Surface Reflectance Intercomparison for Vegetation (SRIX4VEG) Overview

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fiducial reference measurements for vegetation

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FRM4Veg

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- ESA-funded Fiducial Reference Measurements for Vegetation (FRM4Veg)
- Support the validation of key European satellites and vegetation biophysical variables: surface reflectance (SR), fraction of absorbed PAR (fAPAR) and canopy chlorophyll content (CCC)
- FRMs have the following qualities:
  - Documented SI traceability (or conform to appropriate international community standards)
  - Independent from the satellite geophysical retrieval process
  - Accompanied by an uncertainty budget for all instruments and derived measurements
  - Adhere to community-agreed, published and openly-available measurement protocols/ procedures and management practices
  - Accessible to other researchers allowing independent verification of processing systems

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Why surface reflectance over vegetation?

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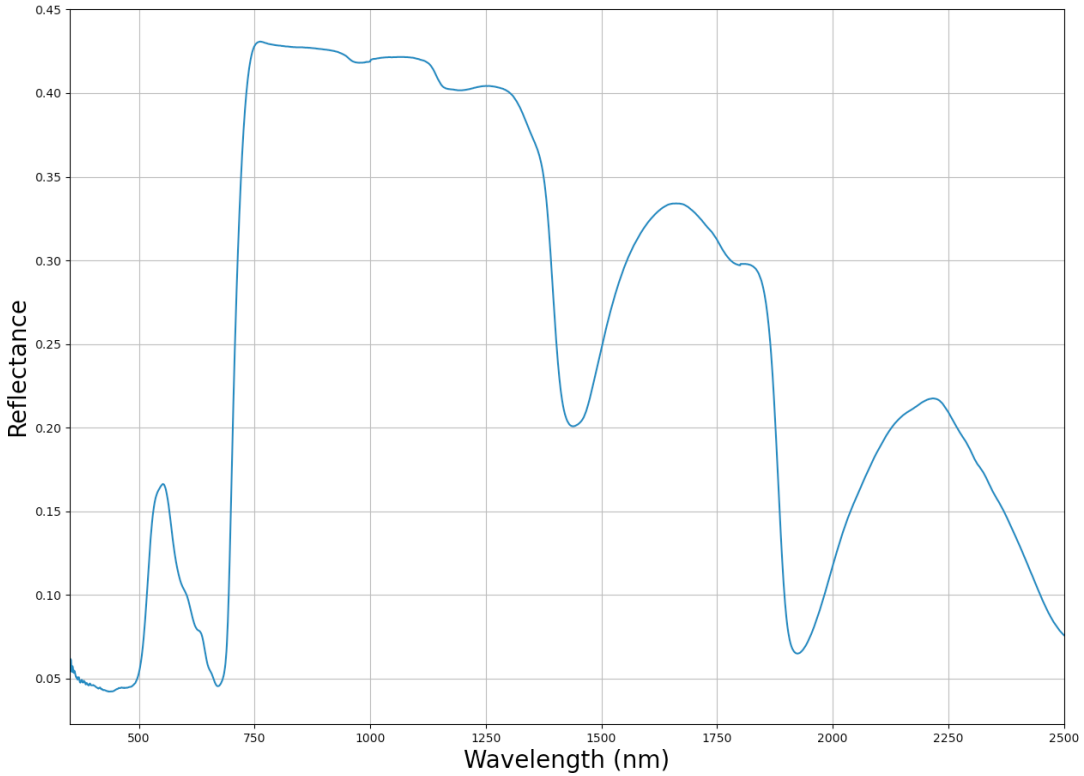
- Dynamic in:
  - Time
  - Space
  - Spectrally
  - Angularly



- Several biophysical satellite products derived for vegetation depend on SR

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Previous work at Barrax and Wytham

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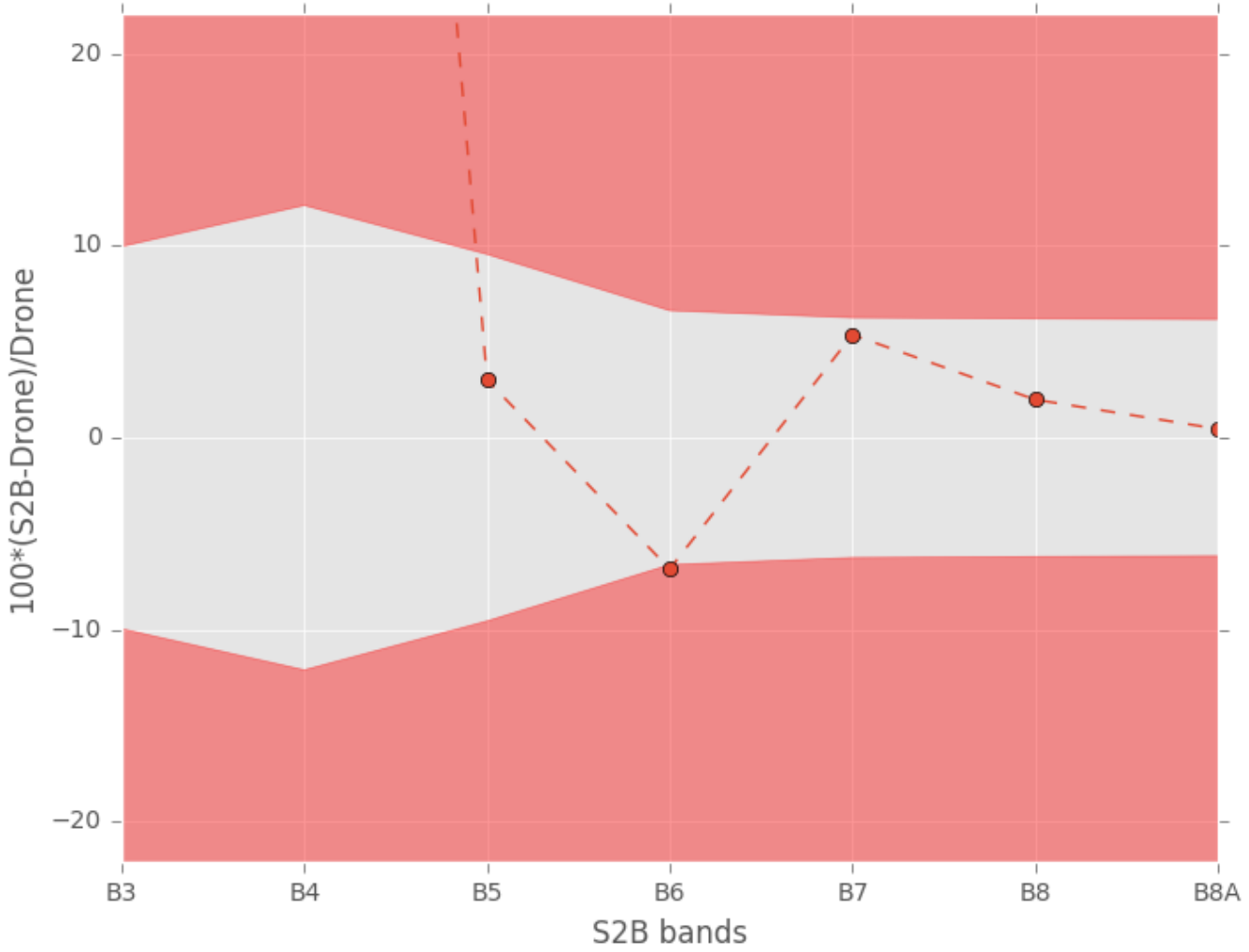

Courtesy of FGI

Origo et al (2020)

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Context of research problem

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- Significant interest in UAV-based hyperspectral instruments
- Expected to grow as instruments get lighter, cheaper and easier to use
- Surface reflectance validation is expected to become a key use of these instruments
  - Cover a greater area
  - Removes site disturbance
  - Measure inaccessible sites (water, trees, etc.)
  - Compliment permanent infrastructure
  - Measure complicated sites (mixed pixels, etc.)

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Premise of SRIX4VEG

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- Protocols around this are yet to be developed and lots of people are developing different things (some more systematically than others)
- The idea of SRIX4Veg is to assess the variability associated with different teams conducting the same validation work
- Then move towards a community-agreed protocol to reduce this variability

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Premise of SRIX4VEG

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Two experiments:

1. SR validation data collected as you (the participants) would do it given some pre-defined information

2. SR validation data collected by you following a pre-defined initial protocol (developed by the SRIX4Veg team, CSIRO, USGS and GA)

Following feedback from the participants the draft protocol will be refined and put forward as a community good practice protocol

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Experiment 1

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The first experiment requires each participant to document, prior to the campaign, the procedure they will use to collect SR validation data for a specific (theoretical) satellite overpass.

What we want to know:

- instrument setup
- flight plan
- data capture
- post-processing

This will be the process you follow in the field for experiment 1

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Experiment 1

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We will provide information on:

- Spatial resolution
- Spectral bands and response function
- Orbit inclination
- Viewing geometry
- Spatial location and extent of each of the satellite pixels on the ground
- Reflectance quantity

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Experiment 2

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Once we have received all of your data collection procedures we (SRIX4Veg team, USGS, CSIRO and GA) will circulate a draft protocol which everyone will follow in the second experiment (the aim is to minimise cross-fertilisation).

The draft protocol will be circulated at least 1 month prior to the campaign so you can gain familiarity with it.

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Experiment time line

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- Release overpass specs — 11/04/2022
- Participants complete their data collection plans — 16/05/2022
- Draft protocol released to participants — 16/05/2022
- Begin SRIX4Veg — 18/07/2022
- End SRIX4Veg — 22/07/2022

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How will it work

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Flight scheduling for comparability

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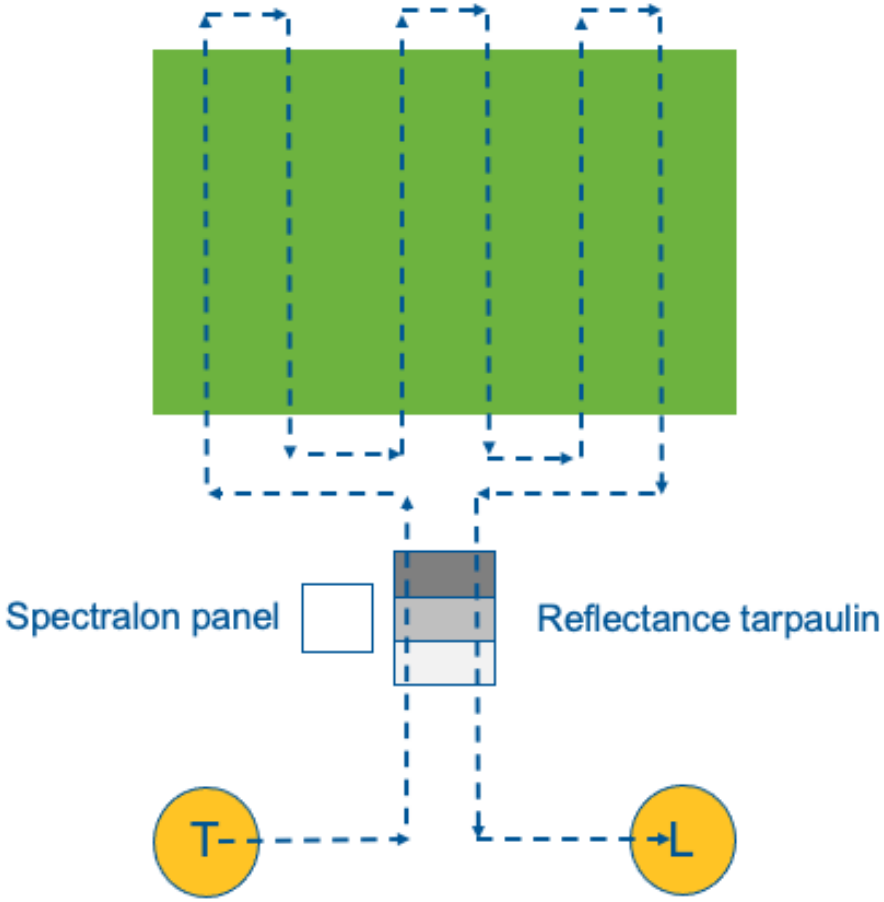
- Each experiment will be a round-robin (everyone will do a flight back-to-back with everyone else)
- Only the pairs will be compared
- Only one UAV in the air at one time
- Because of no self-pairing and AB==BA:

  nPairs = (n*(n-1)) / 2 (n = no of participants)
- Because in a sequence pairs can be made forward and backwards:

  nSequences = nPairs / (n-1)



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Flight scheduling for comparability

B D F A C E

D A E B F C

A	B	C	D	E	F
B	A	B	C	D	E
F	C	D	E	F	D
C	D	A	B	E	A
D	E	E	F	A	B
E	F	F	A	B	C

* works for even numbers; for odd numbers the last participant will have to do one extra flight

On ground instruments

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Solar Light Company
Microtops II

Trimble base station

ASD FieldSpec 4

Tarpaulin
+
Spectralon Panel

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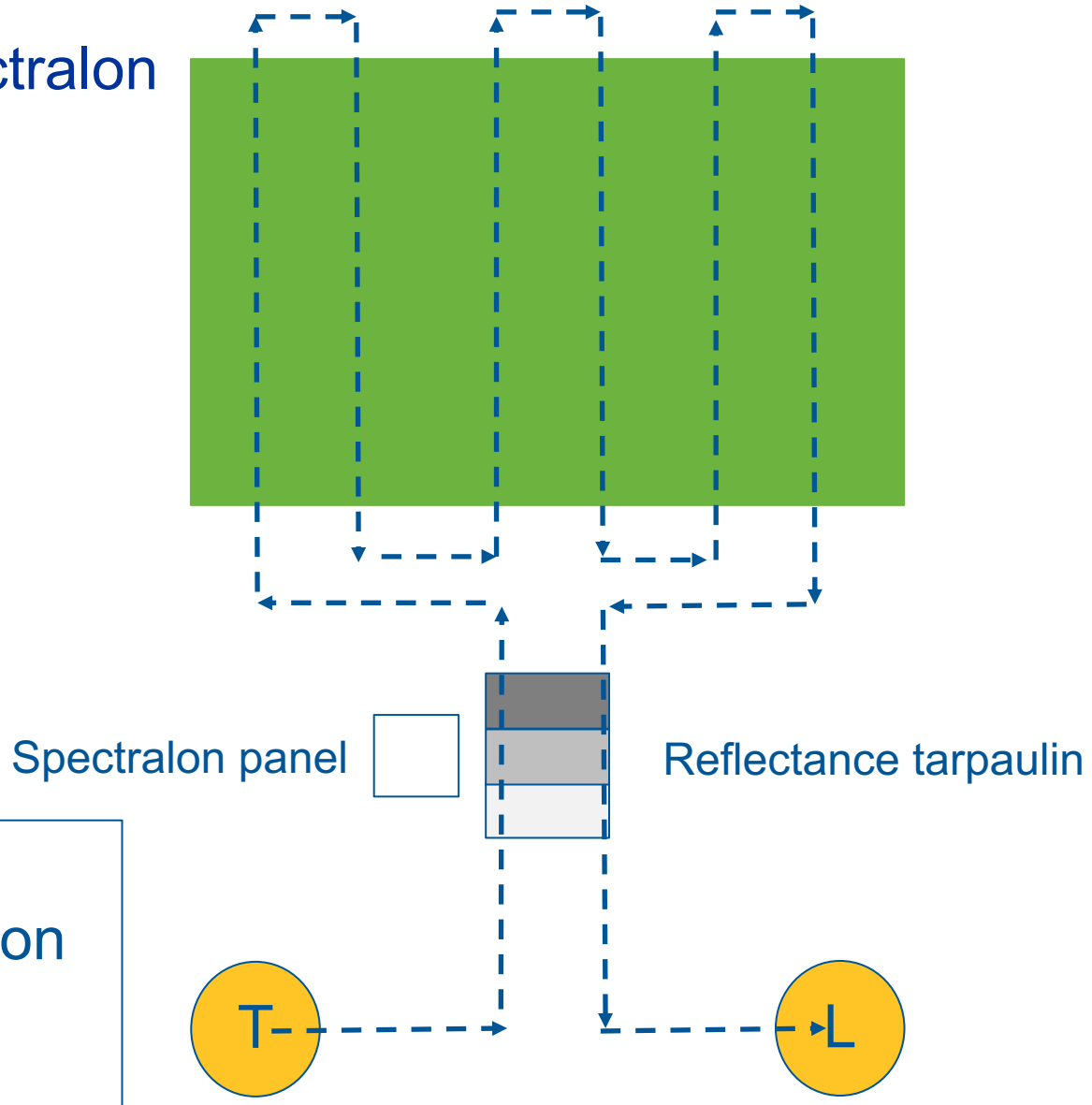
Other instruments and measurements

- ASD Fieldspec 4 (measurements of spectralon panel)
- Microtops (measurement of AOT)
- Spectralon panel
- Reflectance tarpaulins
- Differential GPS base station (Trimble)
- Hypernets HYPSTAR (?)



ASD measurements:
Spectralon > Light > Middle > Dark > Spectralon

5 spectrums per location @ 4 locations

Expectations of participants

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- Be ready for collecting measurements on Monday morning of the 18th July
  - Stay until the end of the 22nd July or whenever all the measurements are completed (whichever is sooner)
- You need to do all data processing specific to your instrument
- You will need to bring anything extra
- You will need to ship your instruments to make sure they arrive on time, ensure they are labelled correctly, and ensure return shipping takes place after the campaign
- Your own/your team's health and safety

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What SRIX4VEG is not doing

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- Validating a specific satellite overpass
- Developing a protocol for all surface reflectance data collection
- Ground measurements with ASDs in the same location as the UAV overpasses (for the vegetation)

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Time line

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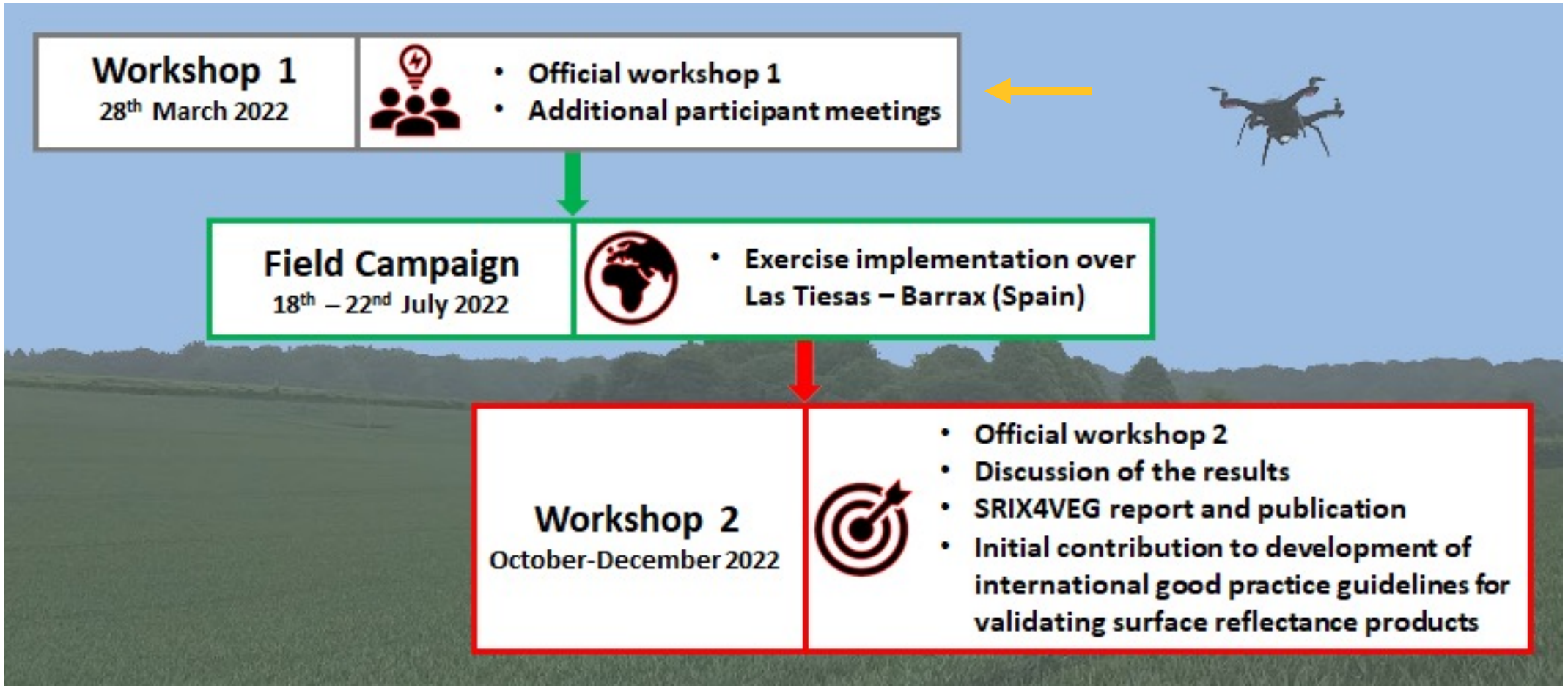

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SRIX4VEG participants

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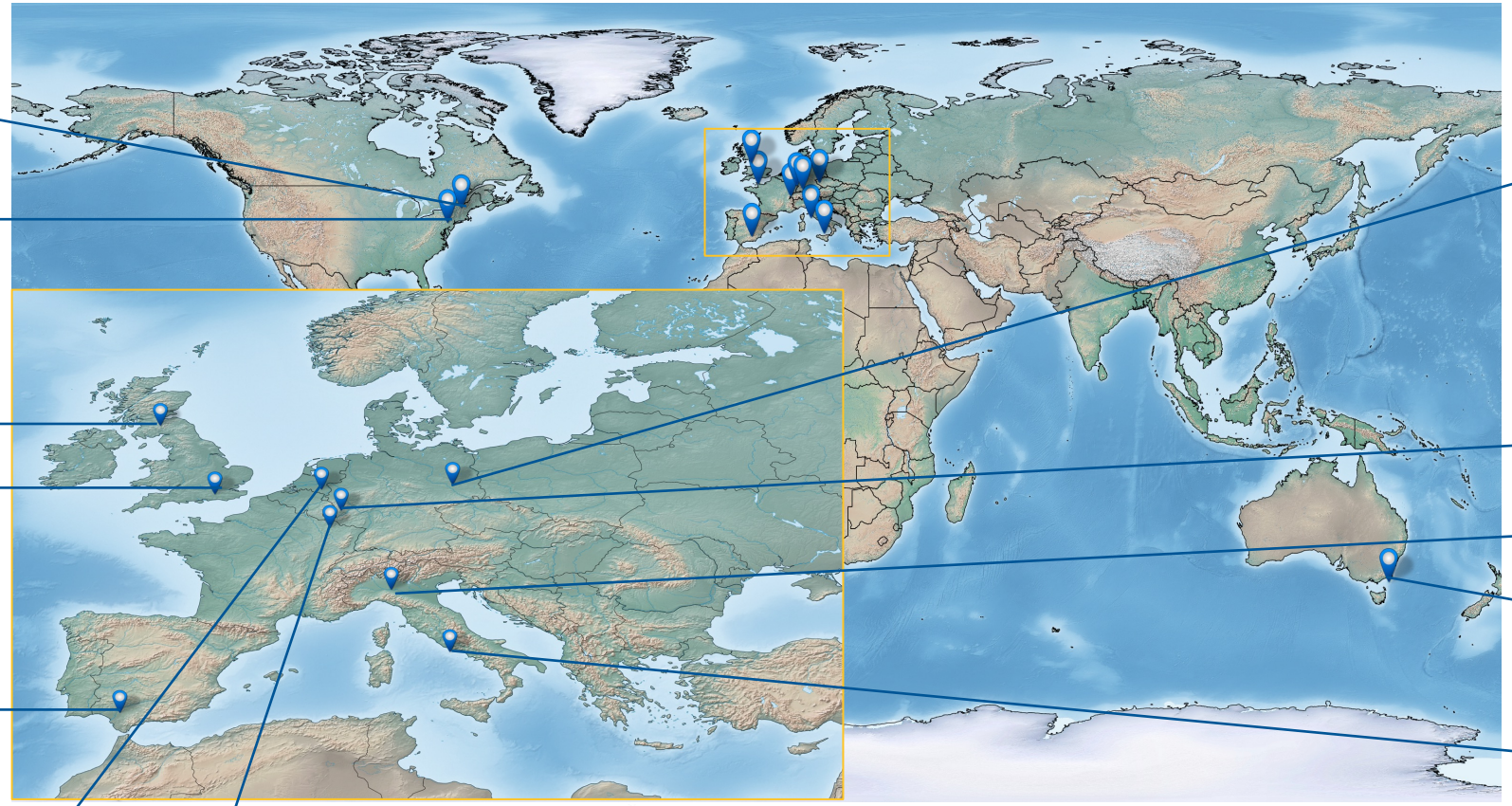
- 12 confirmed participants (with requirements gathered)
- Number of platforms and payloads may be higher



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JB Hyperspectral
UniMIB
GA
GEO-K

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Outputs and next steps

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- Post-campaign workshop
- Scientific paper on the intercomparison
- Good practice protocol for SR data collection for validation
- Considerations for future activities
  - Laboratory comparisons
  - Other sites
  - Repeats

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Thanks for your attention

www.frm4veg.org/srix4veg/

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