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science and knowledge service

Joint Research Centre



📅 11-12 JUNE 2024 📍 ESA-ESRIN, FRASCATI, ITALY

ENVIRONMENTAL CRIMES WORKSHOP 2024

Guardians from above: leveraging Earth Observation to Combat Environmental Crimes. The Nature FIRST experience

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12 JUNE 2024

S6 - Forest and agriculture
related crime



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Boris Hinojo [3edata]

Ondrej Koporec [Presidium of the Police Force, Slovakia]

Gemma Prieto, Tania de la Fuente [Seprona - Civil Guard, Spain]

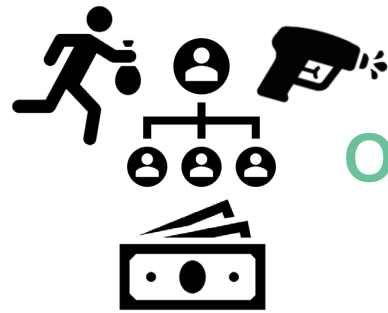
Jan-Kees Schakel [Sensing Clues]

Júlia Janka Faller, Linda van Duivenbode [dotSPACE]

2

Environmental crime is the 4th largest crime sector

91-259 USD billion annually – Rising 5-7% annually [1] Interpol-UNEP 2016



Organised crime

Impunity is high in Environmental crimes.

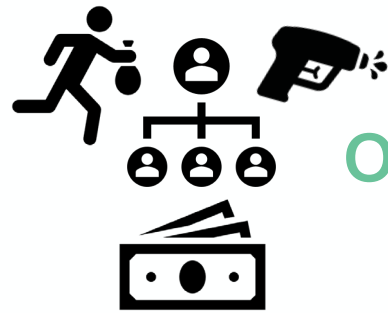
Few proceedings are able to discern the perpetrators of crimes against wildlife and the responsibility for the damage incurred [2] Naves et al, 2020. LIFE Guardianes de la Naturaleza

Cost of not implementing EU environmental law

54.7 EUR bn per year [3] DG Environment 2019

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Environmental crimes and EO application cases



Slovakia



Illegal import of waste (Waste disposal in landfills)

-Reviewing and monitoring activity in Waste management premises. (Waste site analysis)

Hazardous waste / non dangerous waste / inert waste

-Control and extension of waste dumps and the premises

-Classify the waste

-Confirmation of illegal activity

-Vegetation status in and out the landfill

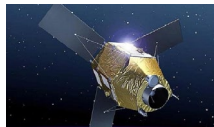


Environmental crimes and EO application cases



Slovakia

Copernicus Contributing Missions



Pléiades mission



2013 - 2018



Worldview-2 / 3 mission

1. Study the landfill site



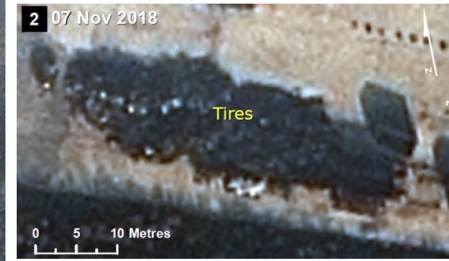
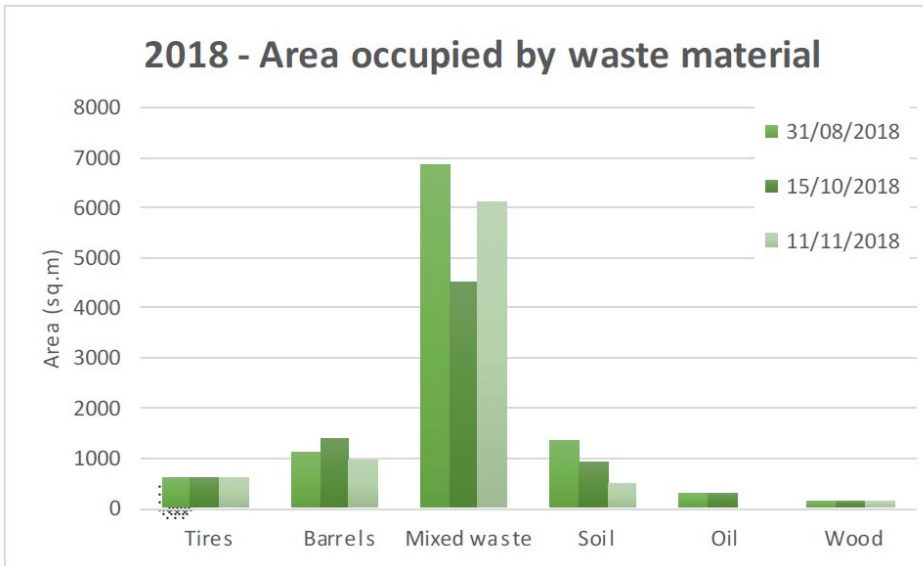
2. Detect landfill's active sections



3. Identify areas occupied by waste



4. Classify waste

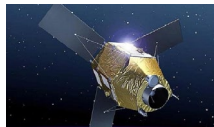


Environmental crimes and EO application cases



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Waste Monitoring

Area 1 (sq.m)	2013	2014	2016	2017	2018
Barrels	156	251	1024	915	1137
Mix	2389	986	1856	2317	1613
Tires	125	71	295	749	589
Soil	1367		1599	987	895
Oil		81	312	171	262
TOT	4038	1390	5086	5140	4496

Area 2 (sq.m)	2013	2014	2016	2017	2018
Mix	3492	3051	5737	8657	4203

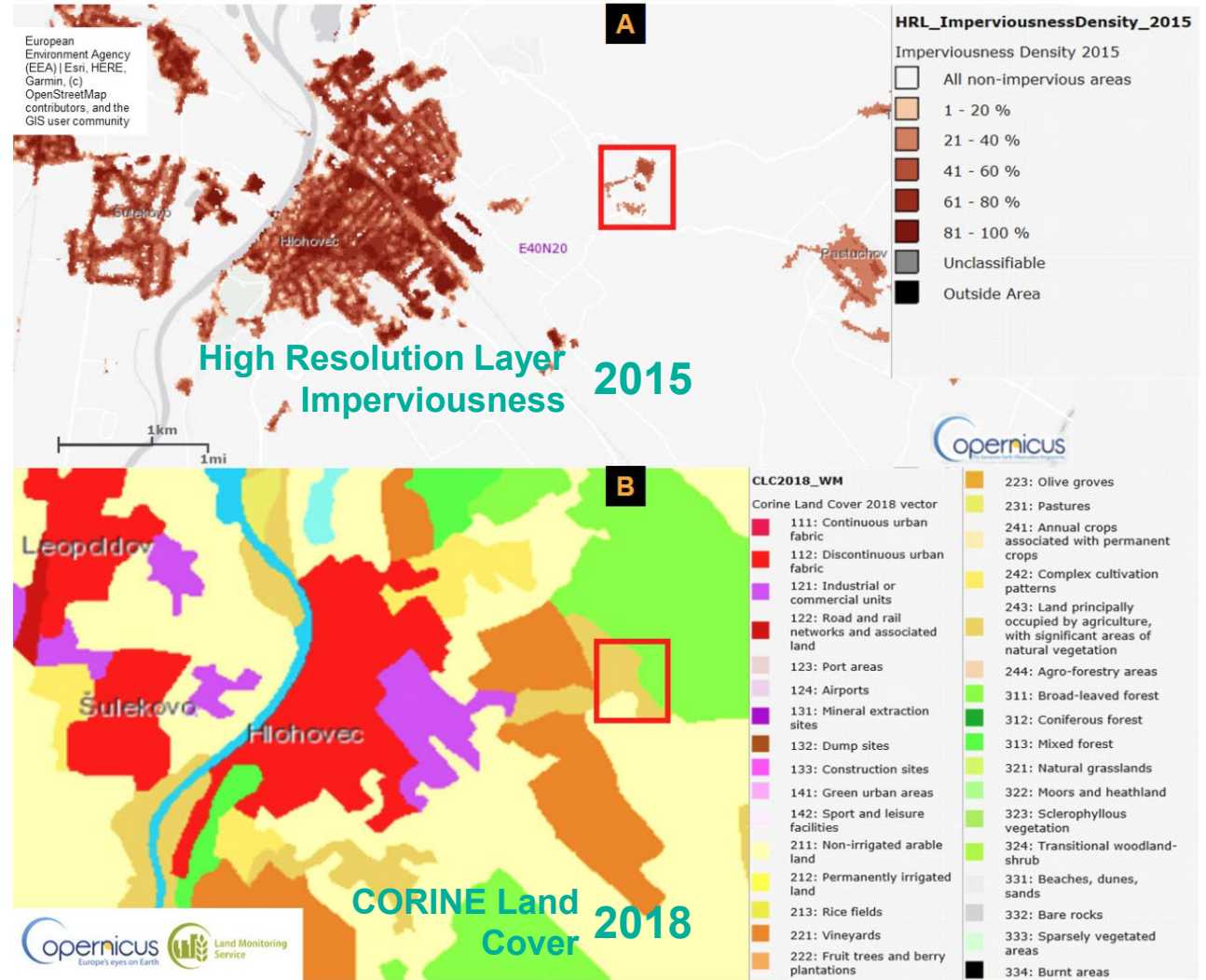
The above tables feature average yearly values. Values for each image are available on request



Environmental crimes and EO application cases



Slovakia



Environmental crimes and EO application cases



Spain

Economic valuation Environmental crime

-Determine the impact value caused by the destruction or degradation of ecosystems caused by various anthropogenic illegal activities.

-Assessment through ecosystem services affected. Comparison after and before damage.

-Mapped expressing economic flows (€ *ha/year) [1 ha/pixel].

VANE Project which developed a territorial information system of natural capital.

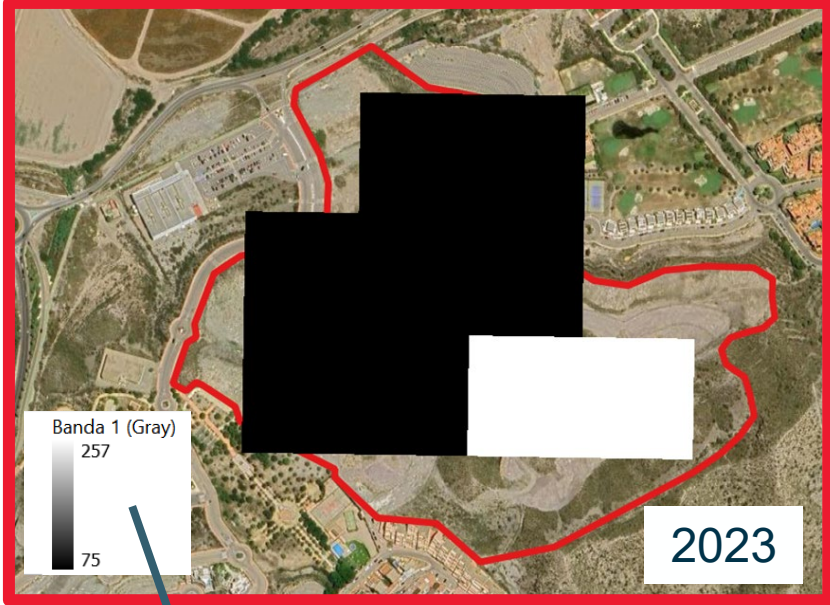
Group	Service
Food and raw material production	<ul style="list-style-type: none"> -Timber production -Firewood production -Pine nut production -Cork production -Mushroom production -Agricultural production -Livestock production -Ocean-caught fishery production -Maximum ocean fishing option -Minimum ocean fishing option -Production of raw material and ocean farmed fishery
Water supply	<ul style="list-style-type: none"> -Agricultural water provision -Industrial water supply -Domestic water supply -Energy water supply
Recreational services	<ul style="list-style-type: none"> -Resident Coastal recreational service -Non-resident Coastal recreational service -Inland recreational service
Hunting and sport fishing	<ul style="list-style-type: none"> -Small game hunting -Big game hunting -Inland water fishing
Erosion control	<ul style="list-style-type: none"> -Erosion control
Tratamiento de vertidos	<ul style="list-style-type: none"> -Treatment of discharges into inland waters -Treatment of discharges into the ocean
Carbon sequestration	<ul style="list-style-type: none"> -Carbon sequestration by trees -Carbon sequestration by shrubs -Carbon sequestration in agricultural soil -Carbon sequestration in peatlands -Carbon sequestration in the ocean
Conservation of biological diversity	<ul style="list-style-type: none"> -Conservation of biological diversity



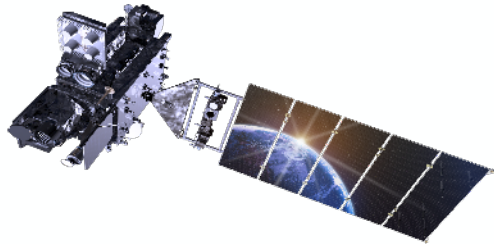
VEGETATION CLEARANCE DIFFERENCE



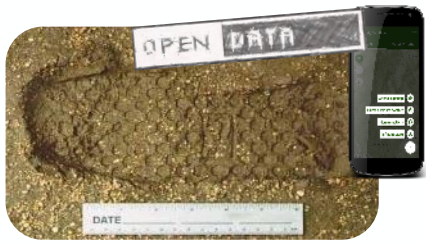
ECONOMIC VALUE OF LOSS OF CARBON CAPTURE BY CUTTING



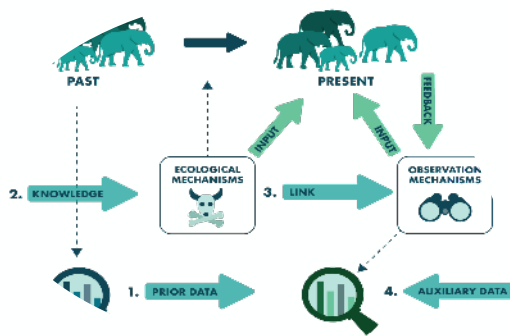
(€ * ha/year)



REMOTE SENSING



ENVIRONMENTAL FORENSICS



ECOLOGICAL DIGITAL TWINS

- 🐾 To map ecosystems and their species
- 🐾 To monitor them and detect changes
- 🐾 To predict changes and events



CONTINUOUS MONITORING

IN NEAR REAL-TIME

&

PROACTIVE ACTION

(also, REACTIVE)



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ACROSS

- Data sources
- Taxonomies
- Area boundaries
- Language barriers

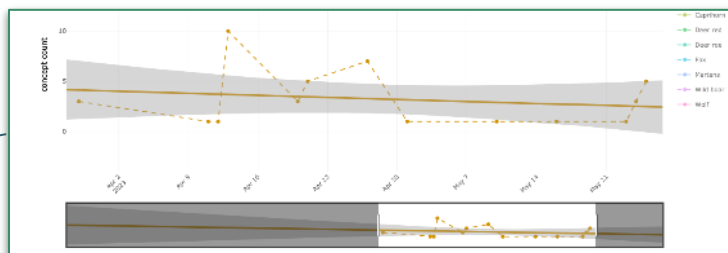
5 maturity levels



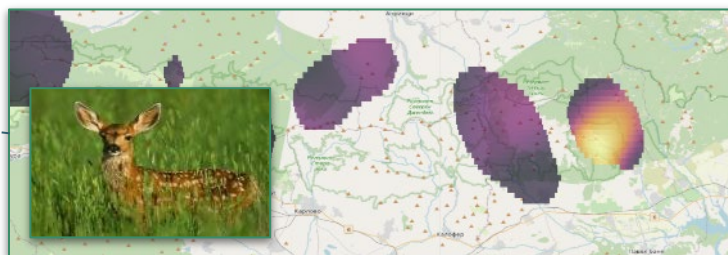
Mapping
the area



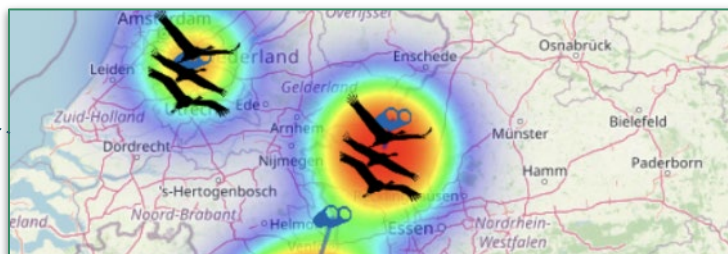
Monitoring
changes



Periodic
predictions



Real-time
predictions



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Scenario-based
projections



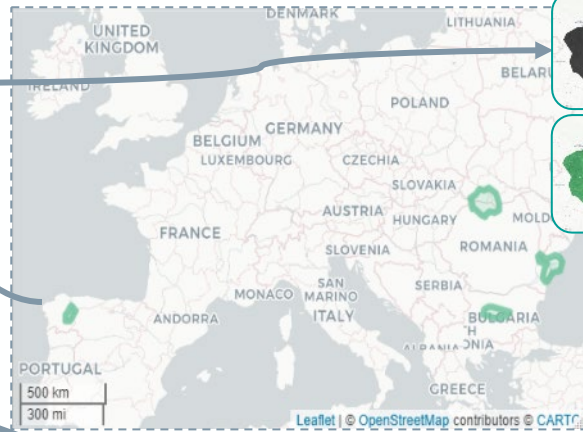
SUPPORT

Management & decision-making
Compliance EU legislation
Law enforcement activity

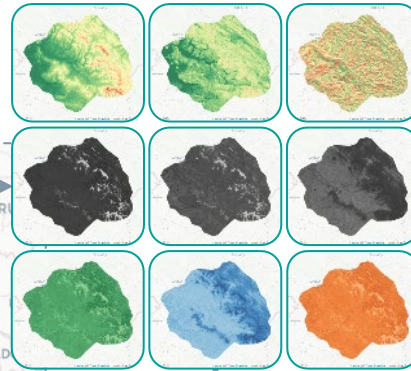
Nature FIRST Proactive solutions



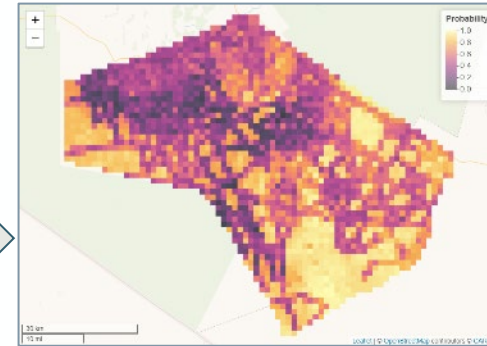
Ecosystem basemaps & predict risks



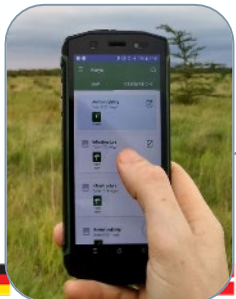
25+ layers



Risk maps



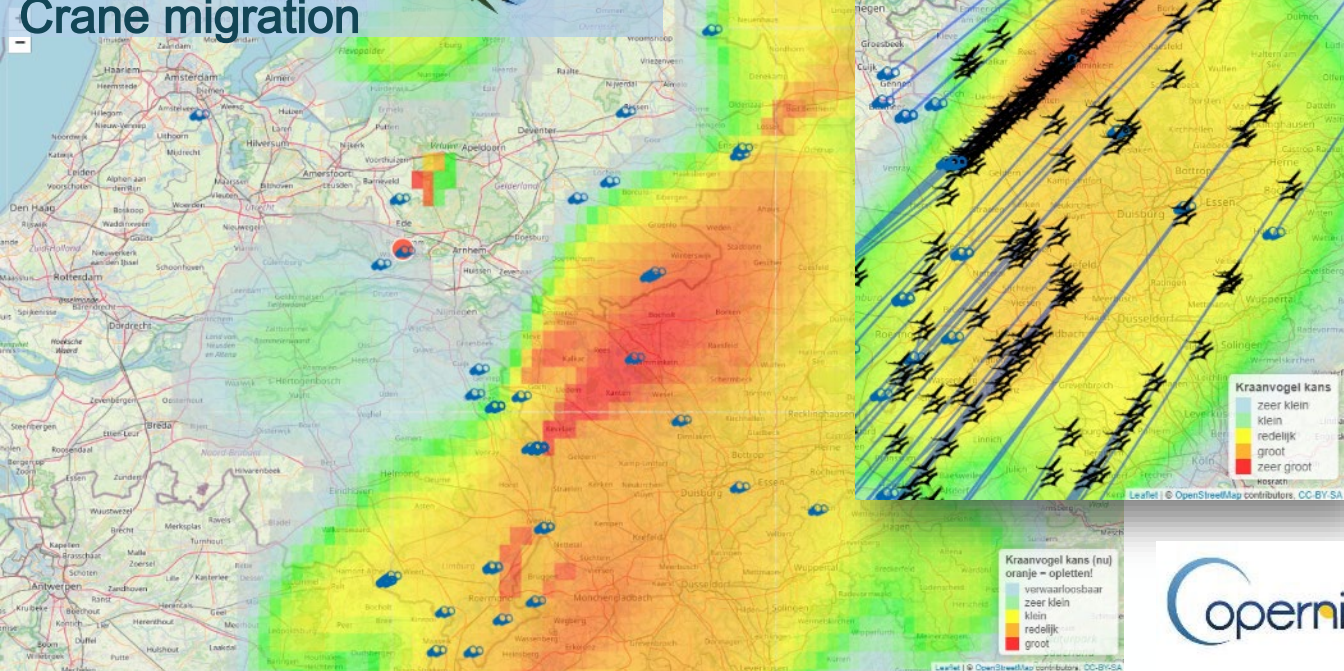
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WFS	2023-03_NDVI_Stara_Plinna	RAS_Stara_Plinna:2023-03_NDVI_Stara_Plinna	OpenLayers KML	Select one
WFS	2023-03_OSAVI_Stara_Plinna	DAS_Stara_Plinna:2023-03_OSAVI_Stara_Plinna	OpenLayers KML	Select one
WFS	2023-03_Sentinel2_L2A_Stara_Plinna	RAS_Stara_Plinna:2023-03_Sentinel2_L2A_Stara_Plinna	OpenLayers KML	Select one
WFS	Aut_Stara_Plinna	DAS_Stara_Plinna:Aut_Stara_Plinna	OpenLayers GML KML	Select one
WFS	Aspect_Stara_Plinna	RAS_Stara_Plinna:Aspect_Stara_Plinna	OpenLayers KML	Select one
WFS	DEM_COPERNICUS_30_DEM_Stara_Plinna	DAS_Stara_Plinna:DEM_COPERNICUS_30_DEM_Stara_Plinna	OpenLayers KML	Select one
WFS	Slope_Stara_Plinna	DAS_Stara_Plinna:Slope_Stara_Plinna	OpenLayers KML	Select one
WFS	Stara_Plinna_zones	RAS_Stara_Plinna:Stara_Plinna_zones	OpenLayers GML KML	Select one
WFS	2023-02_NDVI_Maramures	WWF_Romania_Maramures:2023-02_NDVI_Maramures	OpenLayers KML	Select one
WFS	2023-02_NDVI_Maramures	WWF_Romania_Maramures:2023-02_NDVI_Maramures	OpenLayers KML	Select one
WFS	2023-02_OSAVI_Maramures	WWF_Romania_Maramures:2023-02_OSAVI_Maramures	OpenLayers KML	Select one
WFS	2023-02_Sentinel2_L2A_Maramures	WWF_Romania_Maramures:2023-02_Sentinel2_L2A_Maramures	OpenLayers KML	Select one



Real time predictions & alerting



Crane migration



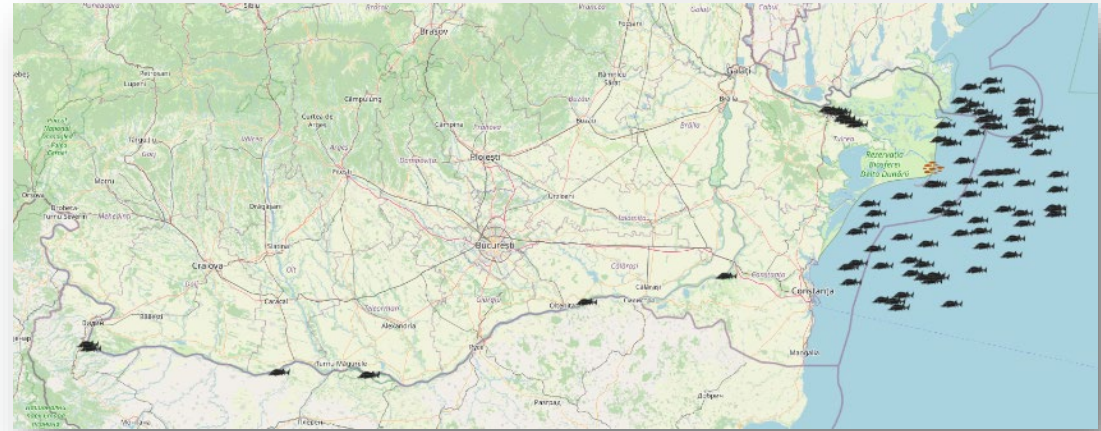
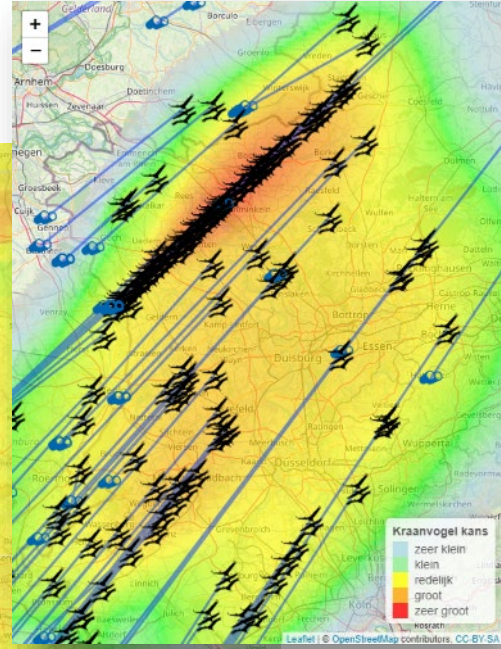
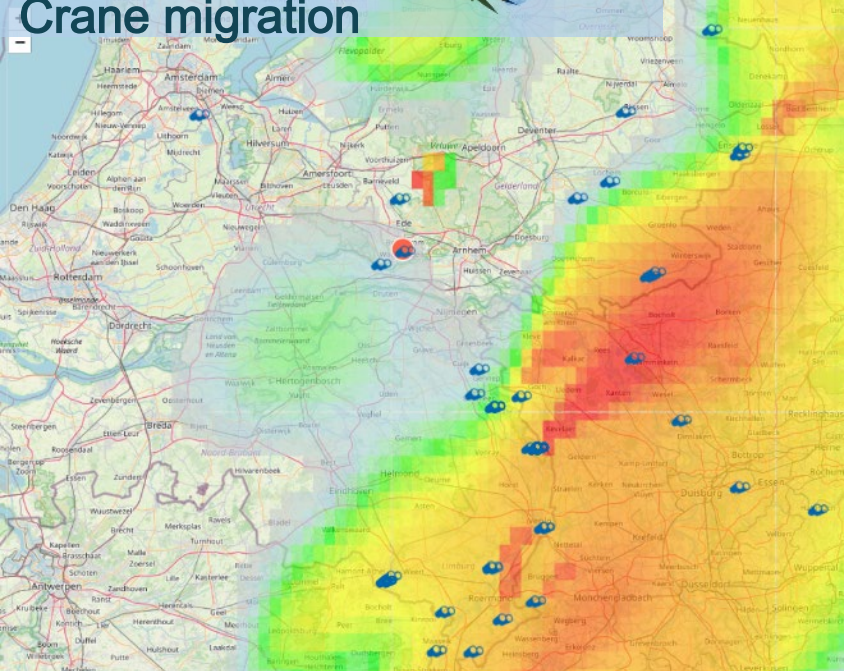
Nature FIRST Proactive solutions



Real time predictions & alerting



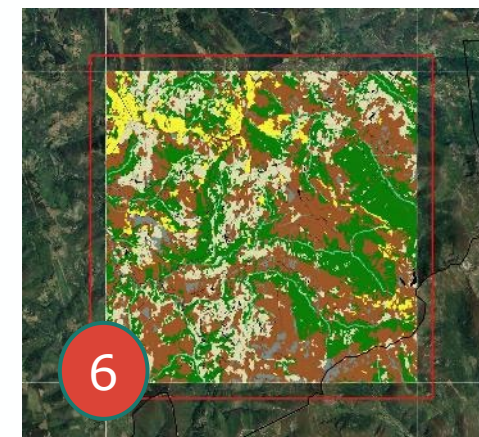
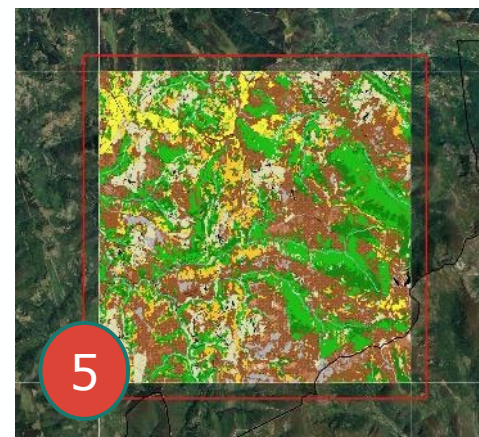
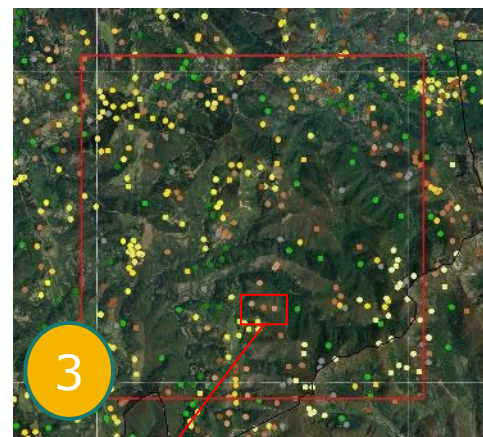
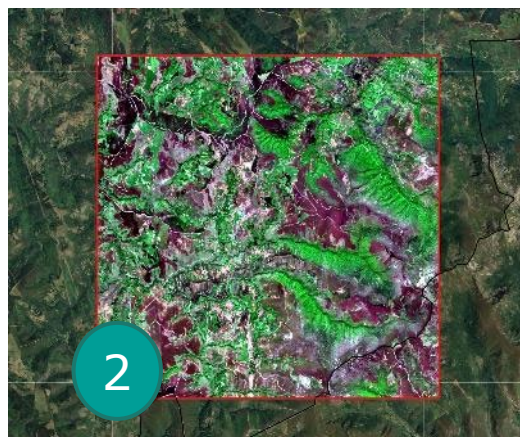
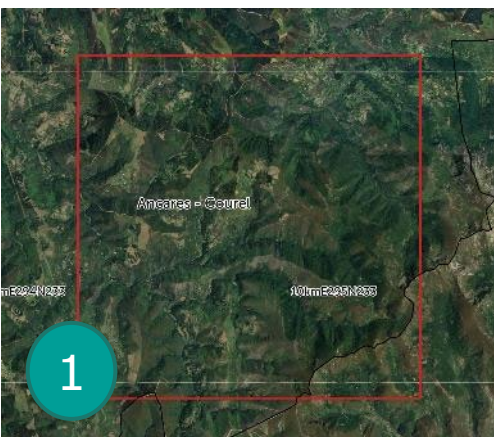
Crane migration



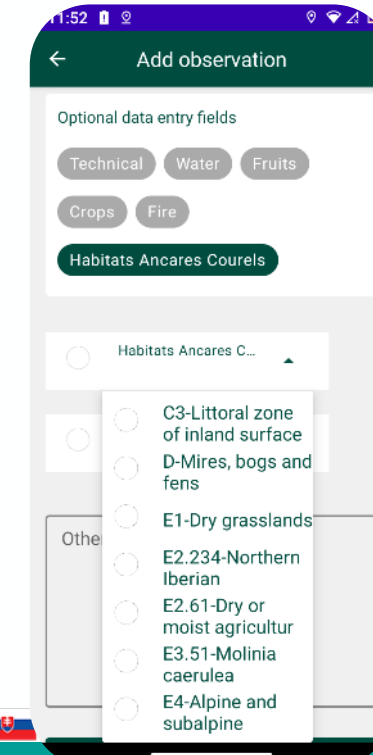
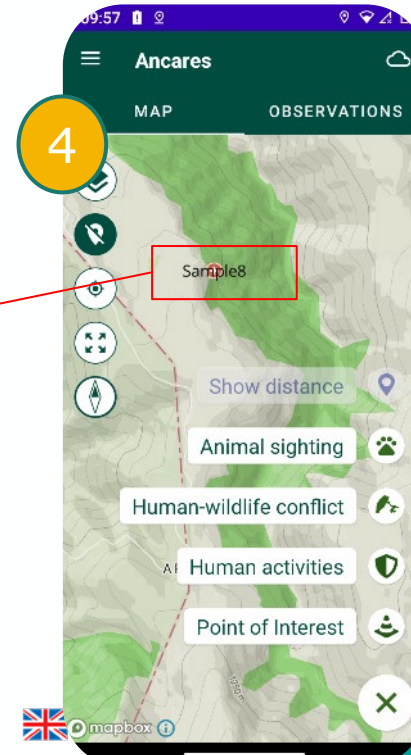
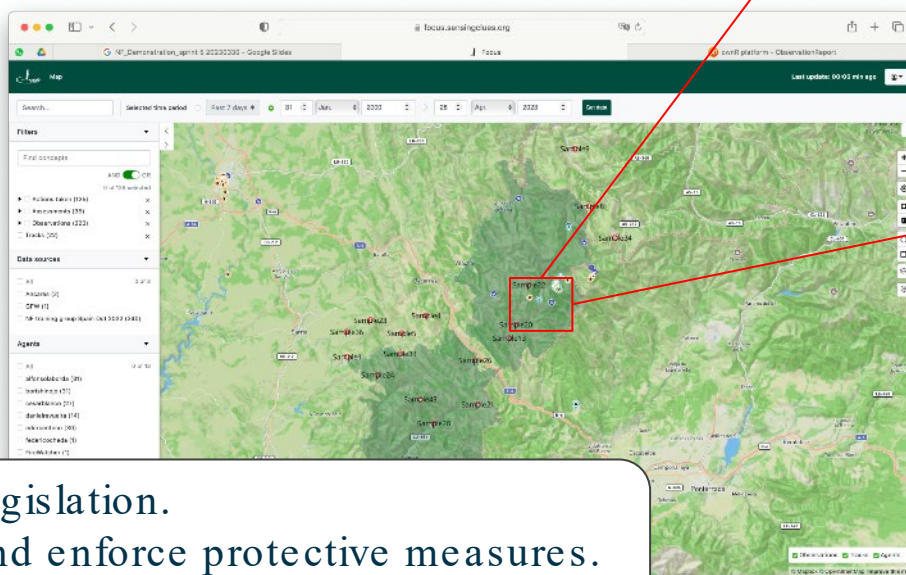
Human-Bear Conflict Risks



Nature FIRST Reactive solutions



Habitat mapping model



Required by EU legislation.
 Needed to take and enforce protective measures.
 Needed to grant or deny permits.



Nature FIRST Reactive solutions



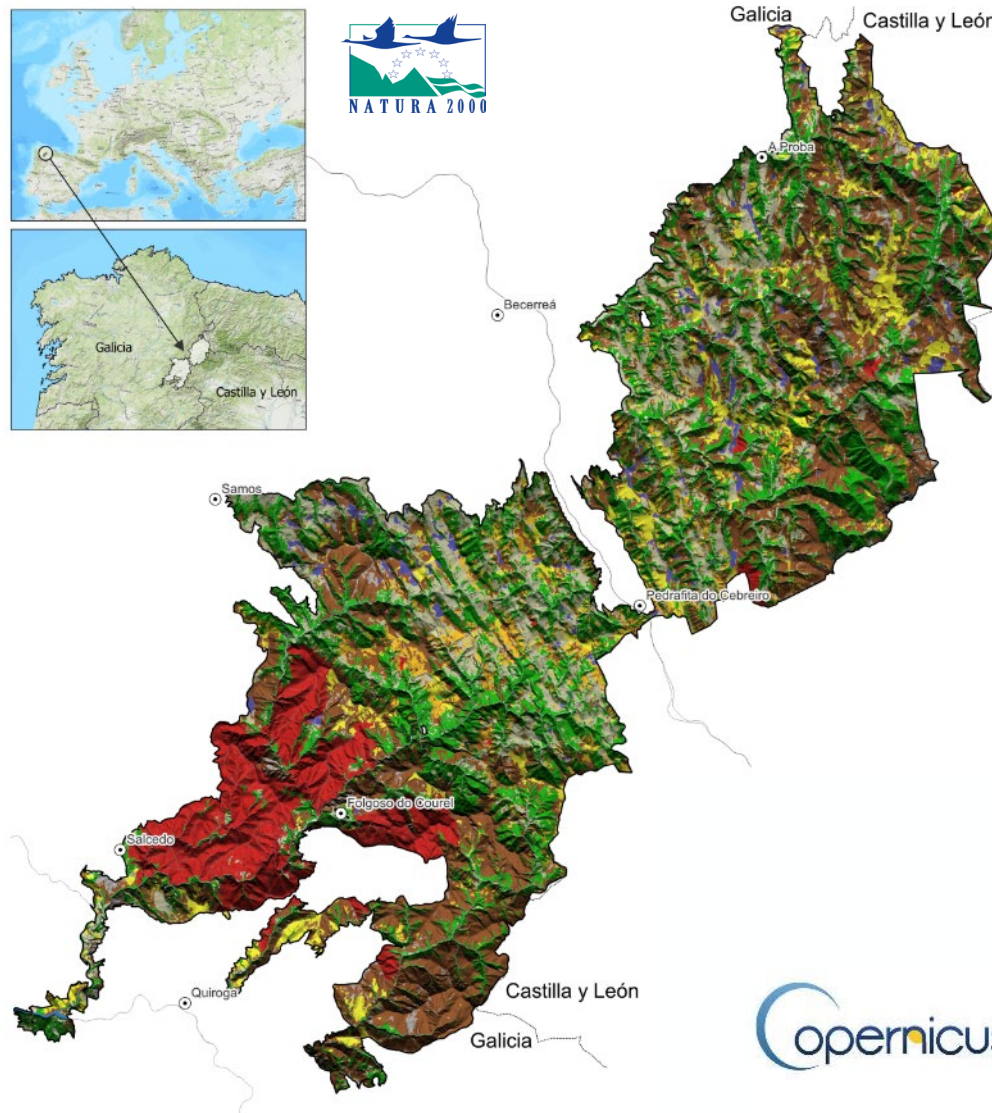
Mapping



Mapping the area



Monitoring changes



Habitat Map Legend (EUNIS level 3)

- C1.1 - Permanent oligotrophic lakes, ponds and pools
- C1.3 - Permanent eutrophic lakes, ponds and pools
- C1.4 - Permanent dystrophic lakes, ponds and pools
- C2.1 - Springs, spring brooks and geysers
- C2.2 - Permanent non-tidal, fast, turbulent watercourses
- C3.4 - Species-poor beds of low-growing water-fringing or amphibious vegetation
- E2.2 - Low and medium altitude hay meadows
- E2.3 - Mountain hay meadows
- E2.6 - Agriculturally-improved, re-seeded and heavily fertilised grassland
- E4.3 - Alpine and subalpine grasslands
- E4.4 - Calcareous alpine and subalpine grassland
- E5.3 - Bracken fields
- F2.2 - Evergreen alpine and subalpine heath and scrub
- F3.1 - Temperate thickets and scrub
- F3.2 - Submediterranean deciduous thickets and brushes
- F4.2 - Dry heaths
- G1.2 - Mixed riparian floodplain and gallery woodland
- G1.A - Meso- and eutrophic oak
- G1.7 - Thermophilous deciduous woodland
- G1.9 - Non-riverine woodland with birch, aspen or rowan
- G1.C - Highly artificial broadleaved deciduous forestry plantations
- G2.1 - Mediterranean evergreen oak woodland
- G2.8 - Highly artificial broadleaved evergreen forestry plantations
- G3.F - Highly artificial coniferous plantations
- G5.2 - Small broadleaved deciduous anthropogenic woodlands
- G5.8 - Recently felled areas
- H2.5 - Acid siliceous screes of warm exposures
- H2.6 - Calcareous and ultra-basic screes of warm exposures
- H3.1 - Acid siliceous inland cliffs
- H3.2 - Basic and ultra-basic inland cliffs
- H3.5 - Almost bare rock pavements, including limestone pavements
- H3.6 - Weathered rock and outcrop habitats
- H5 - Miscellaneous inland habitats with very sparse or
- H5.5 - Burnt areas with very sparse or no vegetation
- I - Regularly or recently cultivated agricultural
- J1 - Buildings of cities, towns and villages
- J4 - Transport Networks
- J4.2 - Road networks (Firebreaks)
- J5 - Highly artificial man-made waters and associated structures

& Habitats of community interest



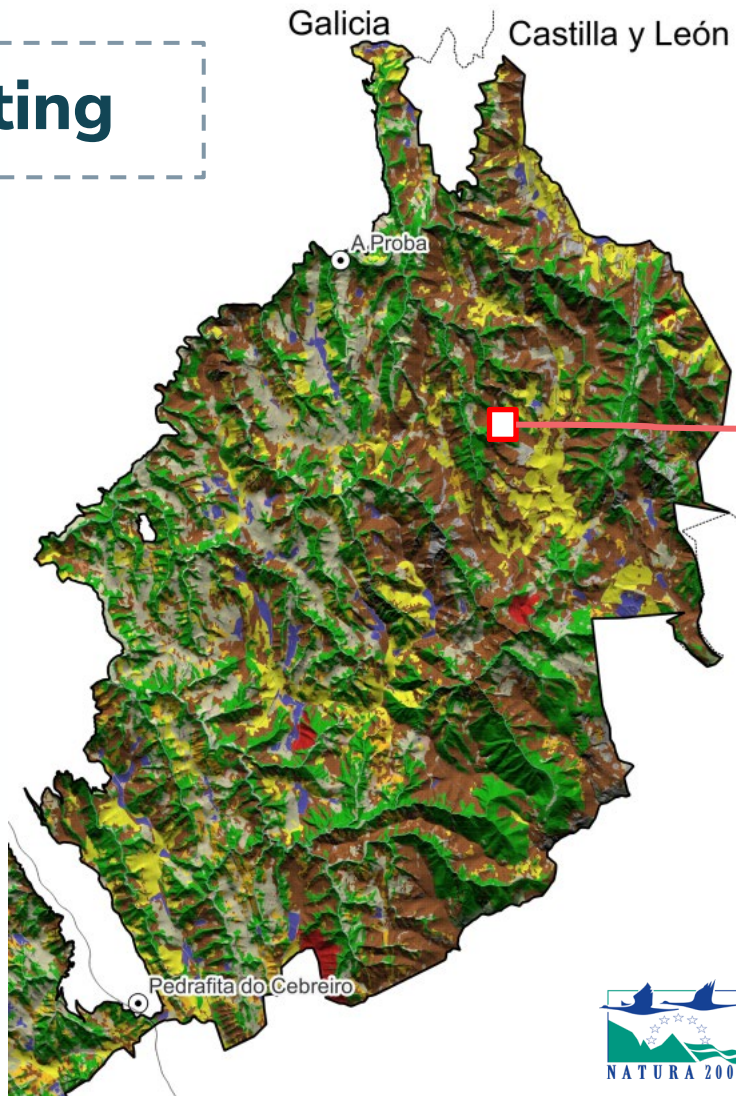
Nature FIRST Reactive solutions



Mapping & alerting



Mapping the area



Automatic detection, alerting and reporting of logging activity

2022-04

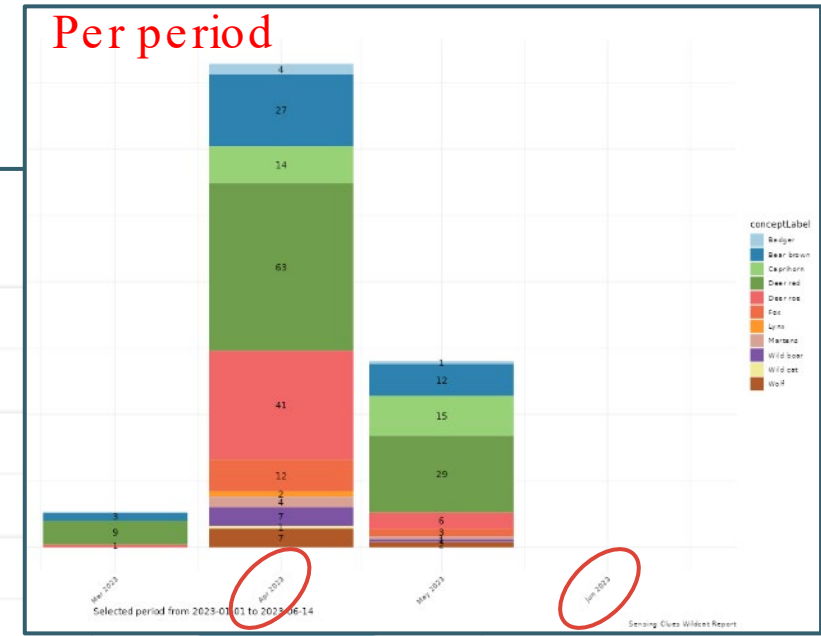
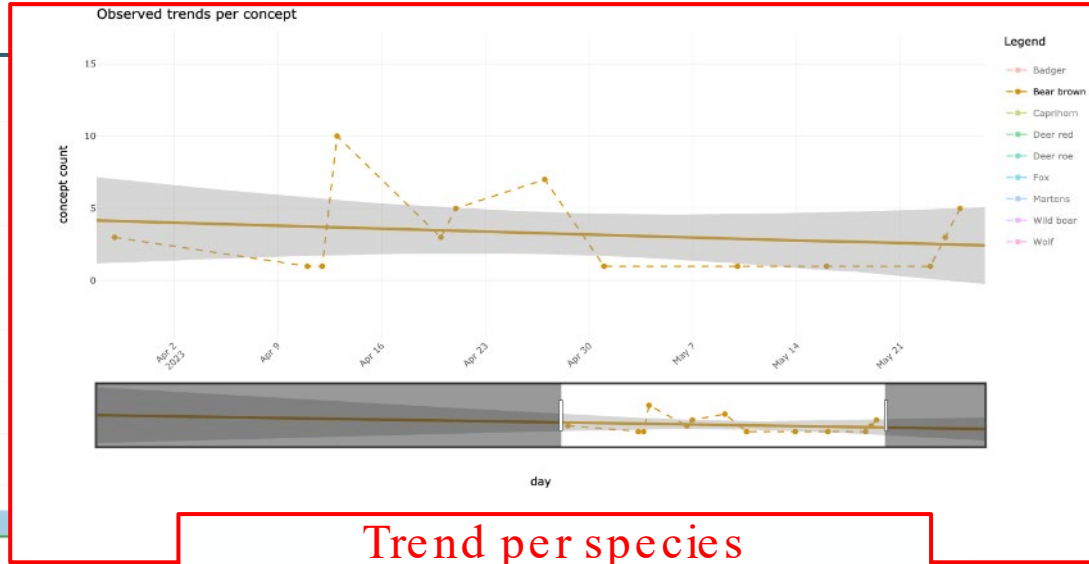
2022-06



Monitoring changes



Nature FIRST Reactive solutions



EO Data

What we currently have (public) [Availability]

- Awareness of the availability of EO data
- Relevance of Very High-Resolution images

How to facilitate access to private EO data [Availability]

- Relevance of environmental crimes
- Cooperation: law enforcement agencies - public institutions / private companies
- Memorandum of understanding with major stakeholders

Facilitate their use by law enforcement agencies [Technology application]

- Bridging the gap between existing solutions and law enforcement agencies

Others

Improve acceptance of EO evidences in judicial processes

Solutions for monitoring air pollution damages and assess impacts



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THANK YOU



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