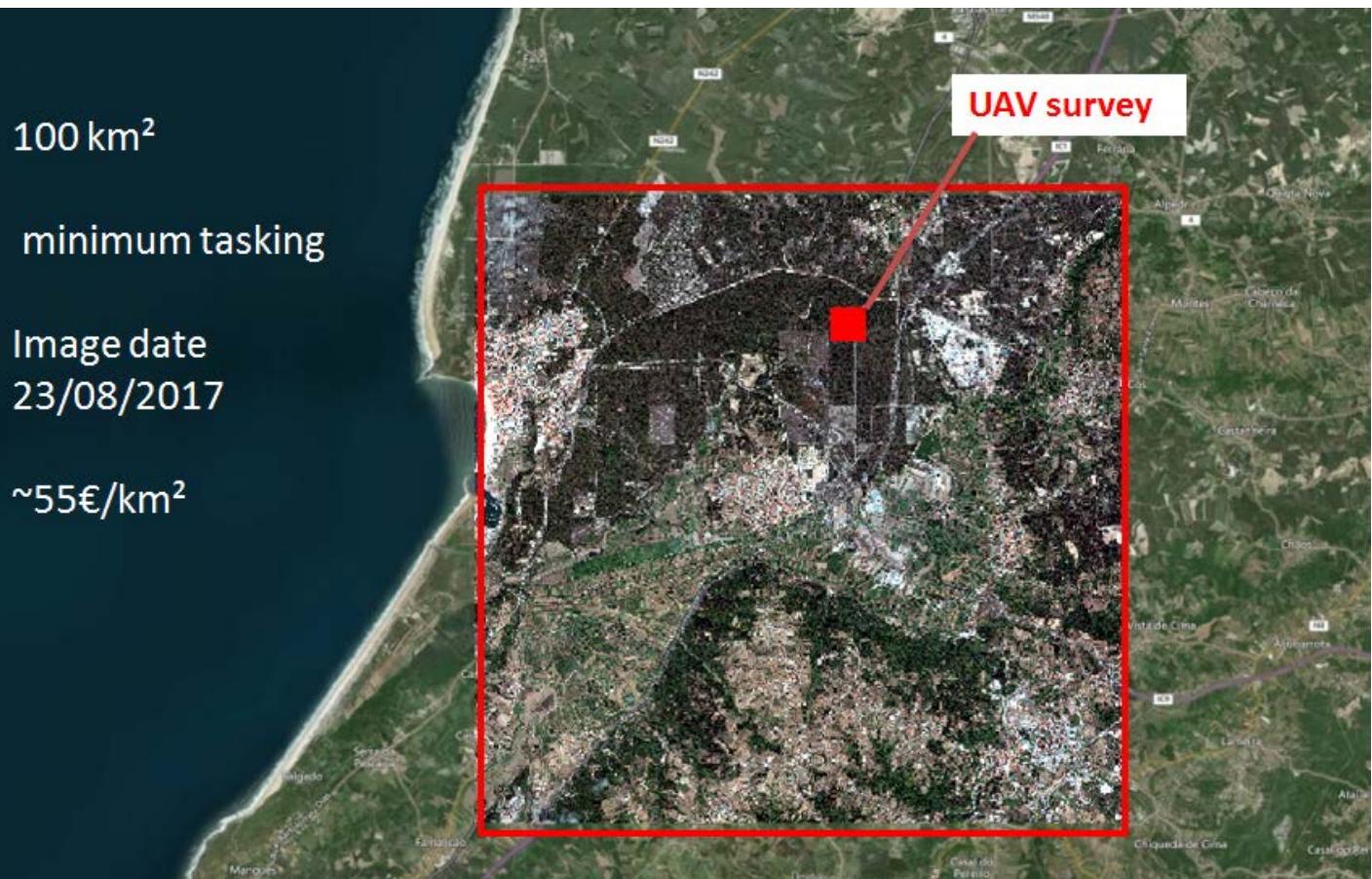
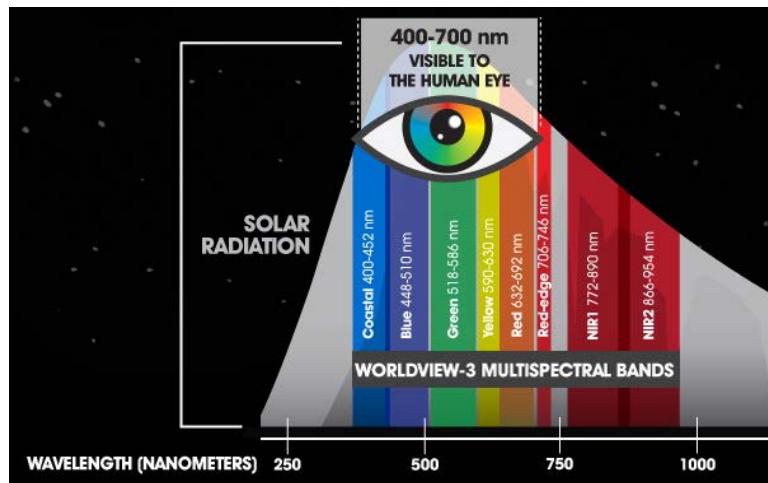
1.1. Use of satellite images

Experiment

Nazaré Pine Forest

WorldView satellite

Very high resolution image (31cm)

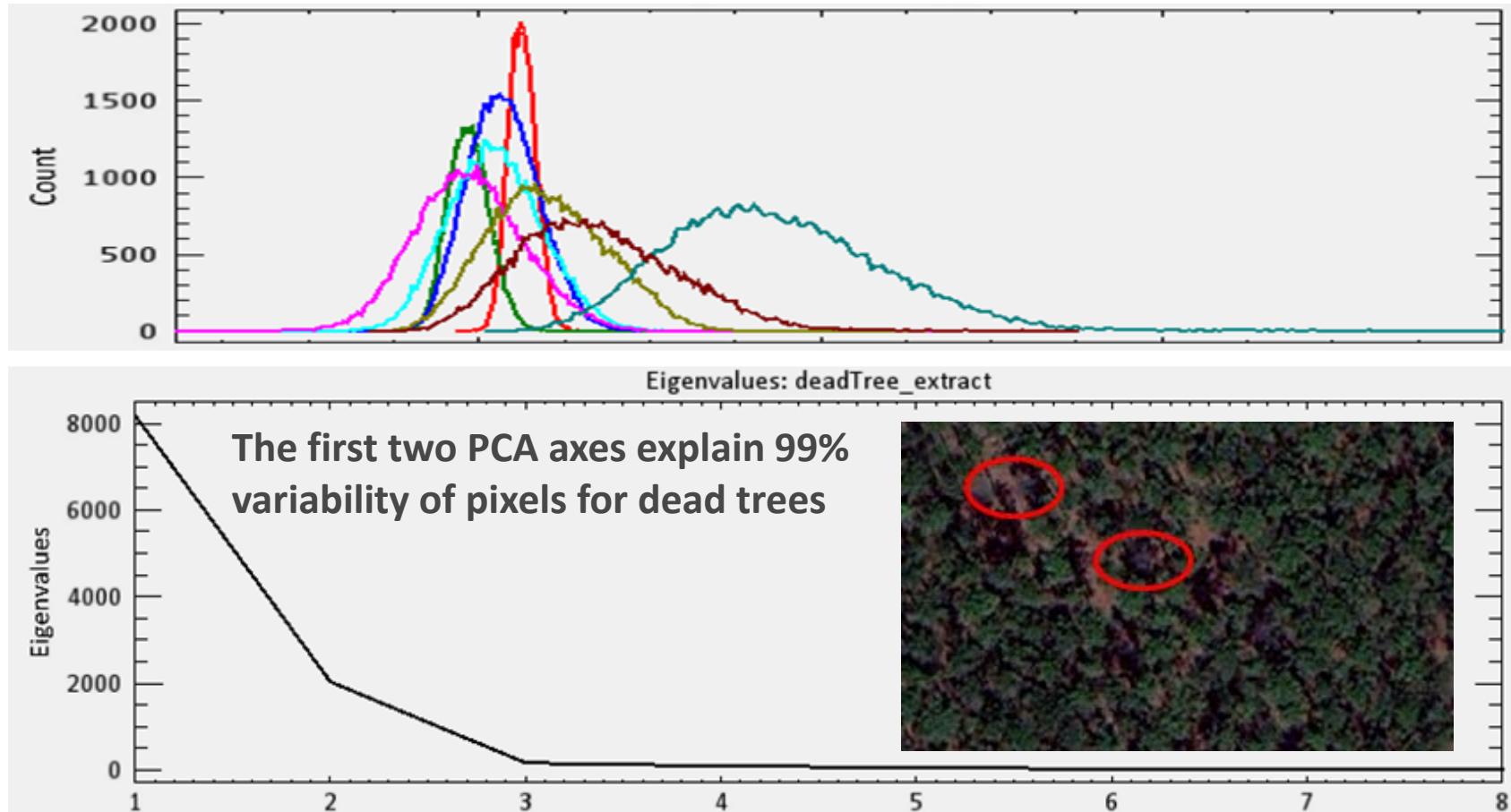


1. Aerial survey of pine forests for early warming detection of PWN infected trees

1.1. Use of satellite images

Experiment

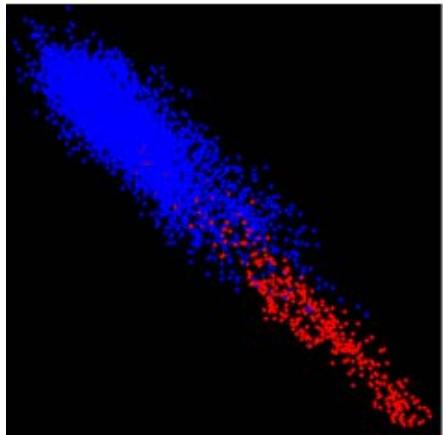
Identification of specific spectral combination (PCA) for symptomatic trees observed in the field in August



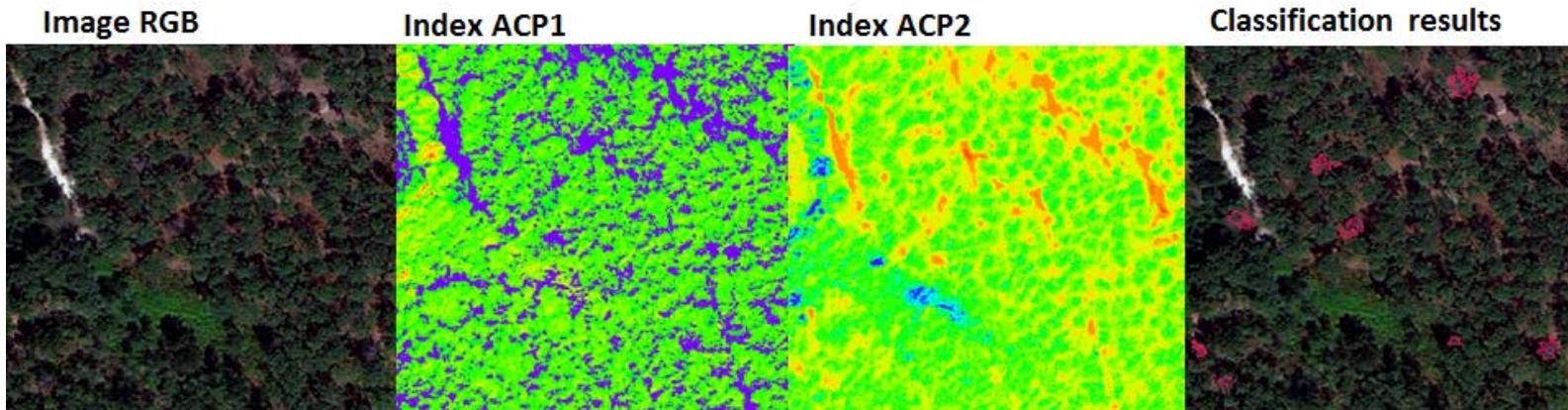
1. Aerial survey of pine forests for early warming detection of PWN infected trees

1.1. Use of satellite images

Experiment

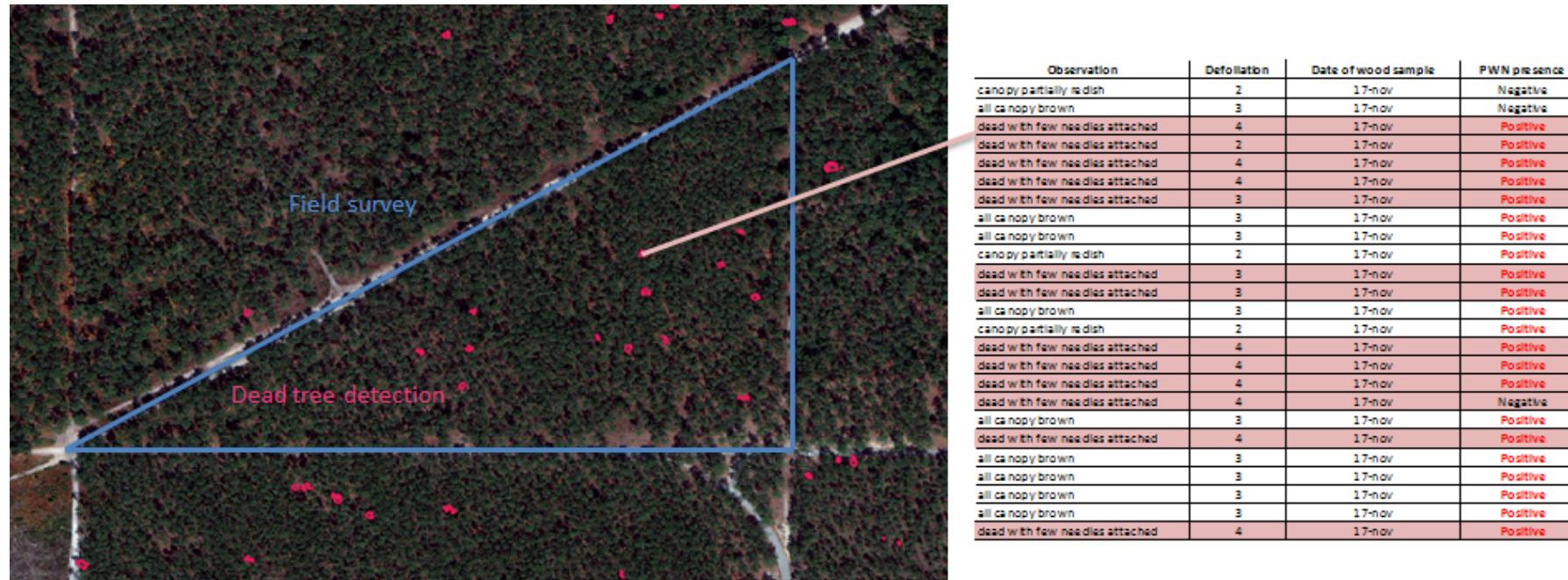


- Dead tree
- Healthy tree



1. Aerial survey of pine forests for early warming detection of PWN infected trees

1.1. Use of satellite images

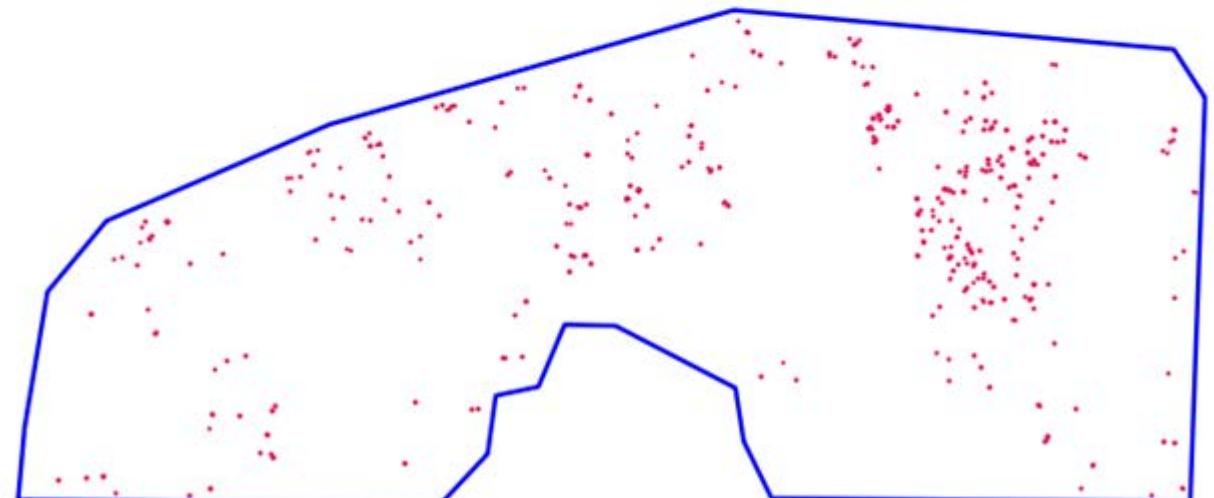


- The 13 dead trees detected on August satellite images were also inventoried in the field in November
- Obviously, no difference were found between dead trees damaged or not by PWN
- No particular spectral signature could be identified for the early detection of PWN symptoms
- No omission and no over detection of isolated dead trees -> promising results

1. Aerial survey of pine forests for early warming detection of PWN infected trees

1.1. Use of satellite images

437 isolated dead trees
could be further mapped
at larger scale (ca. 1500ha)



1. Aerial survey of pine forests for early warming detection of PWN infected trees

1.2. Use of drone (UAV) images

Assessing very high resolution UAV imagery for monitoring forest health during a simulated disease outbreak

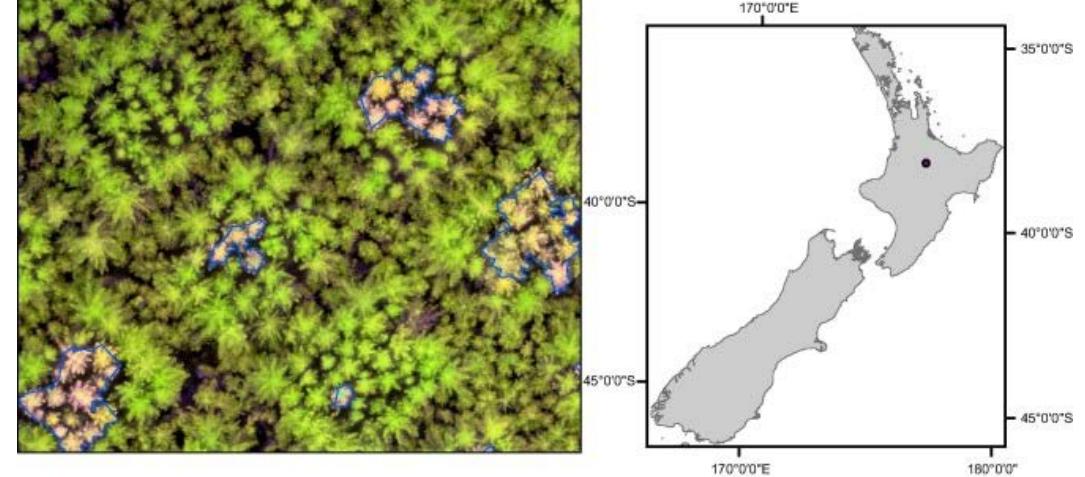
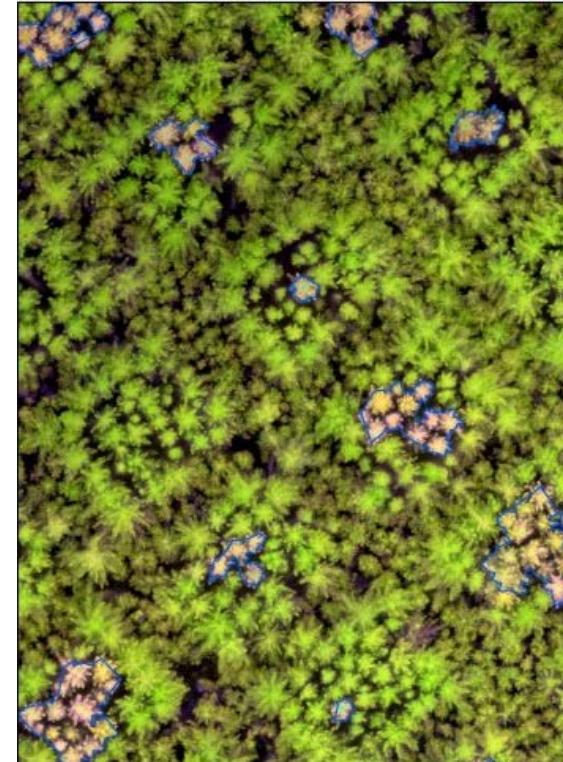
Jonathan P. Dash ^{a,*}, Michael S. Watt ^b, Grant D. Pearse ^a, Marie Heaphy ^a, Heidi S. Dungey ^a

Pros

- Accuracy (small pixels)
- Hovering flights
- Embarked multi/hyperspectral cameras

Cons

- Cover small areas
- Weather conditions
- Experienced pilots



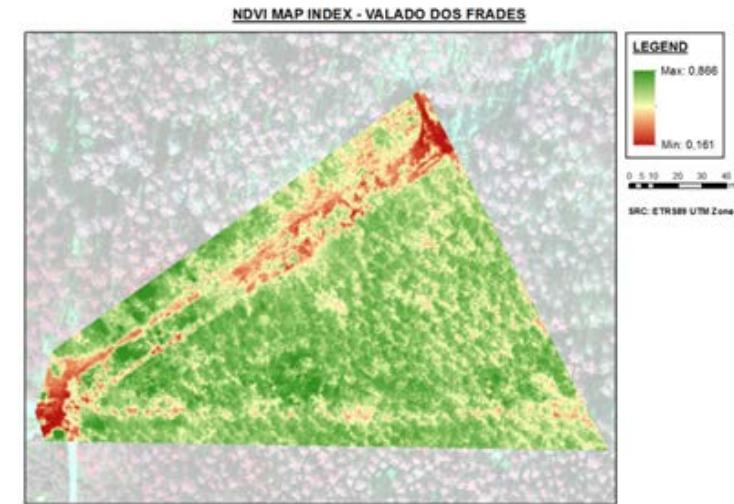
1. Aerial survey of pine forests for early warming detection of PWN infected trees

1.2. Use of drone (UAV) images

Experiment

Site

Mata Nacional Vimeiro. Valado dos Frades
Area: 6 ha Pinus pinaster
Age: 49-67 years, height 25 m



Remote sensing (December 2017): TRAGSATEC

Platform: eBee drone
Multispectral camera red-edge (IR)
Vegetation index, Individual crown segregation



Field survey (December 2017): INIAV

Symptomatic trees
Presence of PWN (at the lab)

1. Aerial survey of pine forests for early warming detection of PWN infected trees

1.2. Use of drone (UAV) images

Experiment



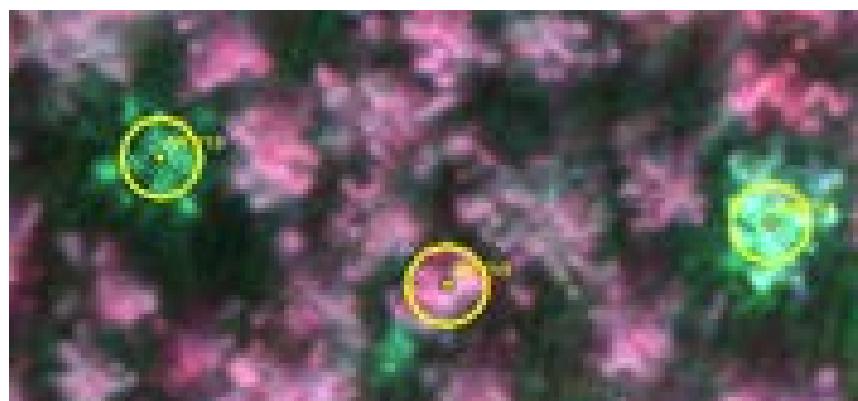
20 trees: 9 asymptomatic
+ 11 symptomatic (9 PWN infected)
10 trees to build the model
10 trees to test the prediction

Model

cct in chlorophyll_a as predictor of tree physiological status
< 1mg/g chloro_a as threshold for decay
cct chloro_a estimated with red edge absorption RE
Logistic regression: infected vs. not infected = f(RE)

Model testing:

100% true positive symptomatic
100% true negative asymptomatic



2. Field survey of insect vectors with pheromone traps for early warming detection of PWN establishment

2.1. Current strategy

Standardized pheromone trapping system



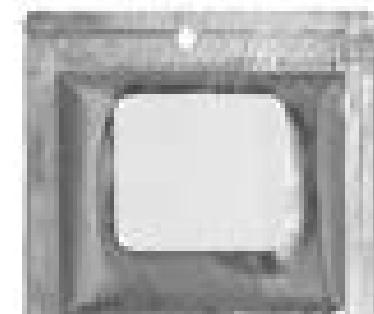
SEDQ

Healthy
crops
in our
hands

FABRICANTE Y PROVEEDOR:
SEDQ
Sociedad Española
de Desarrollos Químicos S.L.

Galloprotect Pack

Use in mass trapping of the pine sawyer
Monochamus galloprovincialis



JOURNAL OF APPLIED ENTOMOLOGY

J. Appl. Entomol.

ORIGINAL CONTRIBUTION

Combining pheromone and kairomones for effective trapping of the pine sawyer beetle *Monochamus galloprovincialis*

G. Álvarez¹, D. Gallego², D. R. Hall³, H. Jactel^{4,5} & J. A. Pajares¹



Agricultural
and Forest
Entomology

A novel, easy method for estimating pheromone trap attraction range – Application to the pine sawyer beetle, *Monochamus galloprovincialis*

Hervé Jactel ^{1*}, Luis Bonifacio ², Inge van Halder ¹, Fabrice Vétillard ¹, Christelle Robinet ³, Guillaume David ^{1,4}

Effective attraction radius = 100m

2. Field survey of insect vectors with pheromone traps for early warming detection of PWN establishment

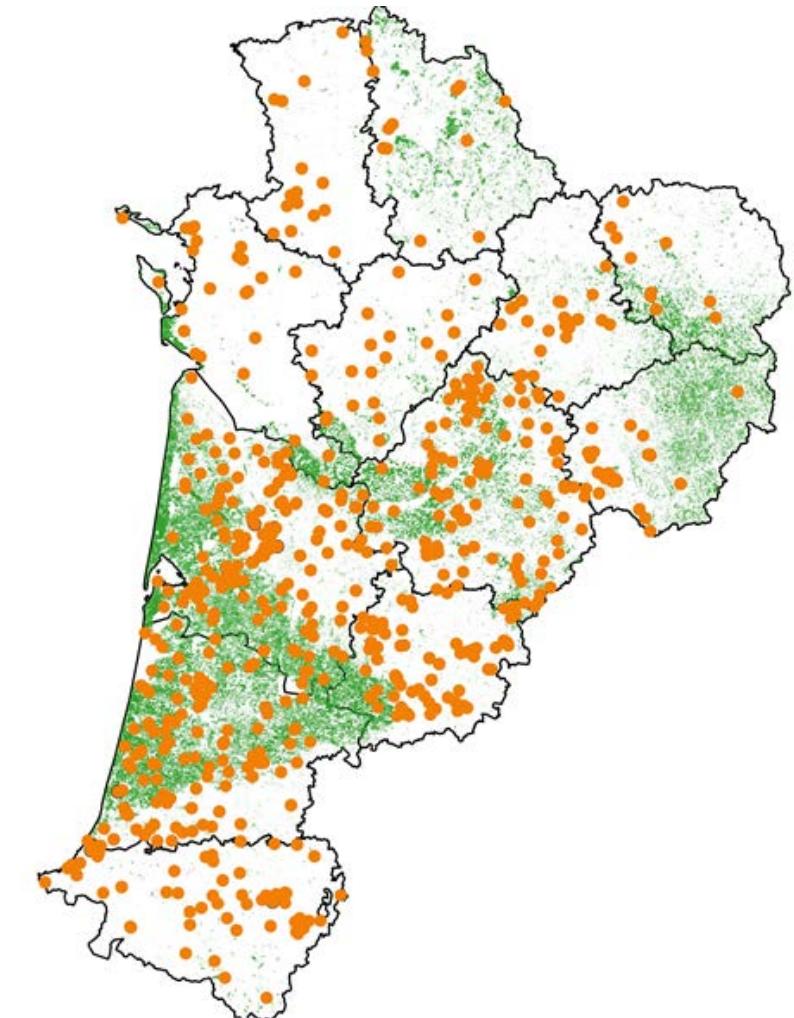
2.1. Current strategy

Focus on areas at risk:

Burnt or wind damaged forests

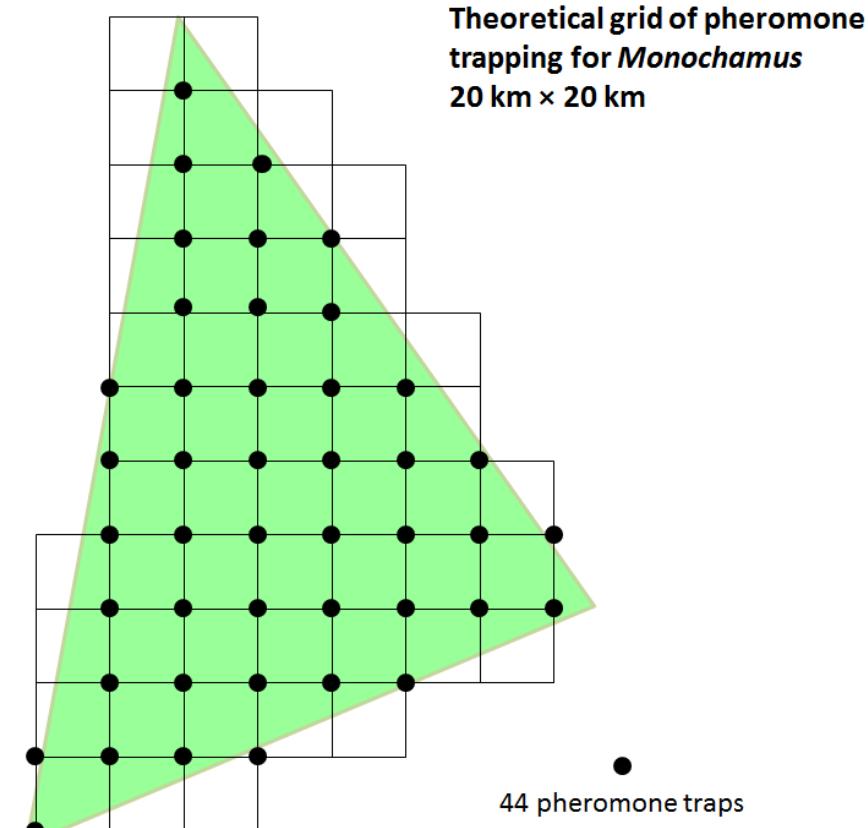
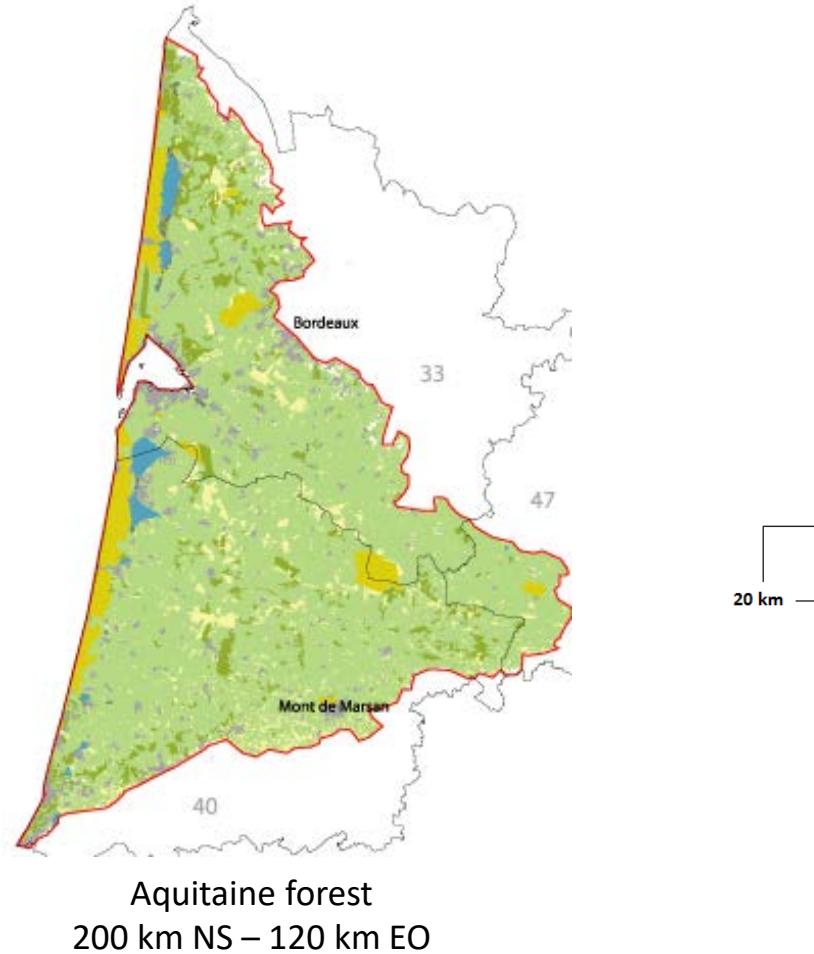
**Along main roads, wood truck parks, ports
wood factories, sawmills, warehouses...**

**But only 20 traps for Aquitaine, to cover
1 million ha (1 trap / 50 000 ha, r=12km)
with permutations**



2. Field survey of insect vectors with pheromone traps for early warming detection of PWN establishment

2.2. Improved strategy: systematic grid of traps



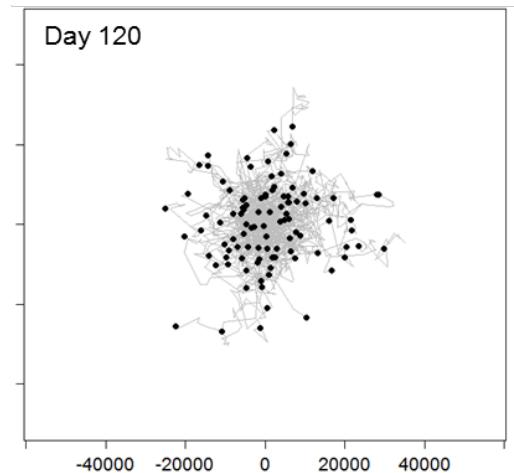
2. Field survey of insect vectors with pheromone traps for early warming detection of PWN establishment

2.2. Improved strategy: systematic grid of traps

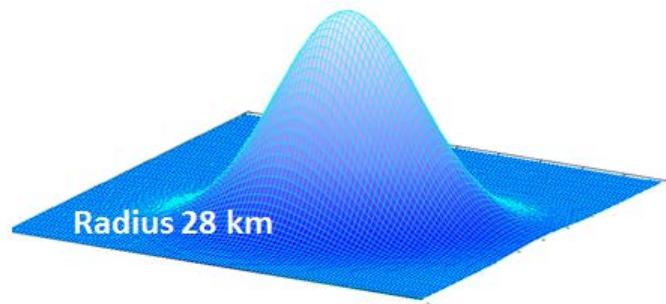
Modelling the distances travelled by insects based on flight mill and mark-release-recapture experiments.

(submitted)

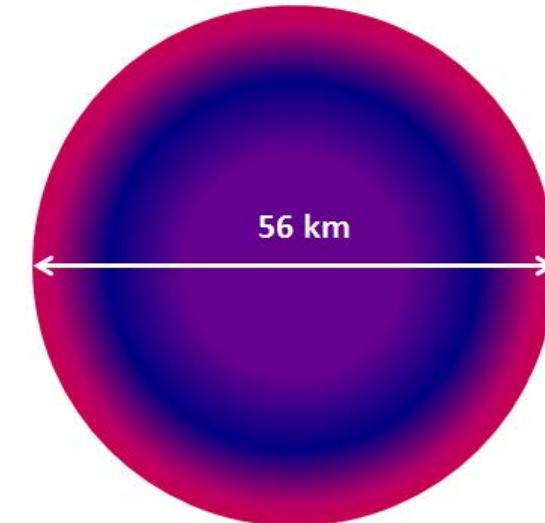
Christelle Robinet^{a*}, Guillaume David^{b,c}, Hervé Jactel^b



Mean dispersal distance = 13 km



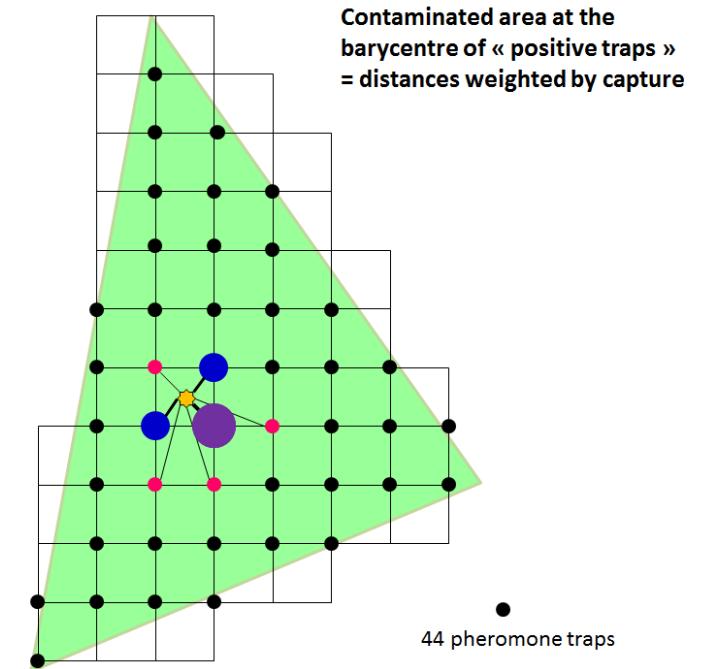
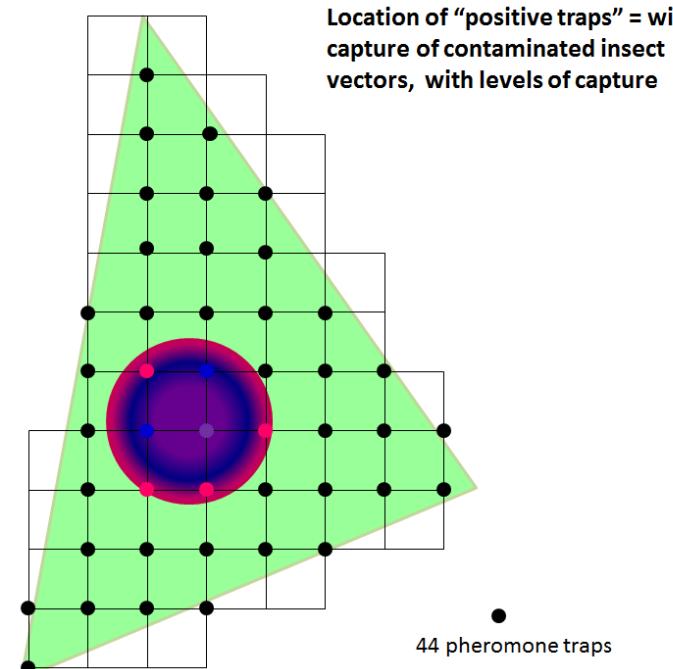
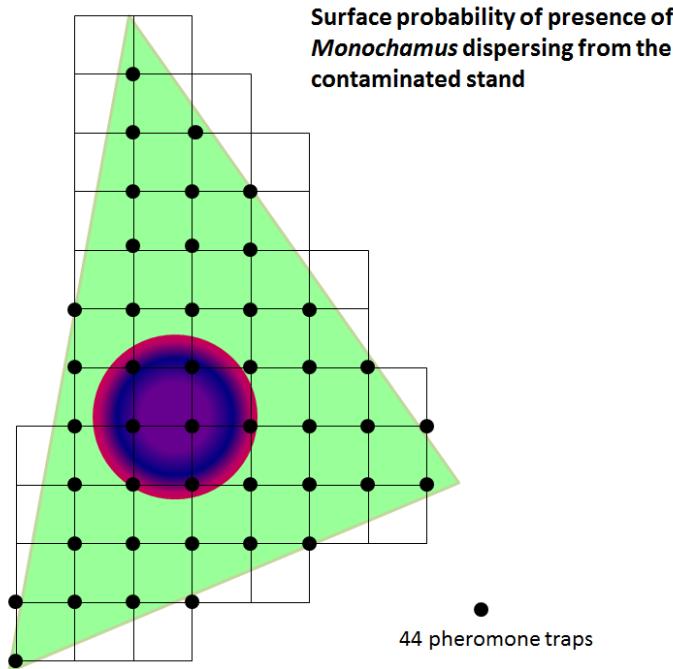
2D representation of frequency distribution of flying distances from the contaminated area



3D representation of frequency distribution of flying distances from the contaminated area

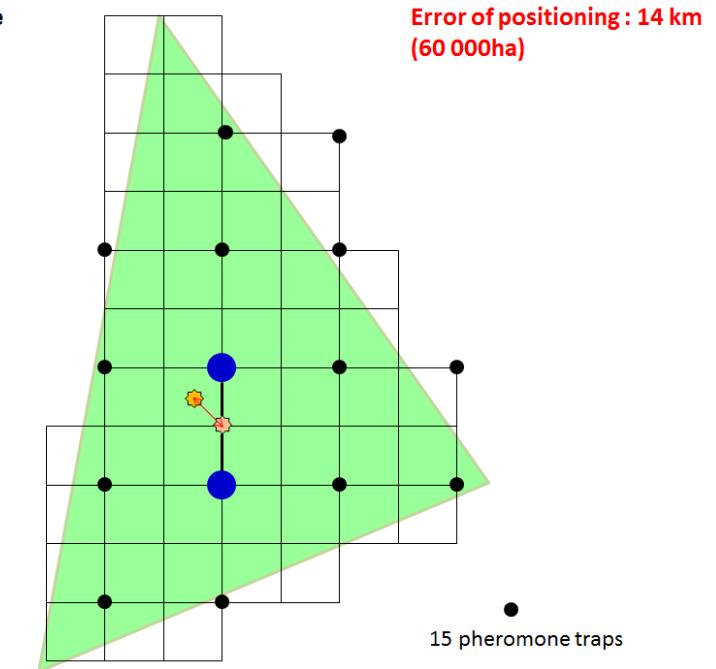
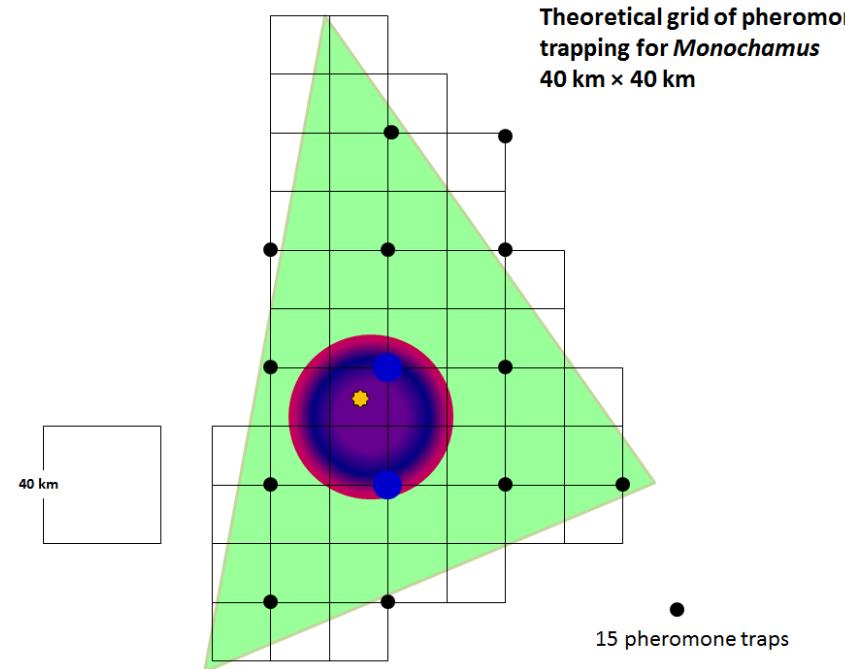
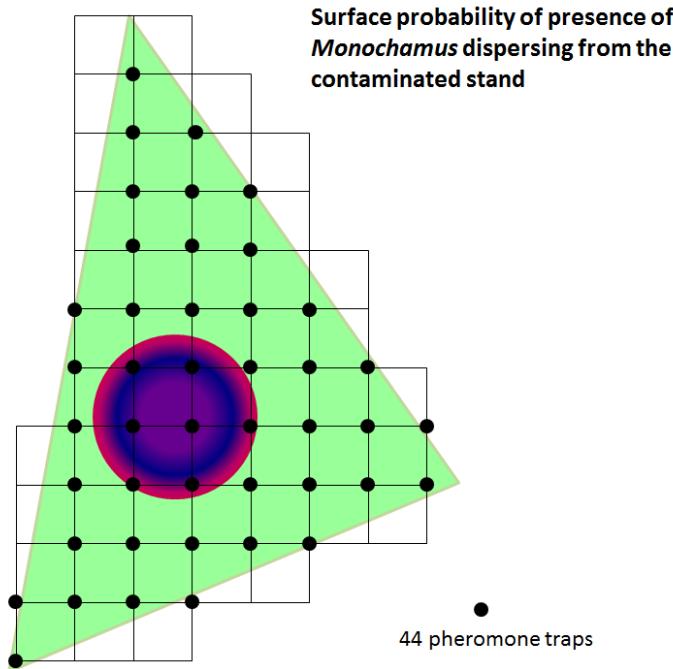
2. Field survey of insect vectors with pheromone traps for early warming detection of PWN establishment

2.2. Improved strategy: systematic grid of traps



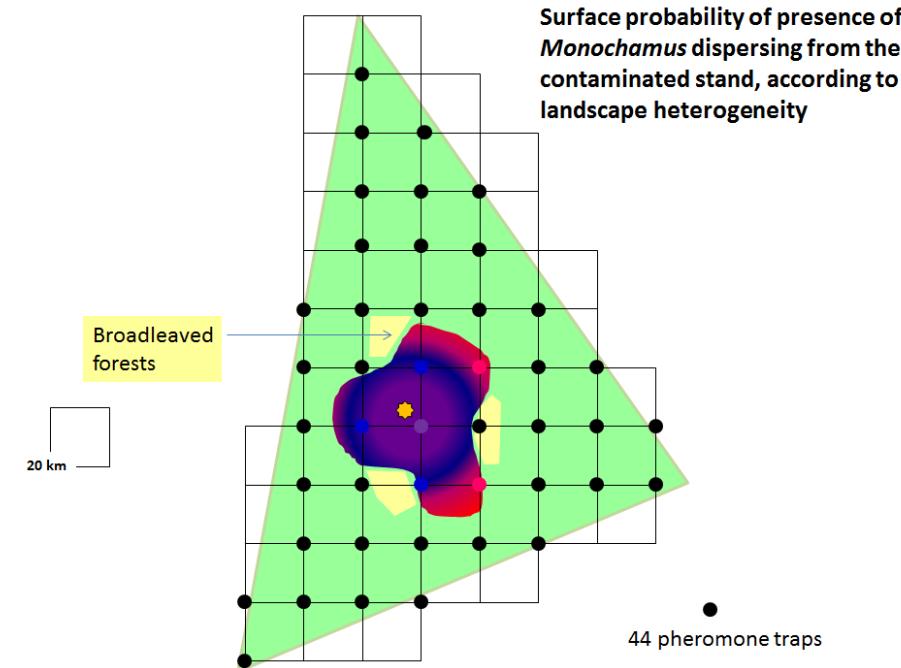
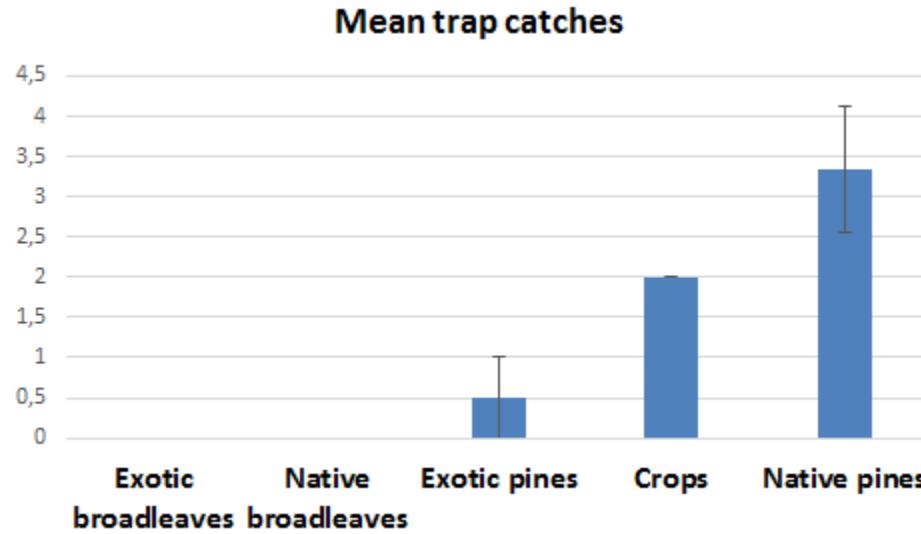
2. Field survey of insect vectors with pheromone traps for early warming detection of PWN establishment

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2. Field survey of insect vectors with pheromone traps for early warming detection of PWN establishment

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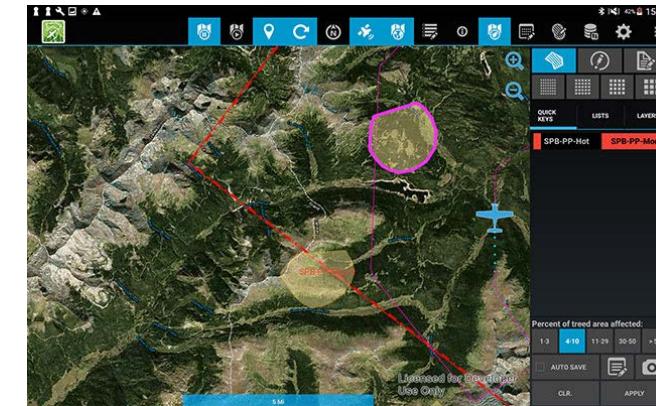


Next steps in PWN risk management

- Remote sensing of PWN infected trees
 - Confirm the prediction model with drone hyperspectral images
 - Test more accurate satellite images
 - Investigate aircraft or helicopter sketch mapping of PWN symptomatic trees



Digital Mobile Sketch Mapping (DMSM)



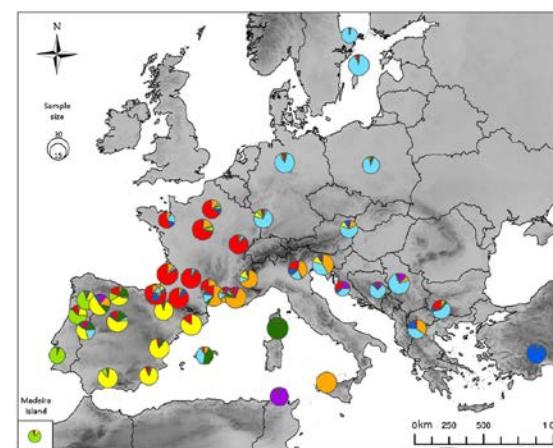
- Develop automatic image analyses to identify spatiotemporal patterns of PWN induced tree decline

Next steps in PWN risk management

- Pheromone trapping of the insect vector
 - Refine the individual-based dispersal model of *Monochamus*, in realistic landscapes
 - Apply the model to optimize a systematic grid of traps
 - Discuss with tree health managers about implementation of systematic grid of traps (pre vs. post detection in risk areas)
- Develop DNA bar coding for identifying the geographical origin of trapped beetles

Phylogeography of *Monochamus galloprovincialis*, the European vector of the pinewood nematode

Julien Haran^{1,2,3} · Jérôme Rousselet¹ · David Tellez^{1,2} · Alain Roques¹ ·
Géraldine Roux^{1,2}



A big thank to our associated partners!

Region	Organisation	Contact person	Associated partners
Portugal	INIAV	Edmundo Sousa	Altri Florestal Instituto da Conservação da Natura e das Florestas RAIZ - Instituto de Investigação da Floresta e Papel
Castilla y León	TRAGSATEC	Jorge Casado	Junta de Castilla y León Empresa de Transformación Agraria
Aquitaine	INRA	Hervé Jactel	Caisse de Prévoyance et de Protection des Forêts du Sud-Ouest Direction régionale de l'alimentation, de l'agriculture et de la forêt Association Régionale de Défense des Forêts Contre l'Incendie



Dryocosmus kuriphilus



(Vespa do castanheiro; Avispilla del castaño;
Cynips du châtaignier; Chestnut gall wasp)



Dryocosmus kuriphilus

Enquadramento do risco biótico



A vespa do castanheiro é considerada em todo o mundo como uma das pragas mais importantes do castanheiro.

- Espécies muito susceptíveis
 - China, Coreia e Japão - *Castanea crenata*, *C. mollissima* e *C. henryi*
 - Estados Unidos - *Castanea dentata*
 - Europa - *Castanea sativa*
- Existem contudo diferentes graus de suscetibilidade entre espécies, variedades e híbridos do género *Castanea*.

A formação de galhas, afeta o crescimento dos ramos e reduz a frutificação

O rendimento pode diminuir cerca de 80%

Afetam a apicultura por reduzirem a produção de flores.

Podem levar nalguns casos à morte das árvores.

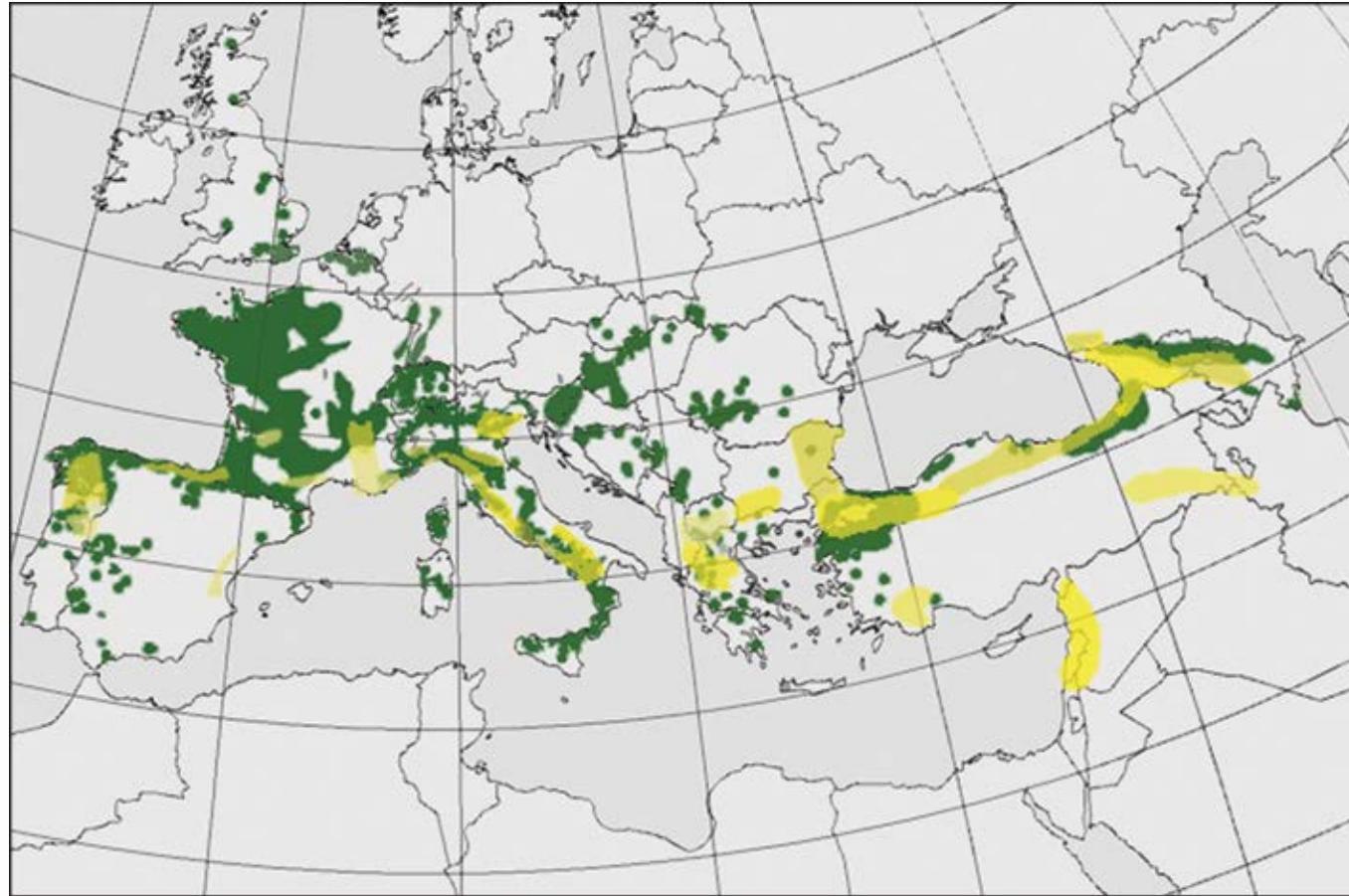
Dryocosmus kuriphilus

Distribuição de *Castanea sativa*

Enquadramento do risco biótico

- Distribuição de *Castanea sativa* (2009) na Europa (verde).
- EUFORGEN distribution map (http://www.euforgen.org/distribution_maps.html)
- Refúgios glaciais potenciais (amarelo).

	Madeira	Fruto	TOTAL
Total	1 780 336	471 923	2 252 259



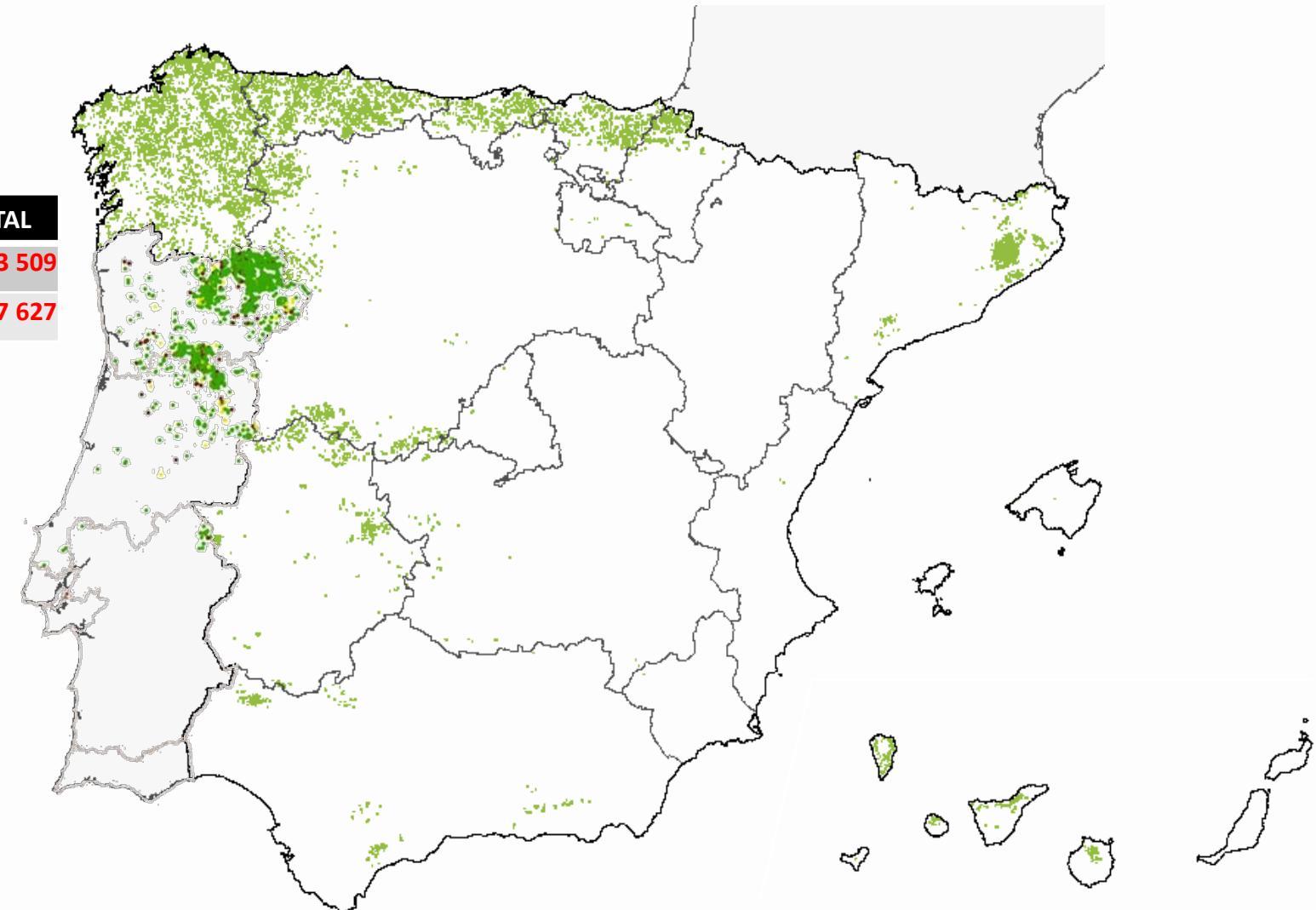
Krebs, P., M. Conedera, M. Pradella, D. Torriani, M. Felber and W. Tinner: Quaternary refugia of the sweet chestnut (*Castanea sativa* Mill.): An extended palynological approach. *Veget. Hist. Archaeobot.*, 13, 145-160 (2004).

Dryocosmus kuriphilus

Enquadramento do risco biótico

Distribuição do
Castanheiro
na Península Ibérica

País	Madeira	Fruto	TOTAL
Portugal	33 900	19 609	53 509
Espanha	99 948	37 679	137 627

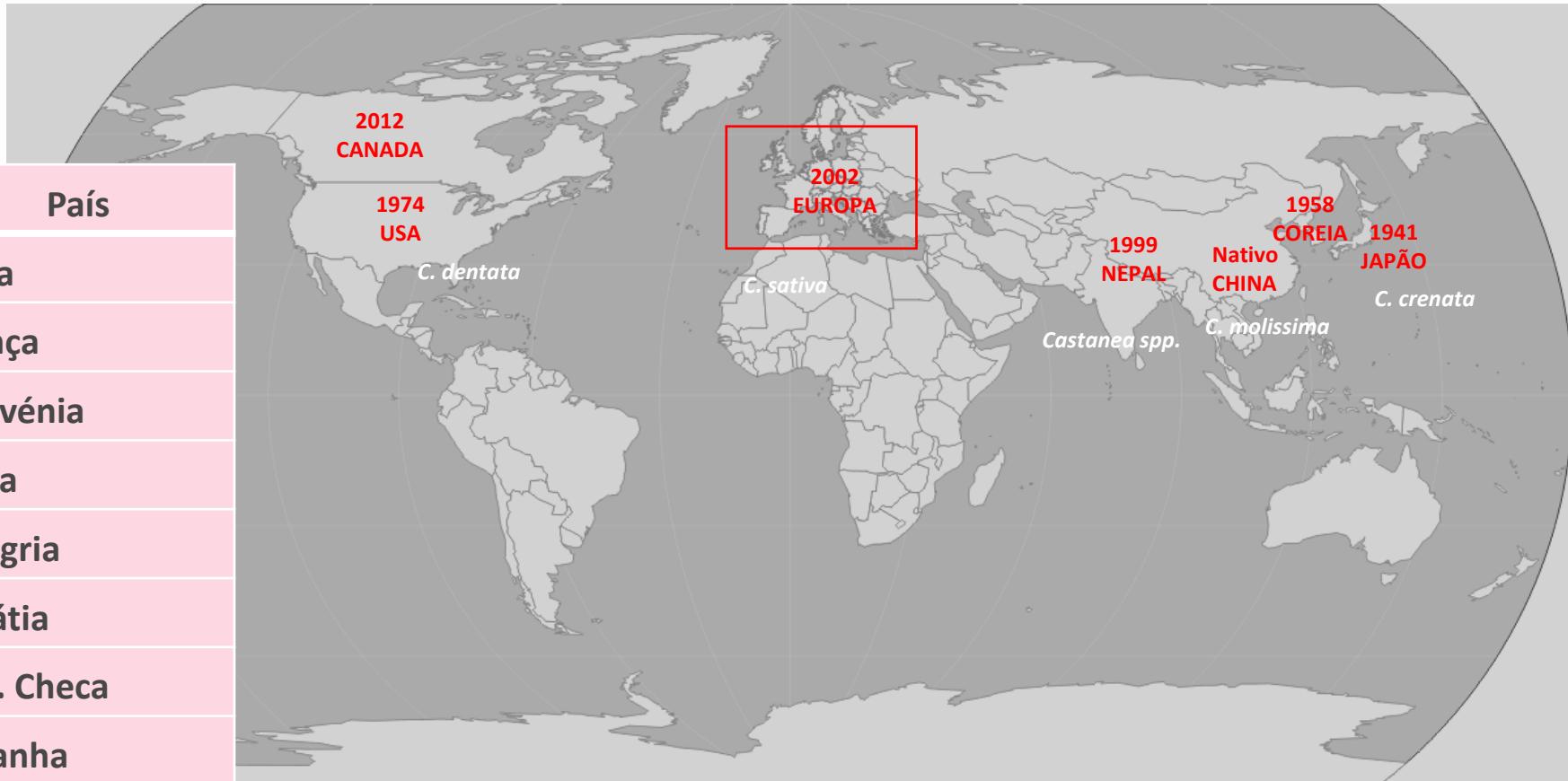


Dryocosmus kuriphilus

Enquadramento do risco biótico



ANO	País
2002	Itália
2005	França
2005	Eslóvénia
2009	Suíça
2009	Hungria
2010	Croácia
2012	Rep. Checa
2012	Espanha
2013	Alemanha
2014	Portugal



Dryocosmus kuriphilus

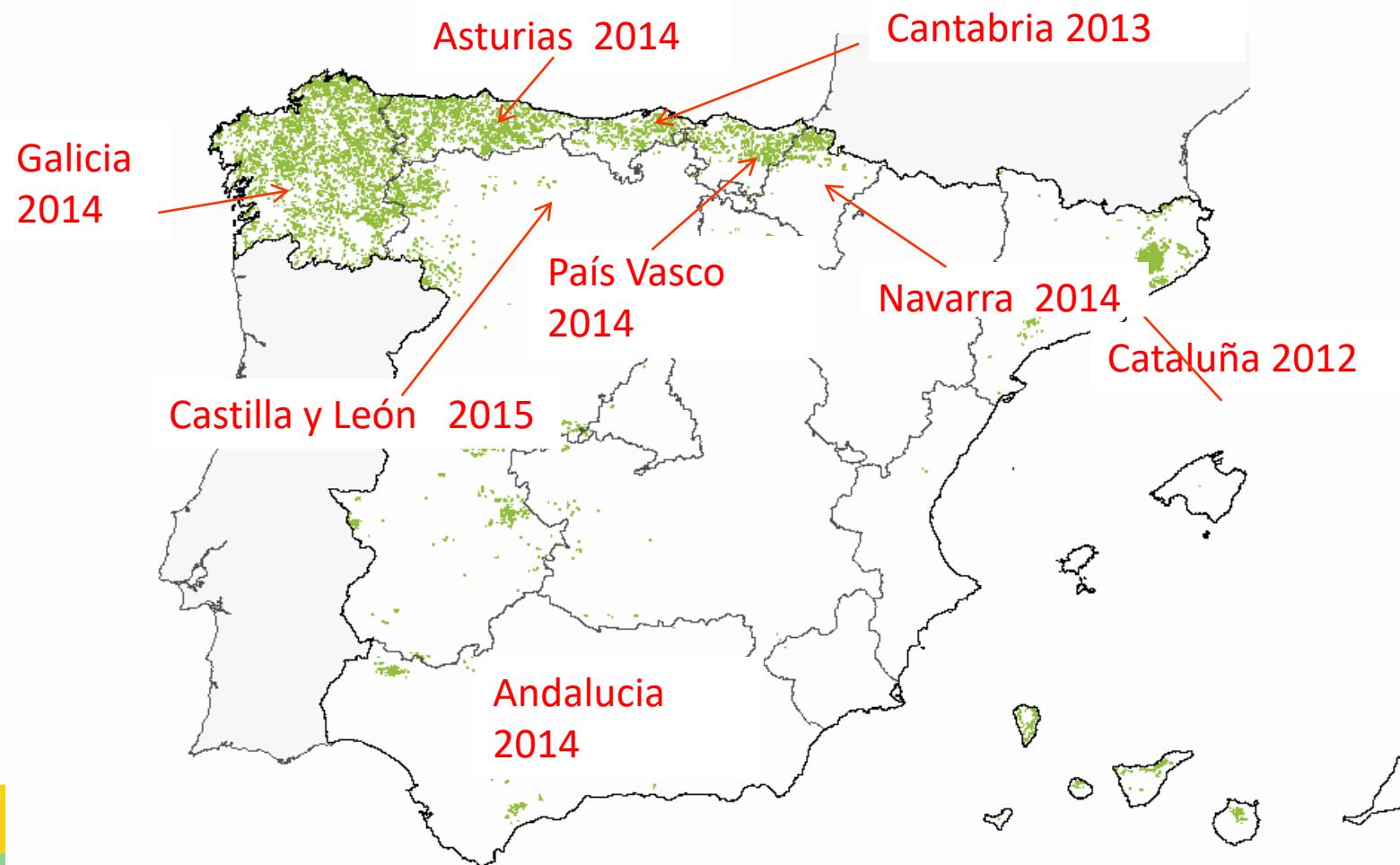
Enquadramento do risco biótico



Dryocosmus kuriphilus

Enquadramento do risco biótico

Distribuição da Vespa do
Castanheiro



Dryocosmus kuriphilus

Enquadramento do risco biótico

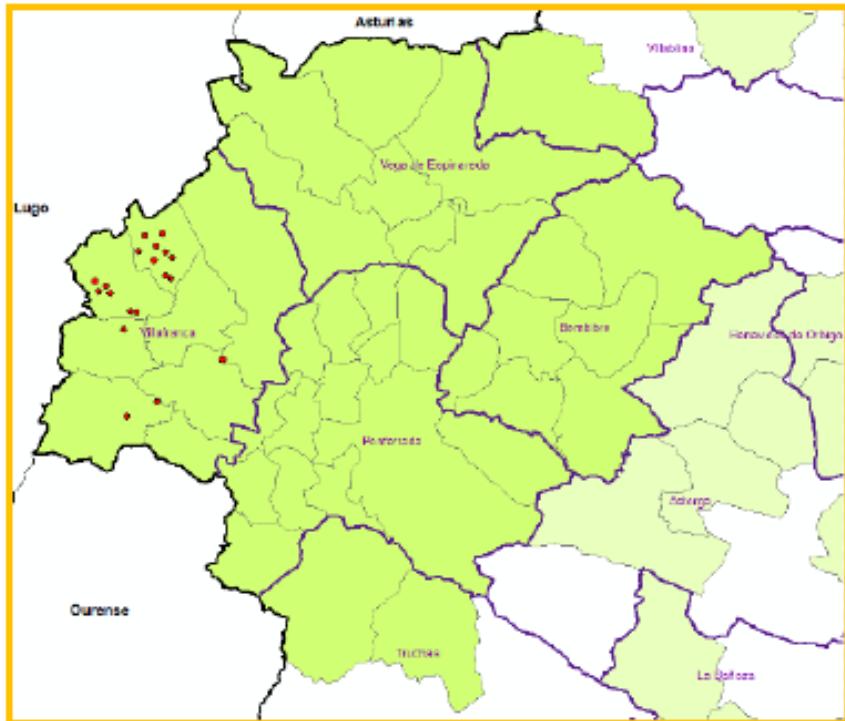
Através del vuelo de los adultos (dispersión natural) desde zonas contaminadas:

- Burgos (Valle de Mena, Espinosa de los Monteros, y Merindad de Montija -2015-).
- León, zona occidental de la provincia (Vega de Valcarce, Balboa, Oencia, Barjas, Corullón, Trabadelo) y noreste (Oseja de Sajambre).

En plantaciones jóvenes de castaño debido al uso de material vegetal infestado (brotes erradicados):

- Zamora (Riofrío de Aliste, ZA).
- Ávila (Cuevas del Valle, AV).

Distribuição da Vespa do Castanheiro en Castilla y León
(Febrero 2018)



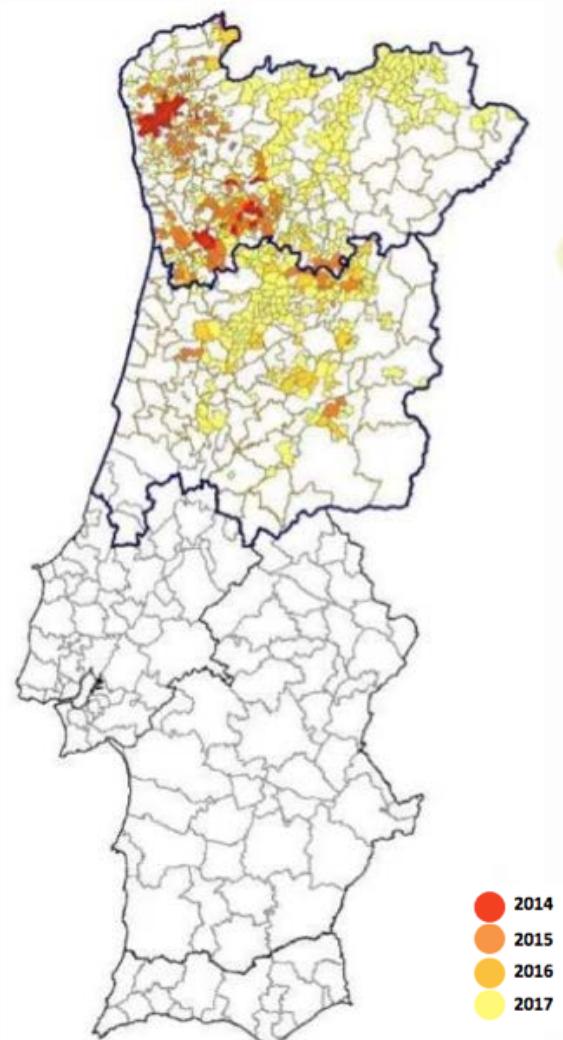
En el la zona occidental de la provincia de León (comarca de El Bierzo), la avispa se encuentra en los municipios cercanos a la región Gallega, y es de esperar que se vaya extendiendo en los próximos años hacia el sur (provincia de Zamora) y, en menor medida , hacia el interior de la provincia de León.

Dryocosmus kuriphilus

Enquadramento do risco biótico

- Em junho de 2014 foram detetados os primeiros focos da praga nalguns concelhos da região de Entre-Douro-e-Minho e no final desse ano o inseto já tinha sido assinalado em 75 freguesias daquela região.
- Em agosto de 2014 foram confirmados os primeiros focos na ilha da Madeira.
- Apesar das medidas tomadas, a situação agravou-se em 2015, tendo a praga sido detetada em Trás-os-Montes, nomeadamente nas três principais zonas produtoras de castanha (Terra Fria, Padrela e Soutos da Lapa) bem como na região Centro, nos concelhos de Trancoso, Aguiar da Beira, Anadia e Fundão.
- Também na região de Lisboa e Vale do Tejo, no concelho de Caldas da Rainha, foi assinalado um foco, mas entretanto erradicado
- Em 2016 a vespa já se encontrava presente em 246 freguesias de 42 concelhos.

Distribuição da Vespa do Castanheiro em Portugal



Dryocosmus kuriphilus

Enquadramento do risco biótico

A possível rápida dispersão do inseto na Europa levou à sua inclusão na Diretiva 2000/29/CE, como organismo de “zona protegida”.

A decisão 2006/464/CE estabeleceu as medidas fitossanitárias provisórias de emergência contra a introdução e a propagação do inseto na EU.

Na Diretiva de Execução 2014/78/UE da Comissão, Portugal, o Reino Unido e a Irlanda foram os únicos Estados-Membros a quem foi reconhecido o estatuto de Zona Protegida (ZP).



5.7.2006 PT Jornal Oficial da União Europeia L 183/29

DECISÃO DA COMISSÃO

de 27 de Junho de 2006

relativa a medidas de emergência provisórias contra a introdução e propagação na Comunidade do *Dryocosmus kuriphilus* Yasumatsu

[notificada com o número C(2006) 2881]

(2006/464/CE)

A COMISSÃO DAS COMUNIDADES EUROPEIAS,

Tendo em conta o Tratado que institui a Comunidade Europeia,

Tendo em conta a Directiva 2000/29/CE do Conselho, de 8 de Maio de 2000, relativa às medidas de protecção contra a introdução na Comunidade de organismos prejudiciais aos vegetais e produtos vegetais e contra a sua propagação no interior da Comunidade⁽¹⁾, nomeadamente o n.º 3, terceira fase, do artigo 16⁽²⁾,

(5) É, por conseguinte, necessário tomar medidas provisórias contra a introdução e a propagação desse organismo prejudicial na Comunidade.

Considerando o seguinte

(1) De acordo com a Directiva 2000/29/CE, sempre que um Estado-Membro considere existir perigo de introdução ou propagação no seu território de um organismo prejudicial não constante do anexo I ou do anexo II da referida directiva, pode adoptar provisoriamente todas as disposições complementares necessárias para se proteger desse perigo.

(6) As medidas previstas na presente decisão aplicam-se tanto à introdução como à propagação desse organismo, à produção e circulação na Comunidade de vegetais da espécie *Castanea*, ao controlo do organismo e à investigação com vista a detectar a presença ou a actividade contínua desse organismo prejudicial nos Estados-Membros.

(2) Em virtude da presença do *Dryocosmus kuriphilus* Yasumatsu na China, na Coreia, no Japão, nos EUA e numa zona limitada da Comunidade, a França informou, em 14 de Maio de 2005, ao Américo Brusco, Membro da Co-

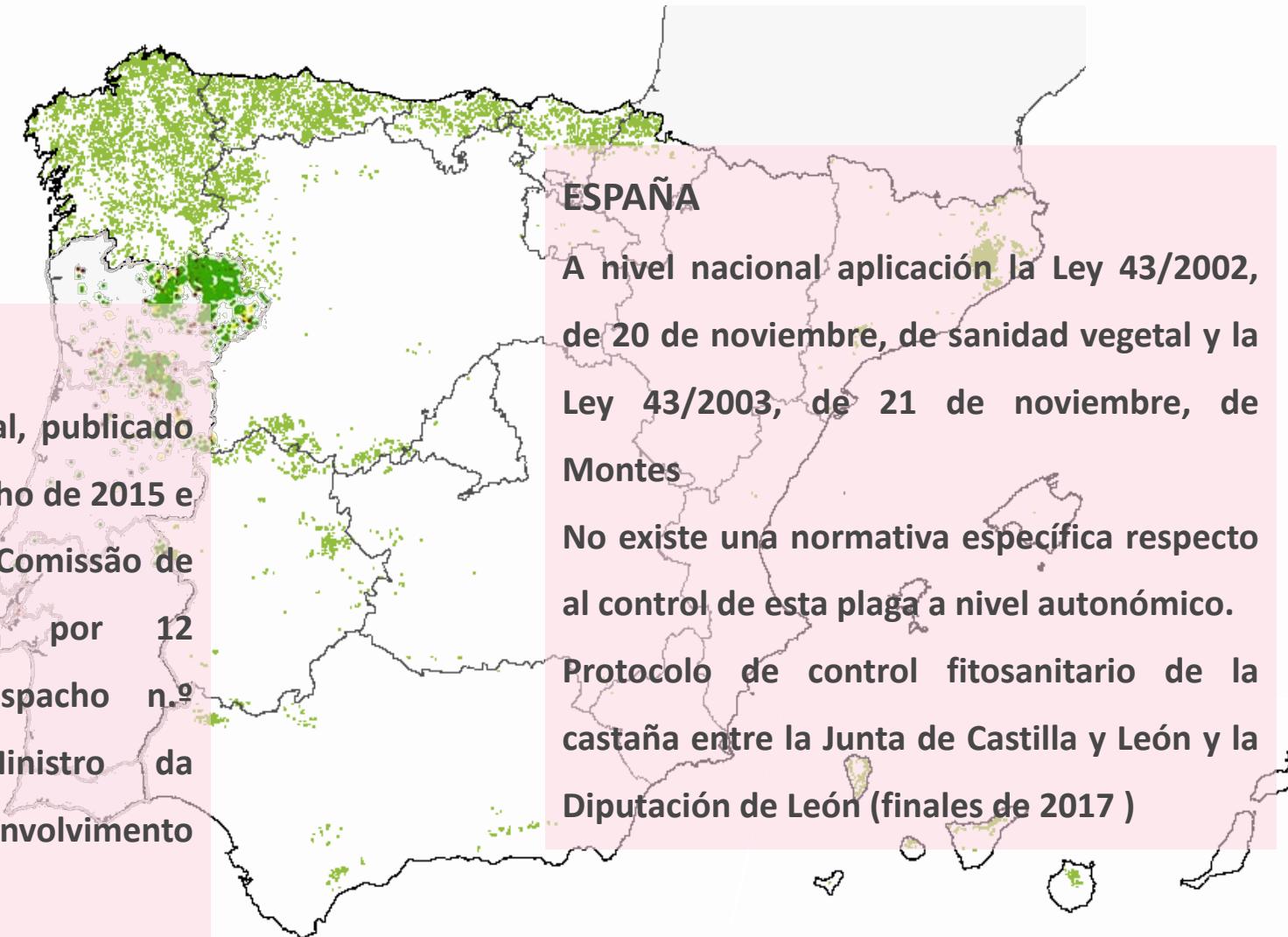
(7) É conveniente que os resultados dessas medidas sejam validados numa base regular em 2006, 2007 e 2008,

Dryocosmus kuriphilus

Enquadramento do risco biótico

PORtUGAL

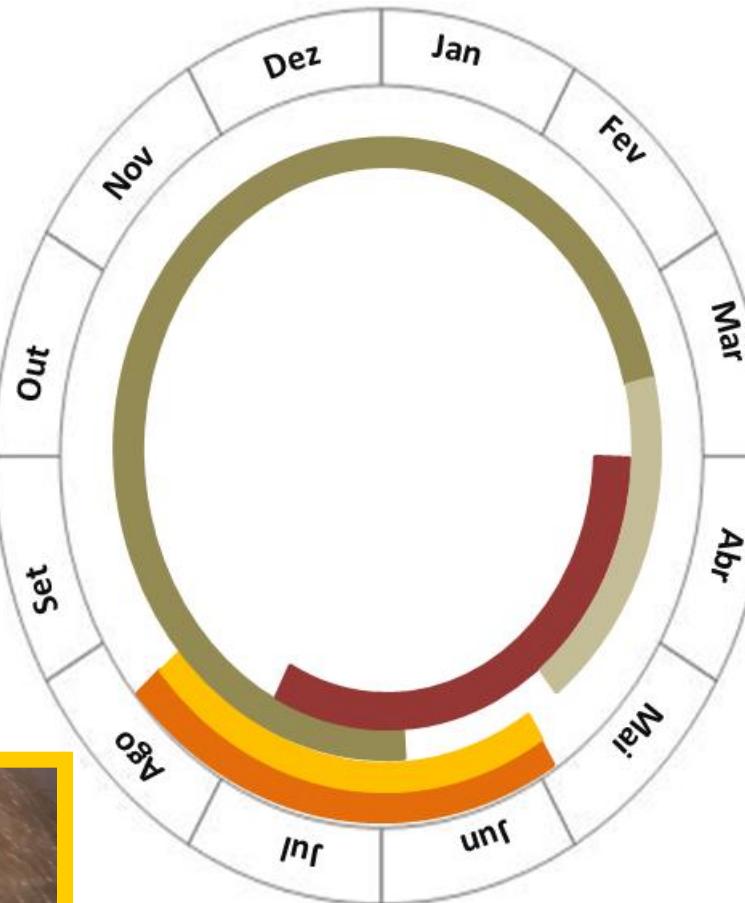
Existe o Plano de Ação Nacional, publicado em julho de 2014, revisto em julho de 2015 e em outubro de 2017, por uma Comissão de Acompanhamento, composta por 12 organismos, criada pelo Despacho n.º 5696/2017, do Senhor Ministro da Agricultura, Florestas e Desenvolvimento Rural.



Dryocosmus kuriphilus

Ciclo biológico do insecto

- As fêmeas adultas vivem entre 2 e 10 dias e emergem no início do verão colocando os ovos nos gomos do castanheiro, os quais se desenvolverão na primavera seguinte;
- Cada fêmea pode colocar um total de mais de 100 ovos, podendo ser encontrados 20 a 30 ovos num único gomo.

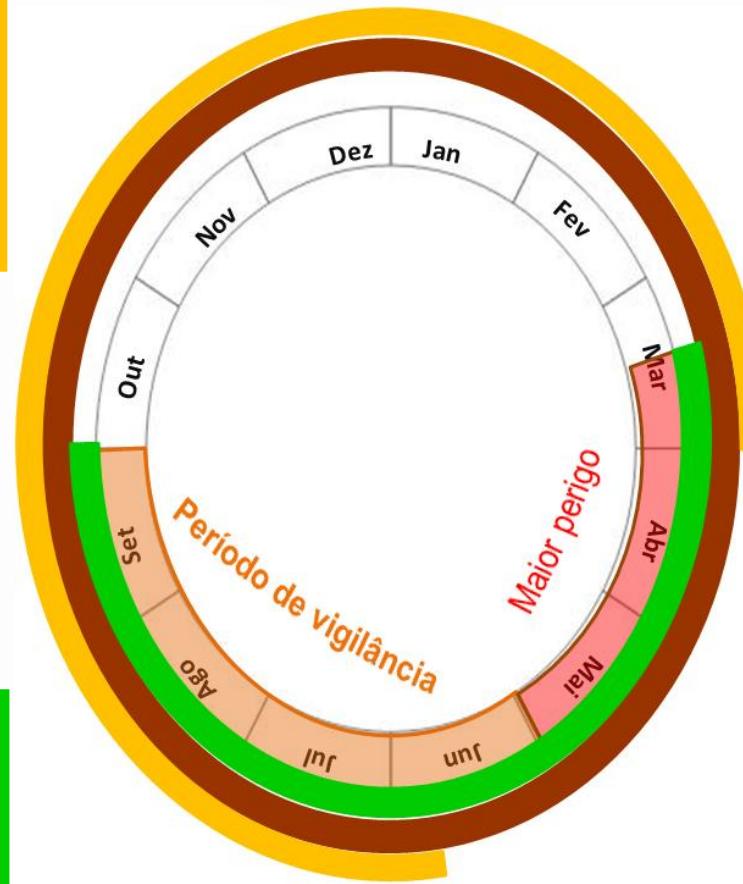
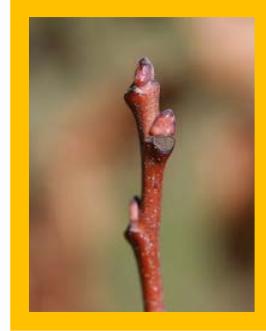


- Fêmeas em voo
- Ovos
- Larvas no ovo
- Larvas
- Pupas

Dryocosmus kuriphilus

Desenvolvimento de sintomas e fases de risco

- As galhas são facilmente detetadas, ao contrário dos ovos e larvas do primeiro instar que se encontram dentro dos gomos
- Os primeiros ataques só serão visíveis após o abrolhamento dos gomos dos castanheiros;
- A fase de maior vigilância deverá ocorrer precisamente na altura em que começam a desenvolver-se as galhas verdes.



- Galhas secas
- Galhas verdes
- Ataques novos sem sintomas

Dryocosmus kuriphilus

Avaliação das ferramentas existentes

PONTOS FORTES	Vigilância, monitorização e alerta precoce	
	España (Castilla y León)	Portugal (região Norte e Centro)
	Instrucciones particulares de prospección y una ficha estándar de muestreo.	Instruções particulares de prospeção e existência de uma ficha de amostragem (DRAP's, ICNF e Comissões Locais CL).
		Existência de uma comissão de acompanhamento das ações
	Inspección en todos los ejemplares de castaño en los viveros y "garden centers"	Inspeção aos fornecedores de material vegetal de reprodução.
	Revisión de 177 puntos fijos situados sobre masas de castaño en una malla coincidente con la de la Red de Evaluación de Daños en Bosques de Castilla y León, de 2 km de lado.	Monitorização da presença e da intensidade do seu ataque nas Zonas envolventes das zonas infestadas, e dos fornecedores de material vegetal de reprodução, nos Soutos recentemente instalados (menos de 5 anos); e nas zonas com elevada densidade de plantas.
	Delimitación de las zonas infectadas	Delimitação das zonas infetadas
	Los vegetales deben viajar siempre acompañados del correspondiente pasaporte fitosanitario.	A importação de plantas e partes de plantas, está condicionada à apresentação do certificado fitossanitário

Dryocosmus kuriphilus

Avaliação das ferramentas existentes

PONTOS FORTES	Erradicação e controle	
	España (Castilla y León)	Portugal (região Norte e Centro)
	Destrucción de las plantas afectadas en los viveros y en los centros de jardinería	Destruição de plantas nos viveiros e nos centros de jardinagem
	Protocolo de control fitosanitario de la castaña entre la Junta de Castilla y León y la Diputación de León (finales de 2017)	Existência de um Despacho n.º 5891/2018 para as largadas do parasitoide <i>Torymus sinensis</i>
En análisis un estudio para largas del parasitoide T. sinensis "		Largadas controladas do parasitoide e avaliação da sua eficácia

Dryocosmus kuriphilus

Melhoria das ferramentas existentes ou criação de novas

Vigilância, monitorização e alerta precoce		
PONTOS FRAZOS	España (Castilla y León)	Portugal (região Norte e Centro)
	Falta de legislación para las acciones a tomar	
	La comunicación de nuevos focos no es completamente eficiente.	A comunicação de novos focos não é completamente eficiente.

Dryocosmus kuriphilus

Melhoria das ferramentas existentes ou criação de novas

Erradicação e controle		
PONTOS FRAZOS	España (Castilla y León)	Portugal (região Norte e Centro)
	Está pendiente de aprobación el Plan Nacional de Contingencia y Control Biológico para establecer y coordinar las labores de control de la avispa entre comunidades, que tratará de regular aspectos como la lucha biológica	
	Conocer la repercusión de utilización masiva de <i>T. synensis</i> sobre el medio natural y la biodiversidad, tal y como exige la legislación nacional y comunitaria.	Falta de conhecimento da eficácia e da altura para as largadas do parasitoide
	Baja financiación para la gestión de la plaga (gastos no subvencionables en la UE)	Baixo financiamento para a gestão da praga (despesas não elegíveis na EU) e para a investigação.
	Conocer la eficacia de los parásitos autóctonos en el control de la plaga	Conhecer a eficácia dos parasitoides autóctones no controlo da praga

Dryocosmus kuriphilus

Melhoria das ferramentas existentes ou criação de novas

APP de alerta temprana fitosanitaria

Para facilitar las labores de alerta temprana, se propone la implementación de una APP específica para su uso tanto por profesionales del sector forestal como por el público en general.

Esta aplicación permitiría al menos, enviar de forma rápida y eficaz las coordenadas del posible árbol o rodal afectado, así como, una foto de las ramas o yemas afectadas para facilitar el posible diagnóstico a los técnicos encargados de revisar la información enviada.

Dryocosmus kuriphilus

Melhoria das ferramentas existentes ou criação de novas

Largadas do parasitoide *Torymus sinensis* Kamijo, 1982

A luta biológica, baseada no inseto parasitoide específico *Torymus sinensis* Kamijo (Hymenoptera: Torymidae) é identificada no Plano de Ação Nacional, como um meio eficaz reconhecido para a redução das populações da vespa, com base na experiência de outros países.



T. sinensis, originário da China, foi objeto de introduções deliberadas :

- Japão (Aebi et al., 2006),
- Estados Unidos da América (Cooper & Rieske 2007)
- Itália (Aebi et al., 2006; Quacchia et al., 2008),
- França (Borowiec et al., 2014),
- Hungria (Szabó et al., 2014)
- Croácia (Matošević et al., 2014)

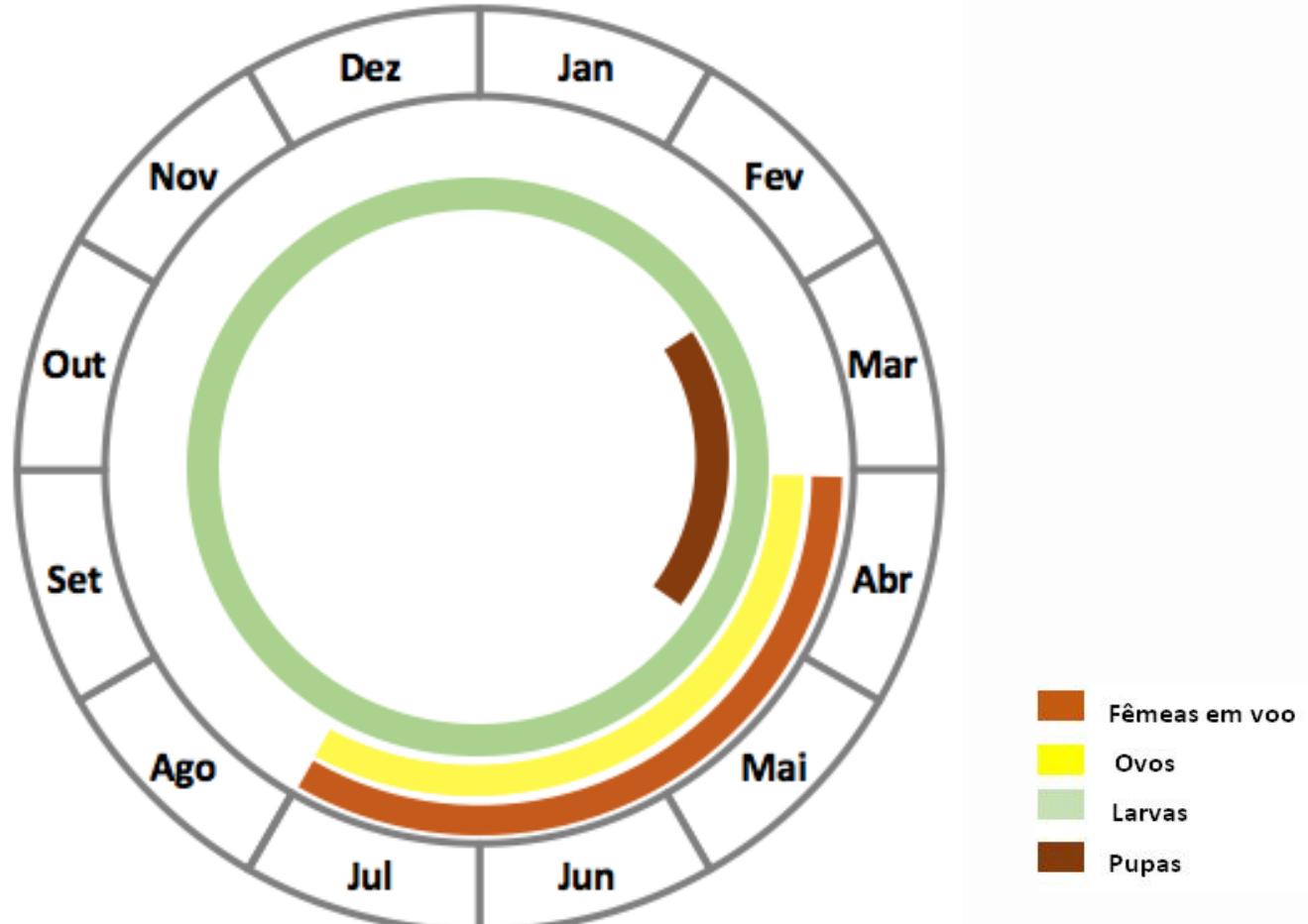


Dryocosmus kuriphilus

Melhoria das ferramentas existentes ou criação de novas

Largadas do parasitoide *Torymus sinensis* Kamijo, 1982

T. sinensis é univoltino (uma geração por ano) como o seu hospedeiro, e o seu ciclo de vida está bem sincronizado com o *D. kuriphilus*, já que o período de vôo dos adultos de *T. sinensis* coincide com a ocorrência das galhas verdes no hospedeiro.



Dryocosmus kuriphilus

Melhoria das ferramentas existentes ou criação de novas

Papel dos parasitoides autóctones no controlo de *D. kuriphilus*



Contudo, nas regiões onde *D. kuriphilus* foi introduzido, observaram-se novas associações entre esta praga e espécies indígenas de parasitoides de insetos que formam galhas em carvalhos e outras folhosas. (Aebi et al., 2006).

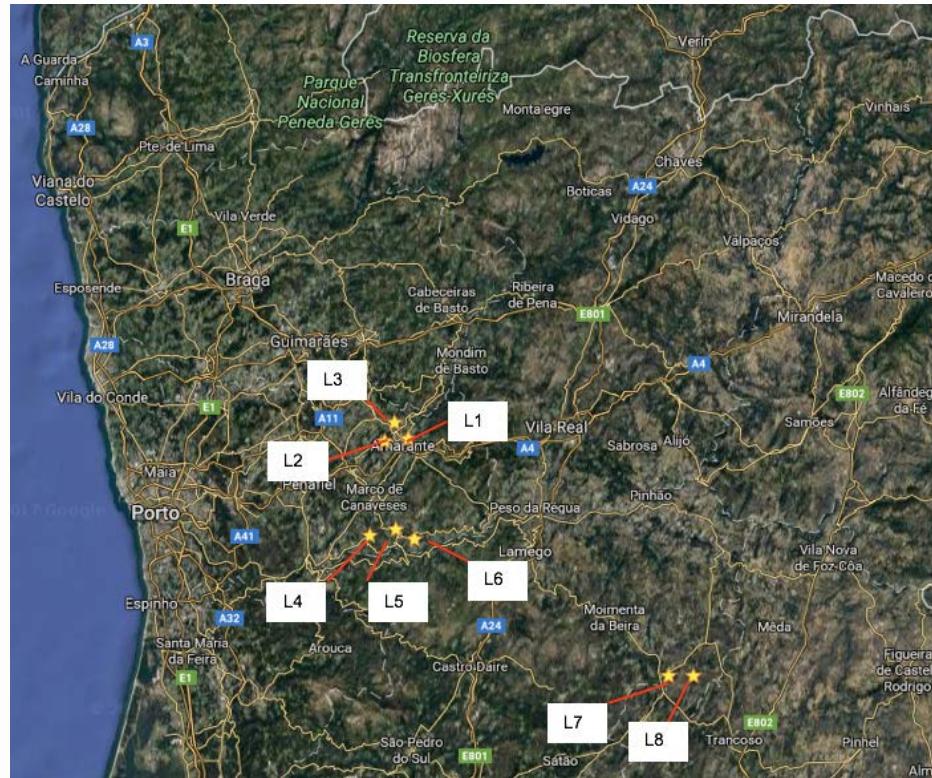
Estas novas associações foram relatadas no Japão, na Coreia do Sul, nos EUA e na Europa, com taxas de parasitismo geralmente muito baixas, na ordem dos 2% ou menos (EFSA, 2010).

Dryocosmus kuriphilus

Melhoria das ferramentas existentes ou criação de novas

Os oito locais de ensaio estão distribuídos em 3 áreas:

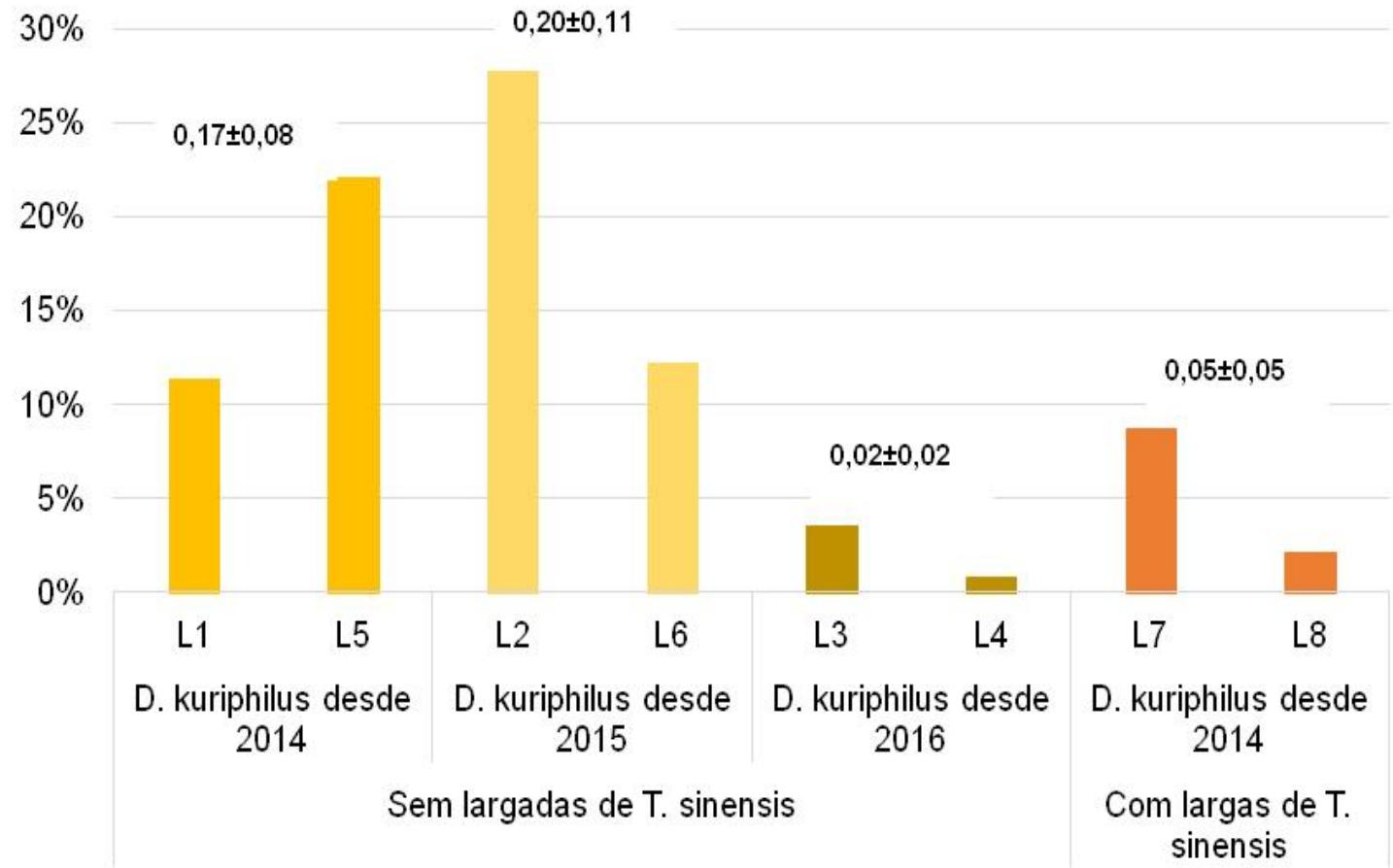
- Amarante – L1, L2 e L3;
- Baião – L4, L5 e L6;
- Sernancelhe – L7 e L8



Dryocosmus kuriphilus

Melhoria das ferramentas existentes ou criação de novas

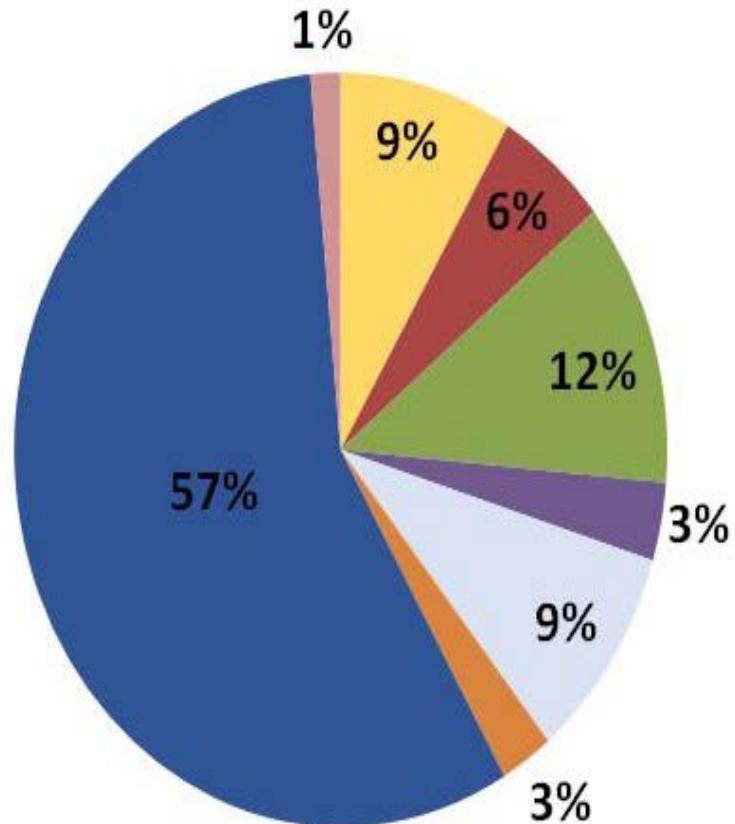
Os valores da taxa de parasitismo variaram entre 1% (em L4) e 28% (em L2).



Dryocosmus kuriphilus

Melhoria das ferramentas existentes ou criação de novas

- Foi identificada a presença de oito espécies num total de 269 exemplares capturados nos oito locais;
- *Sycophila* sp. foi a que apresentou maior abundância, representando mais de metade dos exemplares capturados.



■ *Eupelmus annulatus*



■ Espécie não identificada



■ *Megastigmus* sp.



■ *Torymus* sp.

■ *Ormyrus* sp.

■ *Mesopolobus* sp.

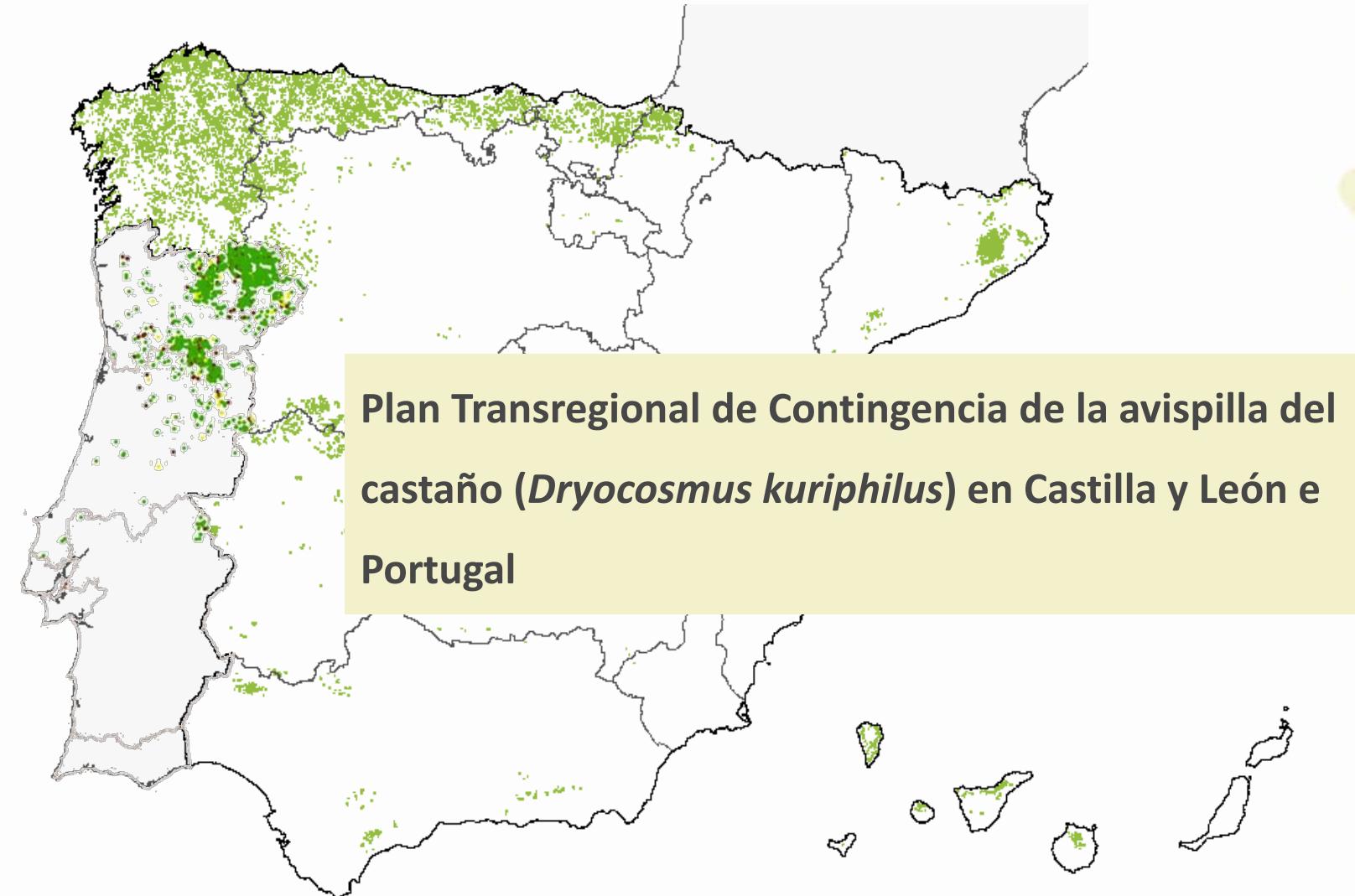
■ *Sycophila* sp.

■ *Eurytoma* sp.



Dryocosmus kuriphilus

Melhoria das ferramentas existentes ou criação de novas





Risk management plan *Eucalyptus weevil*



Manuela Branco¹, Juan Majada², Covadonga Prendes², Elena Canga²,
Paula Soares¹, Margarida Tomé¹, Carmen Romeralo³, Julio Diez³

¹ ISA, ² CETEMAS, ³ UVA



CETEMAS
CENTRO TECNOLÓGICO FORESTAL Y DE LA MADERA



INSTITUTO
SUPERIOR D'
AGRONOMIA
Universidade de Lisboa

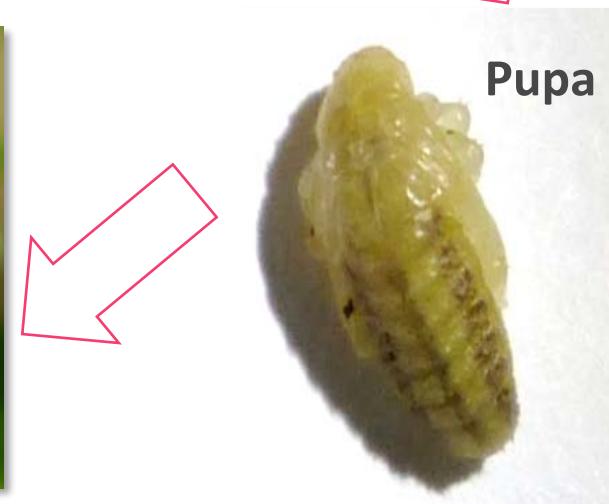


General information

The Eucalyptus weevil *Gonipterus platensis*, originate from Tasmania is the main pest problem in Eucalyptus plantations in the Iberian Peninsula



General information



General information

Heavy defoliations, mainly on the upper third of the tree crown



General information



In most affected areas wood loss reach 100%.
Portugal estimates:

- 1M m³ wood loss per year
- 650M € in the last 20 years.

General information

Biological Control with *Anaphes nitens* (Hym: Mymaridae) is the main control strategy.

Yet, the parasitoid is not effective everywhere.

However, If the parasitoid had not been introduced, current costs would have been 4 to 11 times higher!



ECOLOGICAL ECONOMICS 149 (2010) 40–47



ELSEVIER

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon



Analysis

Economic Outcome of Classical Biological Control: A Case Study on the *Eucalyptus* Snout Beetle, *Gonipterus platensis*, and the Parasitoid *Anaphes nitens*



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ARTICLE INFO

Keywords:

Eucalyptus Weevil
Cost-Benefit Analysis
Biological Invasions
Pest Management
Natural Enemy
Defoliation

ABSTRACT

Despite the importance of invasive pests, few studies address the costs and benefits of the strategies used to control them. The present work assesses the economic impact of the *Eucalyptus* snout beetle, *Gonipterus platensis*, and the benefits resulting from its biological control with *Anaphes nitens* in Portugal, over a 20-year period. Comparisons were made between the real situation (with *A. nitens*) and three scenarios without biological control: 1) replacement of *Eucalyptus globulus* by resistant eucalyps; 2) insecticide use; and 3) offset of yield losses by imported wood. A cost-benefit analysis was performed to evaluate a programme that aimed to accelerate *A. nitens* establishment. Although *A. nitens* provides adequate pest control in several regions, 46% of the area planted with eucalyps is affected by the beetle, causing wood losses of 648 M euros over 20 years. Losses in the three hypothetical scenarios were estimated at 2451 M–7164 M euros, resulting in benefits from biological control of 1803 M–6516 M euros, despite the fact that only partial success was achieved. Anticipating biological control by just one, two, or three years resulted in benefit-cost ratios of 67, 190, and 347, respectively. Because nonmarket values were not accounted for, these figures are likely underestimated.

Transnational geographical scope



Legislative framework

No specific legislation regarding *G. platensis*

General legislation for pests and diseases applies

Governance

National and Regional Administration, Research Institutions Portugal

- ICNF – Instituto Conservação da Natureza e Florestas
- DGAV – Direção-Geral de Agricultura e Veterinária
- INIAV - Instituto Nacional de Investigação Agrária e Veterinária

Cantabria, Asturias:

- Sección de Producción y Mejora Forestal de la Dirección General del Medio Natural:
- Dirección General de Desarrollo Rural
- Laboratorio de Sanidad Vegetal
- CETEMAS

Governance

Enterprises and Forest Associations

Portugal

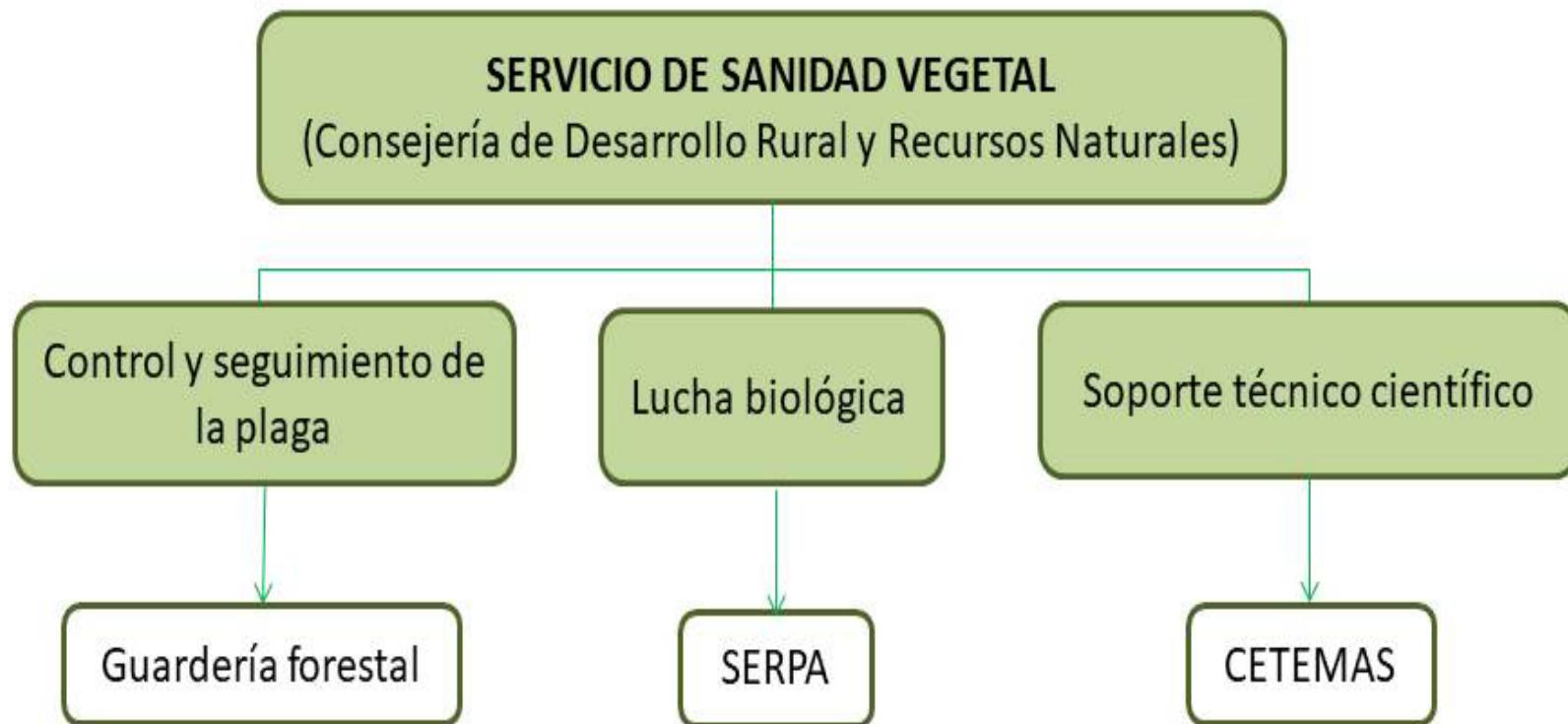
- ALTRI
- RAIZ
- CELPA
- FORESTIS

Spain

- ENCE
- TRAGSA

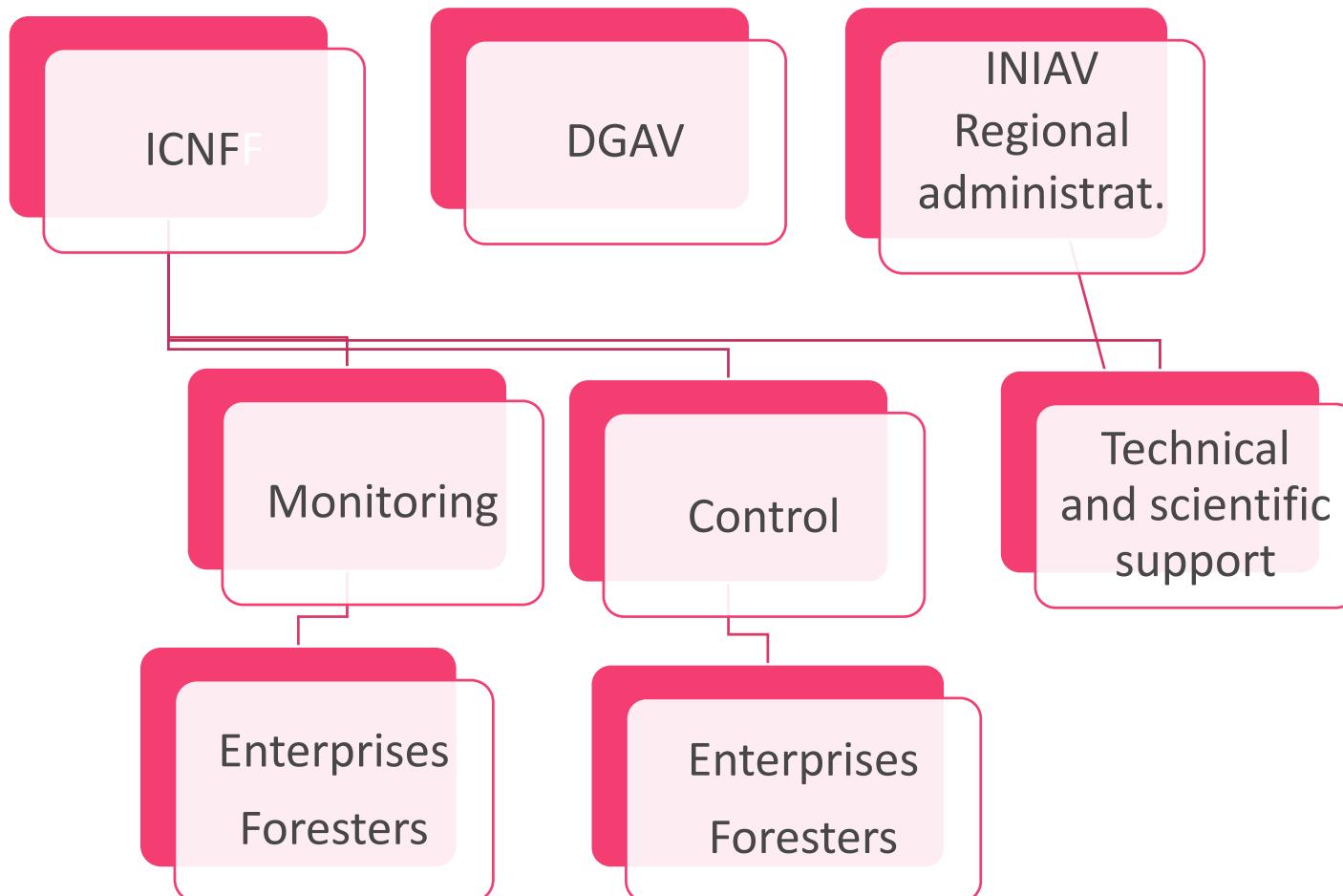
Governance

Asturias, Cantabria

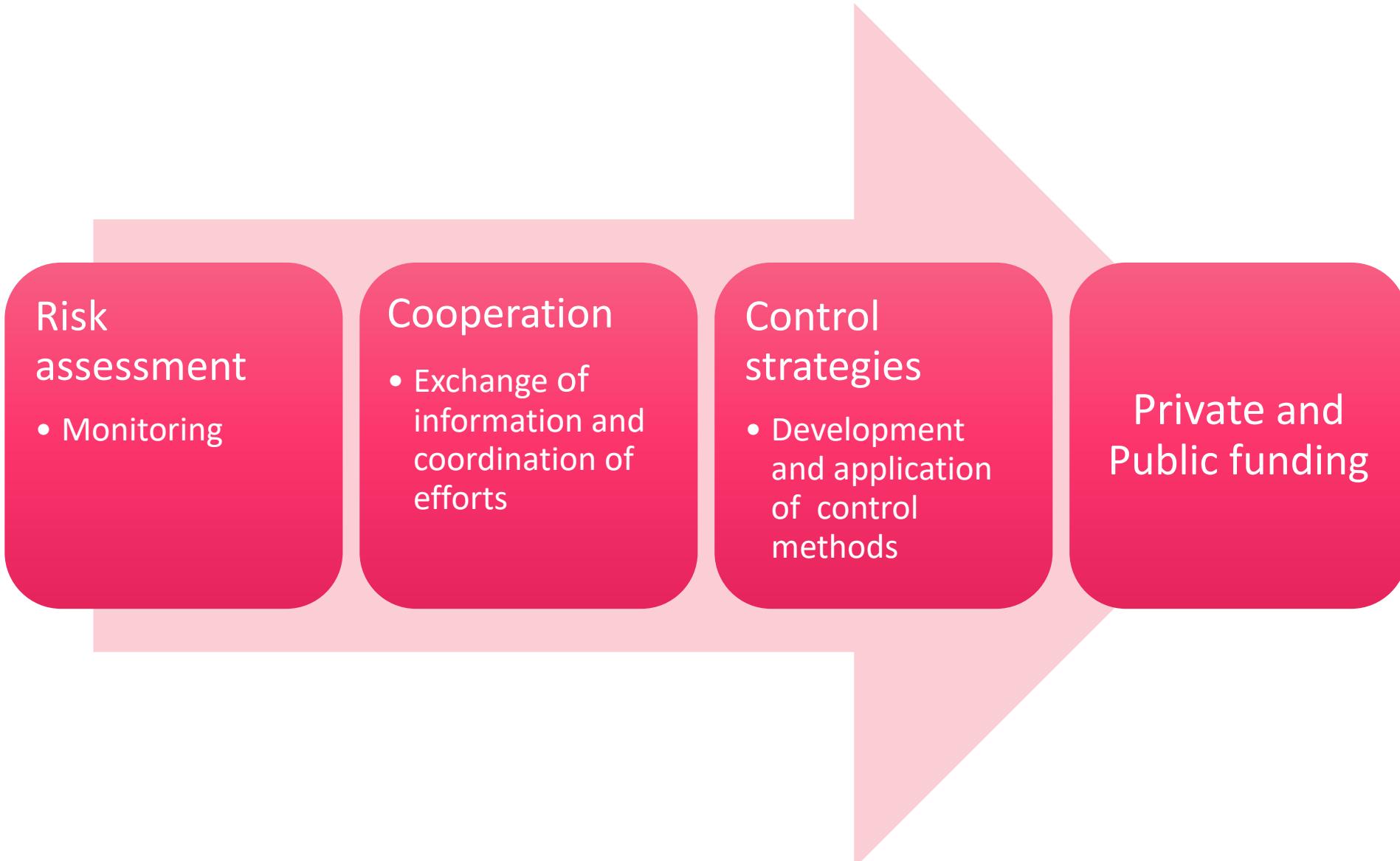


Governance

Portugal



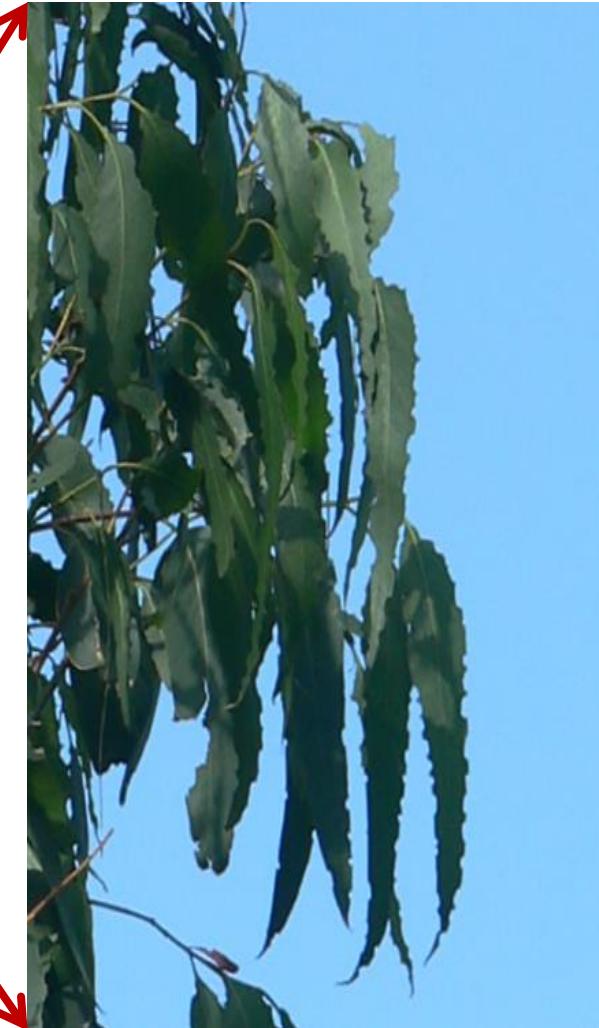
Executive framework



Detection and identification

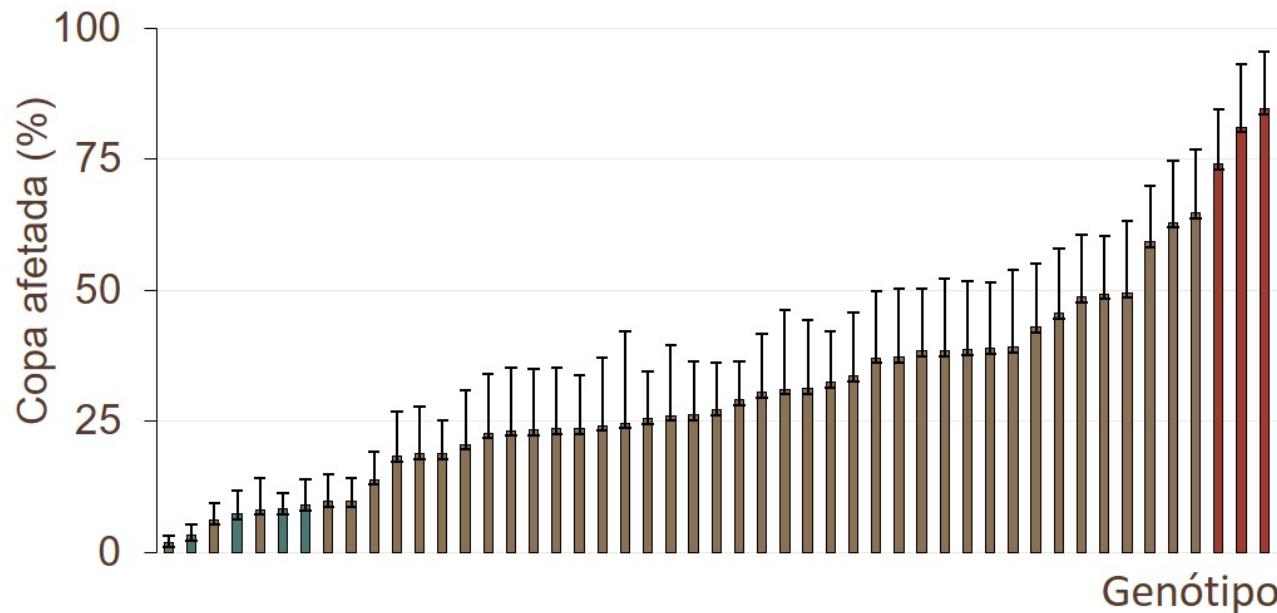


Detection and identification



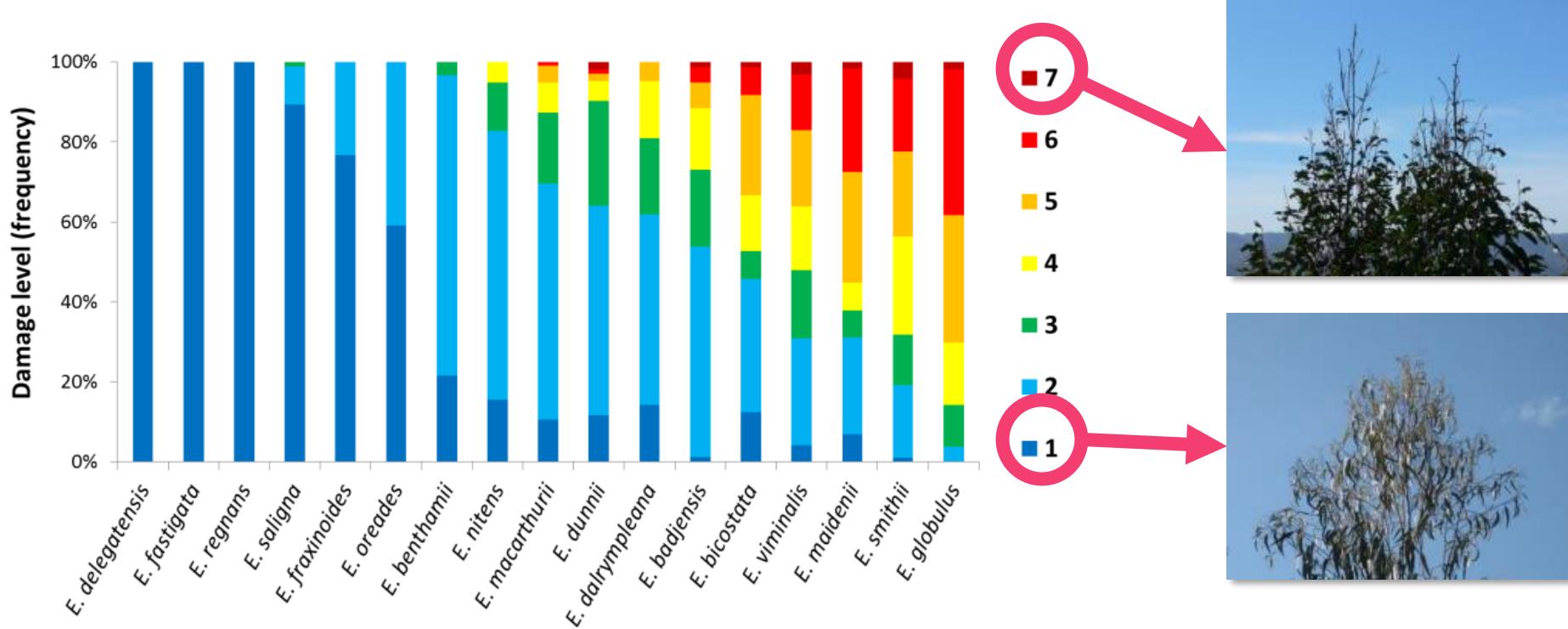
Prevention

- Select /develop resistant and tolerant genetic materials
- Silvicultural practices



Eucalyptus selection

- 16 species of *Eucalyptus sp* (45 provenances)



Monitoring, Surveillance



- Visual surveys, defoliation classes

Monitoring, Surveillance

- Defoliation level determines pest management decision
- Monitoring is crucial!

Management decision, ALTRI Portugal	Attack intensity	Visual observations	Management decision
	Without attack	No signs	No intervention
	Weak attack	<20% defoliation	Continue monitoring
	Medium	20-90%	Control
	Strong	>90%	Clear cut

Management decision (Cantabria)

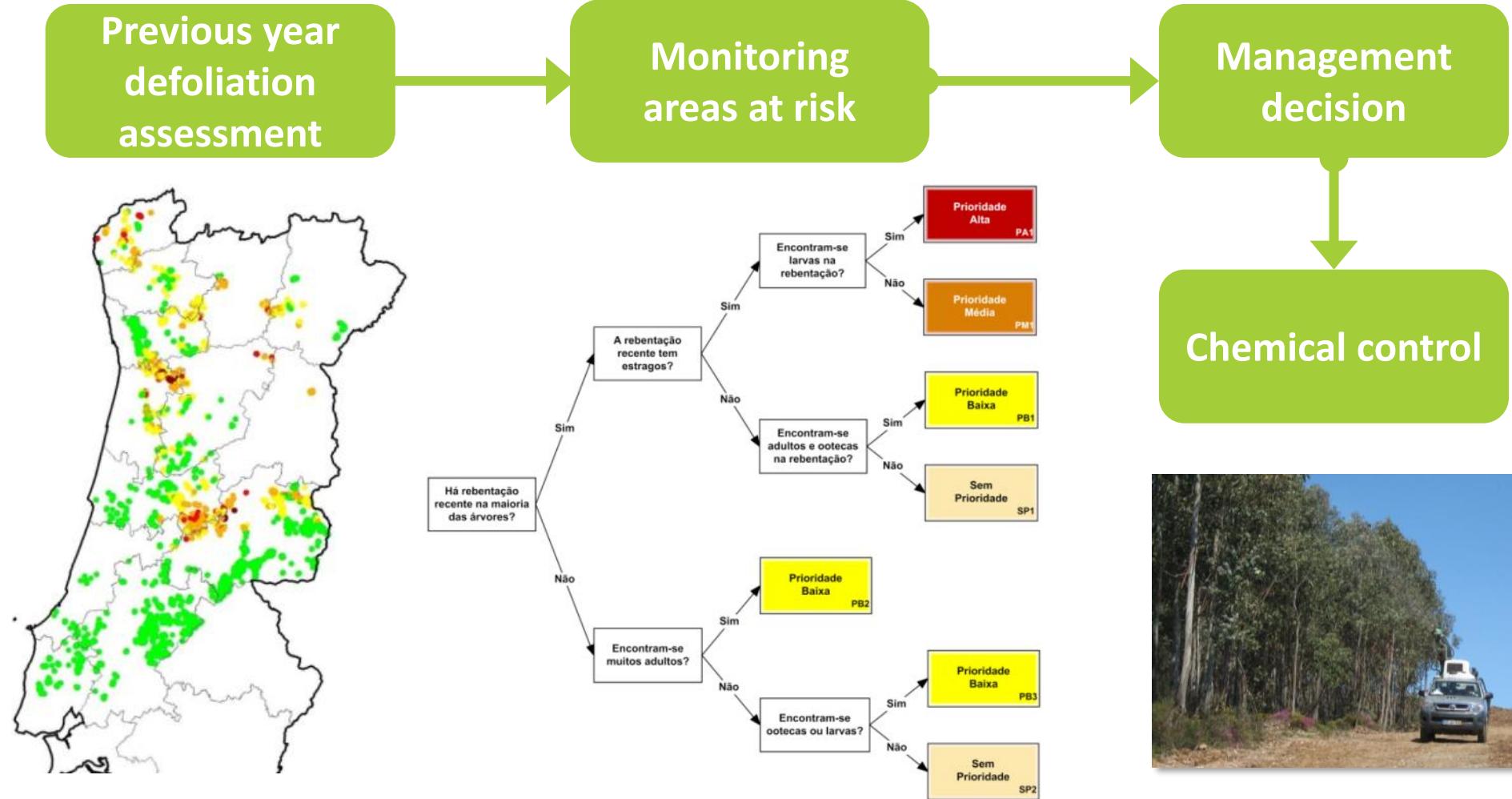
DEFOLIATION (%)	NO INTERVENTION	BIOLOGICAL CONTROL	CHEMICAL CONTROL
0-10	X	X	
11-25		X	
26-45		X	X
> 46	X		X

Options:

- 1.- Spraying (backpack sprayer).
- 2.- Nebulizer.
- 3.- Aerial treatments ULV (Ultra Low Volume).



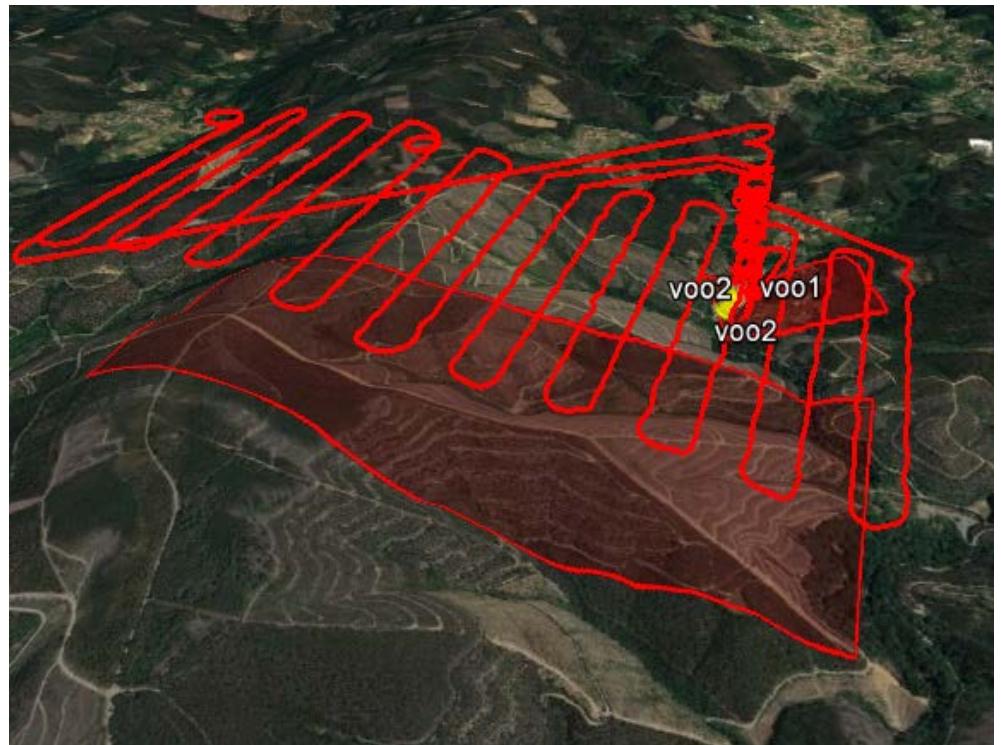
Management decision control (RAIZ, Portugal)



Tools are needed for monitoring,
and to support management
decision!

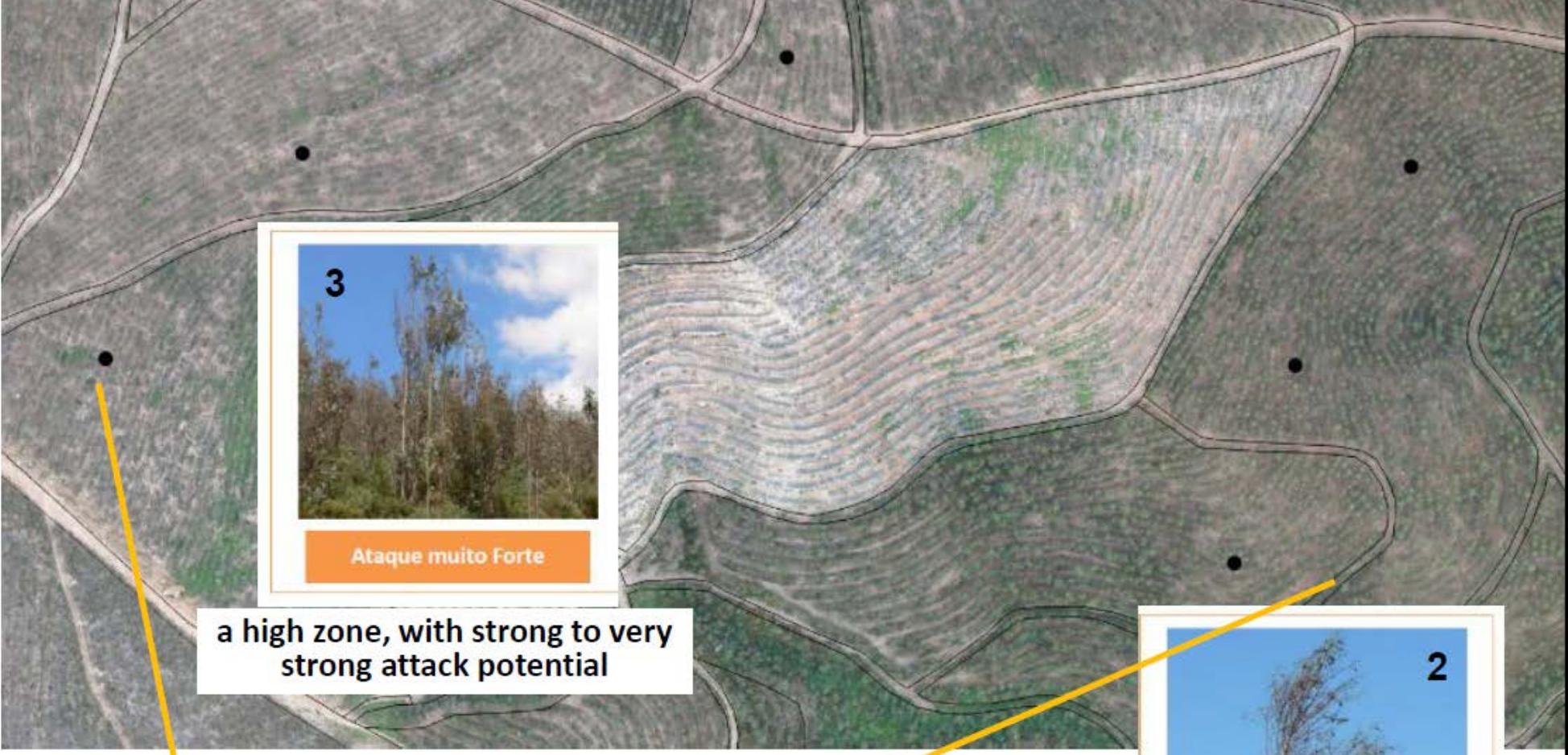
New Tool From PURIFOR -1

Defoliation assessment through
multispectral cameras mounted on UAVs

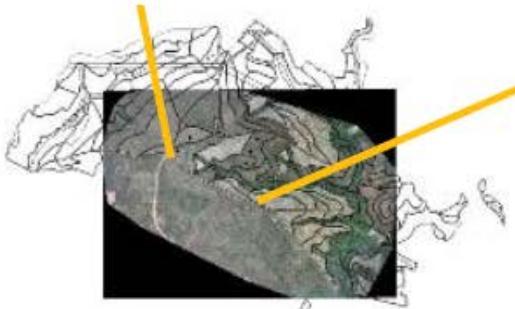


Sensors:

- Multispectral (RGB, Green, Red, NIR, Red Edge)

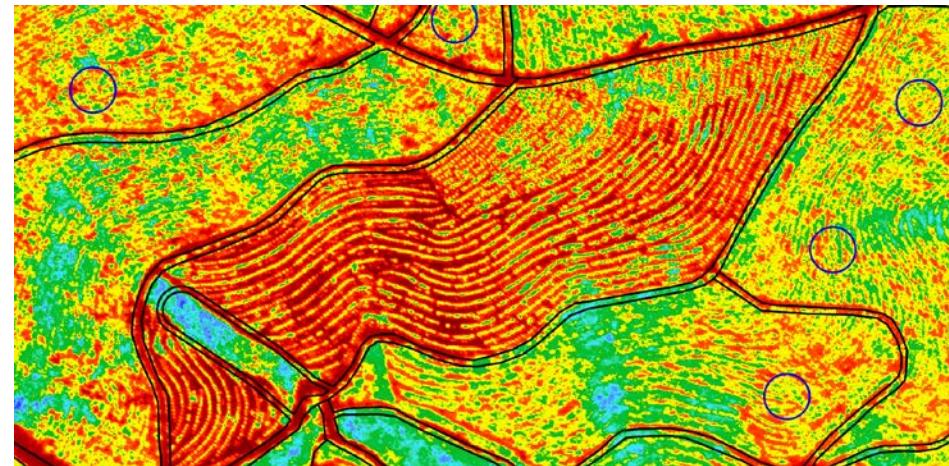
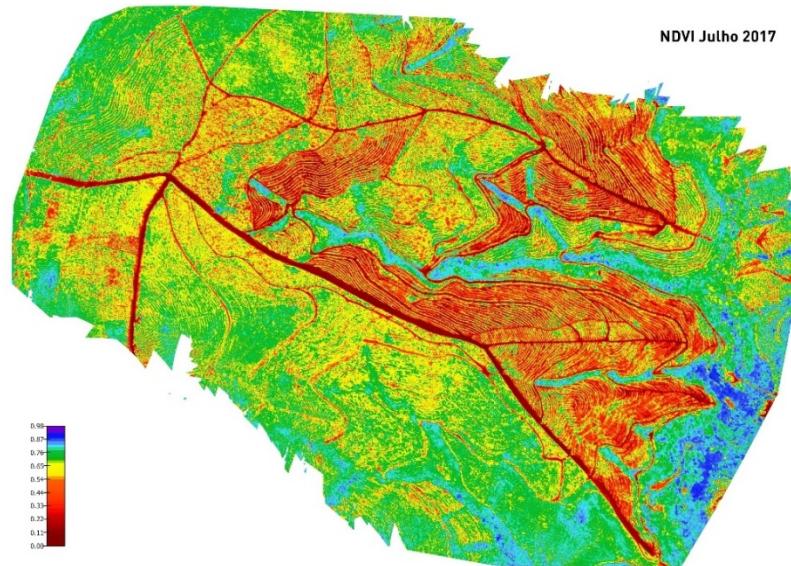
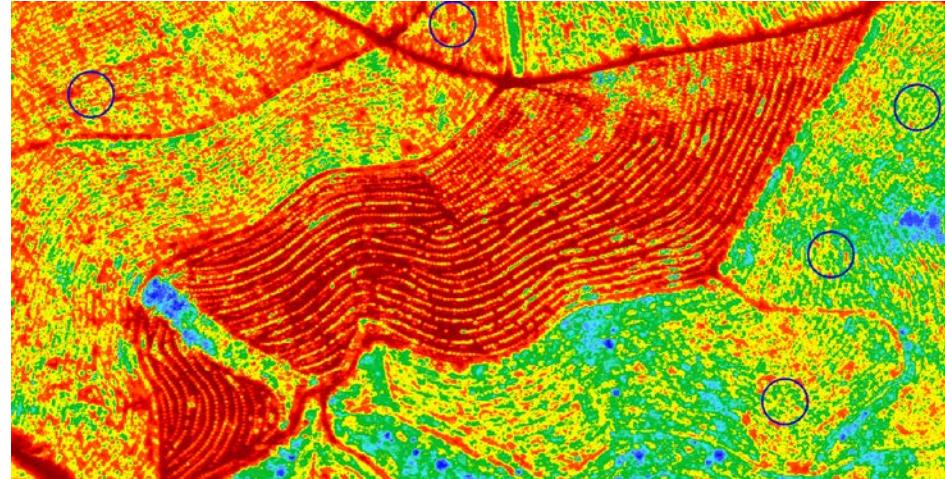
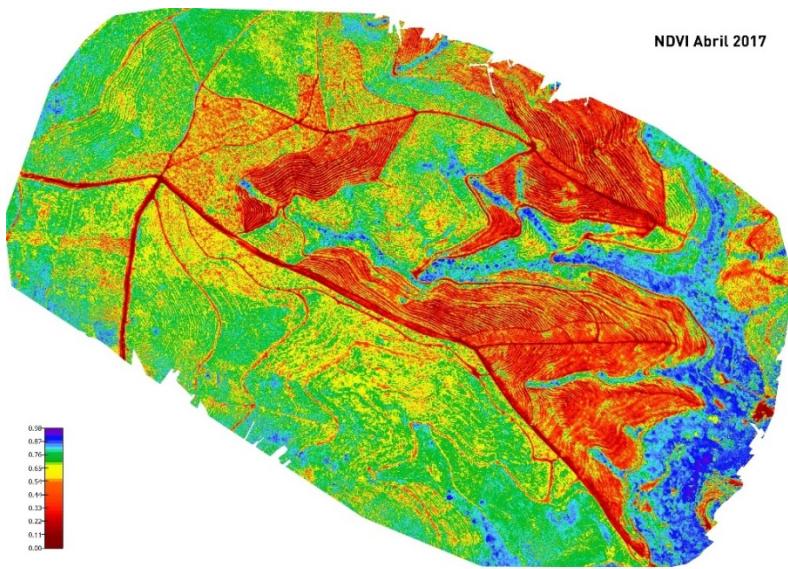


2nd rotation stands (coppice) with 6 and 7 yrs old



a zone with a lower elevation,
with moderate to strong attack
potential

Classes of defoliation - NDVI April and June 2017, Portugal



GONIPTERUS PLATENSIS

DEFOLIATION ASSESSMENT THROUGH MULTISPECTRAL CAMERAS MOUNTED ON UAVs



General information

Description	A tool to assess and monitor defoliation in eucalyptus stands	
Geographical area	Eucalyptus distribution area	
Group of tree species	Eucalyptus species	
Date	May 2018	
Authors (affiliation)	Covadonga Prendes (CETEMAS), Elena Canga (CETEMAS), Juan Majada (CETEMAS), Paula Soares (ISA), Manuela Branco (ISA), Francisco Lario (TRAGSA), Julio Díez (UVA)	
Contact e-mail	Juan Majada: jmajada@cetemas.es	
Tool type	Map remote sensing	Case studies
Tool format	Cartography layers (GIS)	
Language	English	
Risk management plans to which the tools can be added	Risk management plans for the eucalyptus weevil from Portugal, Asturias and Cantabria	
Risk management plans link	[Web links to the risk management plans to which the tools can be added]	
This tool is...	<input checked="" type="checkbox"/> a new tool	<input type="checkbox"/> an improved tool
Original tool of which this one is an improvement	[none]	

Tool implementation stage and requirements

For the implementation of the tool it will be necessary guidelines for:

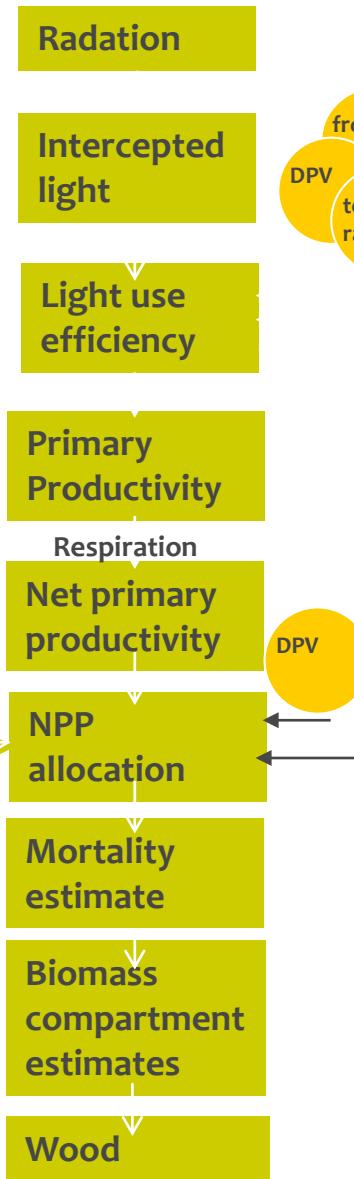
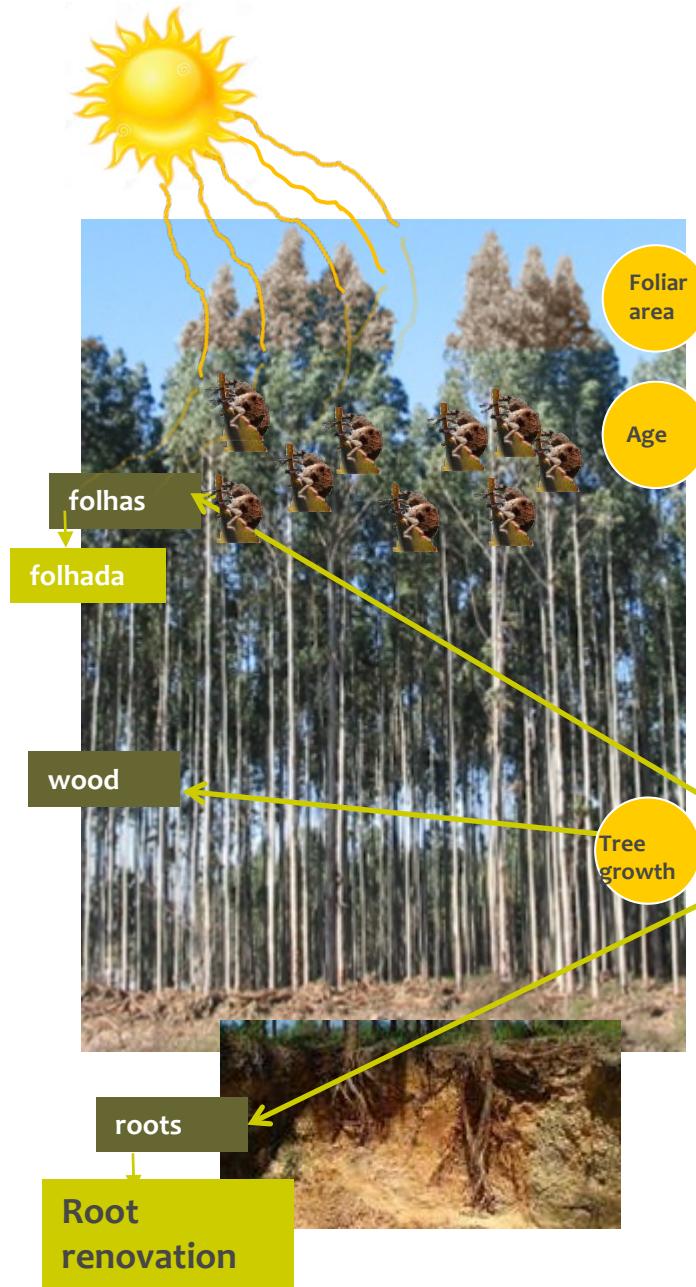
- Obtaining the images:
 - 1) Platform type;
 - 2) Flight parameters - Trajectory, overlap and altitude;
 - 3) Sensor type: multispectral images,
- Image processing:
 - (1) Estimate appropriate indexes to obtain the different levels of defoliation (validated with field observations)
 - (2) Visualization of information - creation of defoliation maps

New Tool From PURIFOR - 2

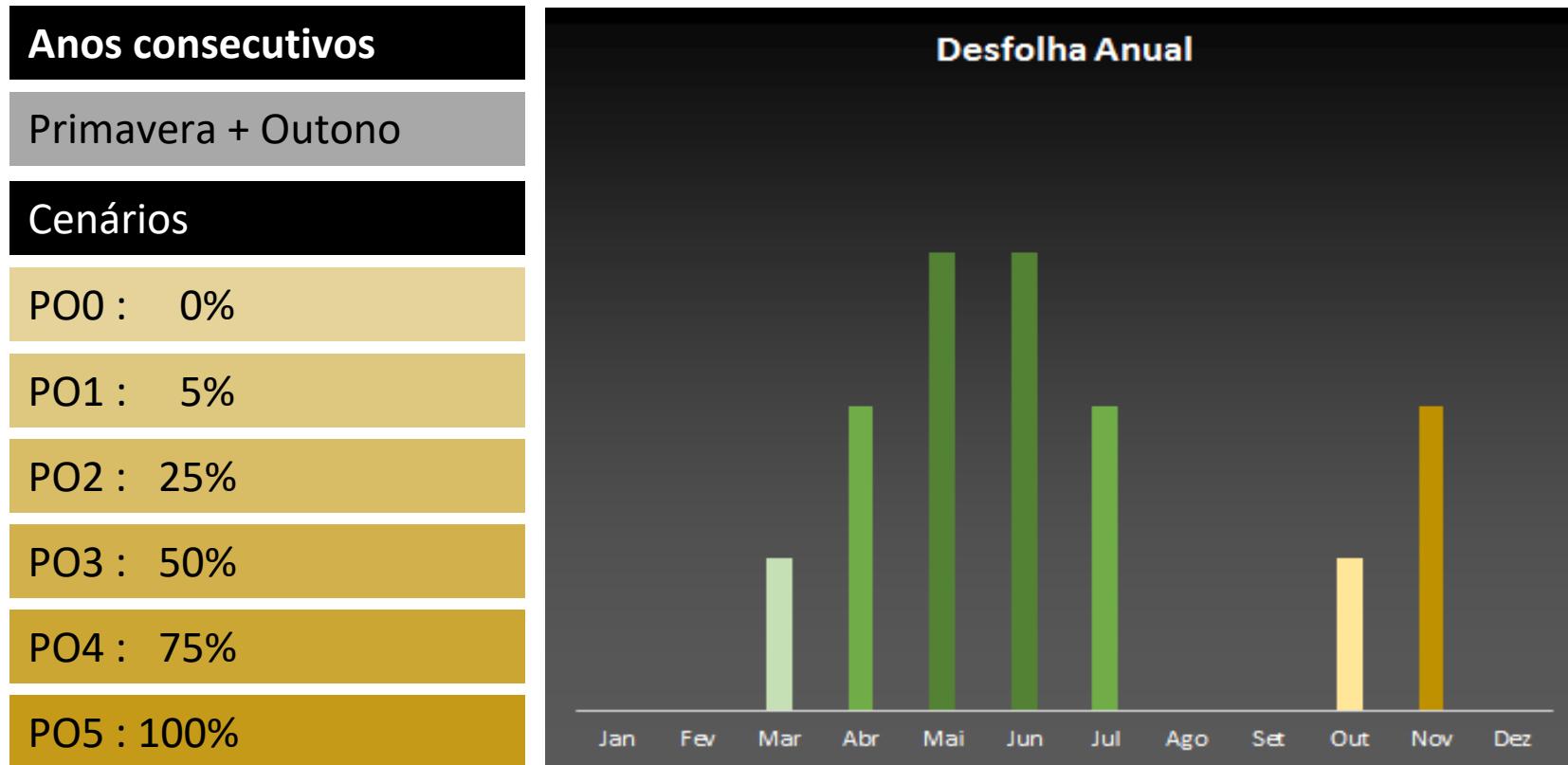
Predicting wood loss under different scenarios using
process-based models

Model:

- 3PG calibrated for *Eucalyptus globulus* Portugal
- Defoliation – empirical data based on field observations
- Scenarios: different treatment strategies



CENÁRIOS DE DESFOLHA NO 3-PG



CENÁRIOS DE DESFOLHA NO 3-PG

Anos consecutivos

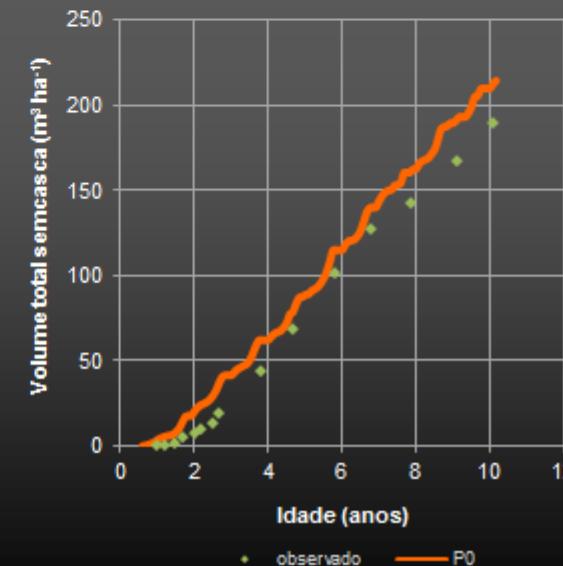
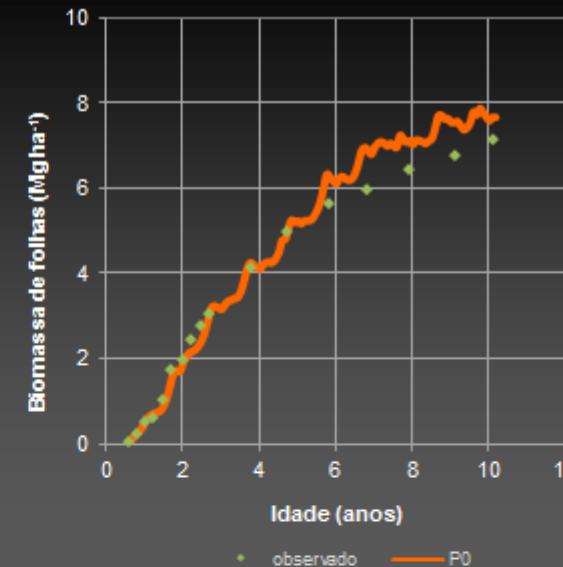
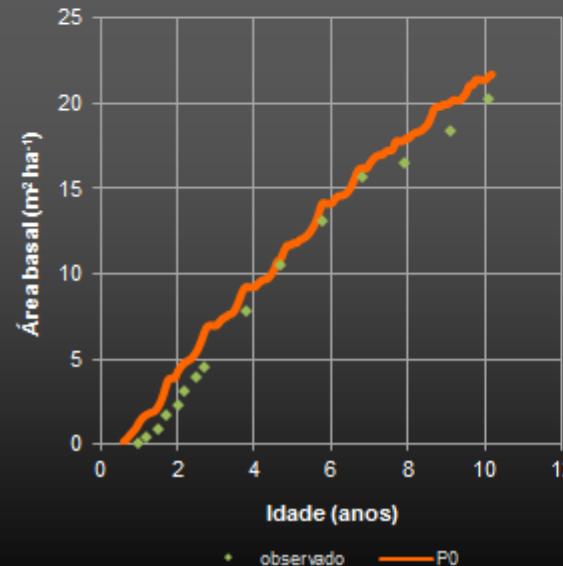
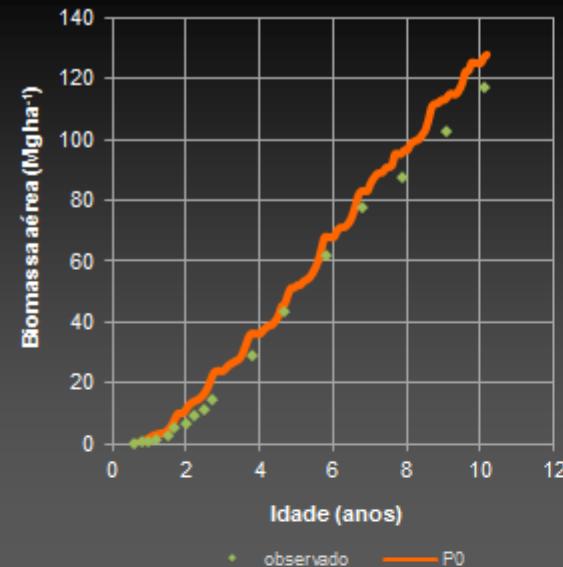
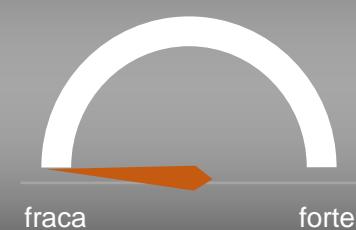
Desfolha Anual

sem
desfolha

Jan Feb Mar Abr Mai Jun Jul Ago Set Out Nov Dez

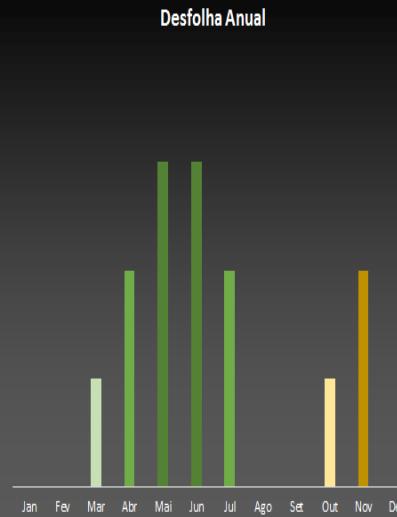
Cenário

0 %



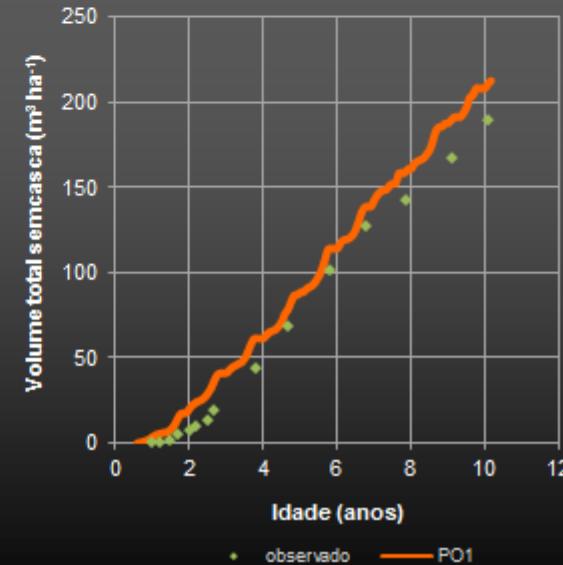
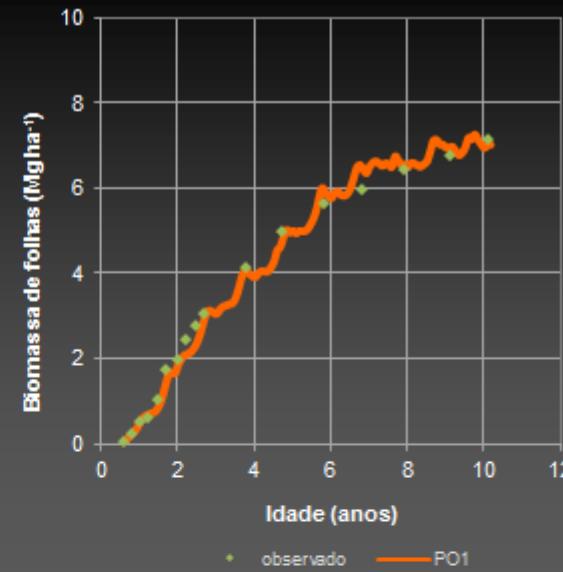
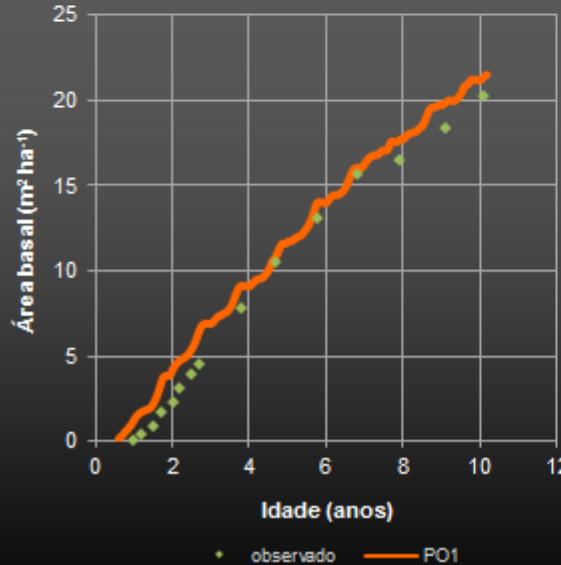
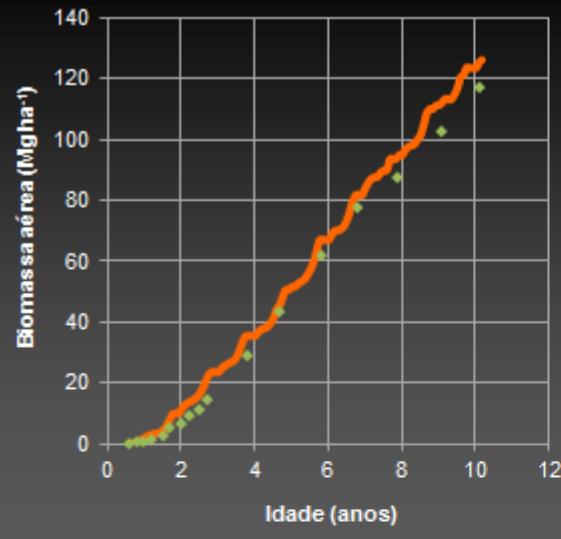
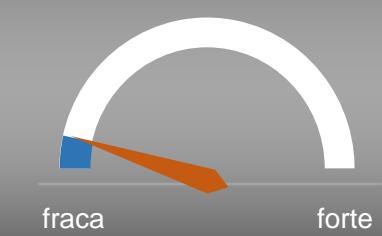
CENÁRIOS DE DESFOLHA NO 3-PG

Anos consecutivos



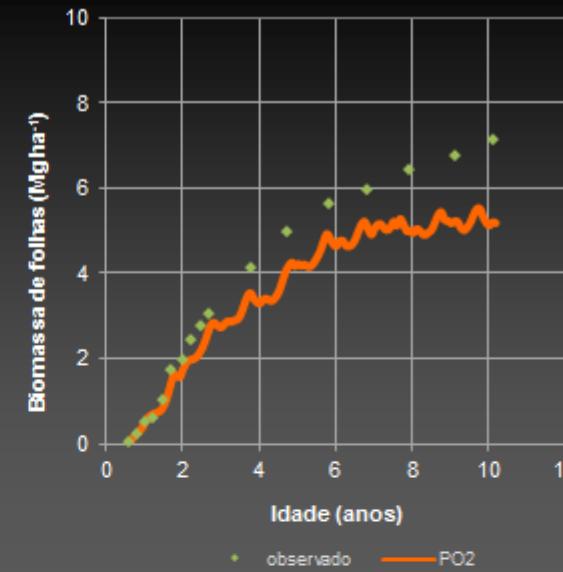
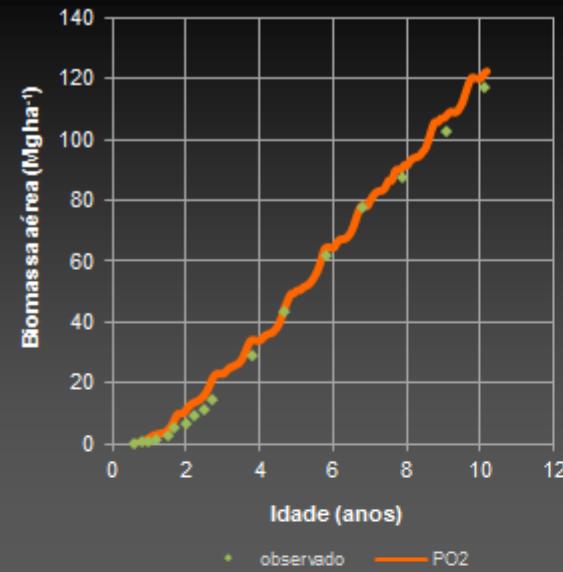
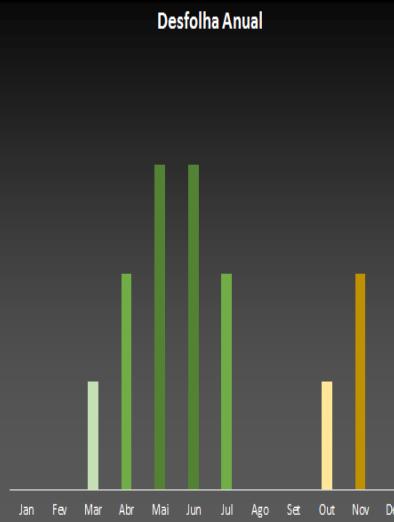
Cenário

5 %



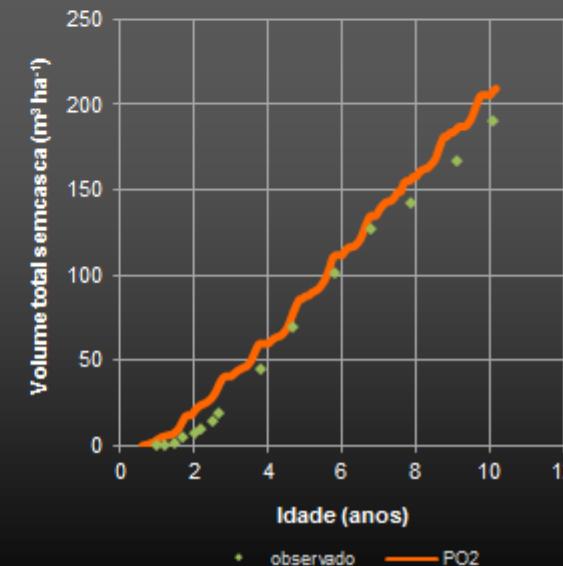
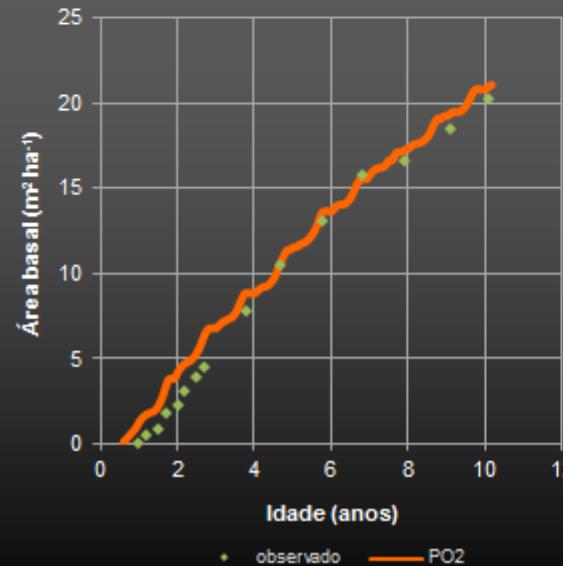
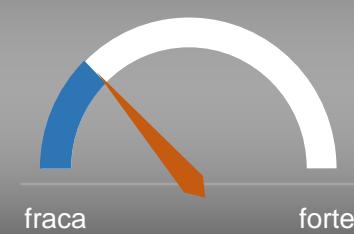
CENÁRIOS DE DESFOLHA NO 3-PG

Anos consecutivos



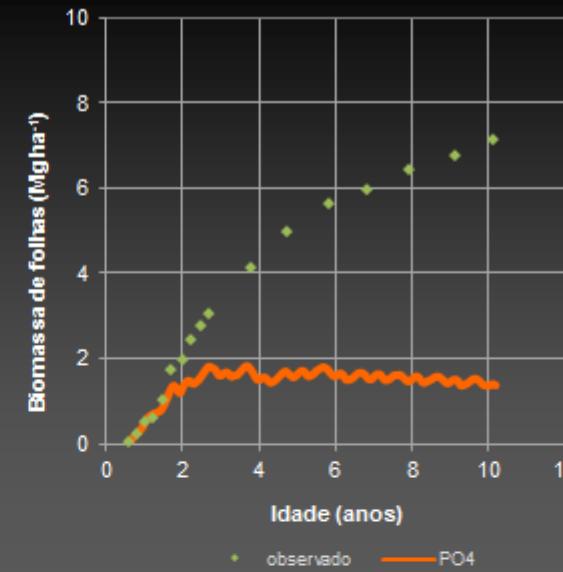
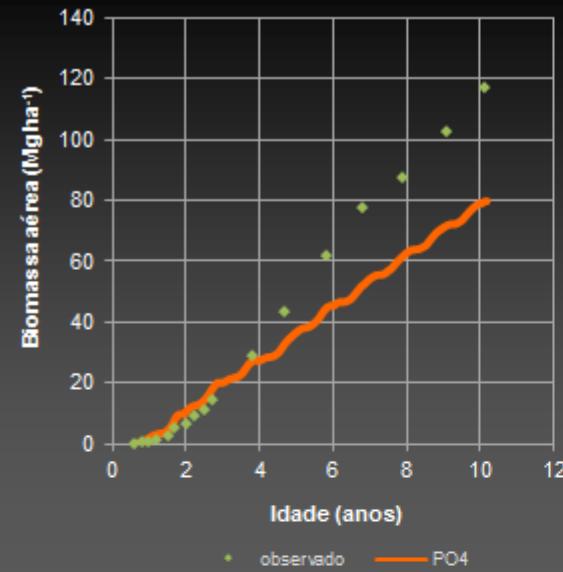
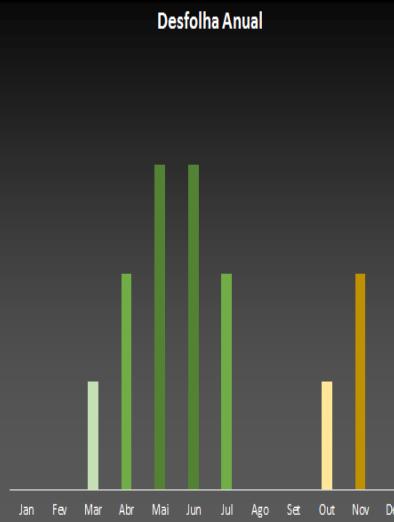
Cenário

25 %



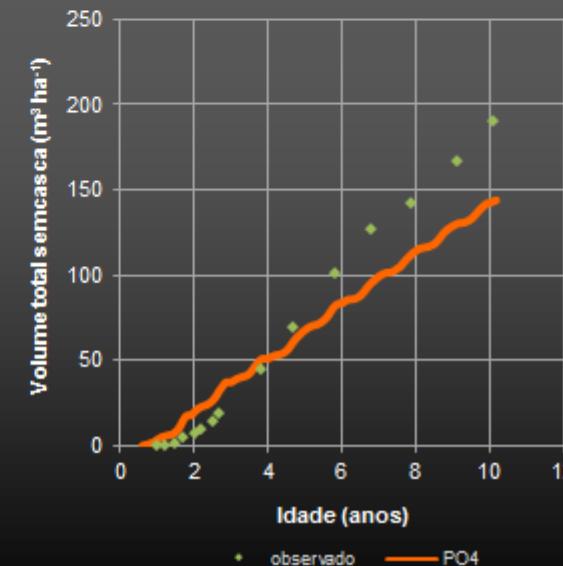
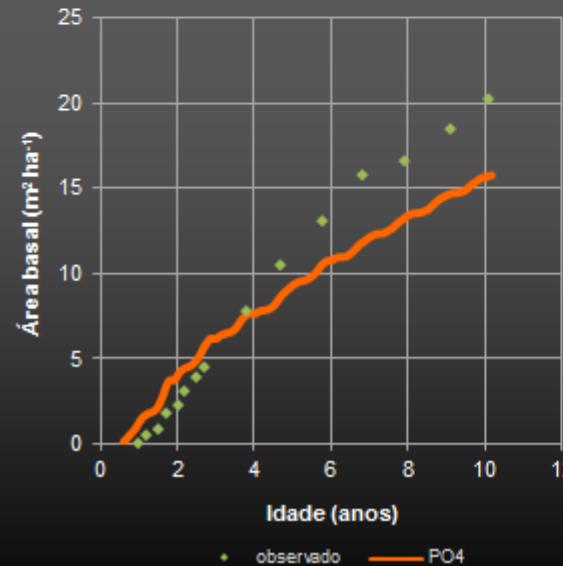
CENÁRIOS DE DESFOLHA NO 3-PG

Anos consecutivos



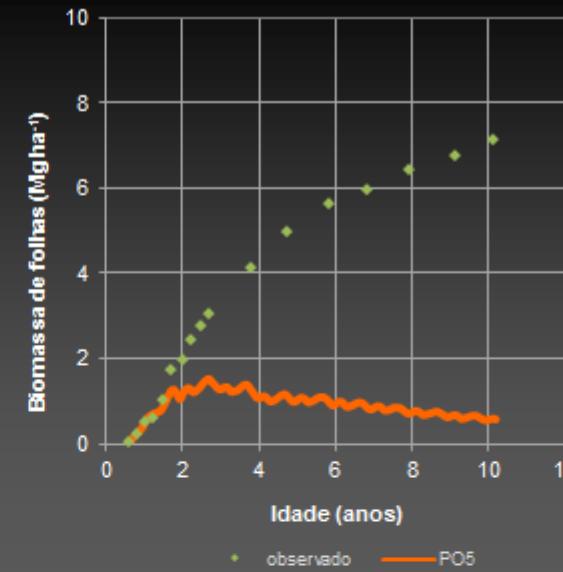
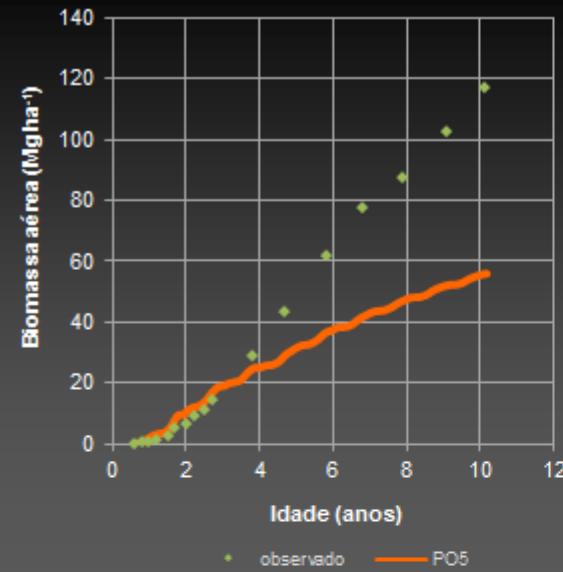
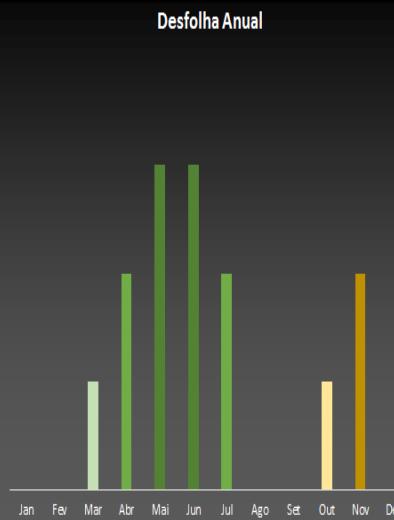
Cenário

75 %



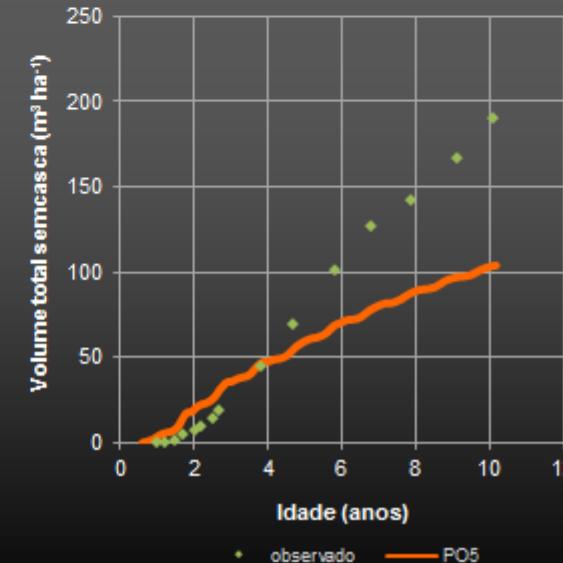
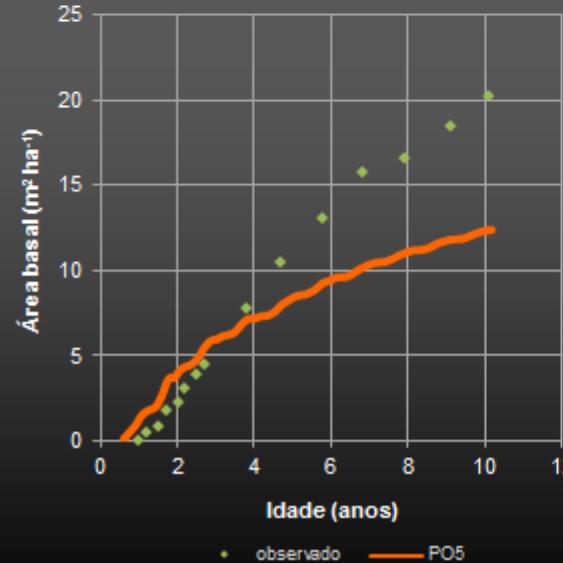
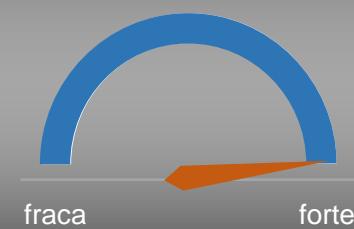
CENÁRIOS DE DESFOLHA NO 3-PG

Anos consecutivos



Cenário

100 %



Control strategies

Chemical control

Two insecticides are homologated and applied



Calypso - tiaclopride
Epik - acetamiprid

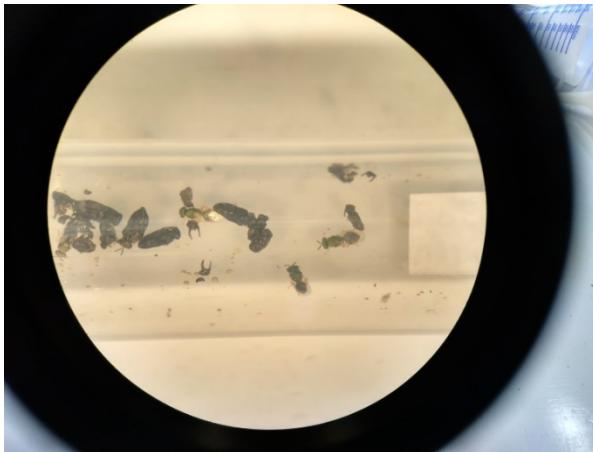
Biological control

Rearing and augmentative release of *Anaphes nitens* (Hym: Mymaridae)



Biological control

Second phase measures: risk assessments for the introduction of new BC agents from Australia or Chile



Rehabilitation/restoration

- Cutting
- Reforestation with resistant material



Communication Strategy

- Transnational workshops
- Mixed meetings with researchers, technicians and foresters
- Participation in Operational Groups
- Communication between Operational Groups from different regions

Acknowledgements

- Ana Reis & Luís Leal - ALTRI Florestal
- André Garcia, João Rua & Susana Rocha – ISA
- António Macedo - CELPA
- Carlos Valente - RAIZ
- Dina Ribeiro & Helena Martins - ICNF
- Ricardo Marinho - Forestis

Pine Pitch Canker





One more risk...!



Emerging and invasive forest pests and diseases

M. Branco, E. Sousa, A. Ortiz, J. Casado, A. Cantero, J. Diez,
E. Mauri, C. Orazio, H. Jactel



Context

- **Exponential increase** in the number of exotic, invasive pests and diseases that get established in Europe
- As a result of **global change** (climate, trade, urbanization)
- **Rising threat to European forests**, particularly to planted forests of southwestern Europe



Rationale for emergency plans

- The next invader might be unknown as a pest, or even undescribed
 - Need for generic plans
- The introduced species is likely invasive
 - Need for transboundary cooperation
- Better prevent than cure
 - A priority to early detection

Tentative framework for early warning detection of invasive forest pests (and diseases)

- Sequential framework, following the steps of introduction
 - ✓ Origin of the pest
 - ✓ Transport
 - ✓ Entry = Arrival and Establishment
- Asking the same questions
 - ✓ How ?
 - ✓ Where ?
 - ✓ By whom ?

Step 1. Monitoring scientific and technical literature

- EPPO alert bulletins, studies, PRAs
- EPPO website
- Can be checked by anyone

The screenshot shows the homepage of the EPPO Alert List. At the top, it features the logo of the European and Mediterranean Plant Protection Organization (EPPO) with the text "European and Mediterranean Plant Protection Organization" and "Organisation Européenne et Méditerranéenne pour la Protection des Plantes". Below the logo is a navigation bar with links for "Home", "About EPPO", "Meetings", "Plant quarantine", "Plant Protection Products", "Invasive alien plants", and "Standards". A "Google Custom Search" bar is also present. To the right, there is a section titled "EPPO Alert List" with the text "(last updated in 2018-05)". Below this, a paragraph explains the purpose of the Alert List, mentioning early warning and Pest Risk Analysis (PRA). A link to "Read a short introduction to the EPPO Alert List" is provided. On the far right, a "WHAT'S NEW" box lists three species: "Agrilus fleischeri", "Naupactus xanthographus", and "Prosopis species".

- Scientific papers or presentations
- Web of Science, SCOPUS, international conferences (IUFRO)
- Contact with scientists

The screenshot shows the homepage of the IUFRO Unit 7.03.12. At the top, there is a dark blue header bar with the text "7.03.12 - ALIEN INVASIVE SPECIES AND INTERNATIONAL TRADE". Below the header, there are two columns of information. The left column is labeled "Coordinator" and lists "René Eschen, Switzerland". The right column is labeled "Deputies" and lists "Hugh F. Evans, United Kingdom", "Kenji Fukuda, Japan", and "Sankaran Kavileveettil, India". To the right of these columns is a vertical sidebar with a teal background and white text, titled "Unit 7.03.12". It contains a list of links: "Activities and events", "Publications and references", "Expertise offered by Unit", "Toolbox", and "Unit Noticeboard".

Step 2. Install sentinel plantings in areas of origin

- Planting of important European tree species in potential origin areas of introduced species
- In main countries exporting goods and products to Europe and sharing congeneric tree species: Asia!
- In cooperation with scientists and colleagues from exporting countries



RESEARCH ARTICLE

Planting Sentinel European Trees in Eastern Asia as a Novel Method to Identify Potential Insect Pest Invaders

Alain Roques^{1*}, Jian-ting Fan², Béatrice Courtial¹, Yan-zhuo Zhang³, Annie Yart¹, Marie-Anne Auger-Rozenberg¹, Olivier Denux¹, Marc Kenis⁴, Richard Baker⁵, Jiang-hua Sun³

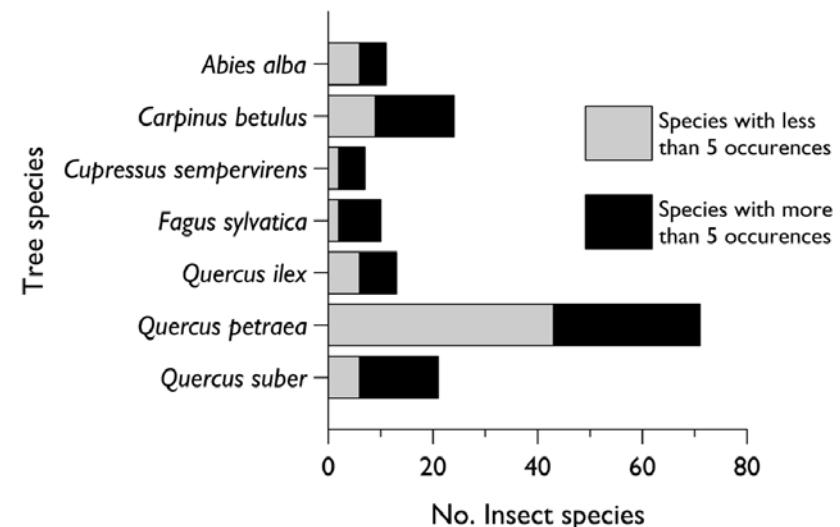
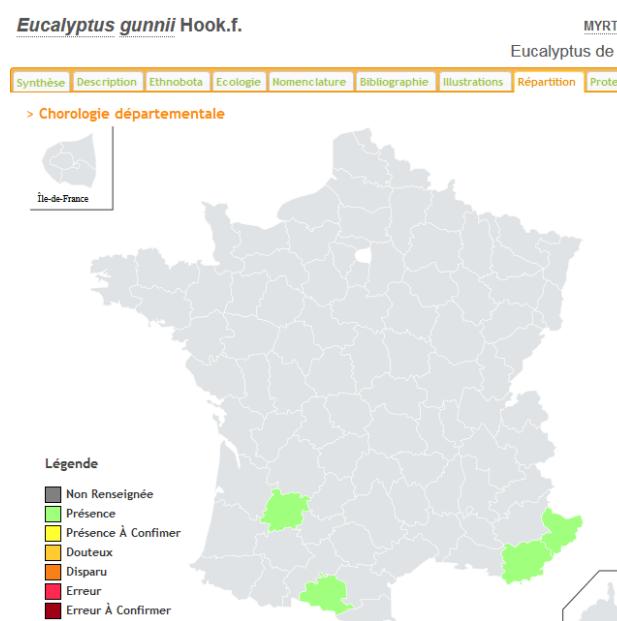


Fig 5. Comparative colonization of the different species of European trees planted at two sites in China and the frequency of the colonization events. No. spp > 5 events means that these insect species were observed on more than 5 seedlings during two different years (pooled over both sites). Note that an individual insect species can be observed on more than a single tree species.

doi:10.1371/journal.pone.0120864.g005

Step 3. Surveillance of forests at risk of invasion

- Identification and surveillance of forests threatened by insects or diseases on alert list, through aerial and/or field surveys
- In main areas of presence of threatened tree species
- By forest health managers with help of forest inventory people



Step 4. Use of arboreta as sentinels for detection

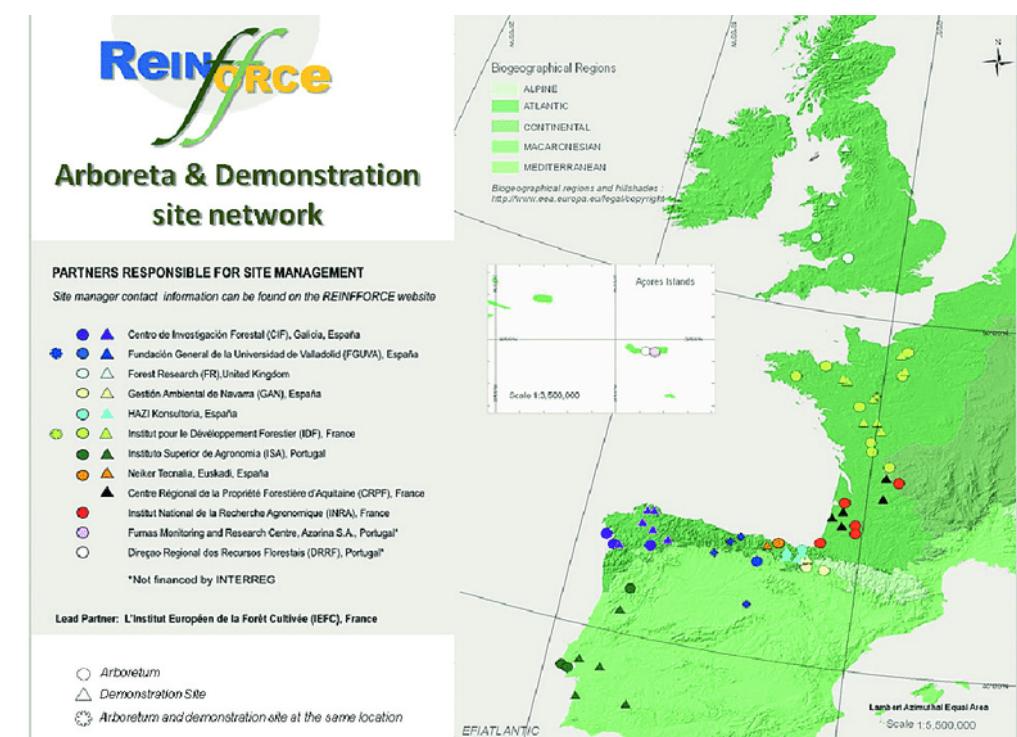
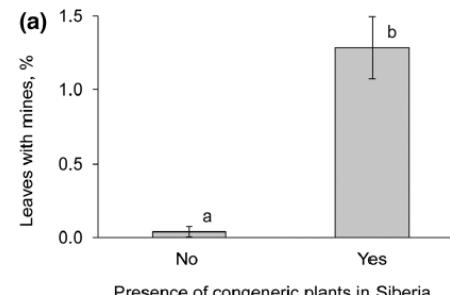
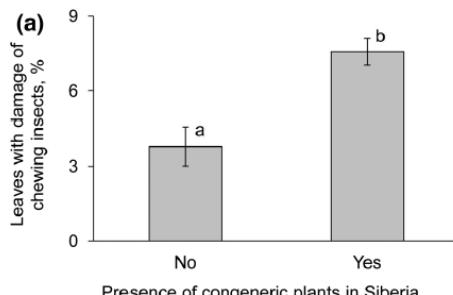
- Network of arboreta & botanical gardens with native and exotic trees species, to serve as “trap trees” of introduced exotic species
- Through the region at risk, close to entry points (ports, roads)
- By forest scientists, forest health agents, forest managers

Oecologia (2016) 182:243–252
DOI 10.1007/s00442-016-3645-y

COMMUNITY ECOLOGY – ORIGINAL RESEARCH

Using a botanical garden to assess factors influencing the colonization of exotic woody plants by phytophagous insects

Natalia Kirichenko^{1,2,3} · M. Kenis⁴

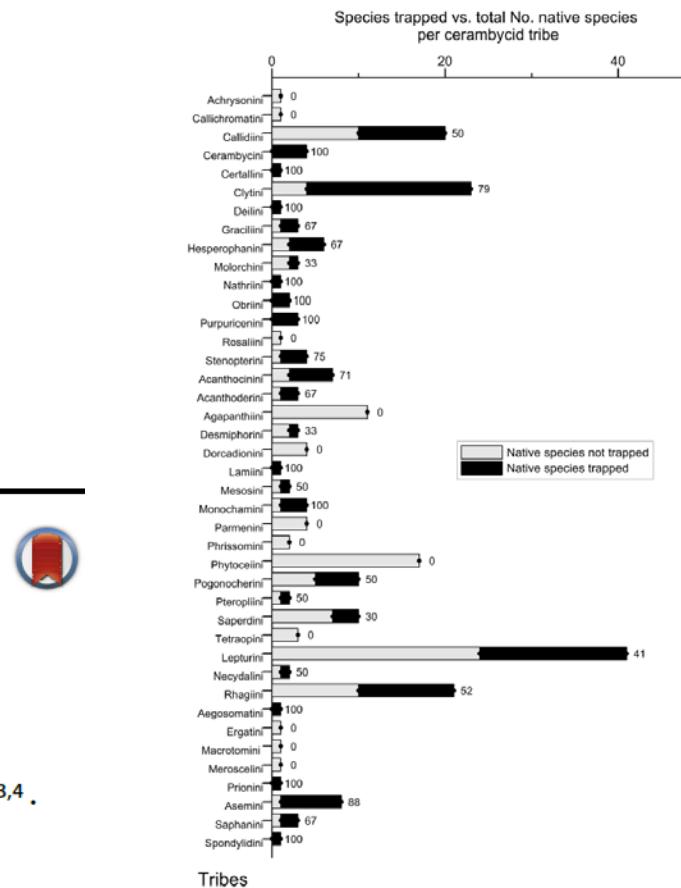


Step 5. Use of multi-pheromone traps

- Installation of multi-pheromone (generic) traps, for the interception of alien species
- In seaports and airports
- By forest health managers, custom agents, with the help of taxonomists

Journal of Pest Science
<https://doi.org/10.1007/s10340-018-0997-6>

ORIGINAL PAPER



Multi-component blends for trapping native and exotic longhorn beetles at potential points-of-entry and in forests

Jian-ting Fan^{1,2} · Olivier Denux¹ · Claudine Courtin¹ · Alexis Bernard¹ · Marion Javal¹ · Jocelyn G. Millar^{3,4} ·
Lawrence M. Hanks⁵ · Alain Roques¹

Step 6. DNA bar coding for the identification of intercepted alien species

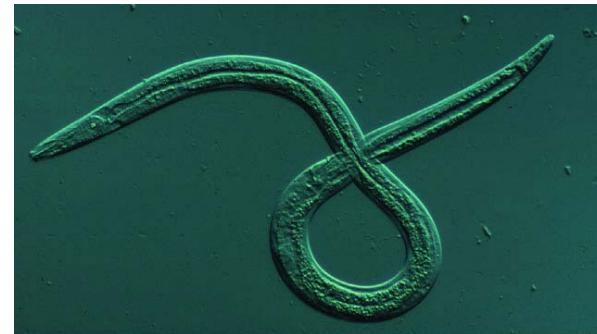
- Development of generic pipelines using NGS data as genetic markers (e.g. SNPs) to identify introduced species, and track their origin
- In research labs and biosecurity agencies
- By scientists and staff members of biosecurity labs

Biol Invasions (2015) 17:1199–1213
DOI 10.1007/s10530-014-0788-9

ORIGINAL PAPER

Worldwide invasion routes of the pinewood nematode: What can we infer from population genetics analyses?

Sophie Mallez · Chantal Castagnone · Margarida Espada · Paulo Vieira · Jonathan D. Eisenback · Mark Harrell · Manuel Mota · Takuya Aikawa · Mitsuteru Akiba · Hajime Kosaka · Philippe Castagnone-Sereno · Thomas Guillemaud

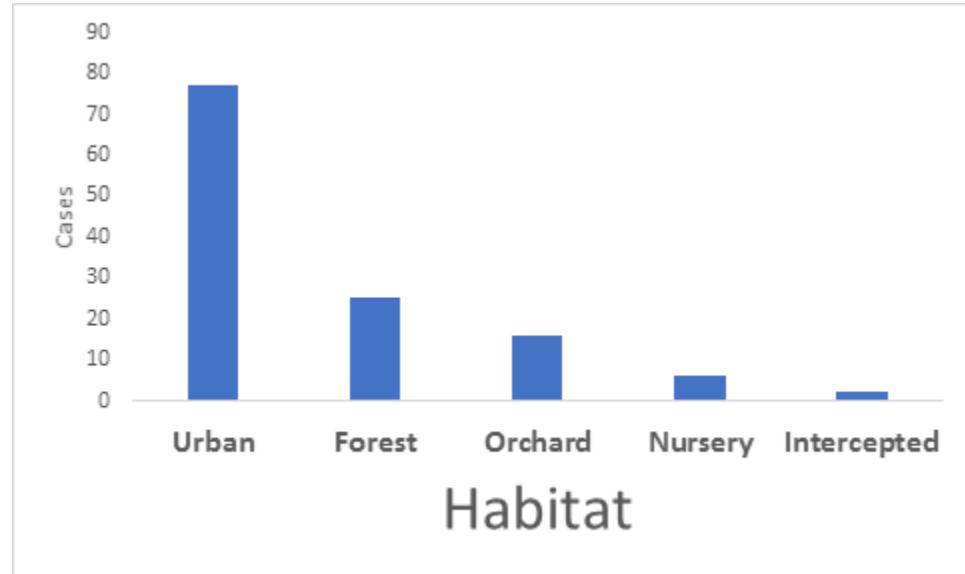


the populations of Portugal/Madeira seem to be closer to the American populations than to the Japanese populations,

Step 7. Citizen science for multiplying the sources of information on emerging sanitary problems

- Development of smartphone application to take pictures of damages or symptoms on trees and detect anomalies
- Everywhere but focus on urban and peri urban areas
- By trained forest (health) managers, then citizens.
Curation and identification by trained people, then artificial intelligence

Type of habitats for the first interception of 126 alien forest pest species in Europe
(PLURIFOR study)



Step 7. Citizen science for multiplying the sources of information on emerging sanitary problems

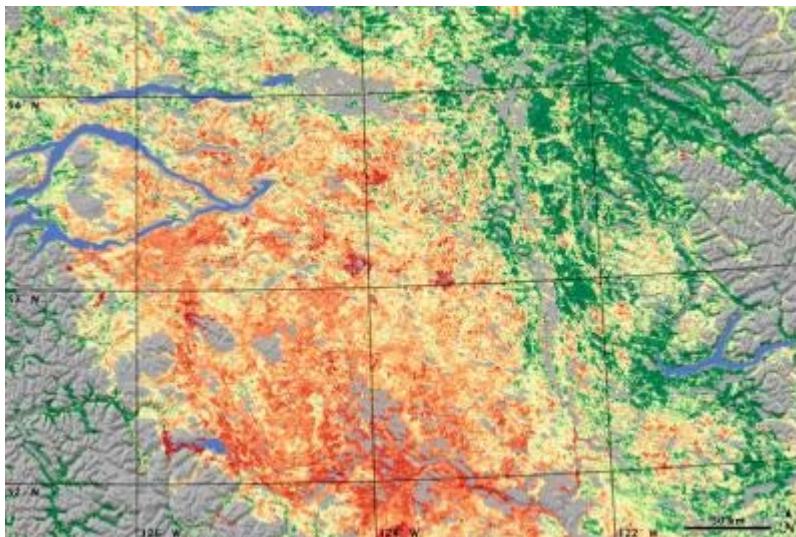
- Development of smartphone application to take pictures of damages or symptoms on trees and detect anomalies
- Everywhere but focus on urban and peri urban areas
- Curation and identification by trained people, at EFI Planted Forests Facility

SILVALERT ®
Developed by EFI in
the PLURIFOR project

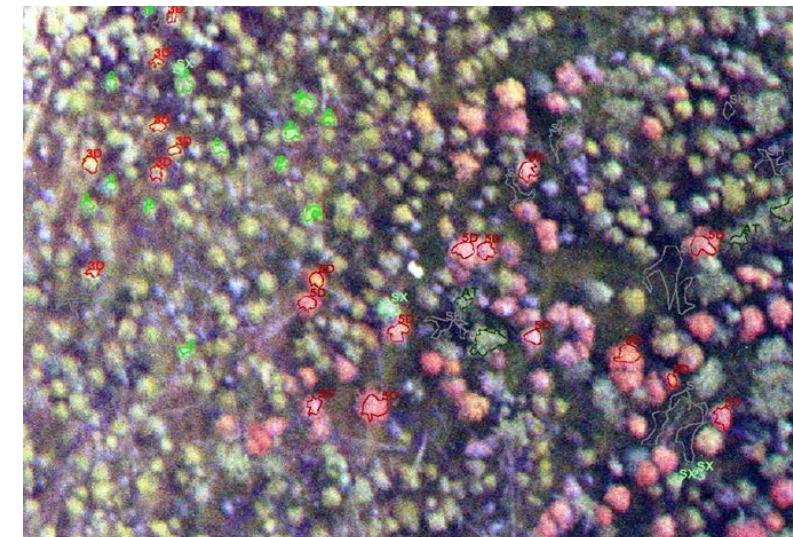


Step 8. Remote sensing of forest damage

- Time series of satellite images over large forest areas to detect new infestations foci and their spatial extension
- Forest areas at risk, regional level
- Forest health departments, biosecurity agencies



Satellite image of Mountain Pine Beetle damage (NASA)



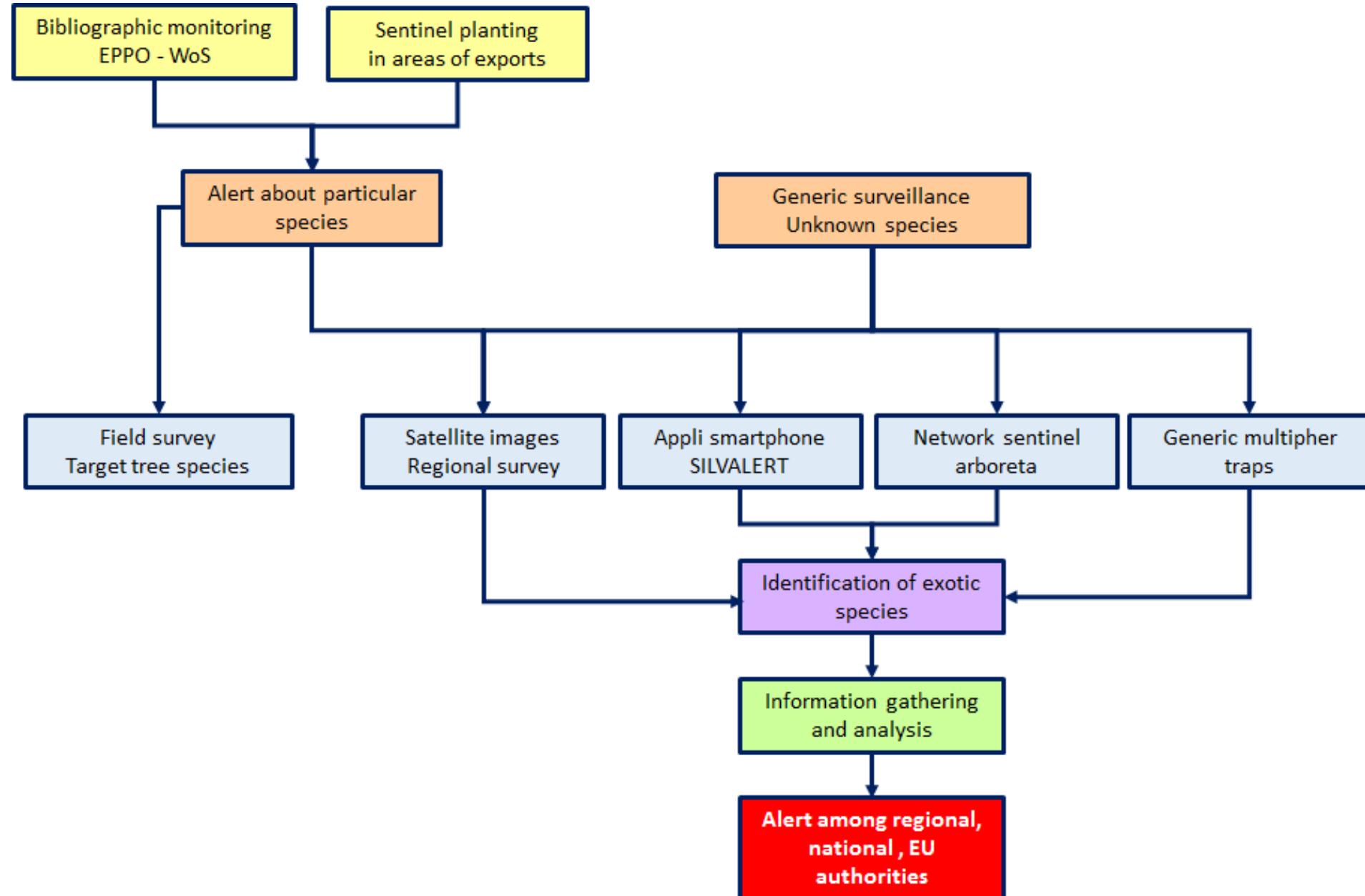
Healthy pine trees (green) and trees infested by mountain pine beetle (red); the delineating polygons used for computerized classification procedures

Step 9. Permanent monitoring unit: "war room"

- Gathering and analysis of information
Updating methods and tools for monitoring and detection purposes
Sending alerts
- At regional level – at European level (e.g. EFI)
- Cooperation btw scientists + forest health agencies + forest managers



Decision tree



More to come...

Addition of *Neodiprion abietis* to the EPPO Alert List



From www.eppo.int - June 2, 2017 4:59 PM

Neodiprion abietis is a North American defoliator of *Abies* spp. and other conifers.

Corythucha arcuata found for the first time in France



From agriculture.gouv.fr - September 28, 2017 4:35 PM

Neonectria neomacrospora: added to the EPPO Alert List



From www.eppo.int - June 29, 2017 5:04 PM

Since 2008, a new and severe canker disease caused by *Neonectria neomacrospora* (anamorph *Cylindrocarpon cylindroides*) has been observed on firs (*Abies* spp.) in Norway. In 2011, the same disease was also found in Denmark causing damage on fir trees. In 2015, the fungus was detected in Southern Sweden. The Panel on Quarantine Pests for Forestry recommended that *N. neomacrospora* is added to the EPPO Alert List

Xylella fastidiosa detected on almond in Alicante (ES)

From www.agroinformacion.com - July 3, 2017 2:17 PM

" La detección por primera vez en la península de la bacteria *Xylella fastidiosa* en una plantación de almendros del municipio de Guadalest, en la comarca alicantina de la Marina Baixa, ha desatado la alarma y la necesidad de que se tomen medidas urgentes para evitar que se pueda propagar a otros cultivos, especialmente el olivar. ..."



Anne-Sophie Roy's insight:

Xylella fastidiosa has recently been detected in an almond orchard in the municipality of Guadalest (Marina Baixa, Alicante). This is the first record of the bacterium on mainland Spain.

Addition of *Xylosandrus compactus* to the EPPO Alert List



From www.eppo.int - March 10, 2017 10:27 AM

A new Asian ambrosia beetle found in Europe



Anne-Sophie Roy's insight:

Xylosandrus compactus is an ambrosia beetle of Asian origin which has recently been found in Italy and Southern France. In Italy, damage has been observed in maquis plants (Lazio).



Nearly there!





SYLVALERT

**A collaborative tool to report
and
analyse forest damages**

Christophe Orazio (EFI)

Concept

- Objective :
 - Participatory approach to report damages in forest
 - Involvement of local authorities
 - Valuable approach for scientists
- Target audience
 - Beta version : only project partners
 - Intermediate stage : forest professional and users
 - Final stage : everybody?

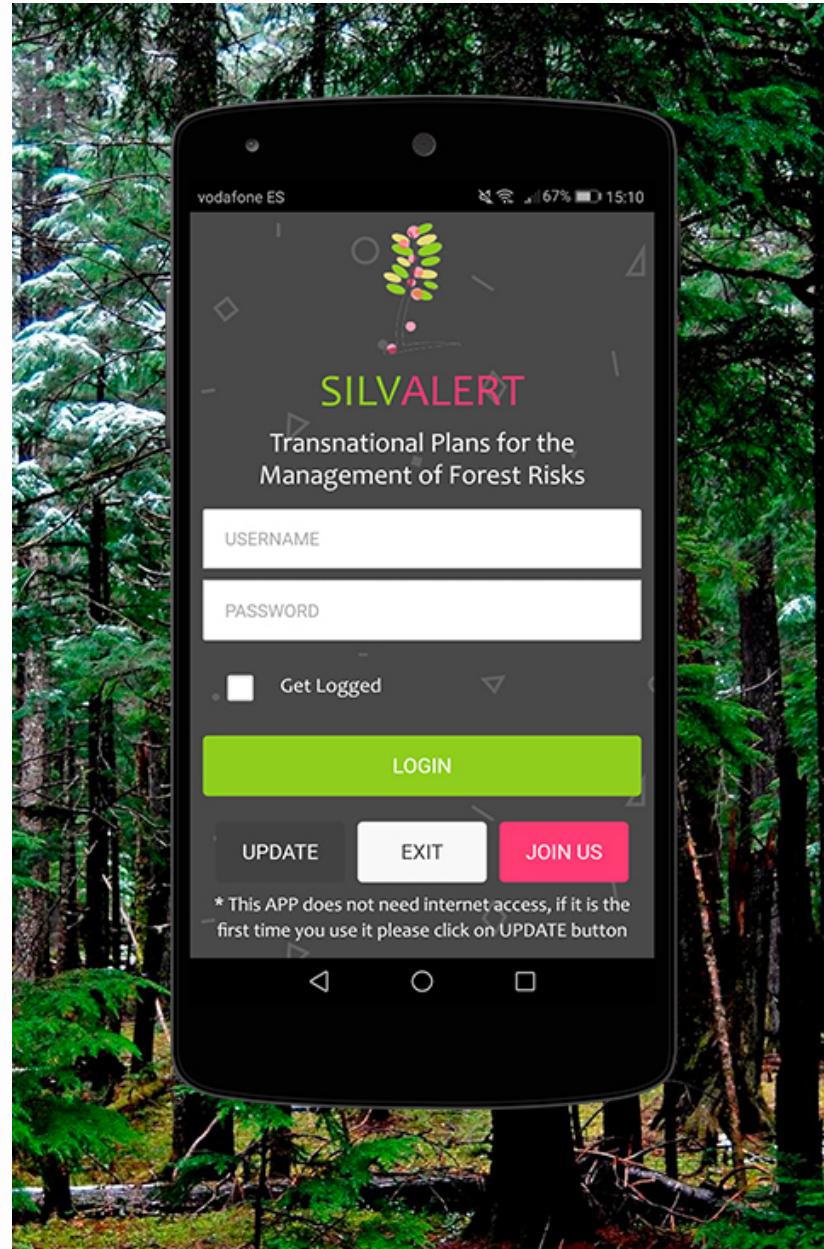
The Phone app

Main steps for a new user

The Phone app

Main steps for a new user

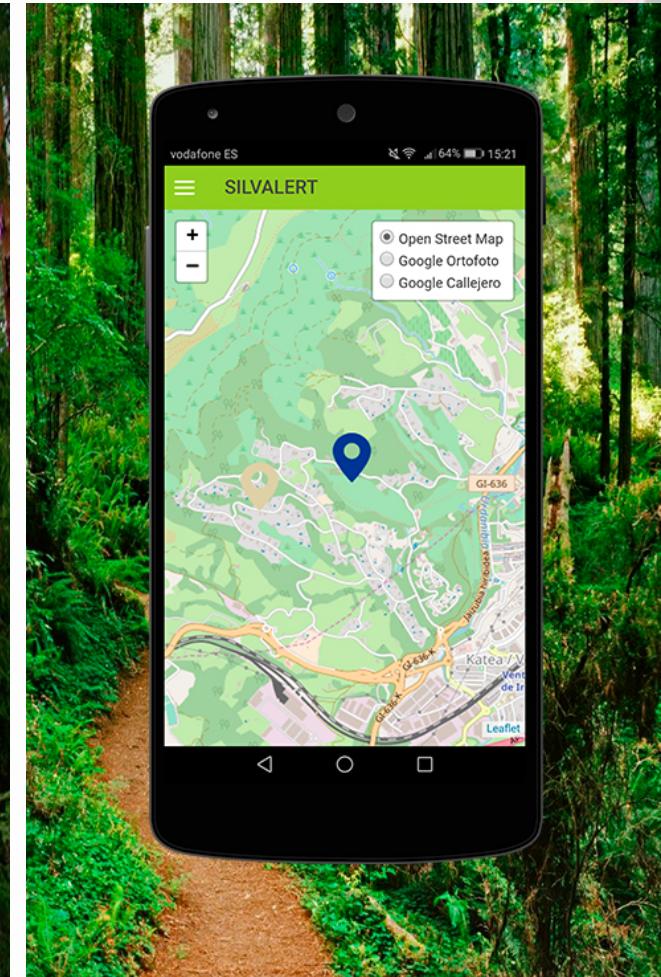
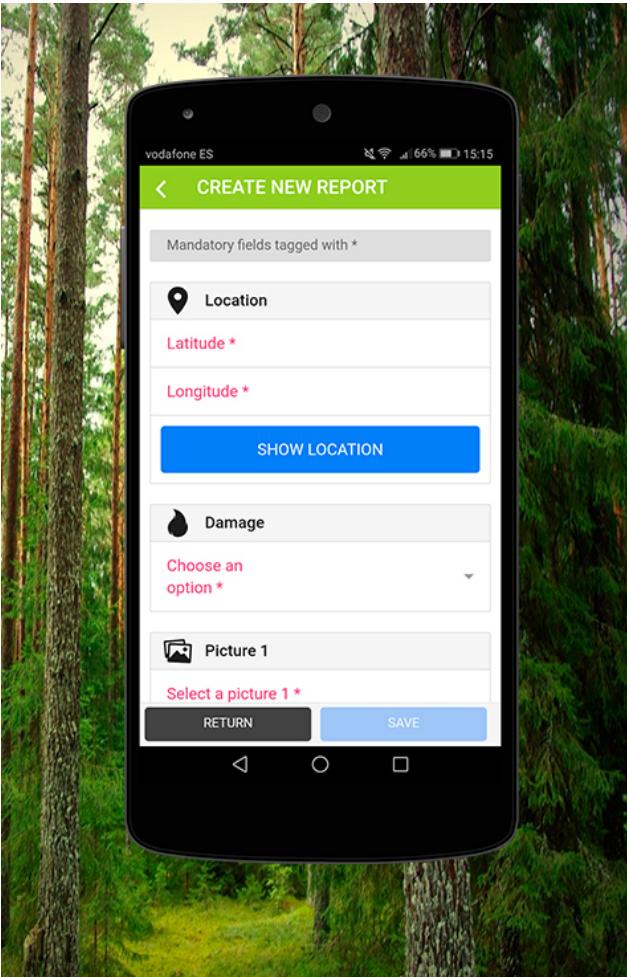
1. Create an account



The Phone app

Main steps for a new user

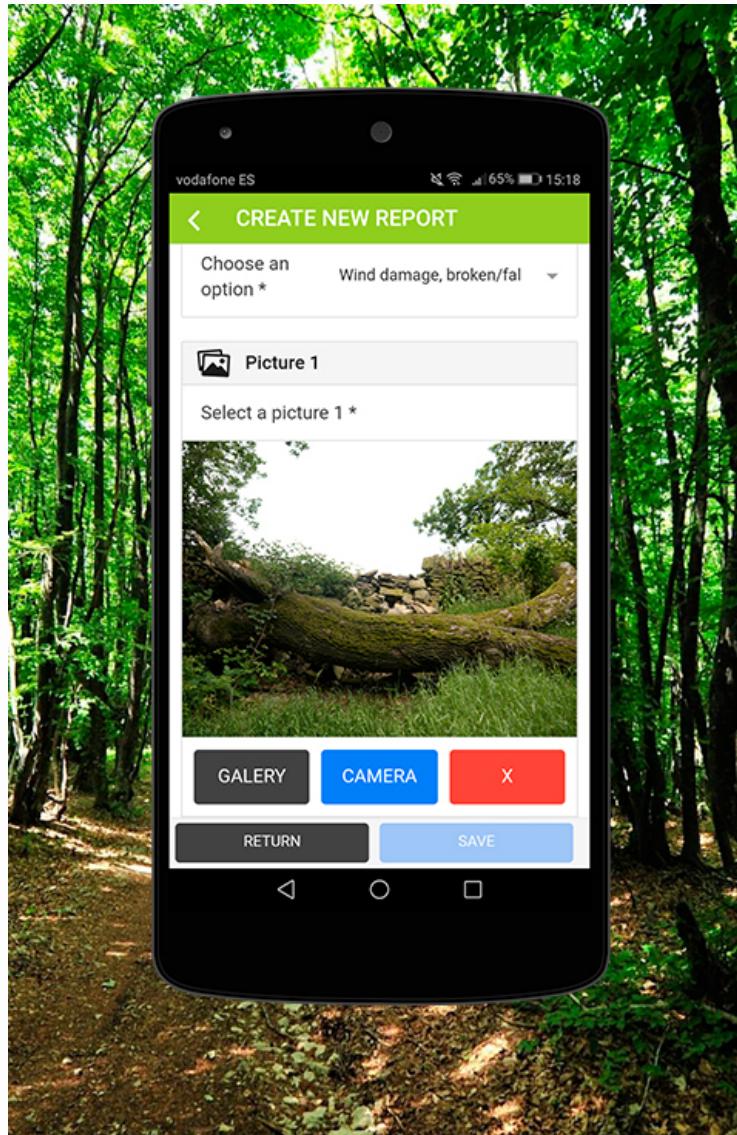
1. Create an account
2. Valid GPS position (or update it)



The Phone app

Main steps for a new user

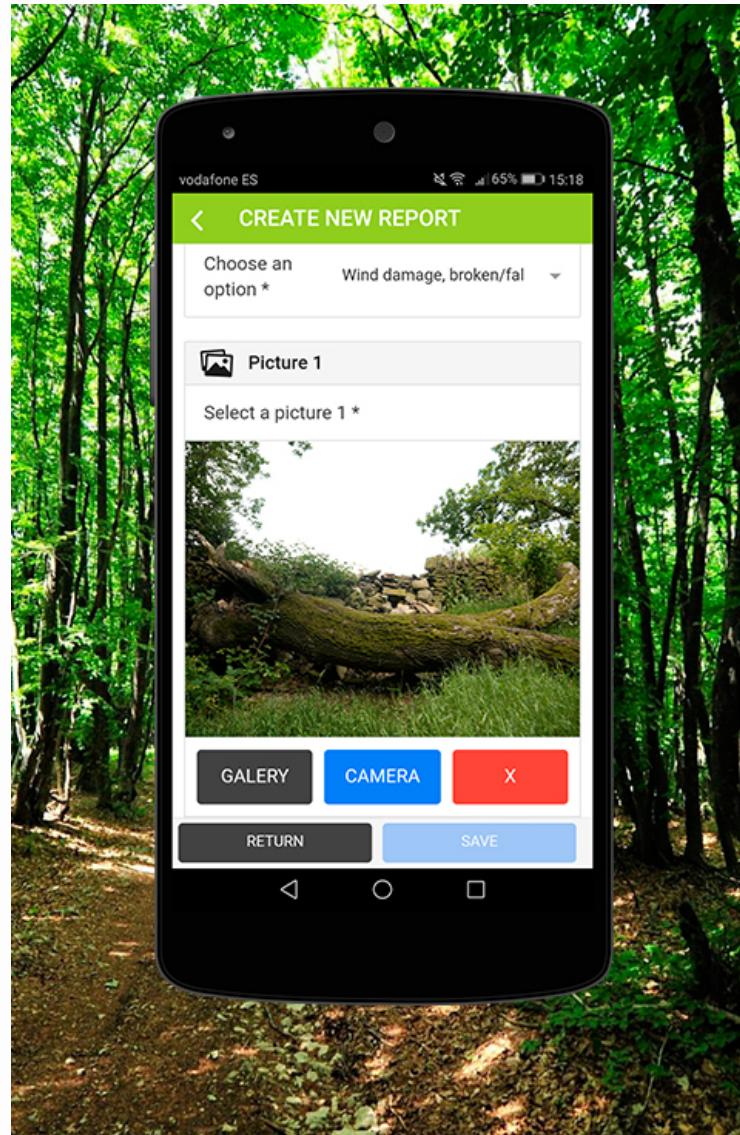
1. Create an account
2. Valid GPS position (or update it)
3. Take a picture (up to 5)



The Phone app

Main steps for a new user

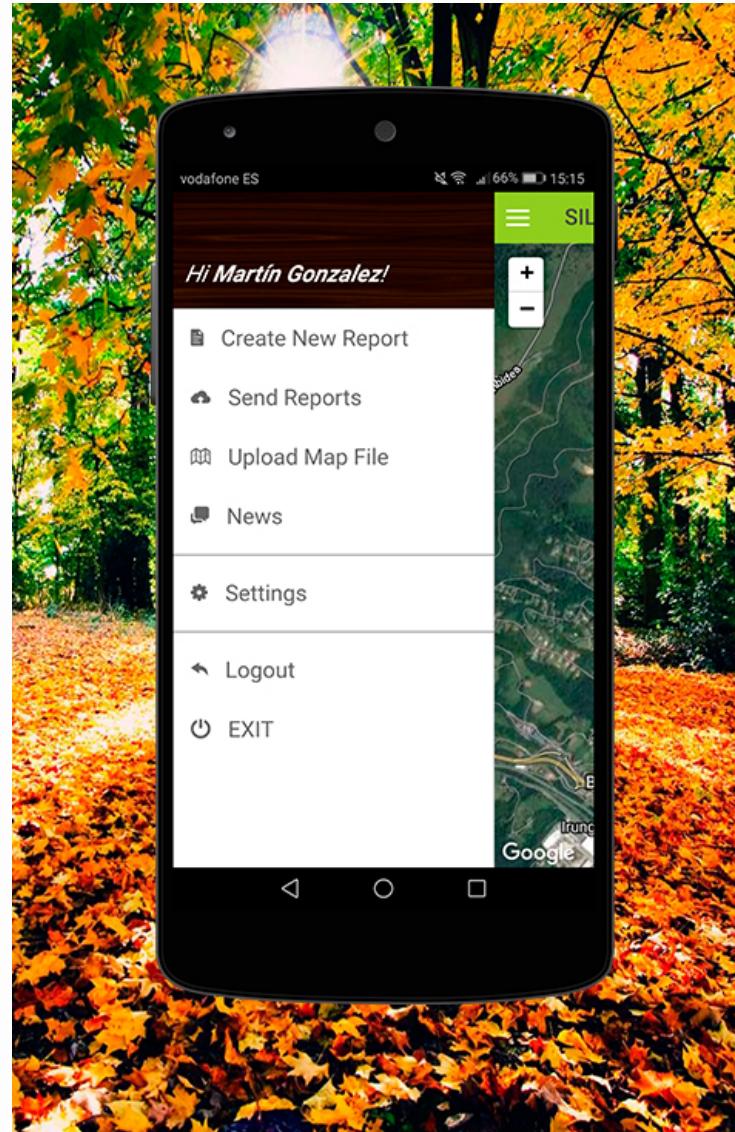
1. Create an account
2. Valid GPS position (or update it)
3. Take a picture (up to 5)
4. Select the part of the tree affected
5. Save the report



The Phone app

Main steps for a new user

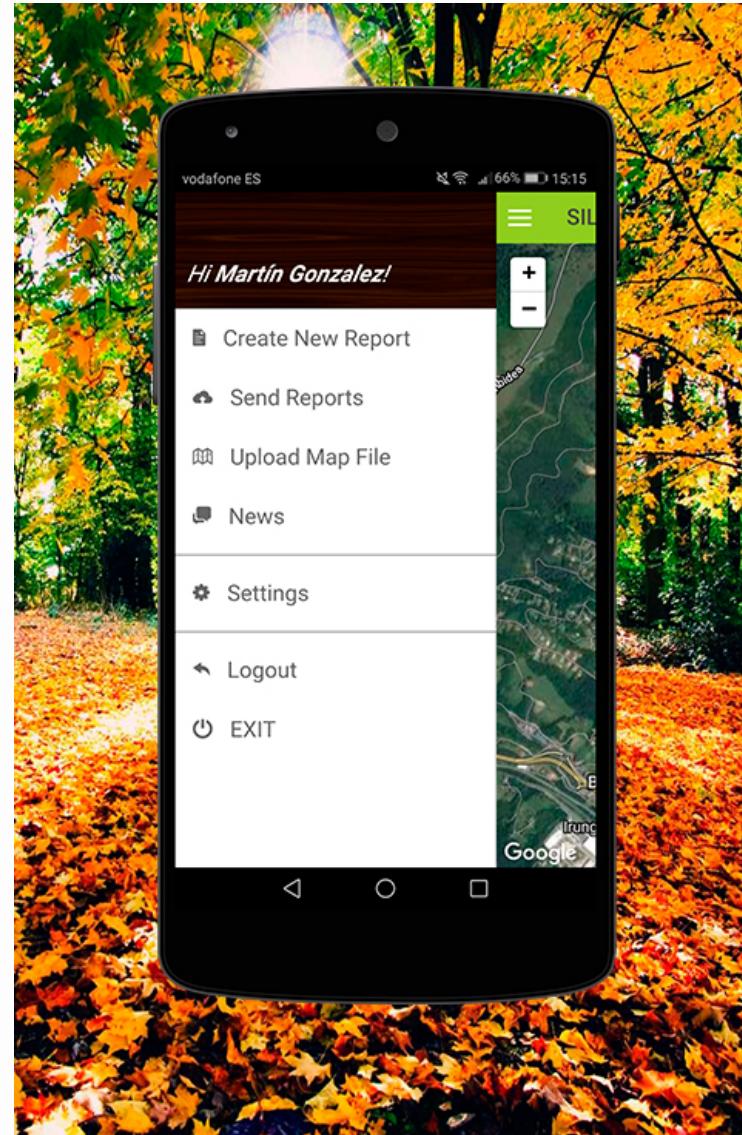
1. Create an account (you need internet connection only for this step) stating your NUTS3 area
2. Valid GPS position (or update it)
3. Take a picture (up to 5)
4. Select the type of damage
5. Select the part of the tree affected
6. Save the report
7. Send all the reports stored on the phone (you need internet connection only for this step)



The Phone app

Optional features (optional)

- Add a text in the comment field
- Specify tree species
- Use already downloaded maps

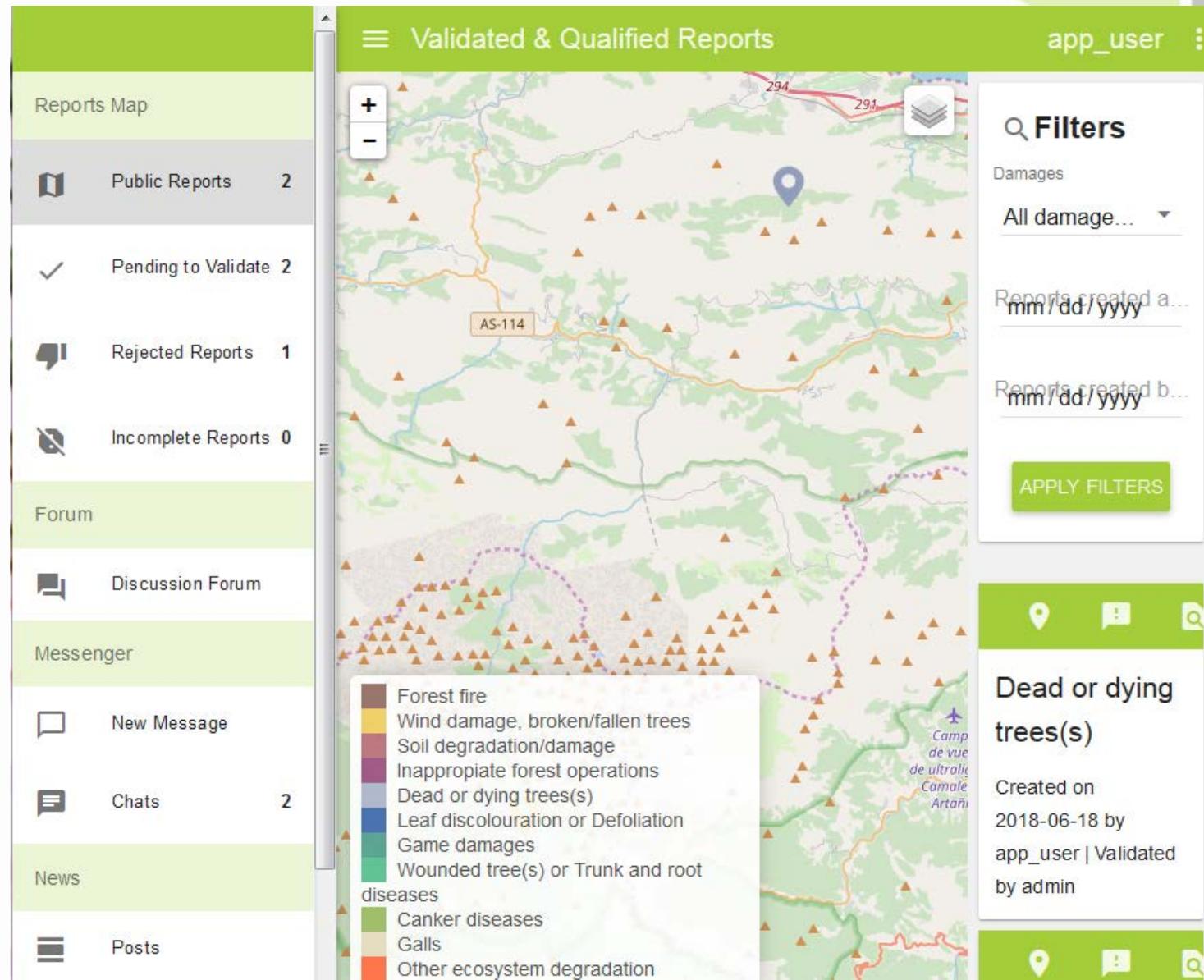


The website

Features for phone app user

The website

- Features for phone app user
- Can see all public reports
 - Can update report before they are validated by authorities
 - Cannot make any change on validated reports
 - Can post messages and participate to community forum



The website

Additional features for **authorities** managing reports

Authorities are warned on a daily or weekly basis about all new reports matching with its area and the type of risk it wants to handle

- Can Validate or Reject or ask for update on a given report
- Can add additional information on a report for internal purpose
- Can push a message to all the users of a given area

The screenshot shows a user interface for managing reports and assigned damages. At the top right, the user is identified as 'orazio'. The main menu includes 'Reports Map', 'Public Reports' (2), 'Pending to Validate' (2), 'Pending to Qualify' (2), 'Rejected Reports' (1), and 'Incomplete Reports' (0). Below this is a 'Download Reports' section with two options: 'Download Reports' and 'Forum' (Discussion Forum). Further down is a 'Messenger' section with 'New Message' and 'Chats' (0). On the right side, under 'Assigned Damages', there is a list of various forest health issues, each with a toggle switch. The listed damages include: Wind damage, broken/fallen trees; Soil degradation/damage; Inappropriate forest operations; Dead or dying trees(s); Leaf discolouration or Defoliation; Wounded tree(s) or Trunk and root diseases; Canker diseases; Galls; Other ecosystem degradation; and Forest fire.

Edit User Account	
Reports Map	
	Public Reports 2
	Pending to Validate 2
	Pending to Qualify 2
	Rejected Reports 1
	Incomplete Reports 0
Download Reports	
	Download Reports
Forum	
	Discussion Forum
Messenger	
	New Message
	Chats 0
Assigned Damages	
Wind damage, broken/fallen trees	<input type="checkbox"/>
Soil degradation/damage	<input type="checkbox"/>
Inappropriate forest operations	<input type="checkbox"/>
Dead or dying trees(s)	<input checked="" type="checkbox"/>
Leaf discolouration or Defoliation	<input checked="" type="checkbox"/>
Wounded tree(s) or Trunk and root diseases	<input type="checkbox"/>
Canker diseases	<input type="checkbox"/>
Galls	<input type="checkbox"/>
Other ecosystem degradation	<input type="checkbox"/>
Forest fire	<input type="checkbox"/>

The website

Features for scientists

- Qualification : add additional information to report
- Download : get all the data from given areas or damages for analysis
- Contribute to forum and can question any user

Reports Map

- Public Reports 2
- Pending to Validate 2
- Pending to Qualify 2
- Rejected Reports 1
- Incomplete Reports 0

Download Reports

Forum

☰ Download Reports

orazio :

Filters

Damage

Country Department Forest fire

RETURN TO MAP DOWNLOAD REPORTS

Areas and risks handled so far

	FIRE	WIND	SOIL	OPERATION	DEAD	LEAF	GAME	CANKER	GALLS	OTHER
Nouvelle-Aquitaine					✓	✓	✓	✓	✓	
Basque country	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cantabria										
Asturias										
Galicia										
Castilla y Leon										
Portugal	✓				✓	✓	✓	✓	✓	

Conclusion and perspective

- A complete set of tools designed for Multilanguage's and international cooperation
- Providing the strength of participatory process to risk management in forest
- An opportunity to expand beyond PLURIFOR areas and in cities with HOMED project and European Risk Facility
- A future development in HOMED for images processing with artificial intelligence
- The beginning of a nice story?!

