# Map for Early Demand of [Land] Systems and Applications

## LAND UNIT

Inés Santé Riveira

*Director of the Institute of Land Surveys, Regional Ministry of Environment and Land Planning*

# Presentation of the Land Unit.

- Grouping the needs of the activities:
  - Generation and management of georeferenced data.
  - Generation of cartographic data and specific applications.
  - Monitoring land uses.
  - Land planning and urbanism.
  - Forest management and control.

- Grouping the challenges:
  - Challenge 1, Geographic Information, agroforestry resources and land.
  - Challenge 5, Heritage: protection, surveillance, conservation and research.
  - Challenge 6, Tourism.
  - It may be useful in certain needs of challenge 3, Efficient management of emergencies, in the land area.

## Results of market consultations in the Land Unit.

- Among the Expressions of Interest received, 49 are related to some of the contents of this block.
- 2 come from European countries, 6 from Madrid, 3 from Catalonia, 1 from Navarre and 37 from Galicia.
- 6 come from large companies, 32 from SMEs and the rest from technology centres and IPOs.

## Innovation procurements identified in the Land Unit:

1. Manager of georeferenced data set obtained by UAVs
2. Acquisition, maintenance and automation of topographic and cartographic bases.
3. Monitoring the dynamics of land occupation and assistance to land planning.
4. Geographic information applications for forest management and control.

# General outline of tenders

## Tender 1. UAV data set manager

- Storage manager
- Catalogue
- Flight Planner
- Quality control

## Data capture by UAVs

## Tender 2. Acquisition, maintenance and automation of topographic and cartographic bases

- Collection of geographic objects
- Editing point clouds
- 3D models
- Data conversion

## Tender 3. Monitoring of land occupation dynamics and support for territorial planning

- Assisted photo-interpretation
- Image classification
- Pattern recognition
- Cartographic generalisation

## Tender 4. Geographic information applications for forest management and control

- Field information
- Forest DB information
- Management
- Operation

## Other UAV projects

## IET

- Topographic bases
- MDT / MDS
- Transport networks
- Hydrographic network
- Buildings
- Non-residential areas
- Land cover
- Land uses
- Territorial diagnosis
- Regional planning
- Urban planning
- Habitat mapping
- Forest inventory
- Fire risk
- Plant health

## Users

- **Local administration**
- Land planning and urbanism / APLU
- Infrastructure Agency
- Aguas de Galicia
- Civil Protection / Emergencies
- Cultural heritage
- Energy and mines
- IGVS
- Mobility
- Forest management
- Rural development
- Natural heritage

## IDEG

## Citizenship

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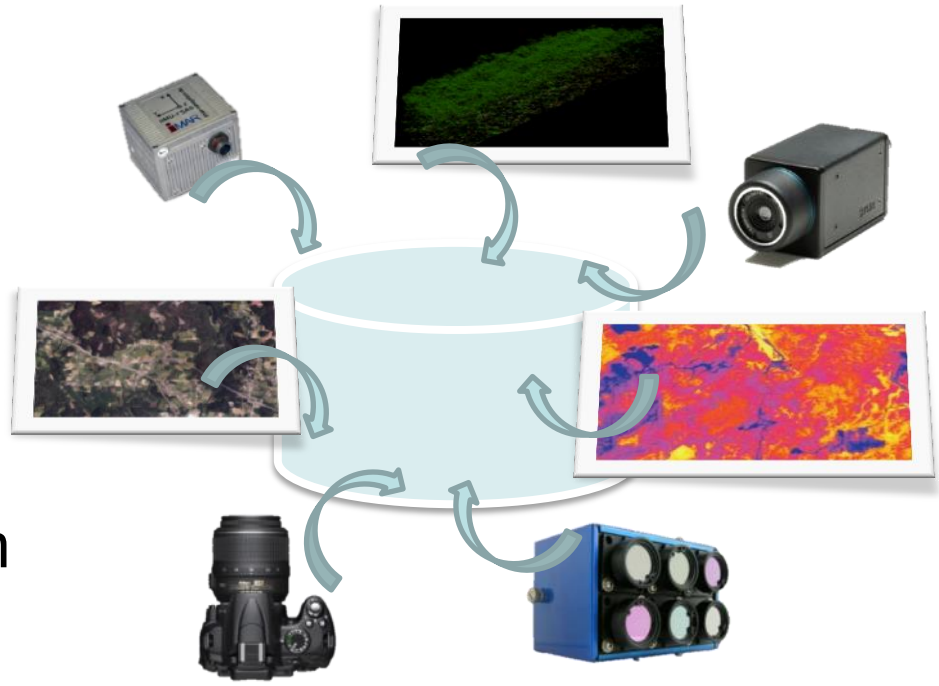
# TENDER 1

## “Manager of georeferenced data set obtained by UAVs”

## Aim of the tender: concept (1)

- **Integration and storage** of georeferenced data collected from sensors transported by UAVs
- **Management** of a large volume of georeferenced information (*GeoBig Data*) with different formats, characteristics and dates.
- Easy **access** and **query** of information by all potential users



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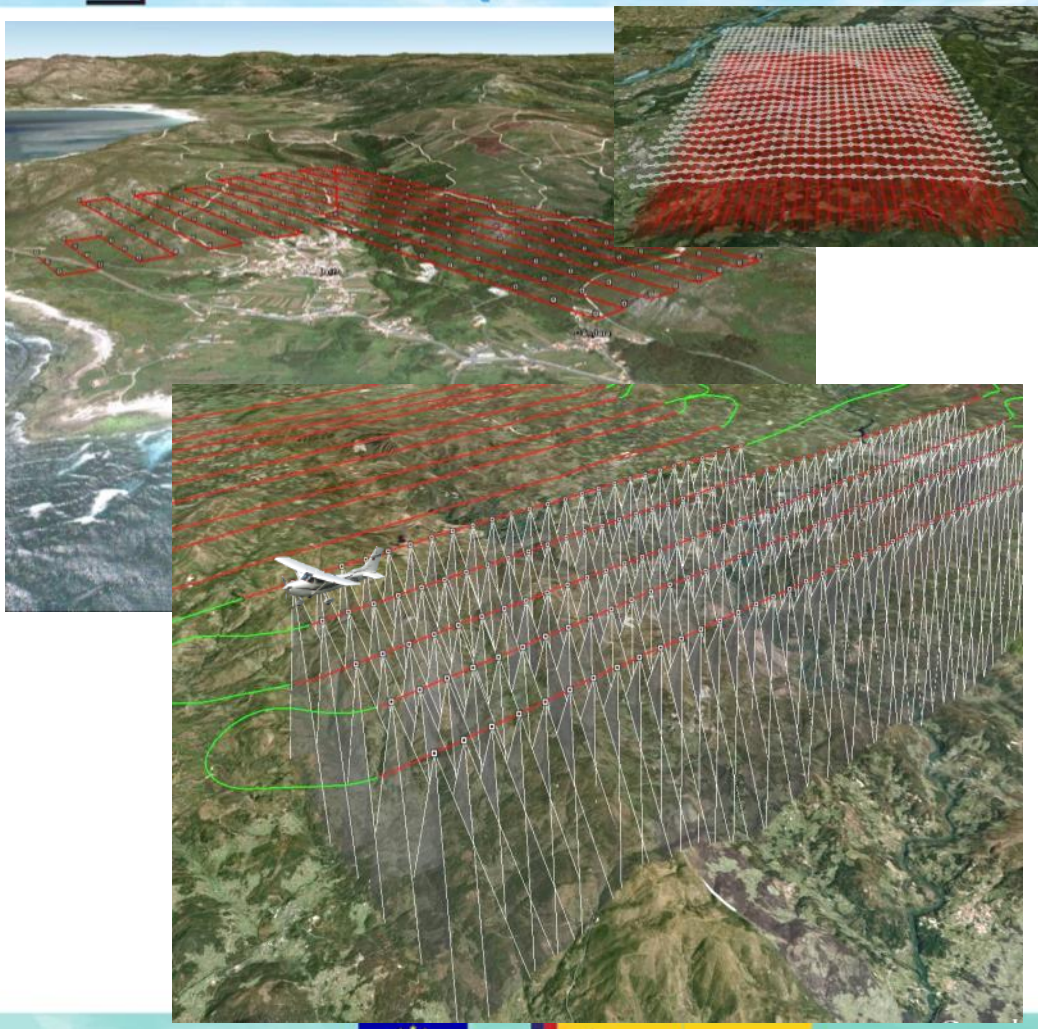
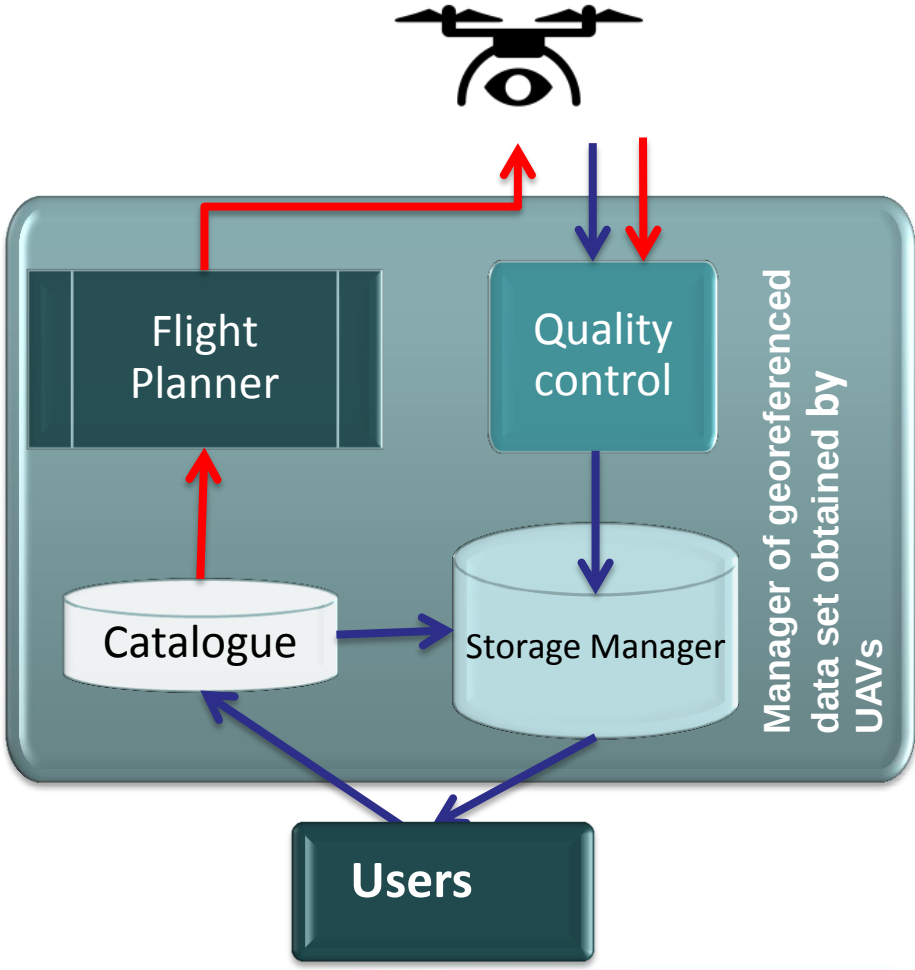
## Aim of the tender: concept (2)

- Management of **flight information**, atmospheric conditions, work execution schedule, mission planning, etc.
- Design of metadata and standardisation of **procedures for the execution of flights**, management of calibration information from UAV sensors...



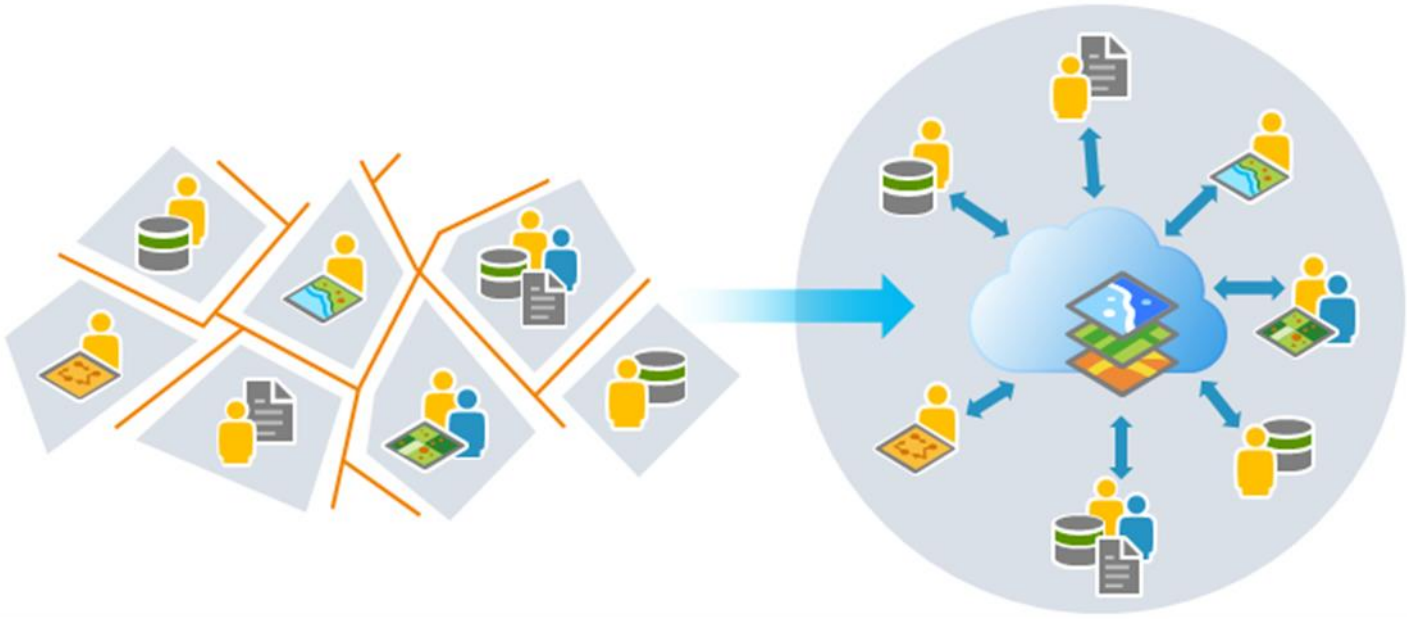
## Aim of the tender: project contents (1)

- **Storage manager:** For storage, reading and access to the different data files
- **Catalogue:** For data search and location, as well as management and consultation of metadata
- **Quality control:** To measure, store and consult values related to quality: positional accuracy, completion, logical consistency, theme...
- **Work scheduler:** Allows users to request non-existent data to plan and execute new missions



## Users

- All users of projects in which UAVs are involved in obtaining information about the territory



## User needs to be covered

- **Consultation** and **access** to data quickly and efficiently
- **Coordination** of the collection of new **data** and coordination between different **projects** with UAVs
- **Reusing** the information
- **Quality** control of the data collected

## Expected results and effects: improvements in current services (efficiency).

- **Accessibility** by any department of the Xunta to a large volume of georeferenced information: aerial photography, LAS files, georeferenced video, multispectral images...
- Better **planning** of new projects to obtain information with UAVs
- Improving **quality control** of the data obtained
- Improving **integral management** and the **coordination** of obtaining geographic information with UAVs

## Expected results and effects: new services or functions (effectiveness).

- Single shared **Repository** of data sources
- Friendly **Interface** for information access
- **Catalogue** of products and tools of information consultation
- Format **converter**: increased interopera and usability
- Sensor **calibration** field

## Results measurement indicators

- ↑ **volume** of accessible geographic information
- ↓ **time** access to information: location and use
- ↓ **costs** and ↑ ease of coordinating data collection for different uses and re-use of information
- ↑ **reliability** in the use of information (quality control)

## Scope of the aim of the tender and deadline

- Expected completion period: 12 months
- Scope:
  1. Data capture by UAVs
  2. Continuous storage of data obtained by UAVs
  3. Assisted cataloguing
  4. Quality control to validate the information
  5. Planning new captures
  6. Validation and verification

# Tender strategy

- CPTI.
- **€ 350,000.**
- Tender in first half of 2017, award in September / October, execution before end of 2019.
- Key assessment criteria:
  - Quality and feasibility of the proposal:
    - Experience in research projects or developments of similar characteristics: georeferenced data management platforms, data capture planners, quality control systems, etc.
    - Experience in developments in other areas with components in common with the proposed project.
    - Development-implementation.
    - Availability of resources for the project: human and technical.
    - Working plan and schedule adapted to the resources and budget proposed.
    - Work methodology: development, management, control and monitoring.
    - Valuation of the proposed solution: reliability, interoperability, functionality and integration capacity.
  - Solution and degree of innovation of the planned proposal.
  - Improvements to technical requirements

# TENDER 2

## “Acquisition, maintenance and automation of topographic and cartographic bases”

## Aim of the tender: concept (1)

- Development and edition of topographic bases from data captured by UAVs
  - Integration of UAV data with other sources of geographic data for the development of geographic and cartographic information
  - Tools for the automatic capture and update of the geographic objects present in the standard topographic bases: buildings and constructions, roads, infrastructures, hydrographic network, contour lines...
  - Cartographic generalisation functions, format transformation, conversion and data models, editing of LiDAR point clouds, obtaining digital terrain models and storage in databases.

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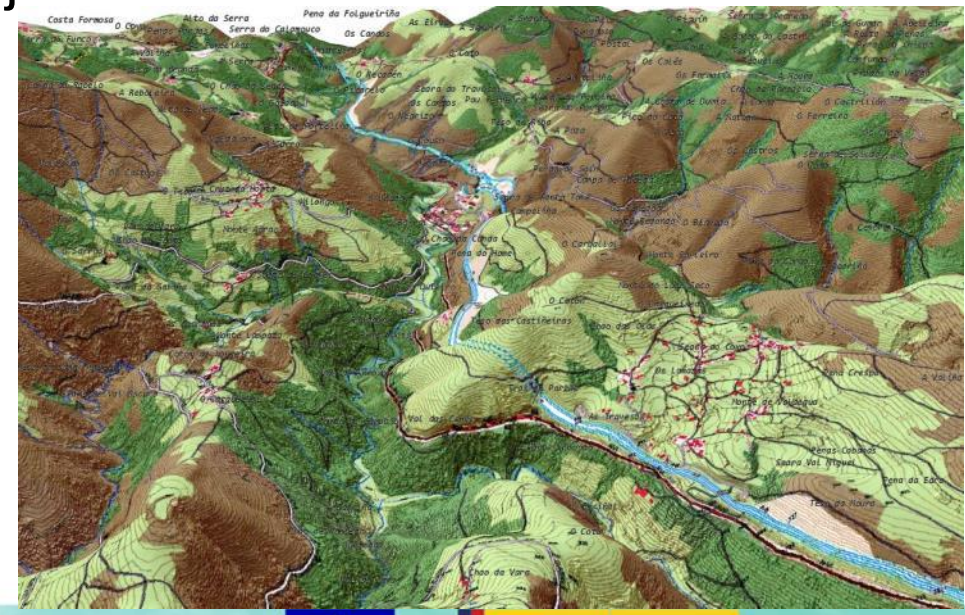
## Aim of the tender: project contents (1)

- **Choice and verification of data sources** for each process.
- Sending the required data not present to the manager.
- **Automatic capture** of vector geographic objects.
- **Systematic editing of point clouds**.
- **Generating 3D** elevation grids.
- **Quality control**according to data models.
- **Conversion of data layouts**.



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## Intermediate users

- Cartography producers: IET, Municipa

## End and potential users

- Geographical information users:
  - Land planning and urbanism
  - APLU
  - Galician Infrastructure Agency
  - Rural development
  - Cultural heritage
  - Civil Protection / Emergencies
  - Energy and mines
  - Tourism

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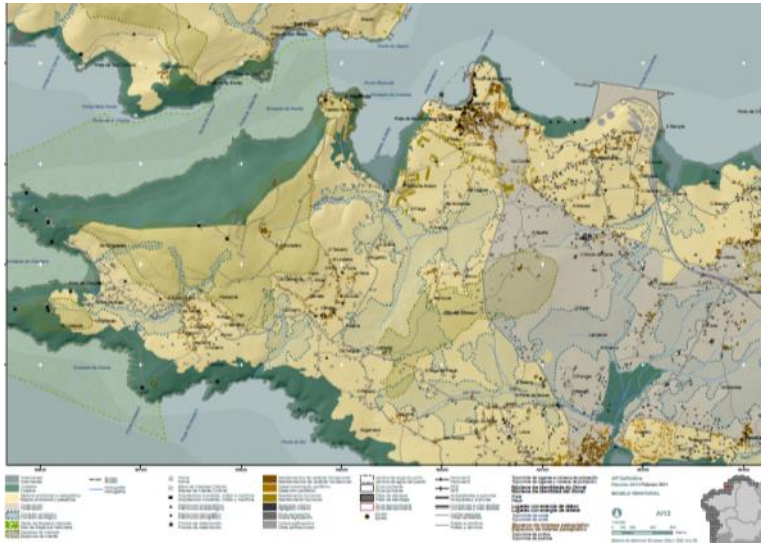
# User Needs

## Intermediate users:

Quality cartographic information, high precision and continuously updated

## End and potential users:

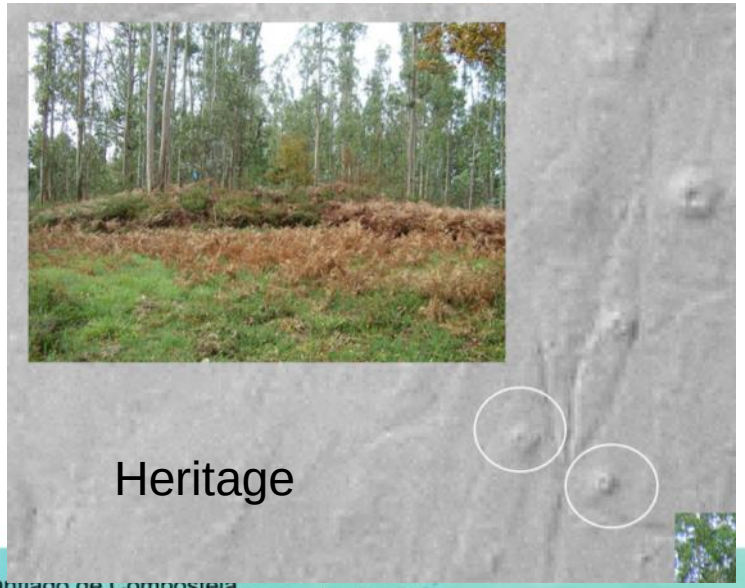
- **Land planning and urbanism**: Development and evaluation of urban plans, development of land management instruments, administrative record management
- **APLU**: Building legality control
- **AXI**: Infrastructure planning
- **Rural development**: Property restructuring processes, agricultural infrastructure planning
- **Mobility**: Public transport planning

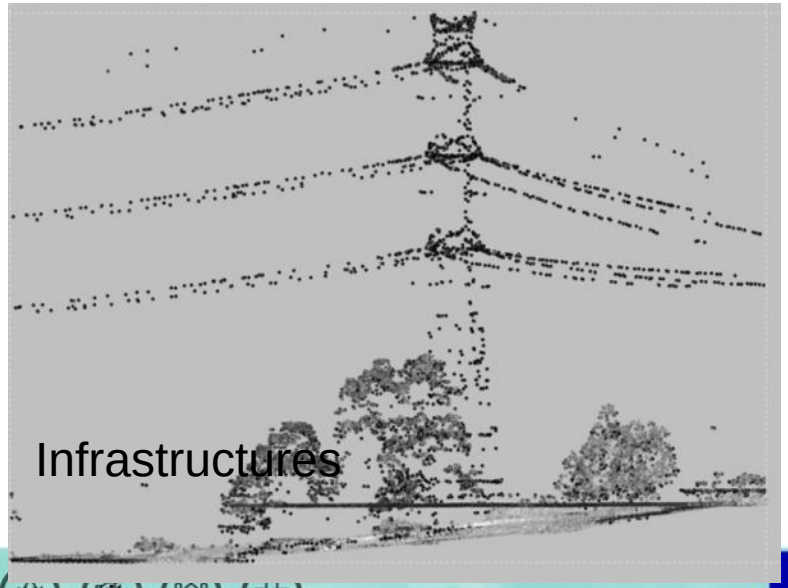


# User needs to be covered

## End and potential users:

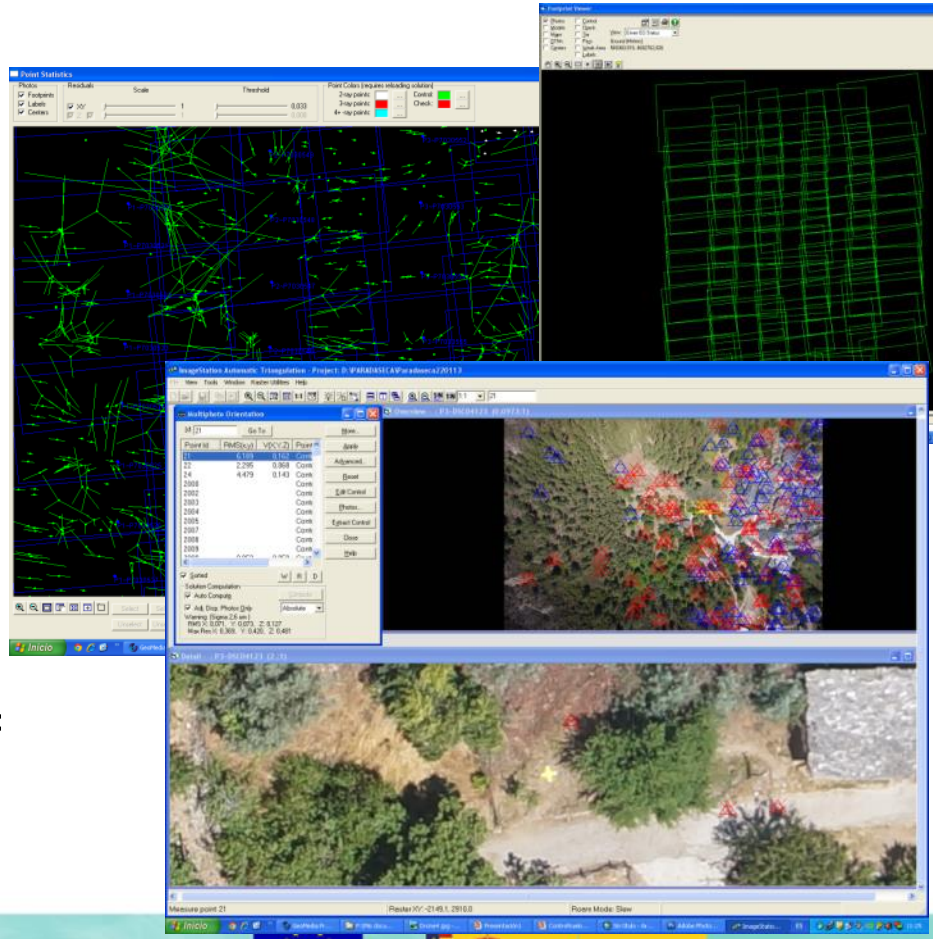
- **Aguas de Galicia**: Hydrological planning, record management
- **Cultural heritage**: inventory and cataloguing of cultural assets, record management
- **Tourism**: route planning and routes of interest, intervention projects




## Expected results and effects: improvements in current services (efficiency).

- **Continuous updating** of the cartography
- Use of more data sources, sensors and devices for the development of geographic information
- **Reduction of costs** in the development of geographic information
- Topographic and cartographic bases of **higher quality and precision**



## Expected results and effects: new services or functions (effectiveness).

- Intermediate users; **New tool for BT development**:
  - LiDAR Data Processing and Classification Tool
  - Calibration fields
  - Reference clouds for quality control...
- End users;
  - **Higher quality** information
  - **new information**
  - **New analyses and information derived** not viable until now.

E.g. Updated topographic bases → ↓ time and cost PXOMs

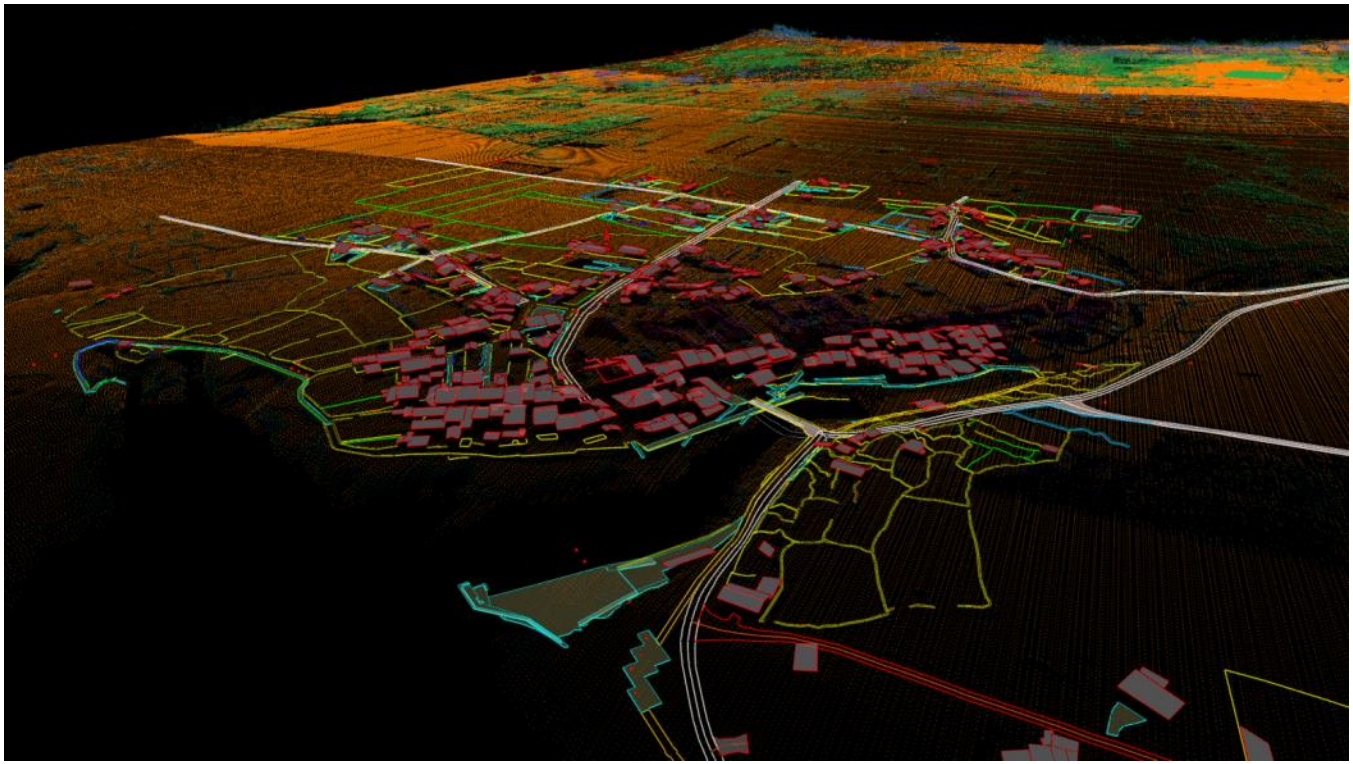
↓ APLU inspections…

# Results measurement indicators

- Processing **time** per surface unit of topographic bases:
  - No. of automatically extracted geographical objects
  - Type of objects automatically extracted
  - Number of automatic format and data model conversions.
- Processing **cost** per surface unit of topographic bases:
- **Quality** and precision of the products:
  - Positional accuracy (horizontal and vertical absolute, vertical relative)
  - Completion (omission and commission errors)
  - Logical consistency (attribute errors, topological errors)

# Galicia Topographic Base

- Continuous→ Update 15 years
- ↓ 30-40% costs (function(application performance, degree automation))
- Quality: ↑ Accuracy, completeness, consistency



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## MDT/MDS

- Point density: 0.5 pt/$m^2$ → >4 pt/$m^2$
- Update: 5 years → > annual
- Automation of derived products: automatic filtering, automatic generation MDT/MDS

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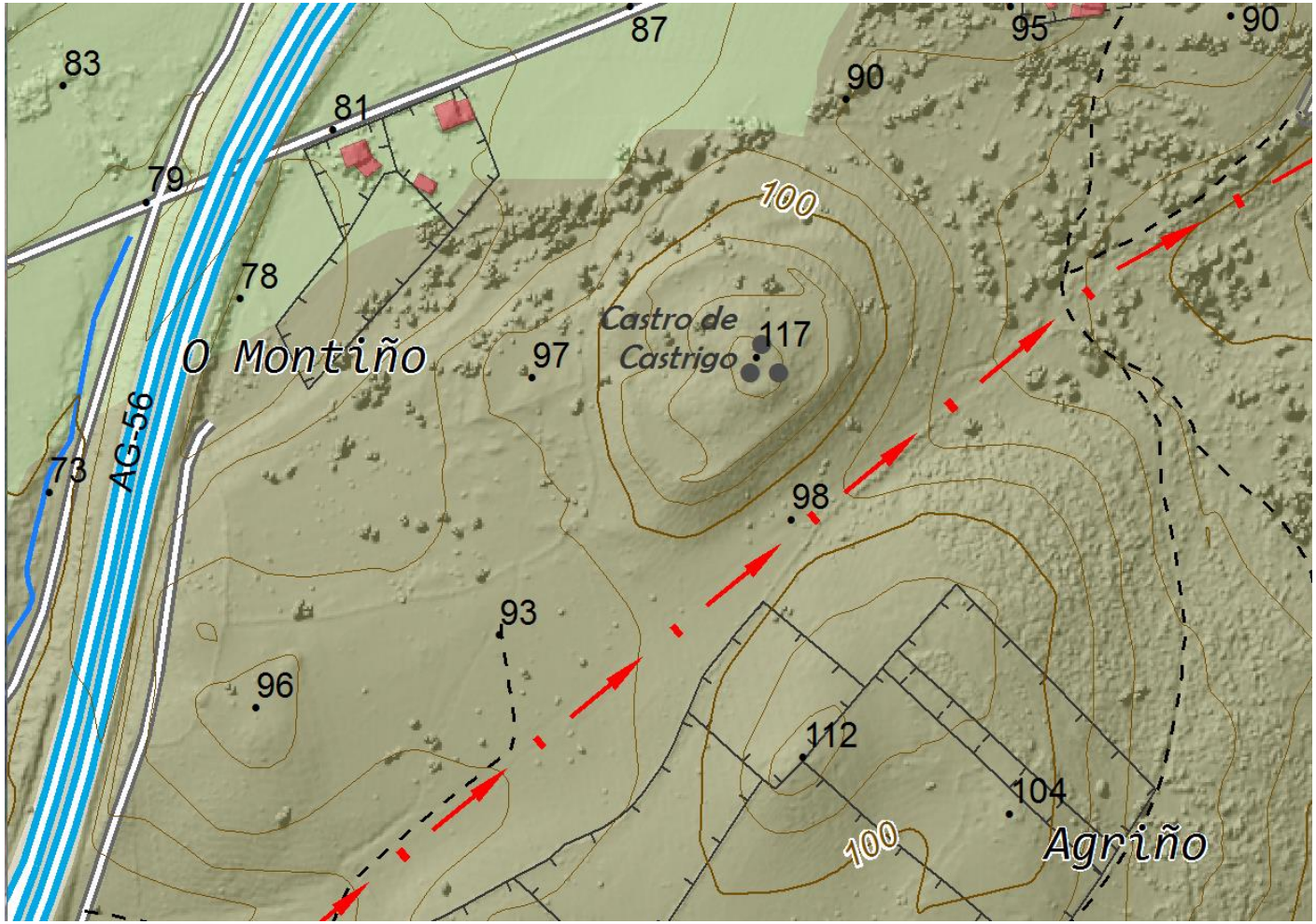
## Applications MDT/MDS

Cultural heritage



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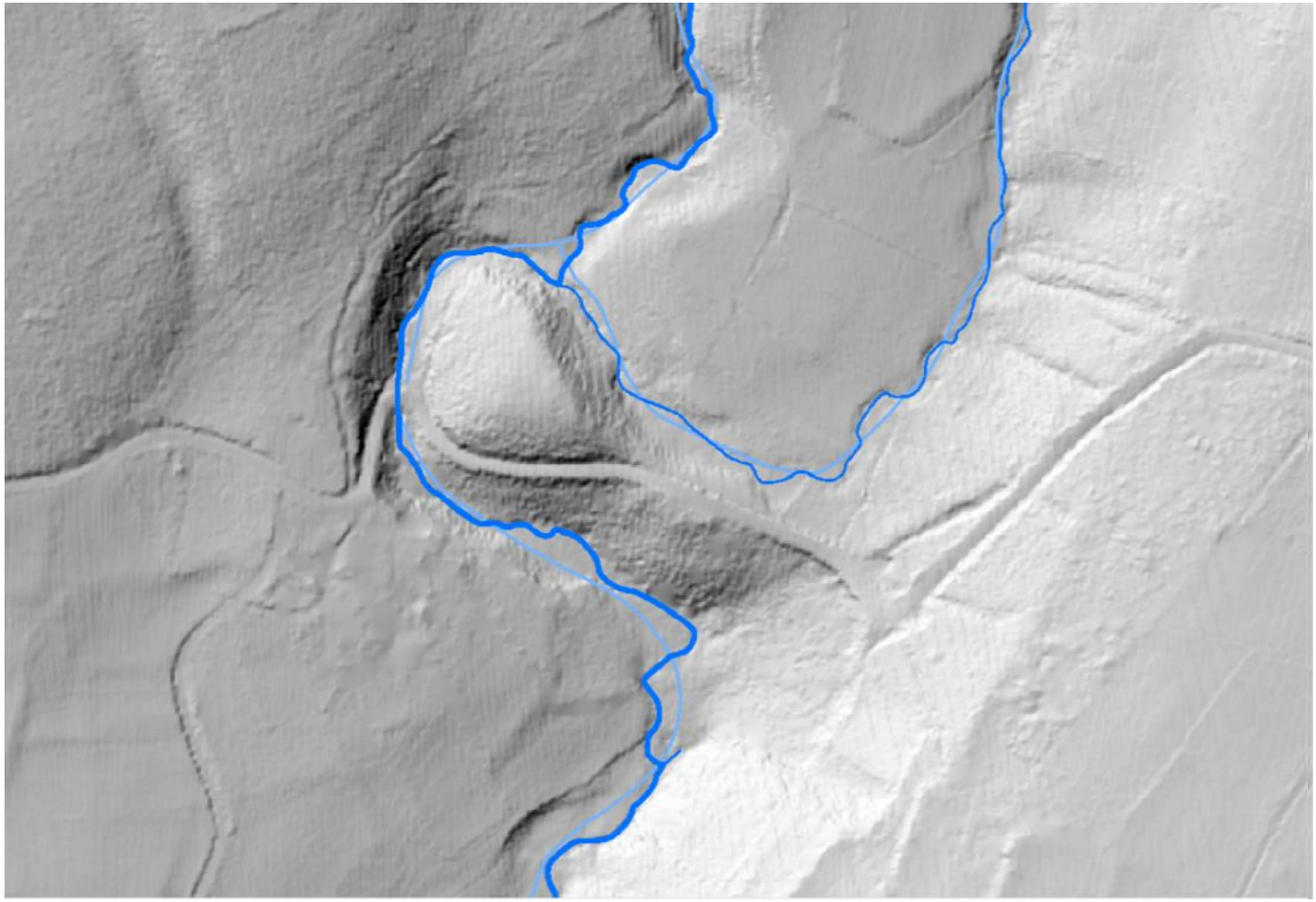
## Applications MDT/MDS

Hydrological planning



## Scope of the aim of the tender and deadline

- Expected completion period: 18 months
- Scope:
  1. Data capture with UAVs
  2. Automation of geographical elements capture
  3. Assisted editing of point clouds.
  4. Obtaining models of terrain elevations
  5. Data model conversion according to different international specifications
  6. Validation and verification

# Tender strategy

- CPTI.
- **€1,500,000.**
- Tender in first half of 2017, award in September / October, execution before end of 2019.
- Key assessment criteria:
  - Quality and feasibility of the proposal:
    - Experience in research projects or developments of similar characteristics: data capture with UAVs, generation of cartographic bases, support systems for base automation, capture of geographicak objects etc.
    - Experience in developments in other areas with components in common with the proposed project. Development-implementation.
    - Availability of resources for the project: human and technical.
    - Working plan and schedule adapted to the resources and budget proposed.
    - Work methodology: development, management, control and monitoring.
    - Valuation of the proposed solution: reliability, interoperability, functionality and integration capacity.
  - Solution and degree of innovation of the proposed proposal.
  - Improvements to technical requirements

# TENDER 3

## "Monitoring the dynamics of land occupation and assistance to land planning"

## Aim of the tender: concept (1)

- Development of **information on land cover and uses**:
  - SIOSE update
  - Mapping of priority habitats
  - Study and control of the evolution of land use
  - Crop and utilisation maps
  - Land use statistics
  - Study of land mobility
- **Decision support** tools:
  - Territorial diagnosis
  - Regional planning
  - Urban planning

# Aim of the tender: project contents (1)

- **M0. Land use:** Tools for capturing information on land use
- **M1. Territorial diagnosis:**
  - Automatic detection of changes in soil use
  - Analysis of the spatial pattern of urban growth
- **M2. Regional planning:**
  - Cartography of soil suitability for different uses
- **M3. Urban planning:**
  - Data model for urban planning
  - Automatic calculation of sectoral conditions
- **M4. Mapping of terrestrial habitats of Community interest and indicators of their conservation status:**
  - Automation of data capture
  - Obtaining status indicators

## End and potential users

- Land planning and urbanism
- APLU
- IGVS
- Environmental quality and climate change
- Natural heritage
- Rural development
- Agriculture, Stock Breeding and Food Industries
- IGE

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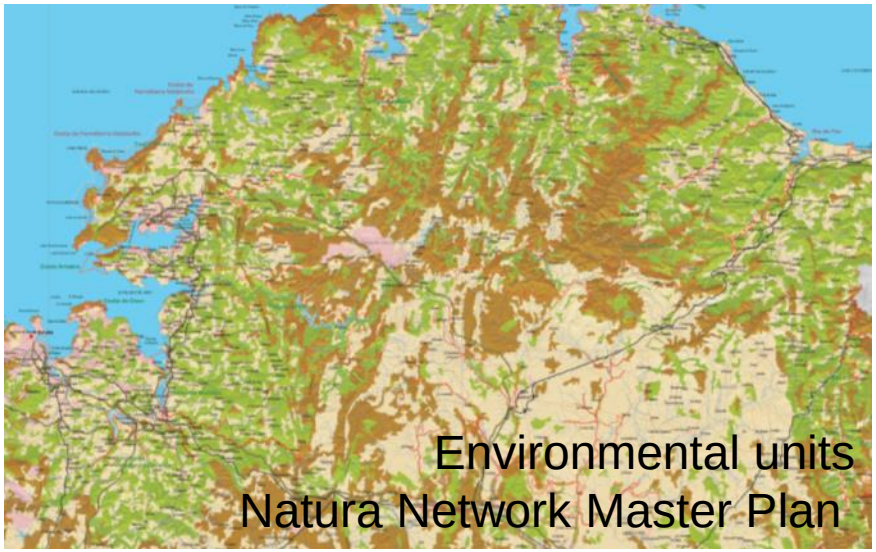
## User needs to be covered

- **Land planning and urbanism**: Development of urban planning and land use instruments, SIOTUGA management, DOT monitoring, urban growth control, urban planning data model, automatic calculation of sectoral conditions
- **APLU**: Control of urban planning law
- **IGVS**: Business Area planning, de
- **Rural development**:
  Agricultural planning, Land Bank, L

## User Needs

- **Natural heritage**: habitat mapping, Master Plan RN, PORN, PRUG
- **Environmental quality:** Climate change strategy ($CO_2$ fixation…)
- **IET**: Green Infrastructure
- **Agriculture, Stock Breeding and Food Industries:** agricultural statistics
- **IGE:** land use statistics



Environmental units
Natura Network Master Plan

## Expected results and effects: improvements in current services (efficiency).

**INTELLIGENT LAND MANAGEMENT**

- Continuous **updating**: SIOSE

  Habitat mapping

- ↓ **time** and **cost** of development of land-management planning instruments (e.g. PTI) and town planning (e.g. basic plans)
- ↓ time and cost of the DOT Monitoring Plan and SIOTUGA management
- ↓ No. town planning inspections
- Better sectoral planning (business, agroforestry, EENN...)
- Better maintenance SITEGAL
- Best soil use statistics

## Expected results and effects: new services or functions (effectiveness).

New information on land uses (crops and utilisations, vegetation species, building density...)

Tools to help decision-making in territorial and sectoral planning.

## Results measurement indicators

- Development time per unit of SIOSE, mapping habitats
  - % Area automatically classified
  - No. of automatically differentiated uses
  - % change of use detected automatically...
- Development cost per surface unit of SIOSE, habitats
- Quality and precision of the products: Scale, thematic resolution (number of uses / habitats)...

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**SIOSE** (Spanish Land Use System)

- 1:20.000 → ≈1:5.000
- ≈ 5 years → annual
- Orthophoto+€120,000 → ↓ 30-4

# Scope of the aim of the tender and deadline

- Expected completion period: 18 months
- Scope:
  1. Data capture with UAVs
  2. Production and edition of land use data
  3. Detection and calculation of land use evolution
  4. Analysis of change and spatial pattern trends
  5. Aptitude mapping
  6. Urban planning data model
  7. Calculation of sectoral conditions
  8. Automation of mapping of habitats of interest
  9. Validation and verification

# Tender strategy

- CPTI.
- **€1,300,000.**
- Tender in first half of 2017, award in September / October, execution before end of 2019.
- Key assessment criteria:
  - Quality and feasibility of the proposal:
    - Experience in research projects or developments of similar characteristics: data capture of land use with UAVs, automatic classification of land uses, planning aid systems, automatic detection of changes of use, etc.
    - Experience in developments in other areas with components in common with the proposed project. Development-implementation.
    - Availability of resources for the project: human and technical.
    - Working plan and schedule adapted to the resources and budget proposed.
    - Work methodology: development, management, control and monitoring.
    - Valuation of the proposed solution: reliability, interoperability, functionality and integration capacity.
  - Solution and degree of innovation of the proposed proposal.
  - Improvements to technical requirements

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# TENDER 4

## “Geographic information applications for forest management and control.”

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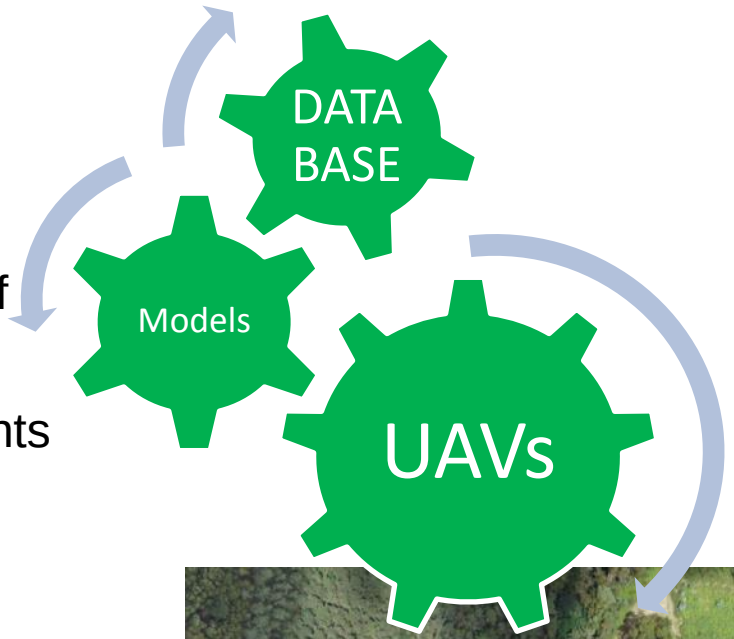
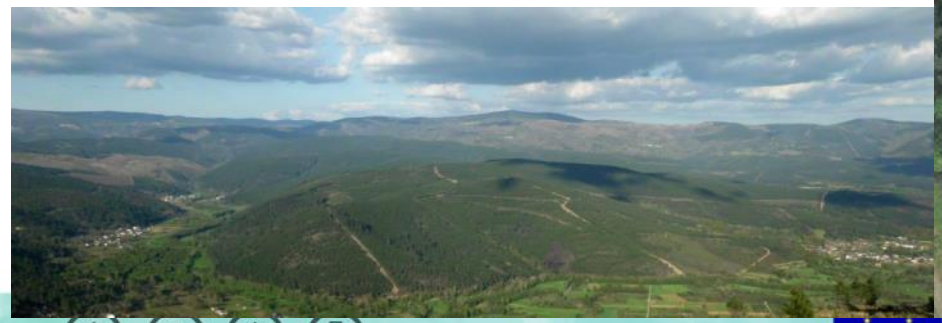
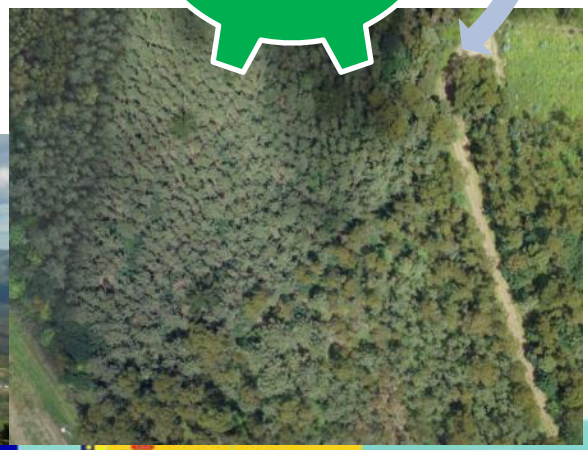
# Aim of the tender: concept (1)

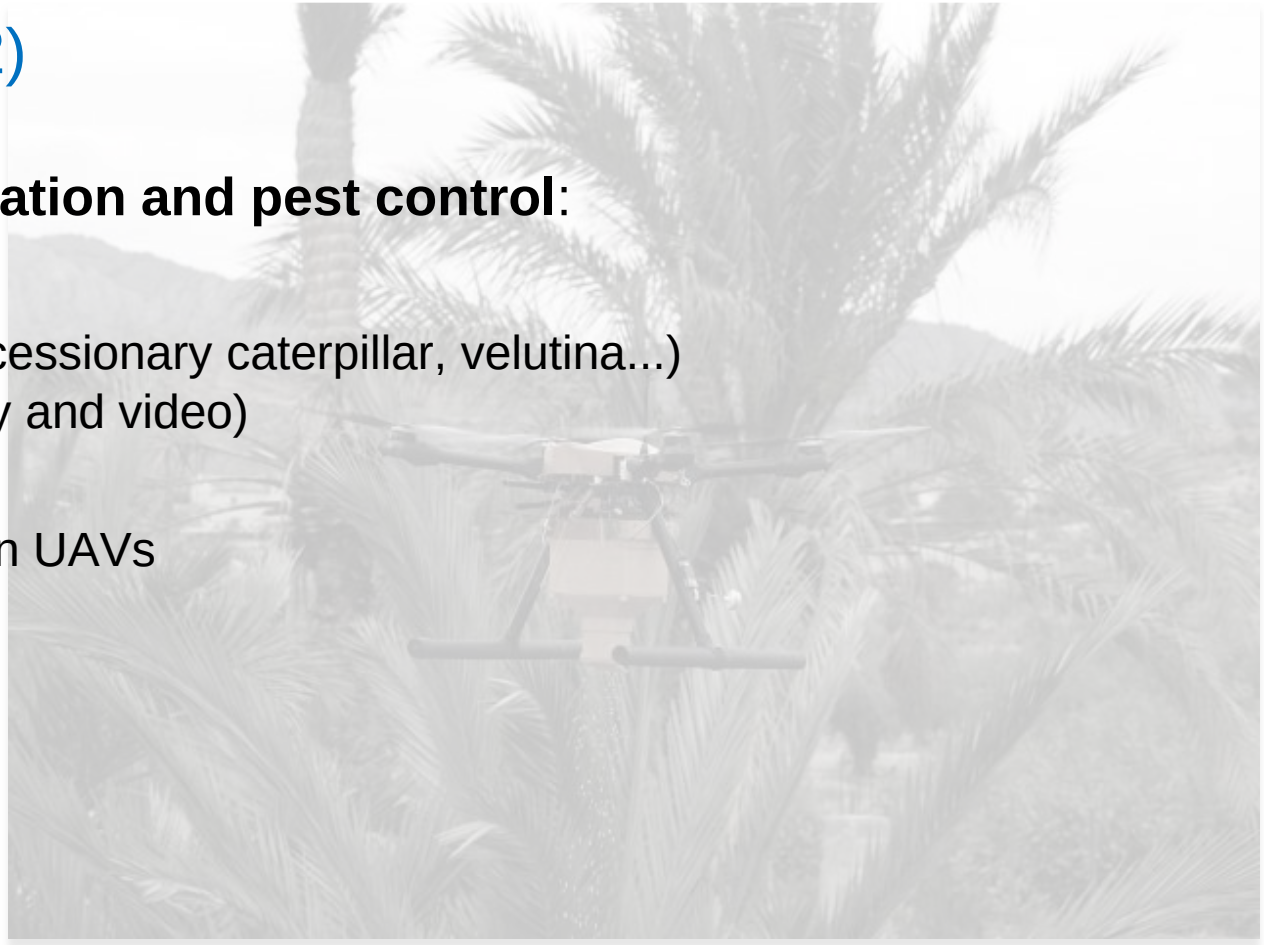
- **Forest information system** for sustainable utilisation, including:
  - Capture and processing (transformation, editing, analysis) of UAV data for regional or forest forest inventory by species
  - Information from forest planning and management instruments
  - Information research and technological centres
  - Galician forestry statistics: production, processing and commercialisation





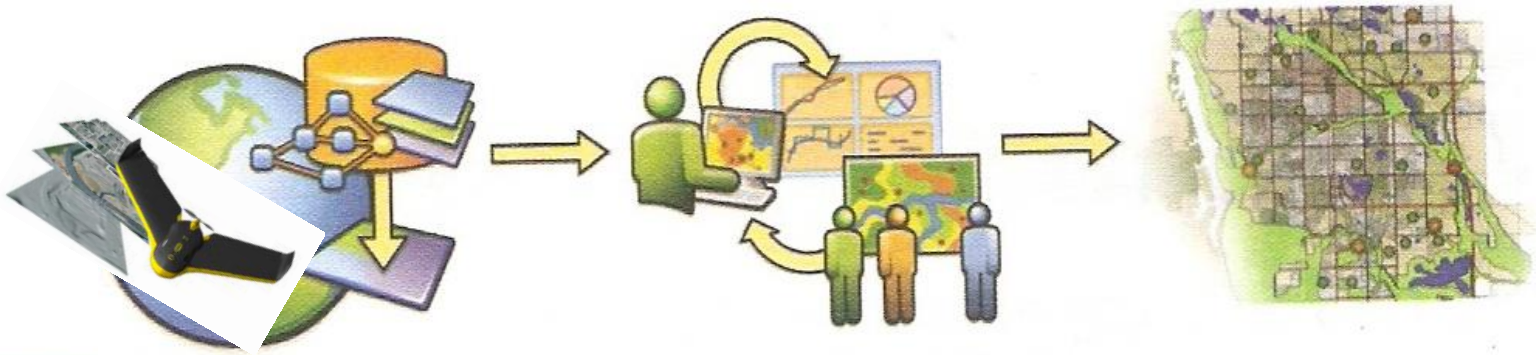
# Aim of the tender: concept (2)



- **Phytosanitary status of vegetation and pest control**:
  - Pest identification system (processionary caterpillar, velutina...) from UAV images (photography and video)
  - Pesticide technology to install in UAVs

## User needs to be covered

- Generation and integration of large volume of forest sector information
- Information management
- Support for decision-making: forest planning, management and control



## Expected results and effects: improvements in current services (efficiency).

- Forest management:
  - Increased availability and ease of access to information required for forest management and control
  - Improved quality of forest statistics information
  - Improvement in procedures
- Fire prevention:
  - More information → reduction of times in fire fighting

## Expected results and effects: new services or functions (effectiveness).

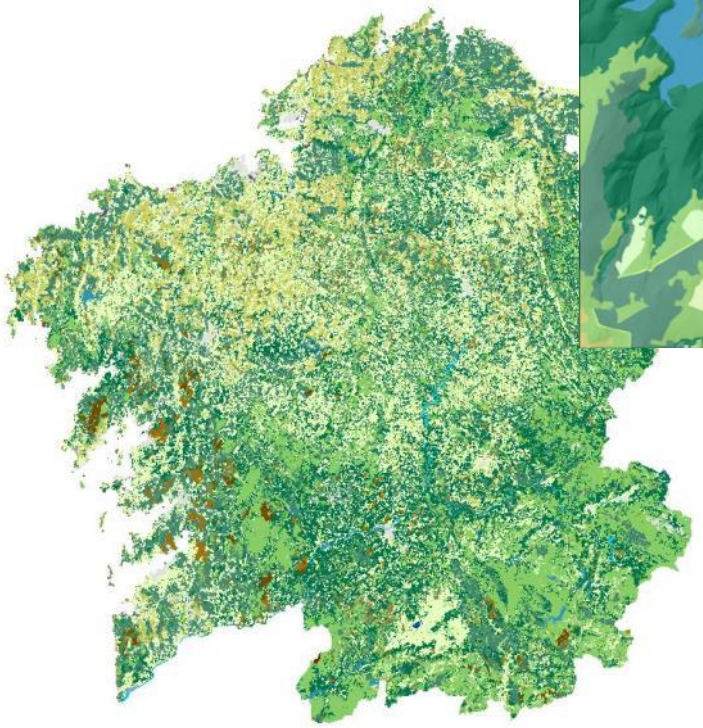
- **New information** not available now:

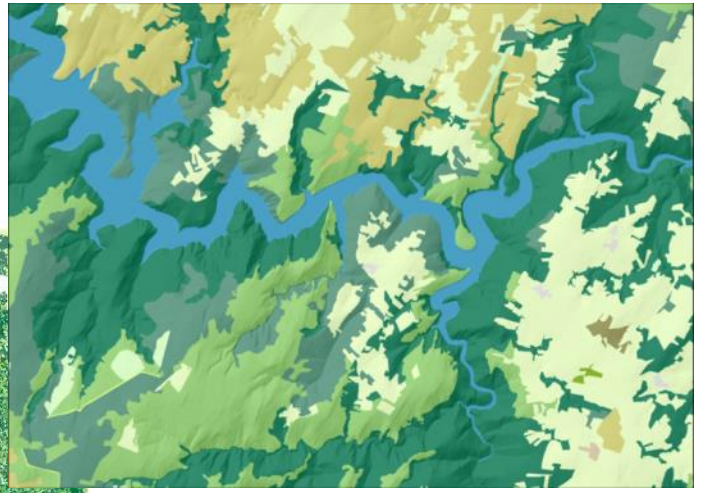
Inventory by species, fuel models, fire risk models, biomass quantification, phytosanitary status indices, forest statistics (production, processing and marketing)...

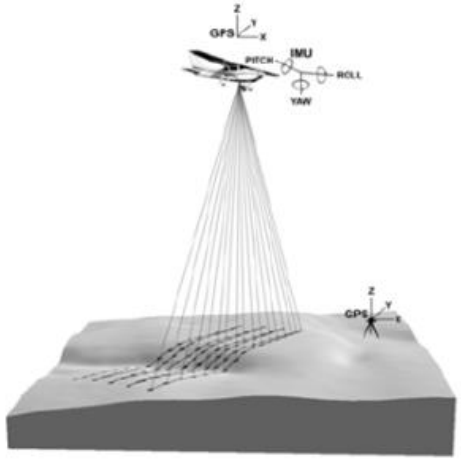
- More **accurate** and **up-to-date** information at **lower cost**
- **Modelling** not currently possible
- **Localized aerial phytosanitary** treatments

## Results measurement indicators

- Improvements in management
- ↑Quality of the information
- ↑Update frequency
- ↑Surface managed



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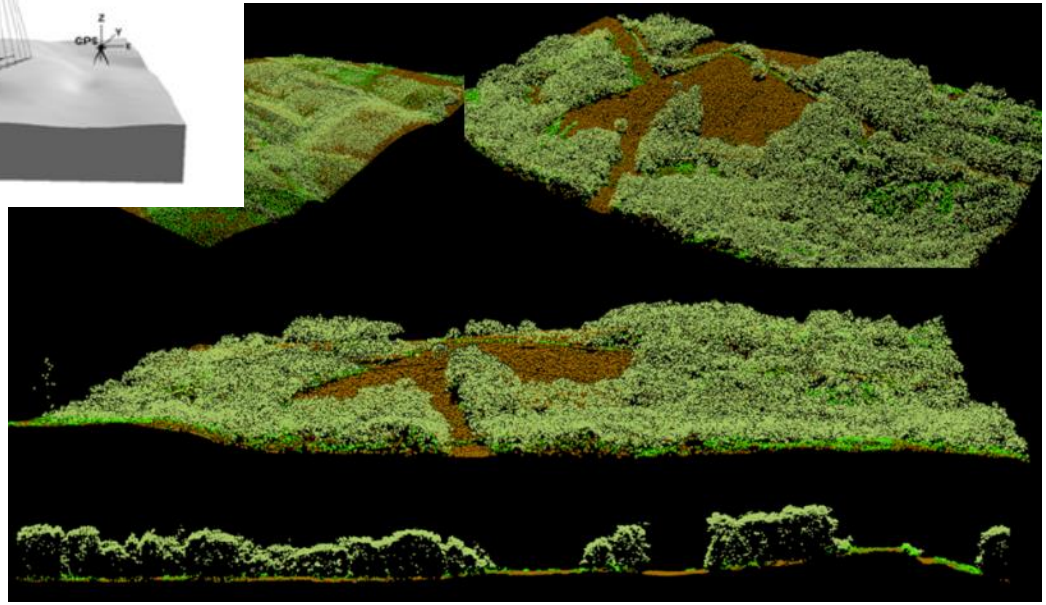

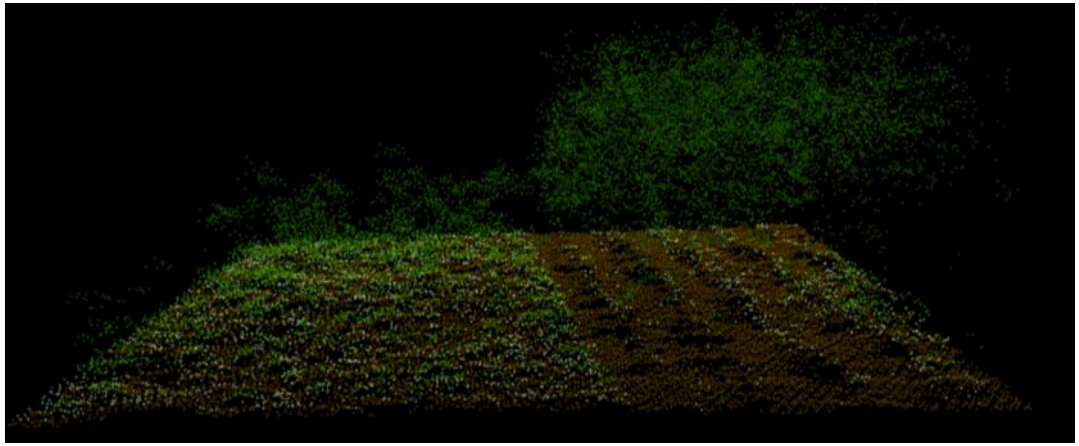

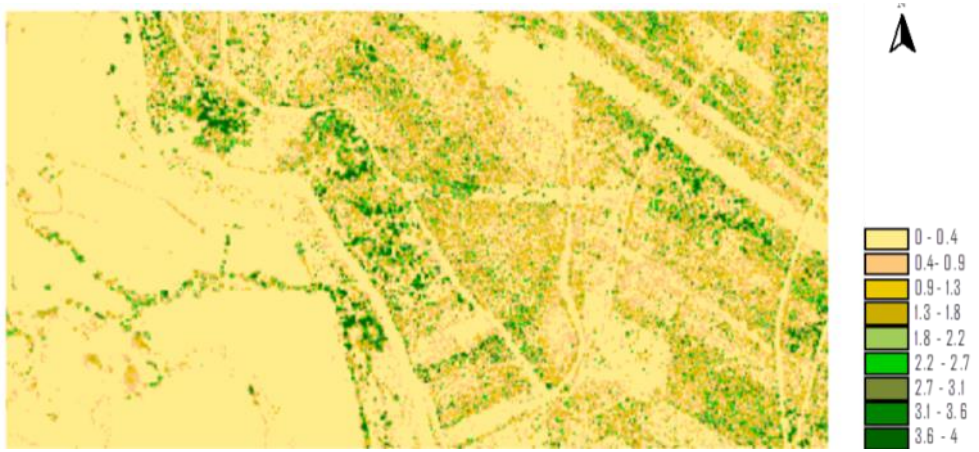
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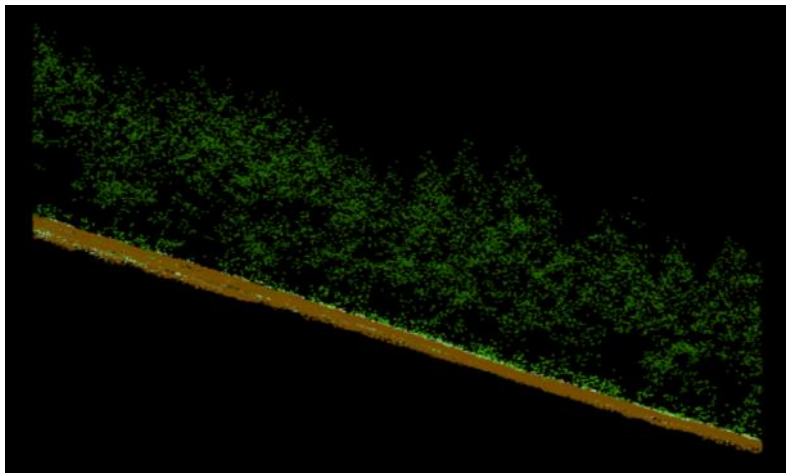
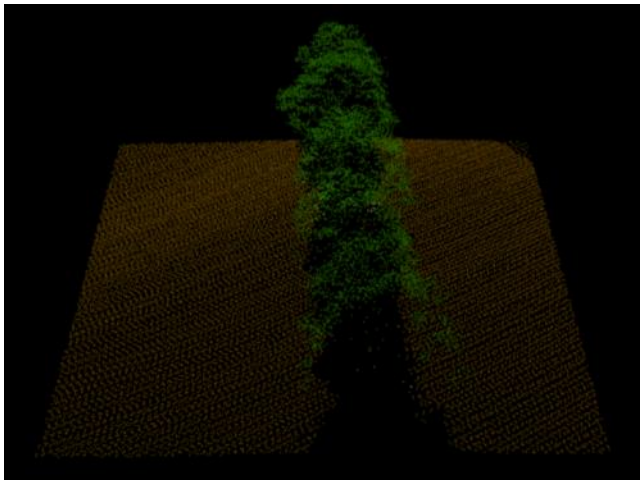
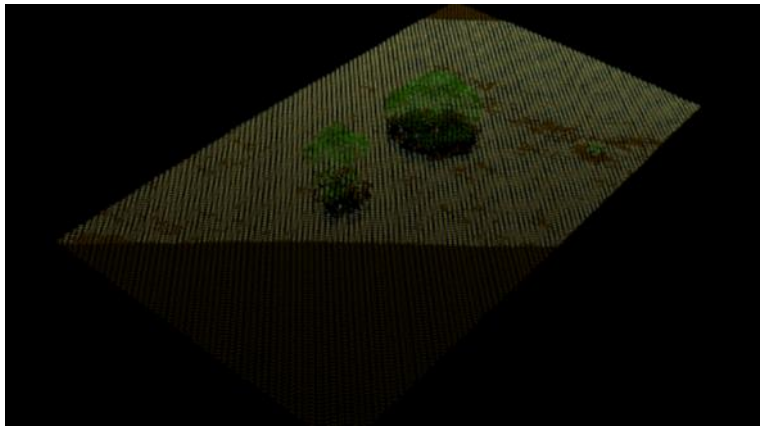
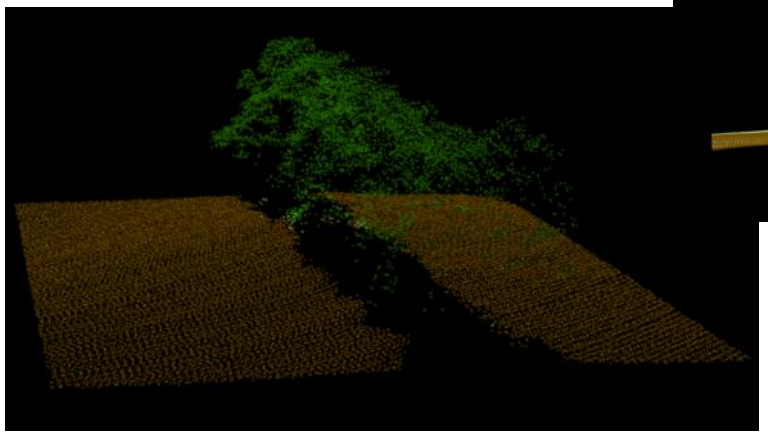
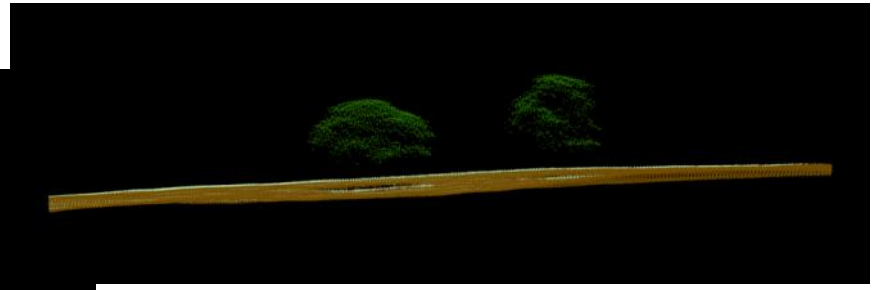
0.4- 0.9
0.9 - 1.3
1.3 - 1.8
1.8 - 2.2
2.2 - 2.7
2.7 - 3.1
3.1 - 3.6
3.6 - 4

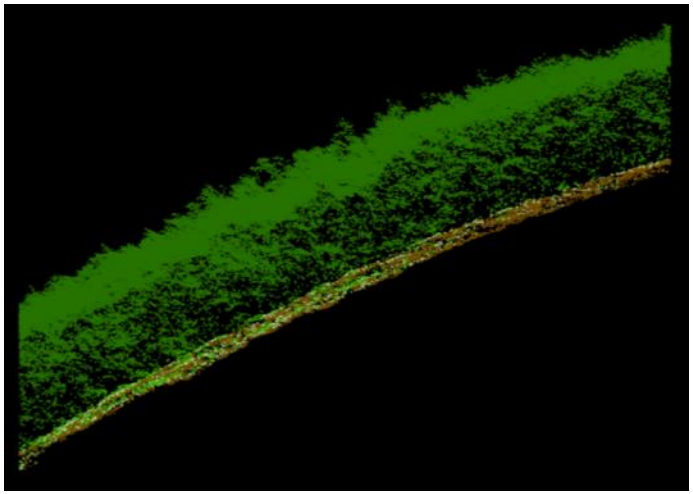


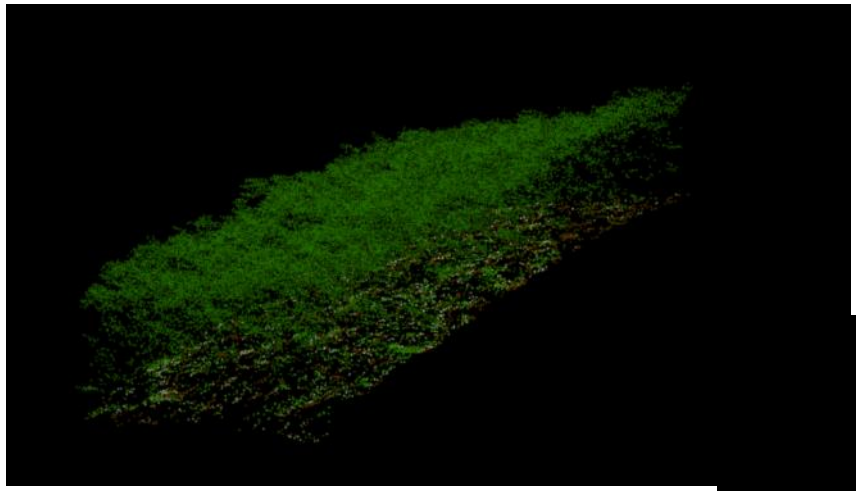


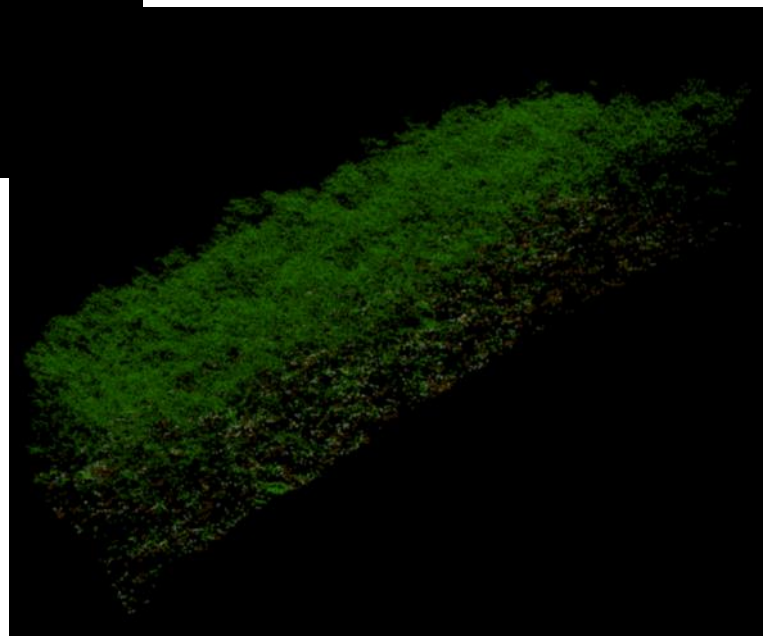


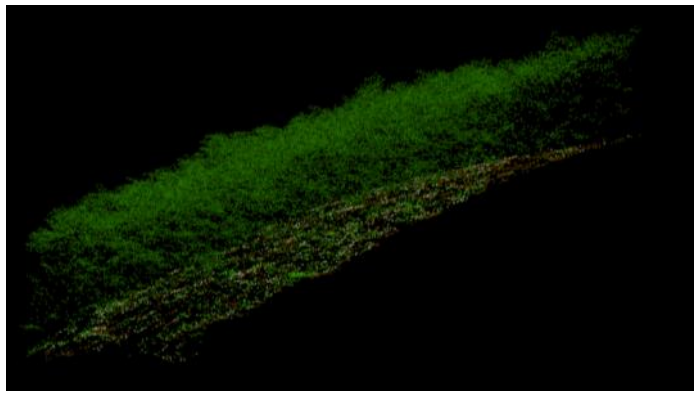












# Tender strategy

- CPTI.
- **€700,000.**
- Tender in first half of 2017, award in September / October, execution before end of 2019.
- Key assessment criteria:
  - Quality and feasibility of the proposal:
    - Experience in research projects or developments of similar characteristics: capture of forest data with UAVs, dasometric models, etc.
    - Experience in developments in other areas with components in common with the proposed project. Development-implementation.
    - Availability of resources for the project: human and technical.
    - Working plan and schedule adapted to the resources and budget proposed.
    - Work methodology: development, management, control and monitoring.
    - Valuation of the proposed solution: reliability, interoperability, functionality and integration capacity.
  - Solution and degree of innovation of the proposed proposal.
  - Improvements to technical requirements