COST Action CA16208 CONVERGES

'KNOWLEDGE CONVERSION FOR ENHANCING MANAGEMENT OF EUROPEAN RIPARIAN ECOSYSTEMS AND SERVICES'

Short Term Scientific Mission (STSM)

'REMOTE SENSING APPLICATIONS FOR RIPARIAN ECOSYSTEMS MANAGEMENT, TETOUAN, MOROCCO' (13/04/2019 - 23/04/2019)

Participants

Antonis Kavvadias (En Agris PC)

Dr. Manolis Psomiadis (Agricultural University of Athens)

Host

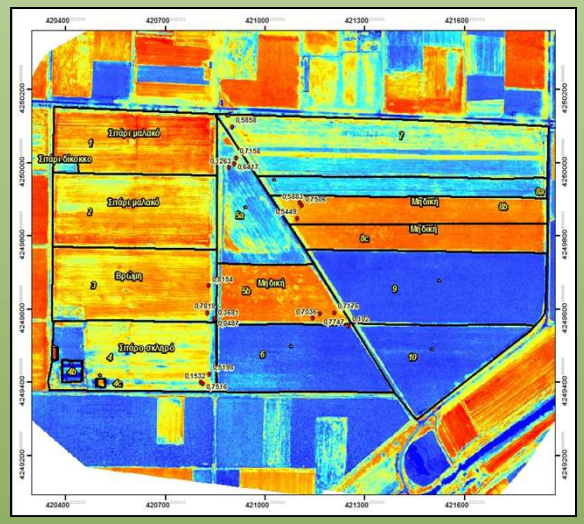
Pr. Mohammed Ater, Abdelmalek Esaâdi University (Tetouan-Morocco)

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

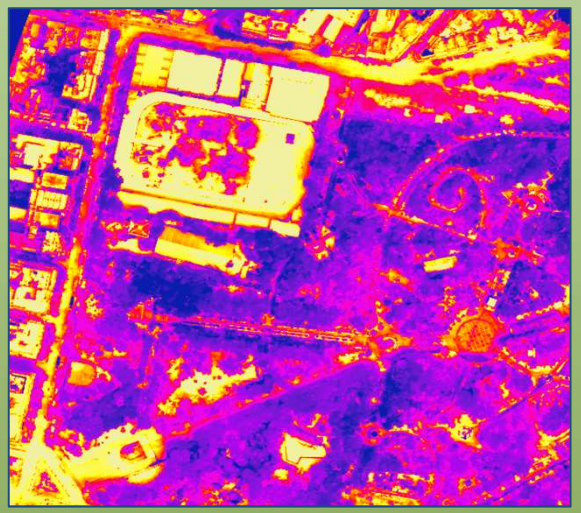
CONVERGES European Riparian Ecosystems

UNMANNED AERIAL SYSTEMS DEVELOPMENT & APPLICATIONS

FORESTRY



AGRICULTURE – IR INDICES



THERMAL IMAGERY

MINING

COASTAL GEOMORPHOLOGY

INFRASTRUCTURE

UAS MATERIAL

UAV: Phoreas, BlackBird, eBee, DJI Phantom, Nauphsicrate

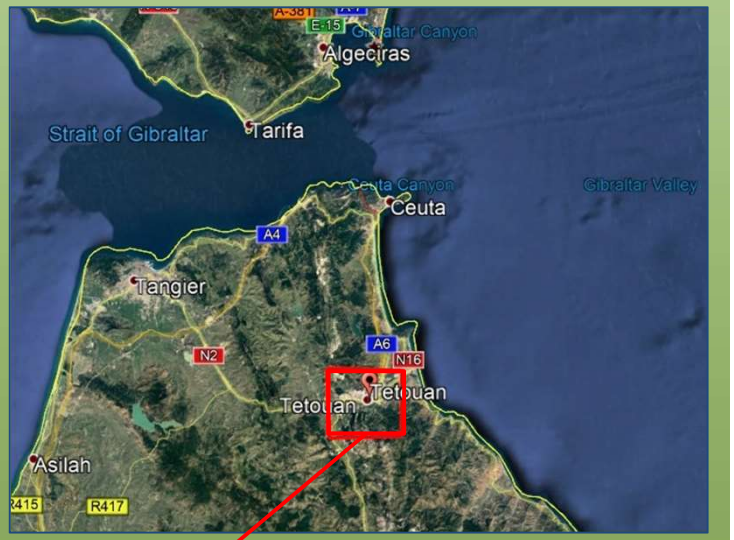
Sensors (RGB/NIR/RE/Thermal)**:** Sequoia, Thermo FLIR VUE, CanonS110 / IXUS, ThermoMap etc

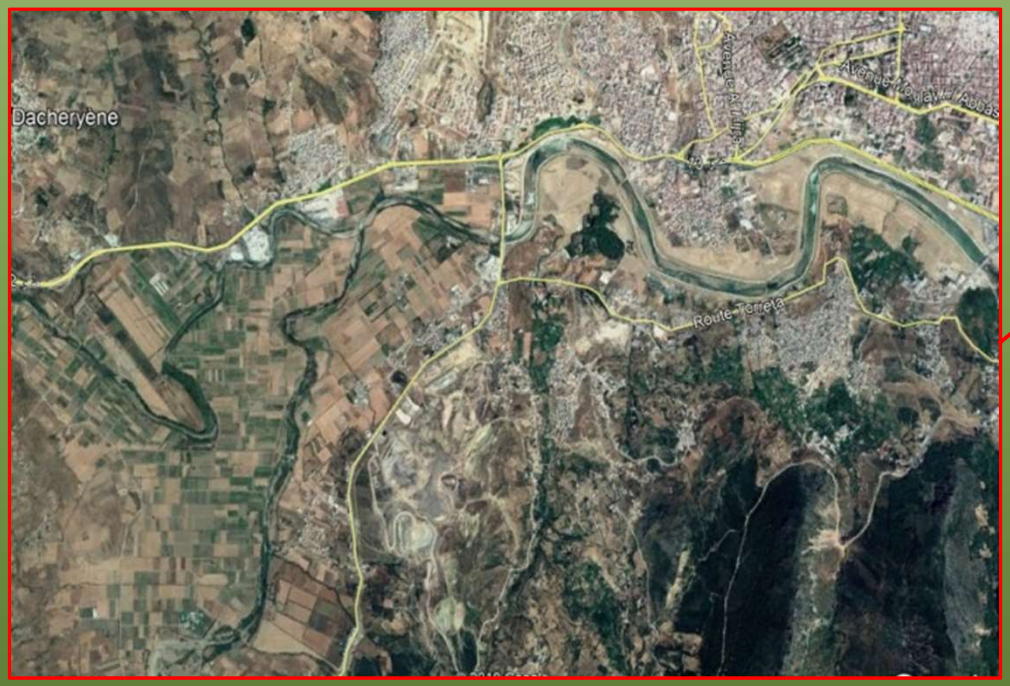
SW: Pix4D, Agisoft, Mission Planner, eMotion, ArcGIS, Civil AutoCAD, ENVI, HECRAS etc

River Martil, Tetouan city (N. Morocco)

Excessive environmental pressures:

- State hydraulic works
- Agricultural activity
- Grazing
- Uncontrolled Waste Disposal





River Martil, Tetouan city (N. Morocco)

Excessive environmental pressures:

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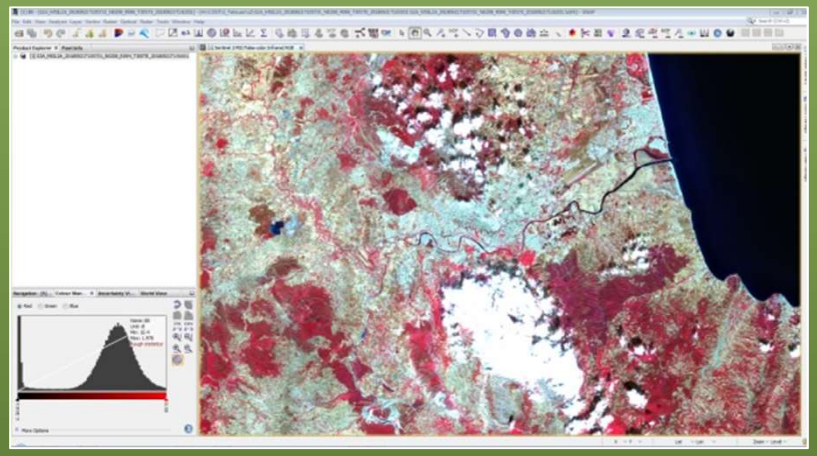
CASE STUDY

Case Study Description

- UAV Aerial Photography
- Ground Photography
- Orthophoto map production
- 3D Digital Surface Model (DSM) production
- Acquisition of Satellite Imagery Data
- Imagery Data Comparison
- UAS and Satellite Imagery Case Studies Presentation

at the Abdelmalek Esaâdi University



EQUIPMENT & METHODS

Unmanned Aerial System (UAS) Mission

Equipment

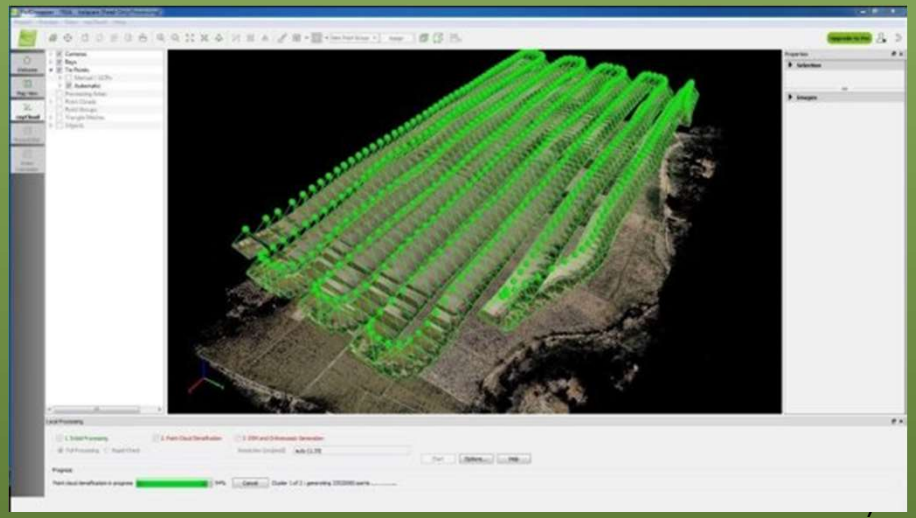
UAV: DJI Phantom 4 Advanced (tetracopter)

Camera resolution: 4K (4096x2160px)

Sensor: RGB / ~~NIR~~

SW

- **eMotion** (Flight planning & control)
- **AgiSoft** (Image processing)
- **ENVI** (Imagery analysis)
- **ArcGIS** (GIS)



Unmanned Aerial System (UAS) Mission Description

Pre-flight Procedure

- Official Permissions (Nope!)
- Weather forecast
- Study Area general check (obstacles, prohibited areas, near-by airports etc)

Aerial Photography Info

- **Flight duration:** 22 minutes
- **Flight Altitude:** 55 meters
- **Number of images:** 96
- **Longitudinal & Lateral Overlap:** 60% & 60%

Post-flight Imagery Data Process

(Photogrammetric SW: Agisoft)

Derivatives:

- Orthophoto map (RGB)
- 3D Digital Surface Model (DSM)

Area: 14 Ha
Spatial resolution: 2,5 cm/px

Orthophoto map

3D Digital Surface Model

DATA

Potential environmental pressures detection

1. Agricultural Activity
2. Free grazing area
3. Small Industrial Installation
4. Ford crossing
5. Waste Disposal

Ground truth of UAS imagery data of the riparian zone

UAV aerial photos



Ground photos

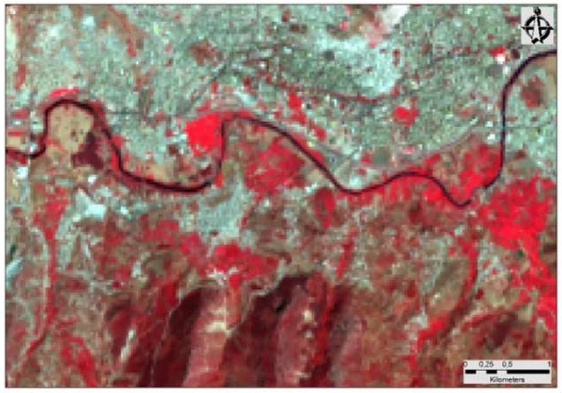


METHODS

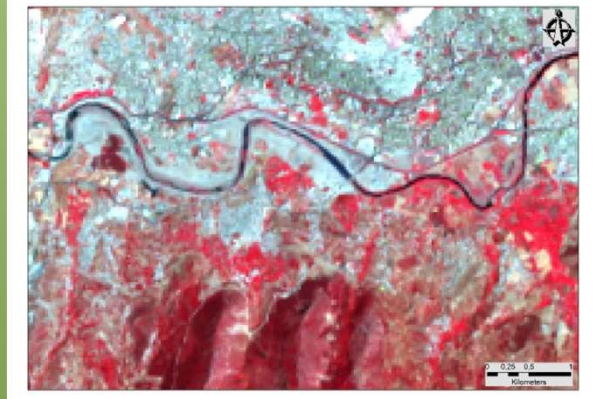
Comparison of Satellite imagery data for riparian ecosystem management and temporal change detection.

A1-A2: Decrease of riparian vegetation cover along the river flood protection constructions.
B1-B2 : Increase of riparian vegetation cover at the western part at the junction of the Martil river with its main tributary (LandSat 5, 8)

A1. 2013

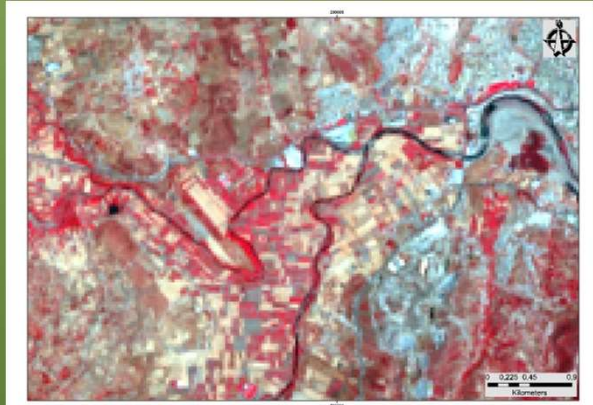


A2. 2018



B1. 1999

B2. 2018



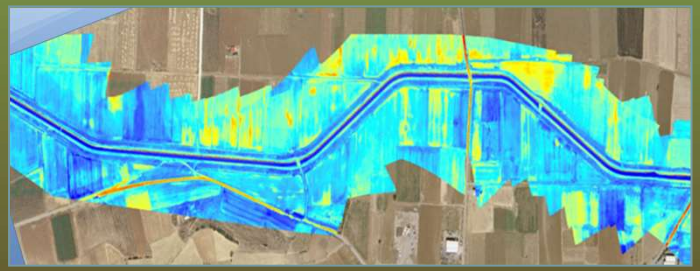
Presentations, Abdelmalek Esaâdi University, Tetouan , Morocco

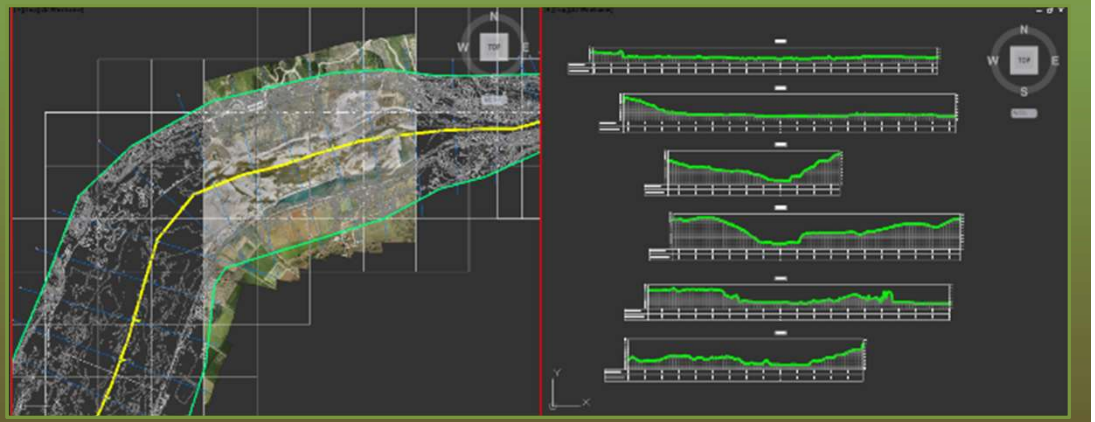
UAS Contribution to Riparian Ecosystems Management

- Detailed 3D modeling and slope mapping (geomorphology analysis)
- Riverbank monitoring (erosion)
- Water surface change (Infrared data)
- River Islets mapping and monitoring
- Hydraulic modeling (water flow measurements, flood risk analysis)
- Study and planning of essential hydraulic projects for improvement and regeneration
- Anthropogenic pressures detection and monitoring (hydraulic infrastructure, Illegal logging, overgrazing, agricultural or industrial deposition, sand extraction etc)

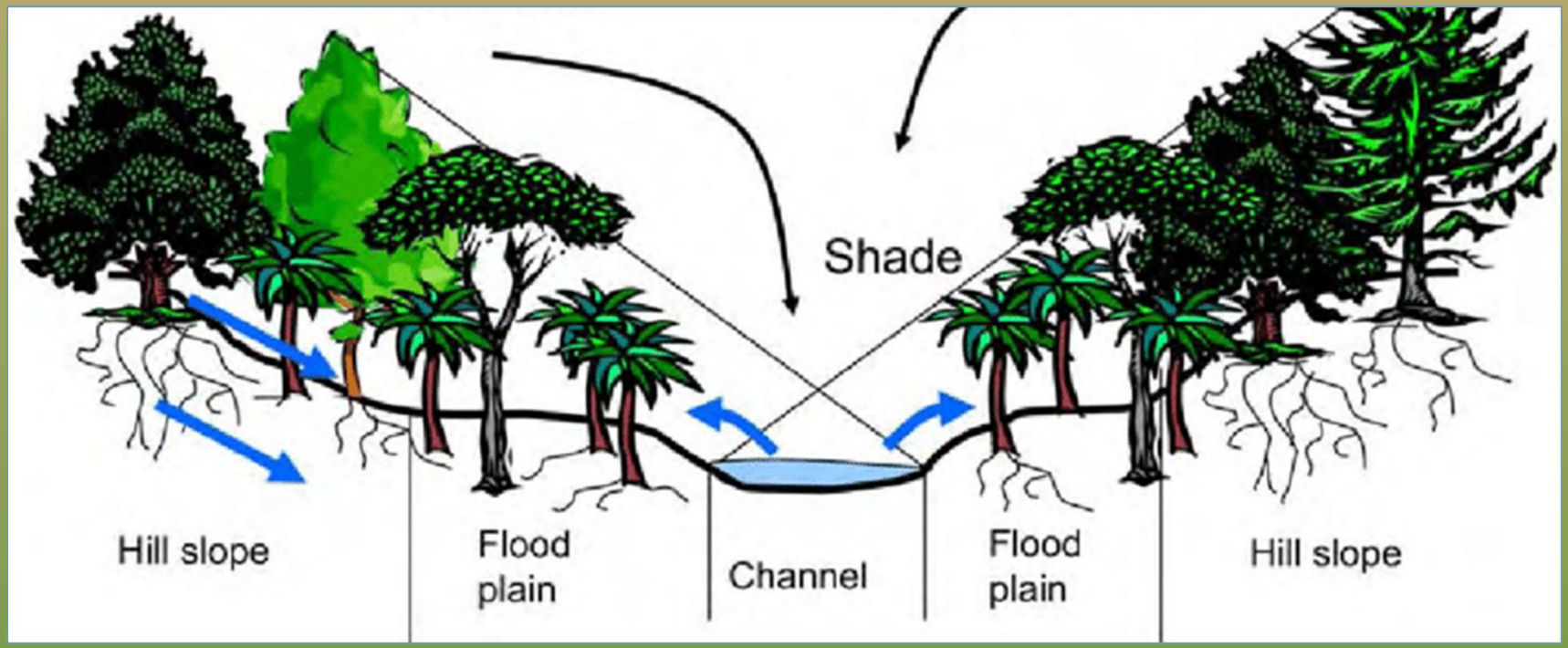
UAS Contribution to Riparian Ecosystems Management

- Sediment accumulation monitoring (ΔDSM)
- Detection and volume measurement of woody debris
- Canopy and biomass volume measurement
- Riparian vegetation species detection
- Riparian vegetation alteration monitoring (repetitive UAS missions)
- Riparian vegetation health conditions monitoring (e.g. NDVI, CI maps)
- Water inflows and springs detection (thermal sensing)





UAV Passive Sensors (Cameras) Disadvantages

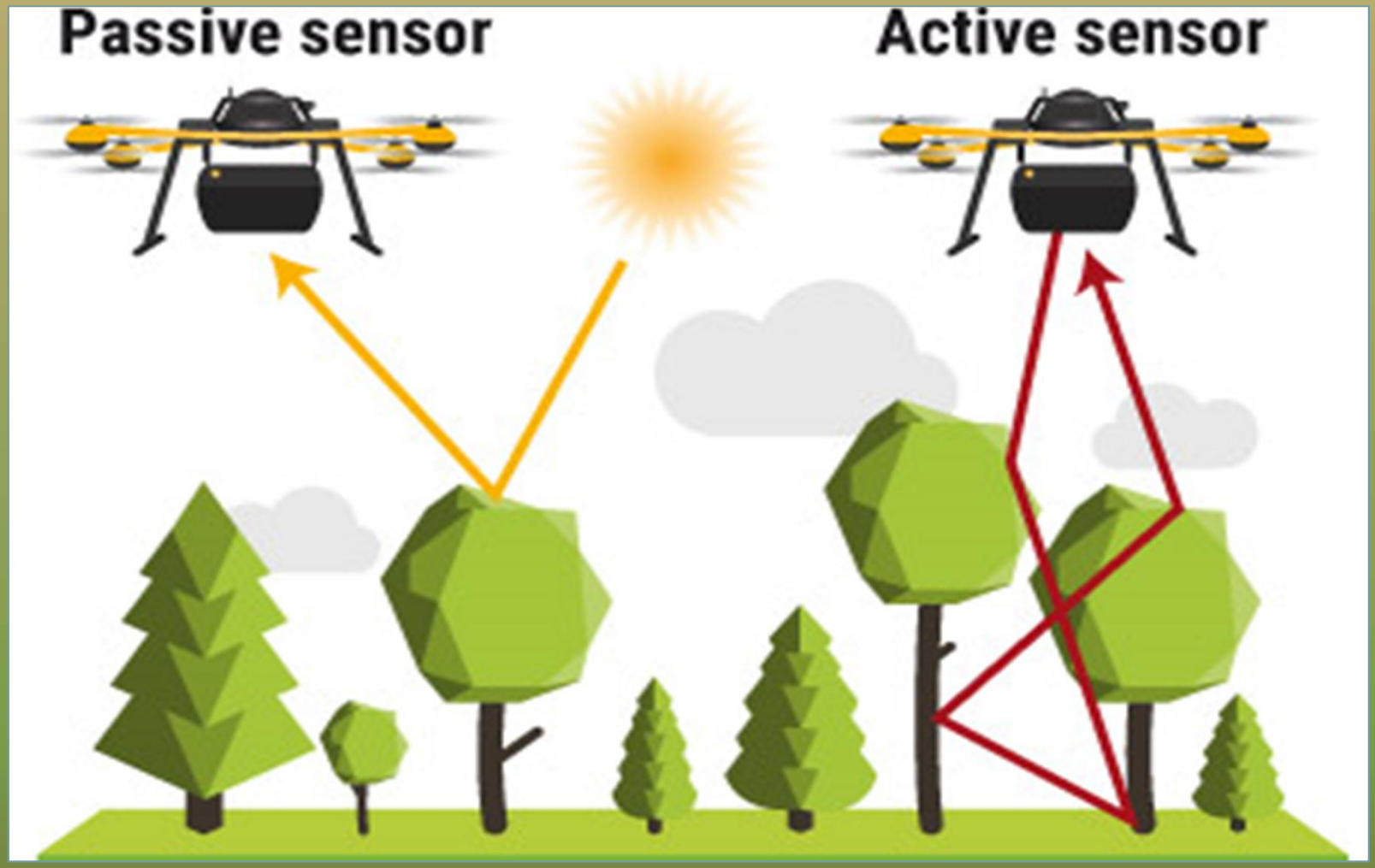


- No vegetation penetration. Cannot acquire data below obstacles such as higher vegetation canopies
- Low flight difficulties
- No water penetration (water movement, turbulence)
- Shaded areas – bad illumination

Point Cloud Creation & 3D Digital Surface Model

Pedion Areos Park, Athens – Greece
3D Mesh Animation Video

The use of Unmanned Aerial Systems & LiDAR

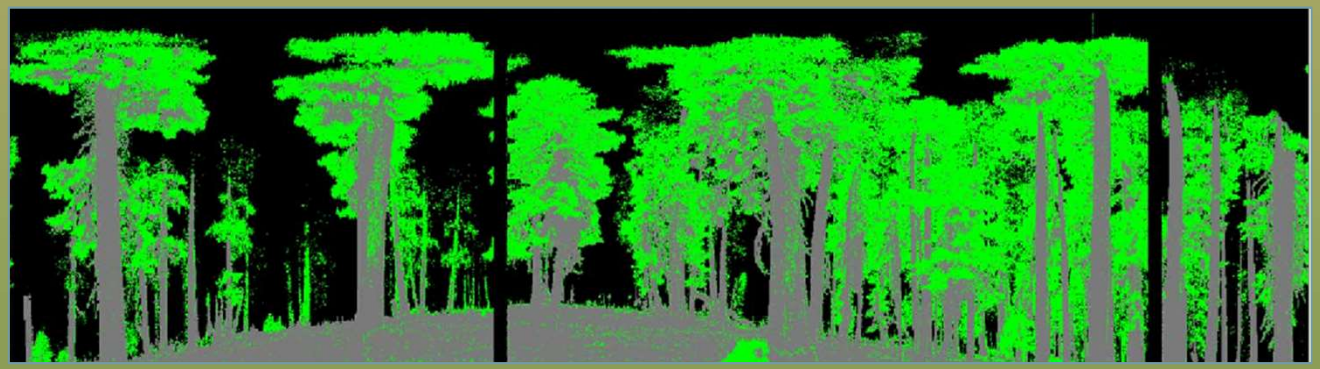


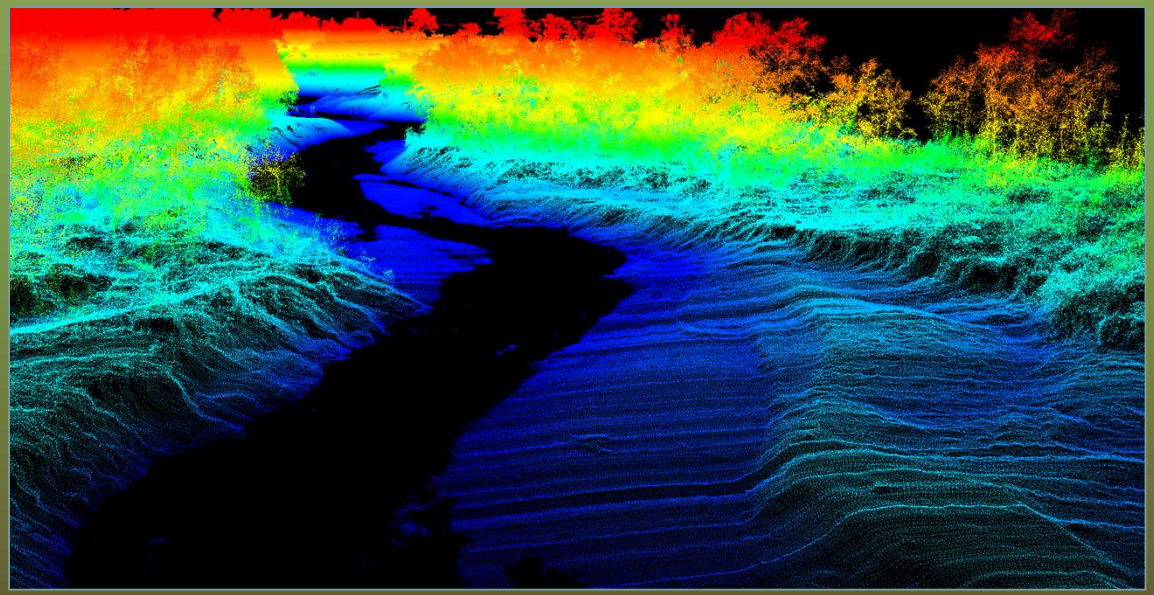
Passive sensors
detect the energy, transmitted
From an energy source
(Cameras)

Active sensors
transmit electromagnetic energy and
detect that energy at the same time
(Lasers & Radars)

The use of Unmanned Aerial Systems & LiDAR

LiDAR (*Light Detection and Ranging)* is a surveying method that measures distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor. Then can be used to make digital 3D representations of the target.



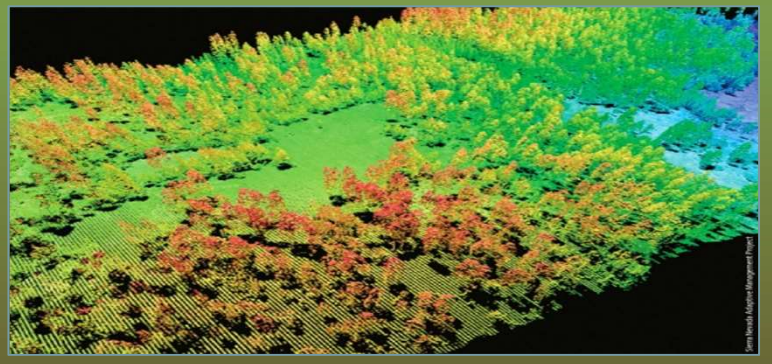


LiDAR point cloud identifies forests and riparian zones structure

Precision Aerial Compliance Solutions; Phoenix miniRANGER UAV Lidar

LiDAR & Riparian Ecosystems

LiDAR Applications in Riparian Ecosystems	
Mapping	• More accurate cartographic data at a faster rate. • Higher resolution 3D mapping
Riparian zone survey	• Determine volumes of vegetation and other debris placed below higher vegetation • Estimate the volume and growth rate of the vertical structure of vegetation communities
Determination of topographic features	• Determination of topographic features such as river channels and river terraces. Mapping of the exact course of the river and its pattern. • LiDAR pulses are able to measure river data such as the depth, the length and the flow of the river.
Flood model	Detailed structure and positioning of the river bank. Flood events modeling



Source: http://lidarradar.com/

Unmanned Aerial Systems & LiDAR

PHOENIX LiDAR SYSTEMS

Whole aircraft weight >20 kg
Expensive: 100k+ Euros

Thank you!

Antonis Kavvadias (En Agris PC)

Dr. Manolis Psomiadis (Agricultural University of Athens)

En Agris

cost
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