living planet symposium | BONN 23–27 May 2022

TAKING THE PULSE OF OUR PLANET FROM SPACE

EUMETSAT ECMWF EUSPA

STUDYING CONSEQUENCES OF EXTREME EVENTS TO LAKE WATER QUALITY WITH EO DATA

3edata EMÜ University of Tartu IGB Leibniz-Institut für Gewässerökologie und Binnenfischerei USC Campus Terra

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May 26th

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Introduction

EU network of mesocosms facilities for research on marine and freshwater ecosystems open for global collaboration.

Mesocosm Facilities | Transnational Access | Metadata | Mesocosm Data

Aquacosm > Project Information > AQUACOSM-plus

AQUACOSM-plus

AQUACOSM-plus: Network of Leading Ecosystem Scale Experimental AQUAtic MesoCOSM Facilities Connecting Rivers, Lakes, Estuaries and Oceans in Europe and beyond

AQUACOSM-plus advances European mesocosm-based aquatic RI by integrating the leading mesocosm infrastructures into a coherent, interdisciplinary, and interoperable network covering all ecoregions of Europe. AQUACOSM-plus widens the user base by extending TA provision (> 13000 person-days), and strengthening the offered services, with 10 new partners, including an NGO and doubling of SMEs. We initiate actions to increase competence in mesocosm science in new EU member states (Hungary and Romania), and emphasize training of young scientists through summer schools covering various disciplines including effective science communication. AQUACOSM-plus develops near-real-time Open Data flows and improved metadata, thus promoting Open Mesocosm Science in collaboration with leading EU-supported initiatives in the EOSC and fosters wider sharing of information, knowledge, and technologies across fields and between academia, industry, and policy makers/advisers.

AQUACOSM-plus develops new technological capabilities for mesocosm research, to effectively execute scenario-testing for Climate Change -related pressures on aquatic systems from upstream fresh waters to the sea. These developments include mobile large-scale mesocosm approaches, leading-edge imaging technologies, and affordable methods to obtain high- frequency data on community change and greenhouse gas fluxes in mesocosm settings.

Introduction

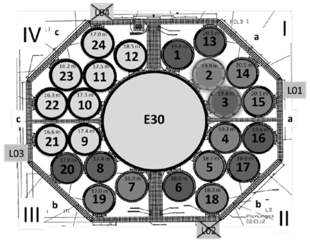
Home > Research > Projects > Connect

CONNECT – Connectivity and synchronisation of lake ecosystems in space and time

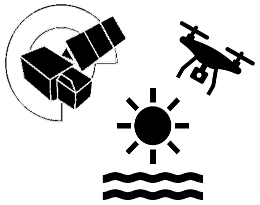
CONNECT Connectivity and synchronisation of lake ecosystems in space and time

The project CONNECT will establish a collaborative network between experts in remote sensing (RS) and freshwater ecology to study connectivity and coherence of lake ecosystems in a regional context at unprecedented temporal and spatial resolution. The overall aim is to understand the yet unexplained variation in phytoplankton dynamics among river-connected German lowland lakes, many of which are presently classified as in poor to bad ecological status. Large-catch-ment shallow lakes face the highest risk of eutrophication, mass development of harmful algal blooms, and high production of greenhouse gases – calling for action.

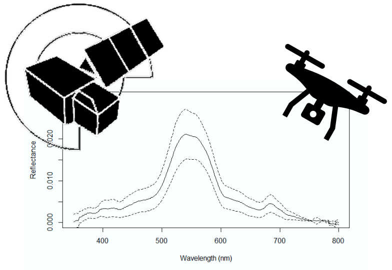
Contents



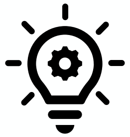
Experimental Design



Material & Methods



Results & Discussion



Conclusions

→ THE EUROPEAN SPACE AGENCY

Experimental Design

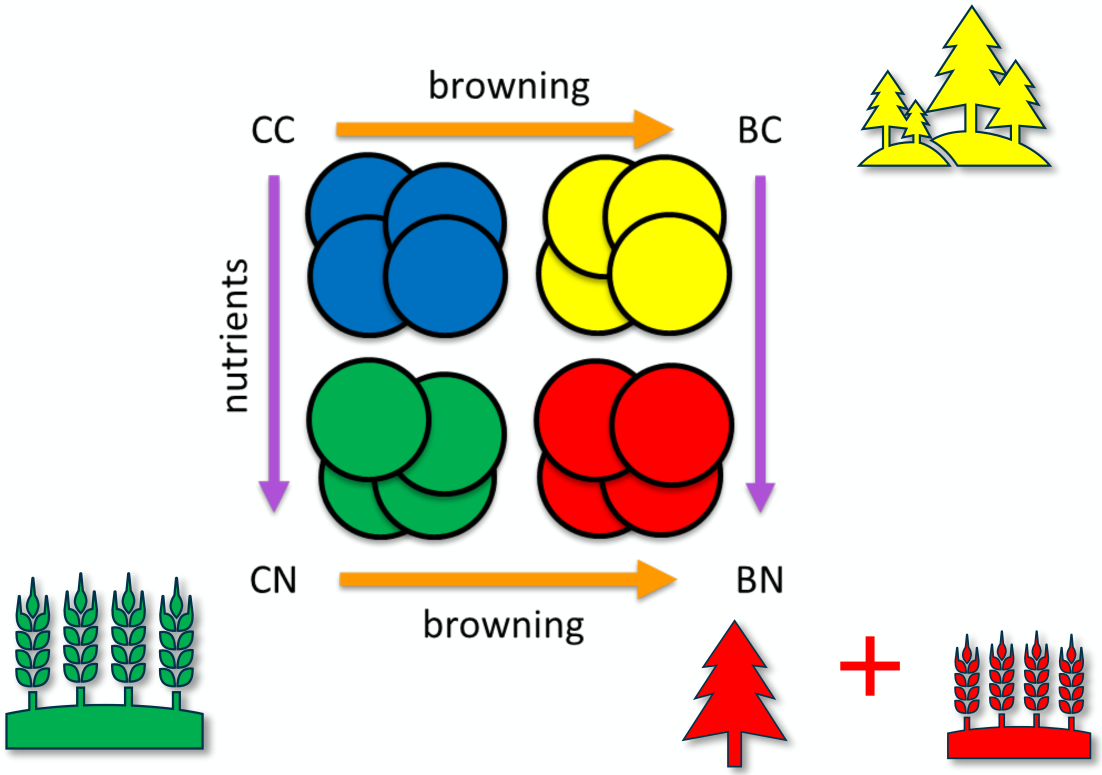
Measured parameters:

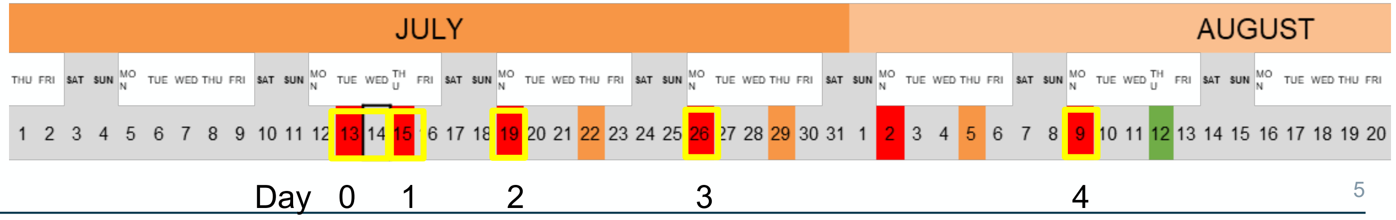
Sensors: Temp, pH, oxygen, cond, light, turbidity, chl and phycocyanin fluorescence (continuous)

Nutrients: TOC, POC, PON, TP, DIP, NO3, NO2, NH4, Si

Bacteria: abundance (fluorescence based method, flowcytometer, microscopy)

Phyto: chl-a, phytoplankton community structure (start, mid, end)
Zoo: microzoo (start, mid, end), mesozoo >250 µm abundance, community composition (start, end)

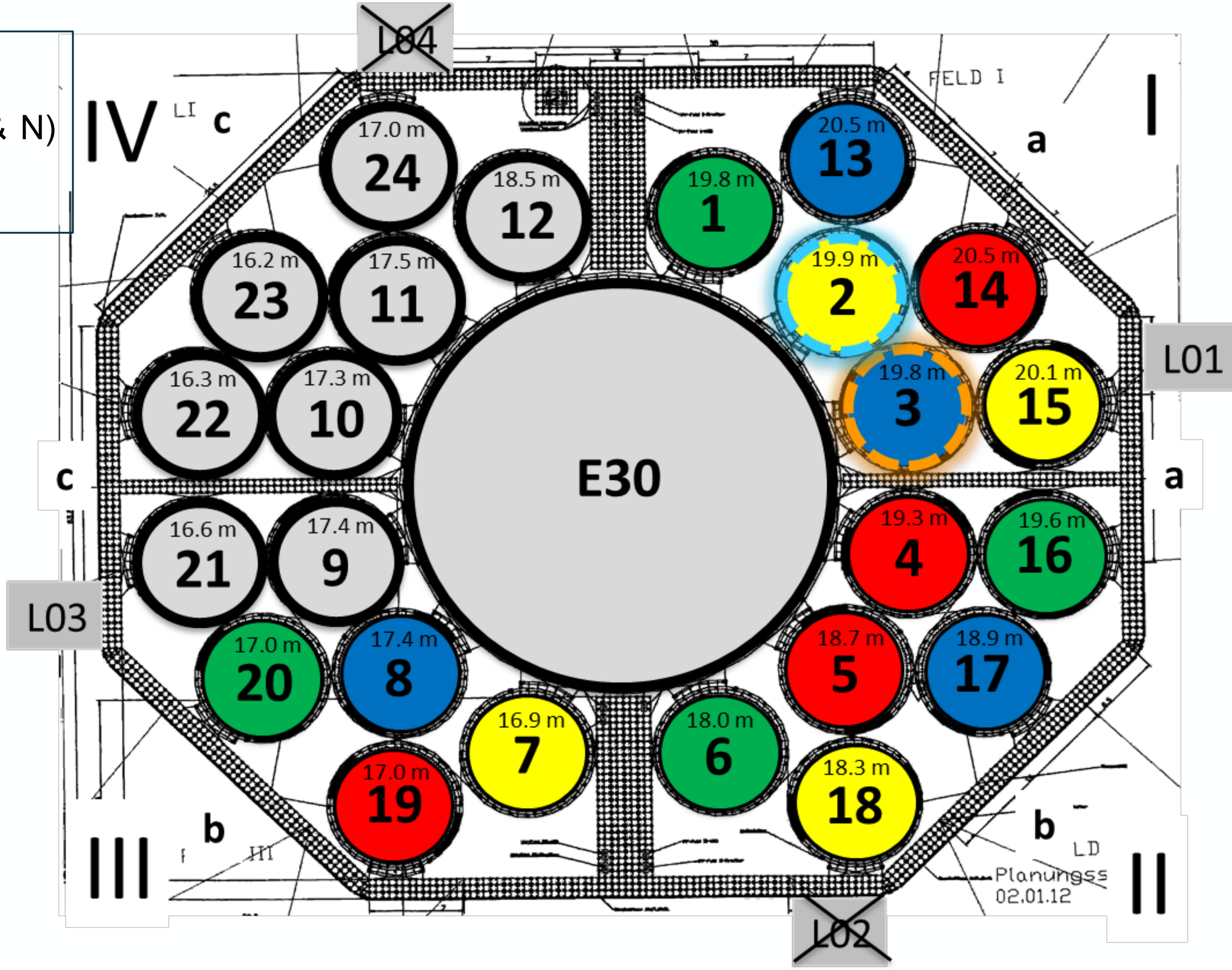




Experimental design

Experimental design of JOMEX-CONNECT 2021 in the LakeLab

HuminFeed® concentration of 2 mg/L in 4 BC, 4 BN. Nutrients (P & N) added to 4 CN and 4 BN. No addition (control) in 4 CC.



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Material & Methods

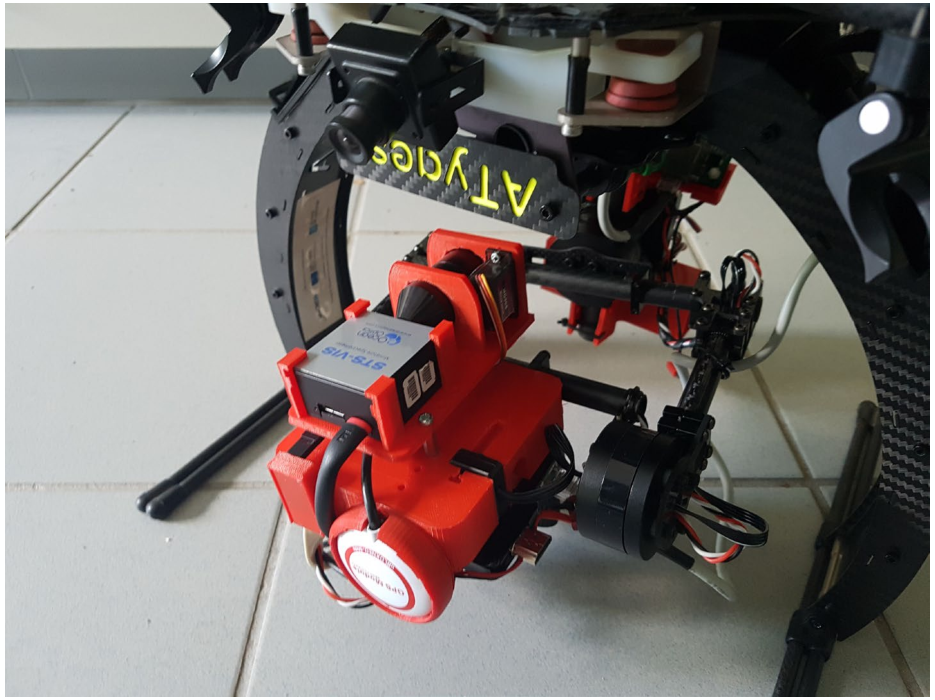
TriOS RAMSES Spectroradiometers

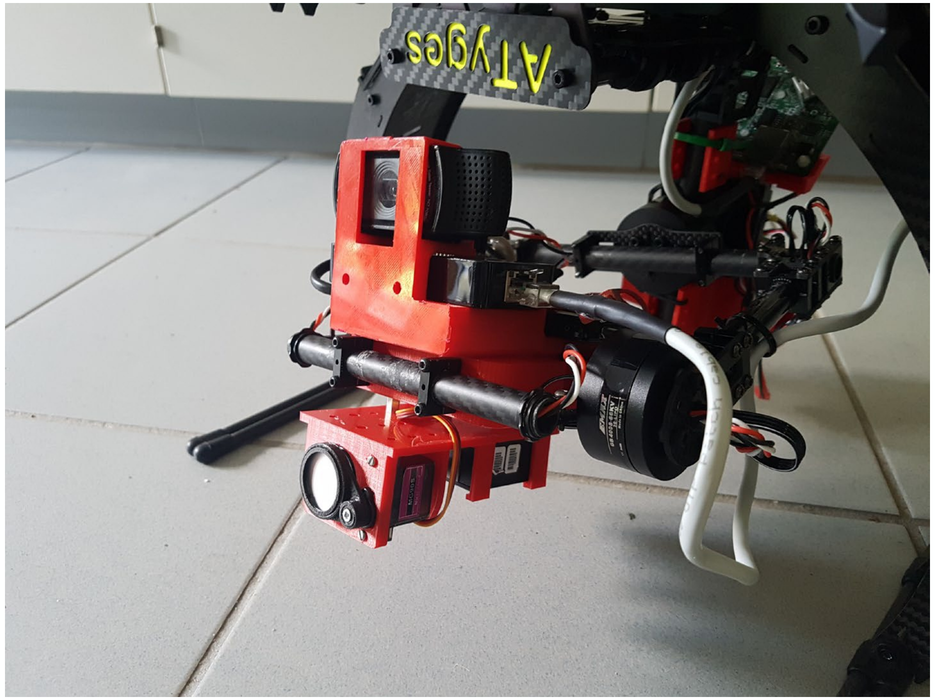
Irradiance (Eu)

Radiance (Lu)

Material & Methods

STS ON BOARD DRONE





Spectroradiometer Ocean Optics STS 350 – 800 nm
1 nm spectral resolution

Material & Methods

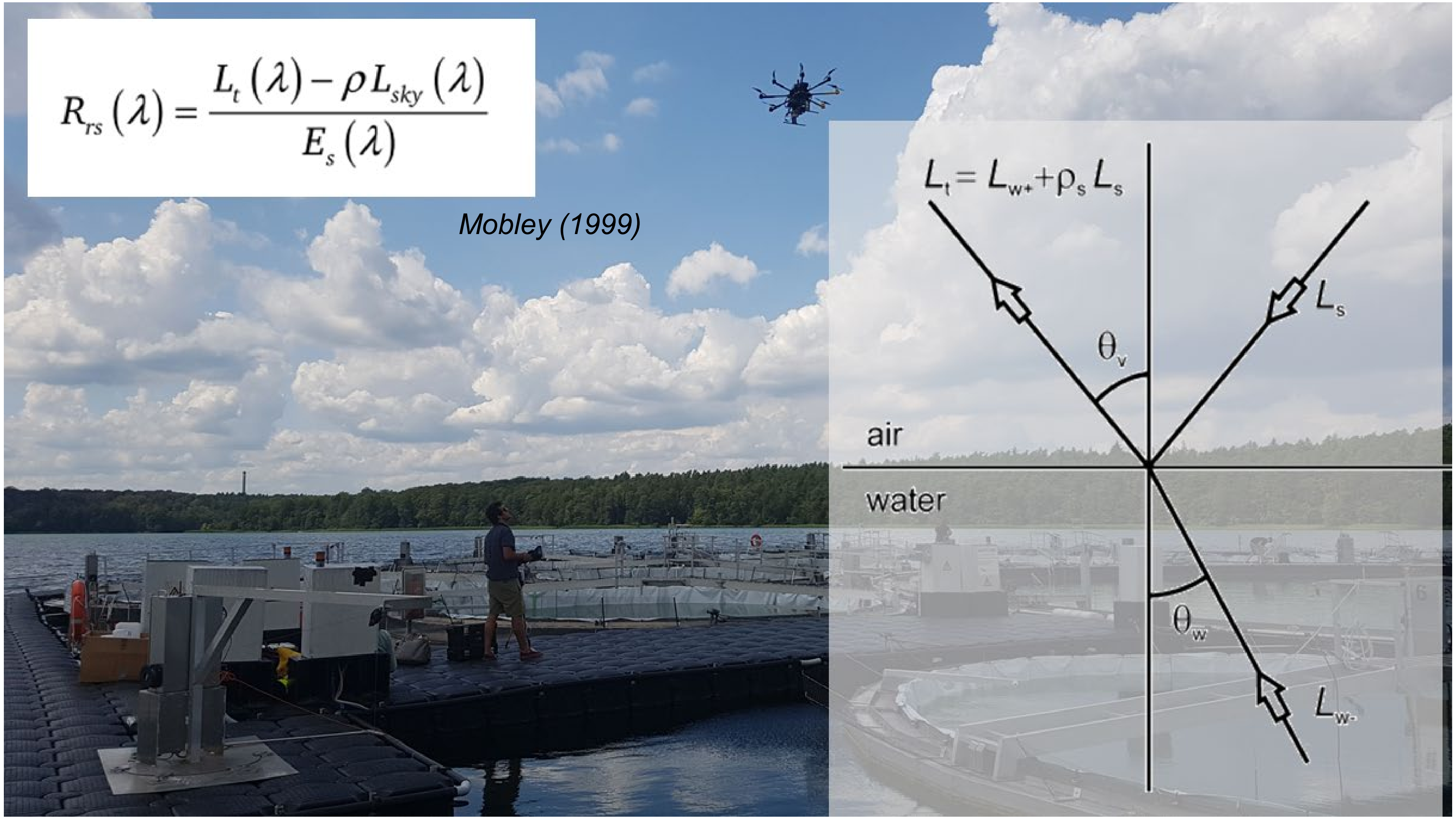
STS ON BOARD DRONE

Material & Methods

STS ON BOARD DRONE

$$R_{rs}(\lambda) = \frac{L_t(\lambda) - \rho L_{sky}(\lambda)}{E_s(\lambda)}$$

Mobley (1999)



Material & Methods

Field spectrometry

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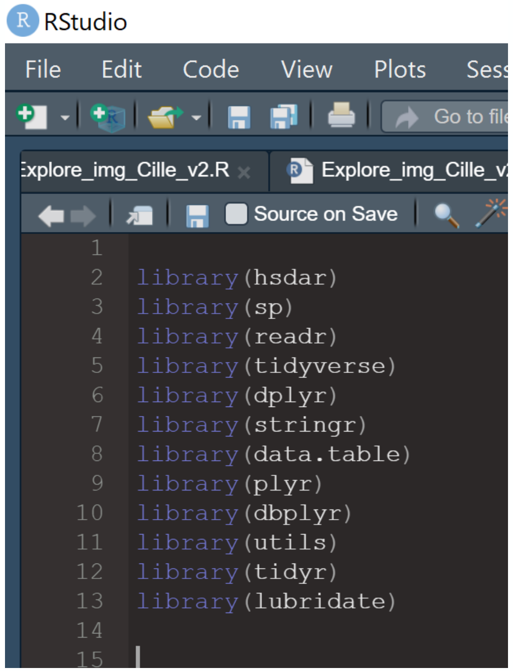
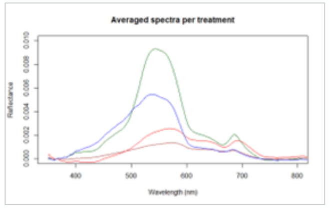
TriOS Ramses



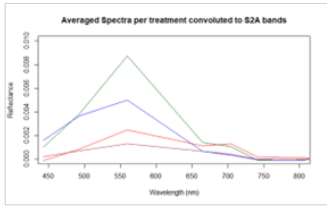
Above water Rrs
Spectral Library STS

Above water Rrs
Spectral Library TriOS



OWTs identificaction (Spyrakos et al. 2018) – Spectral Similarity

Fitting the spectral libraries to Sentinel 2A bands.
Spectral Response Function (hsdar R library)

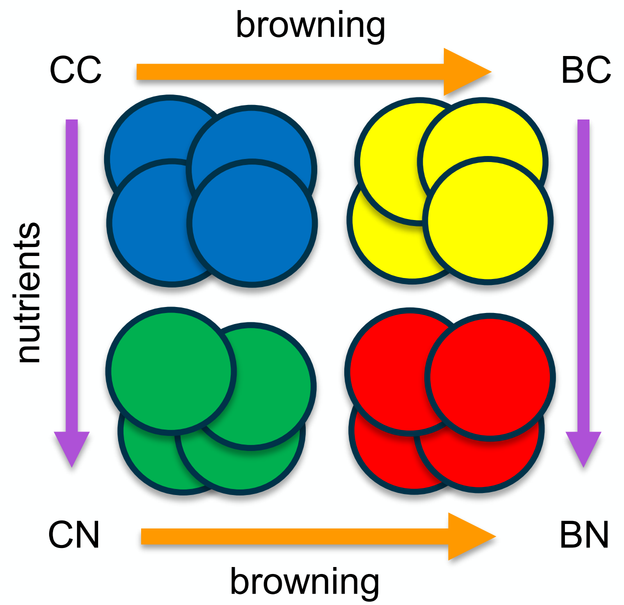


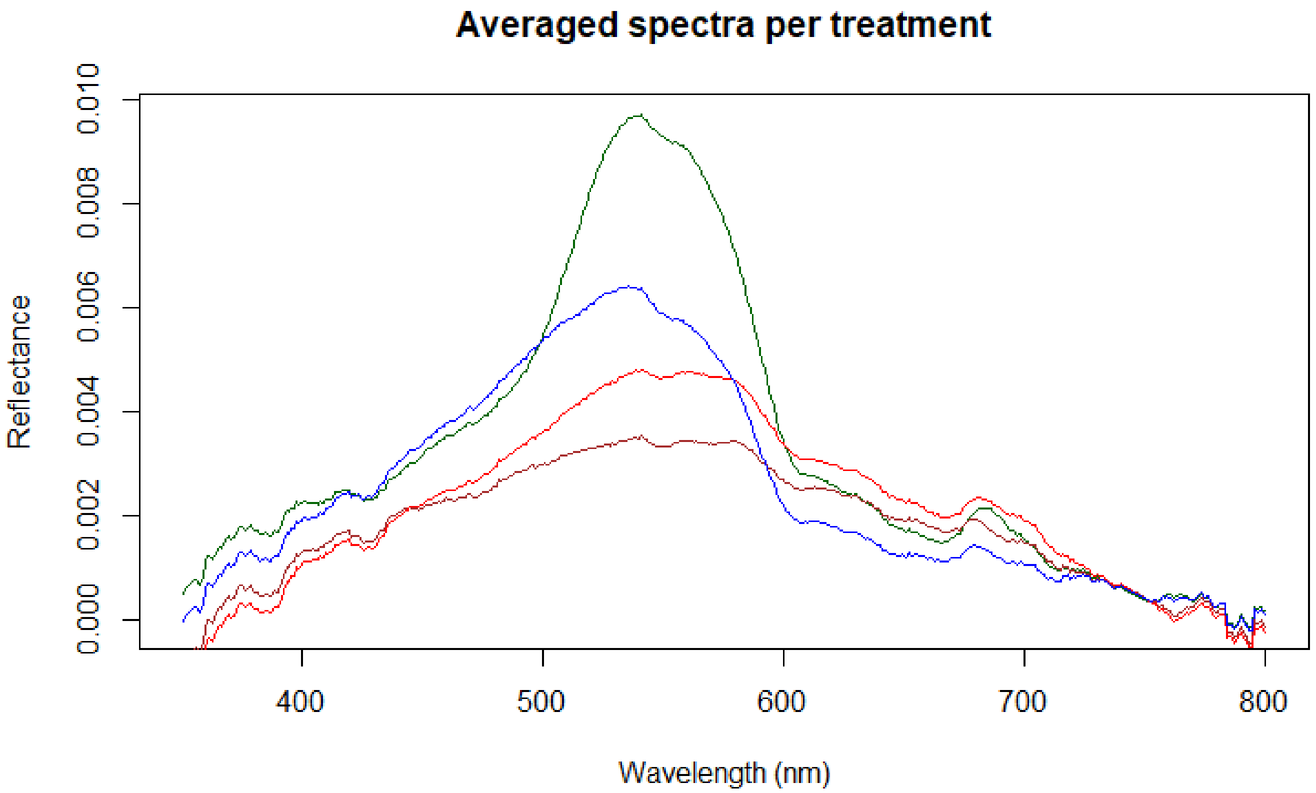
Chl *a* Algorithm assessment
Entire dataset

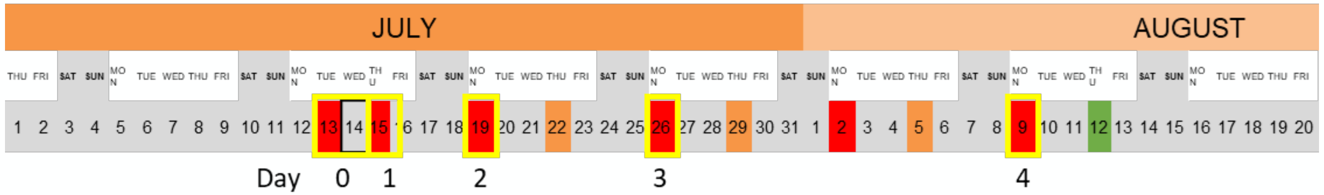
Chl *a* Algorithm assessment for each OWTs

Results and Discussion

STS ON BOARD DRONE





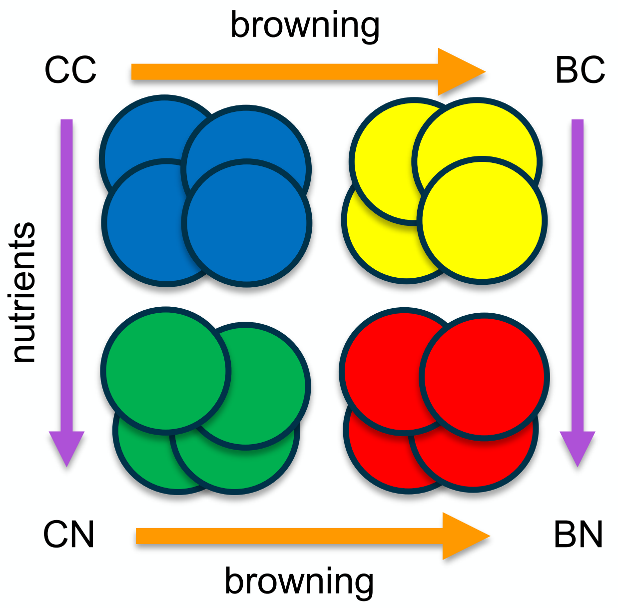


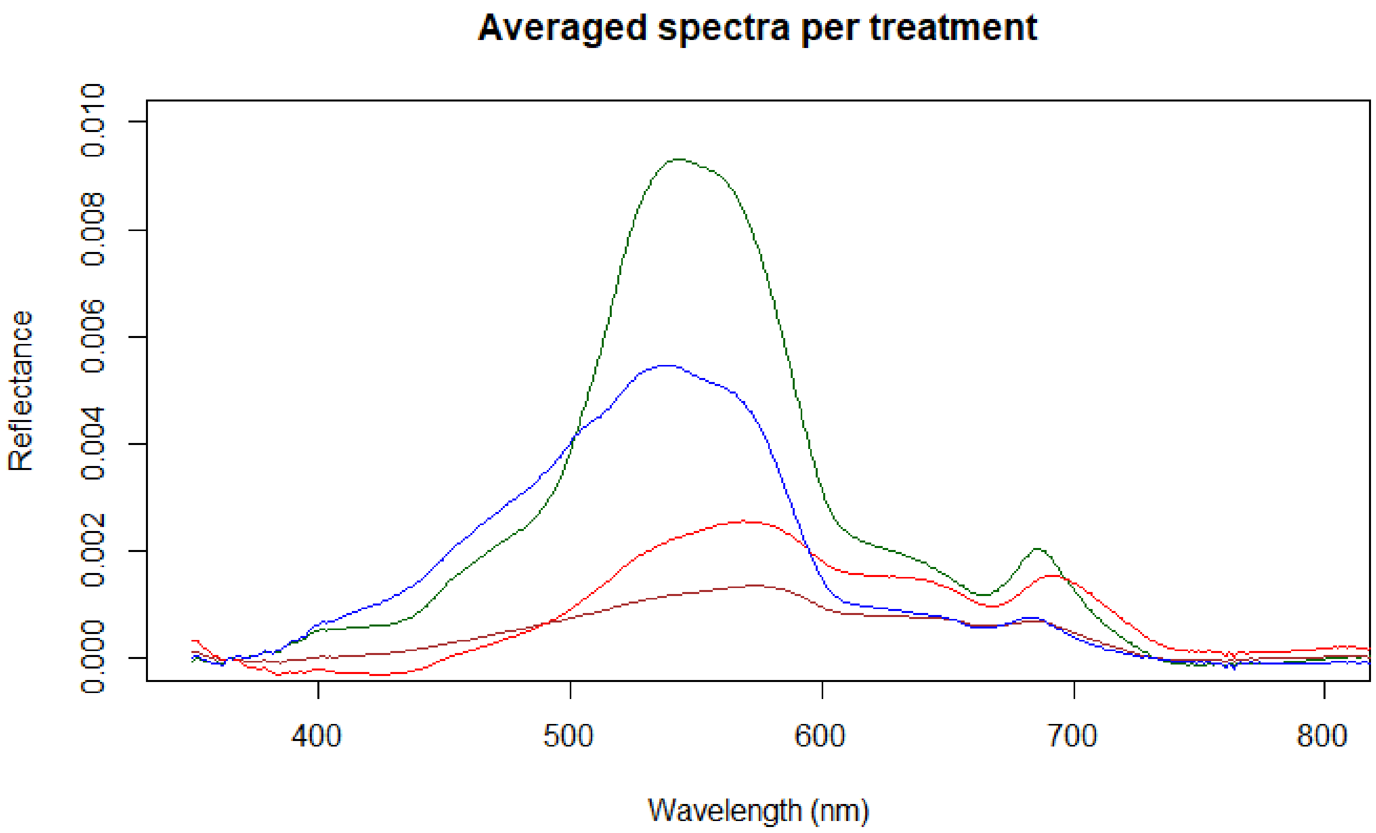
→ THE EUROPEAN SPACE AGENCY

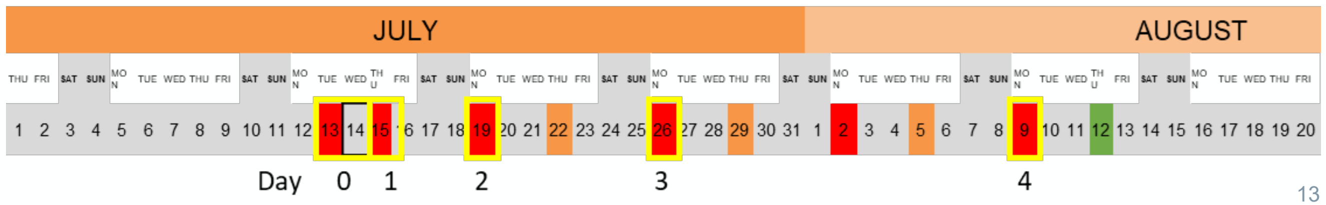
Results and Discussion

esa

TriOS Ramses







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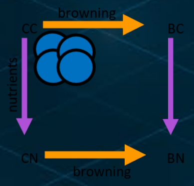

STS ON BOARD DRONE

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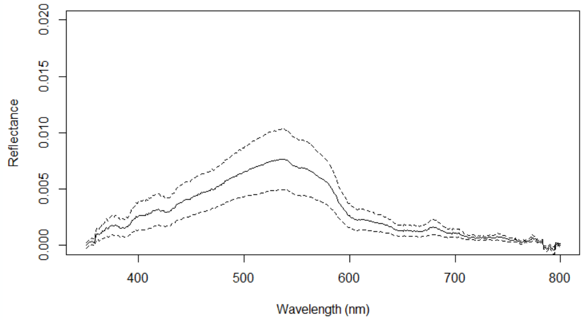

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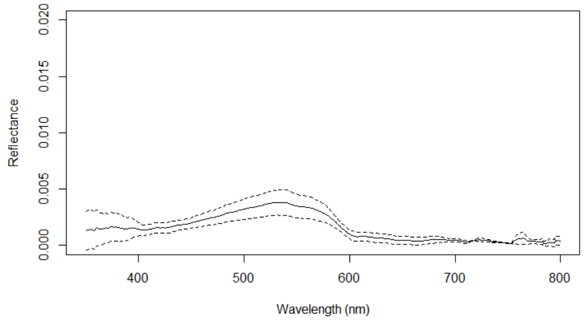

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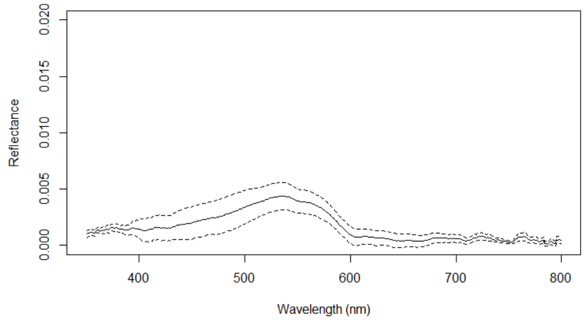

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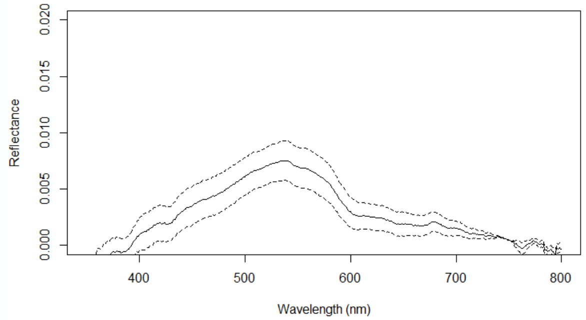

TriOS RAMSES

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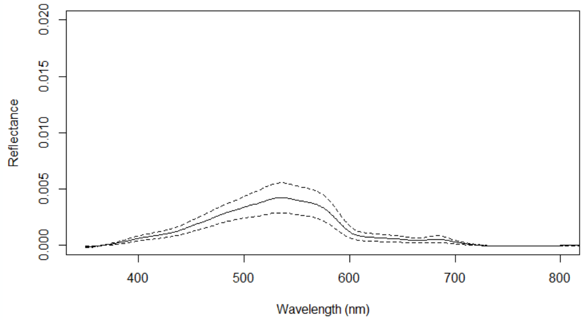

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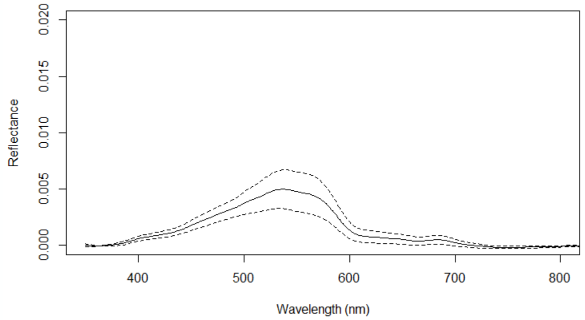

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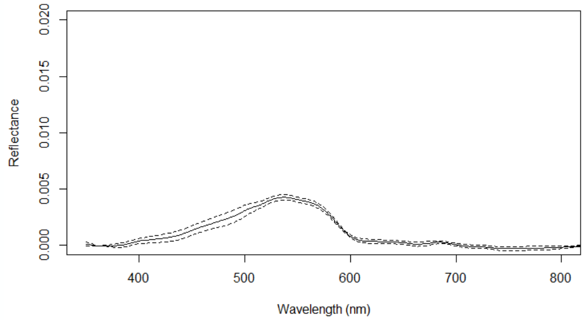

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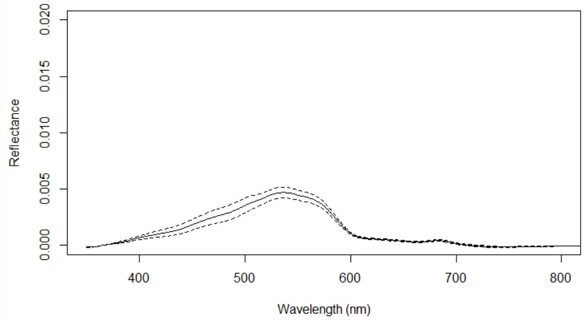

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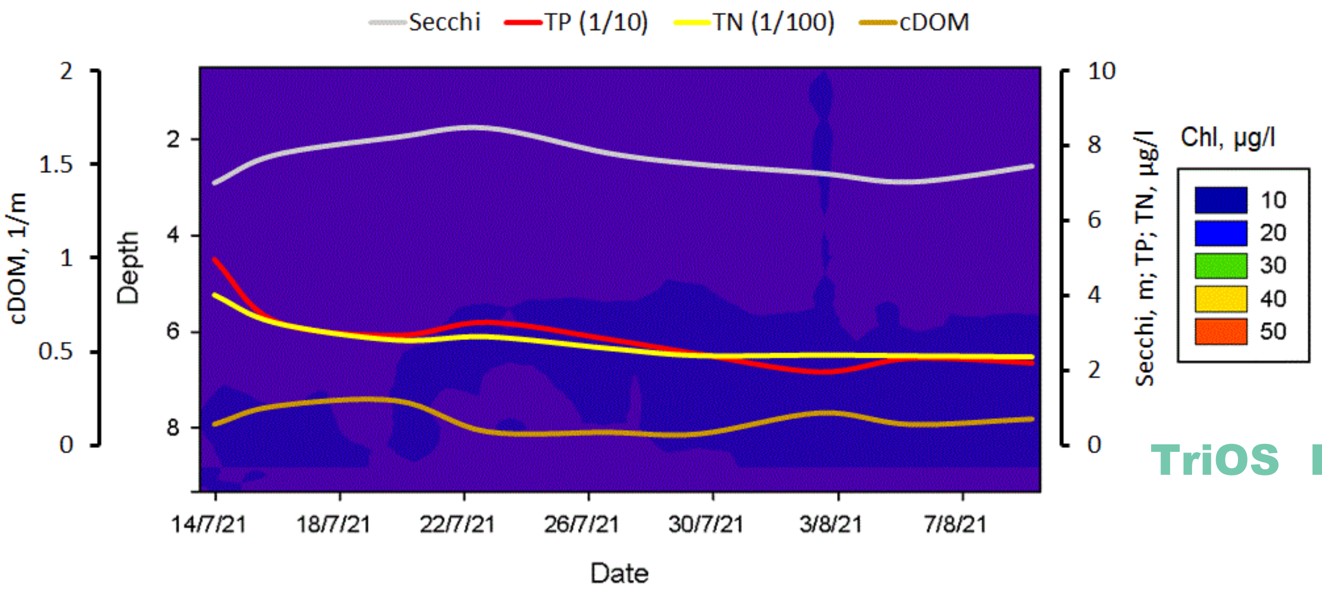
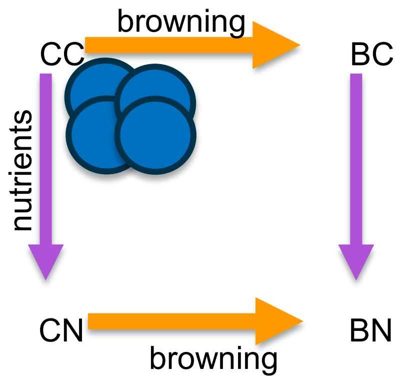
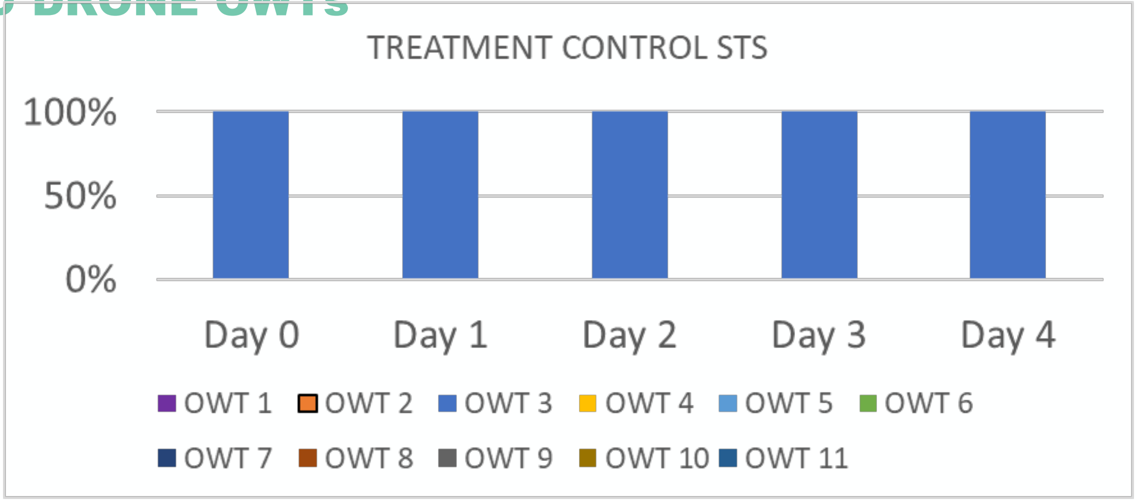




STS ON BOARD DRONE OWTs



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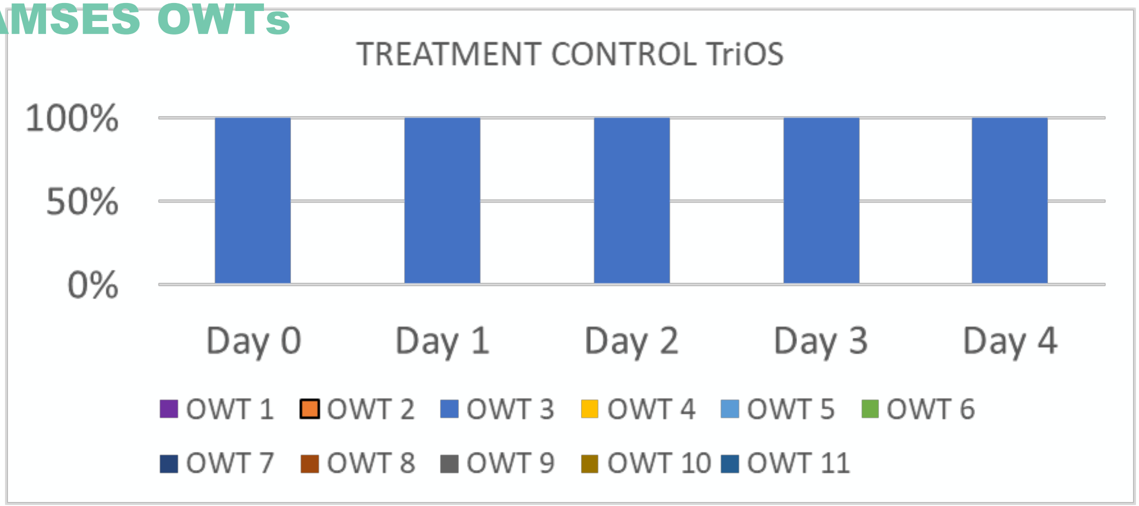

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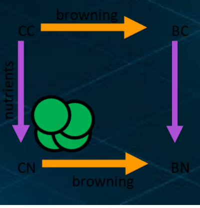

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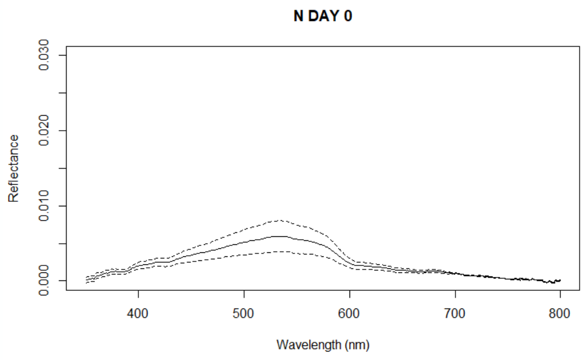

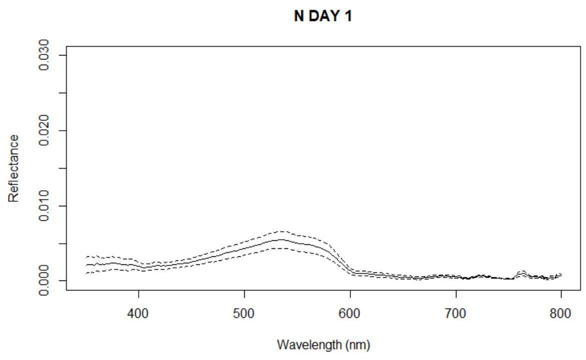

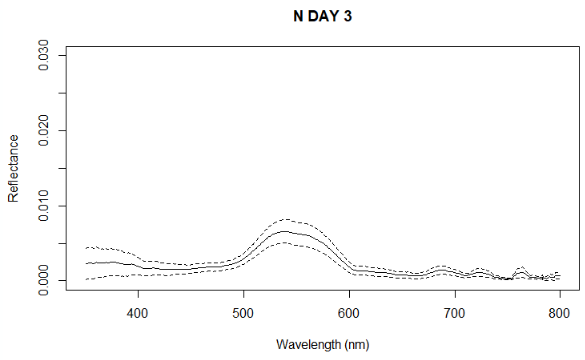

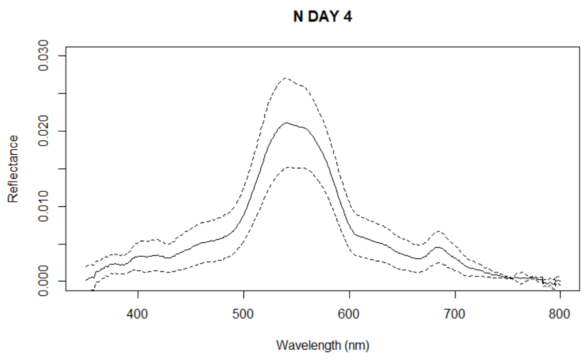

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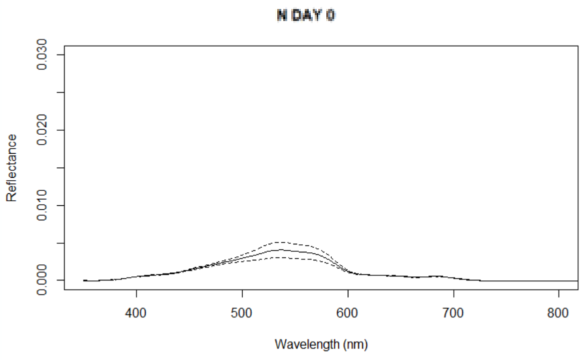

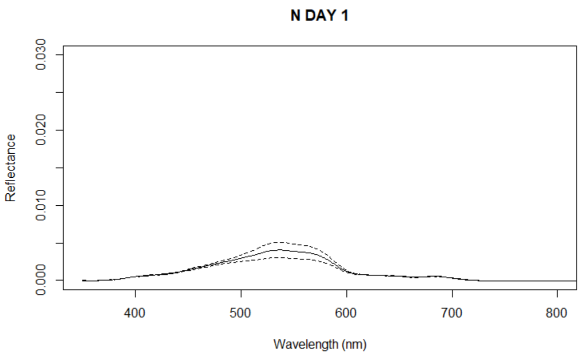

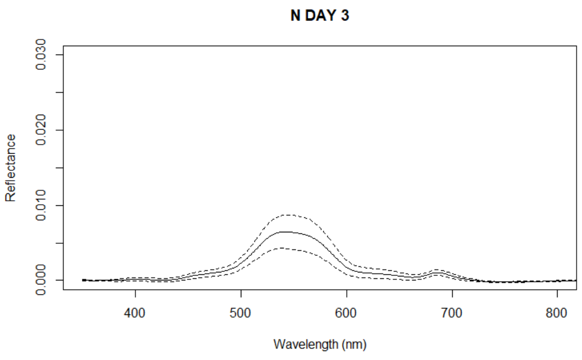

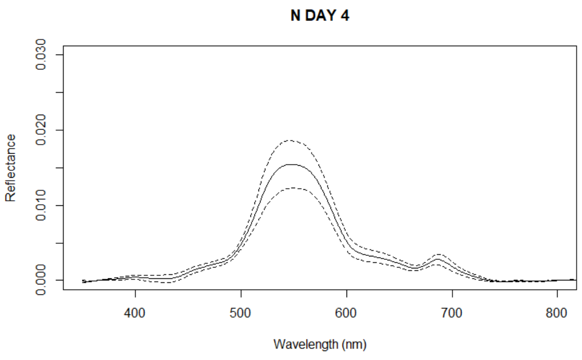

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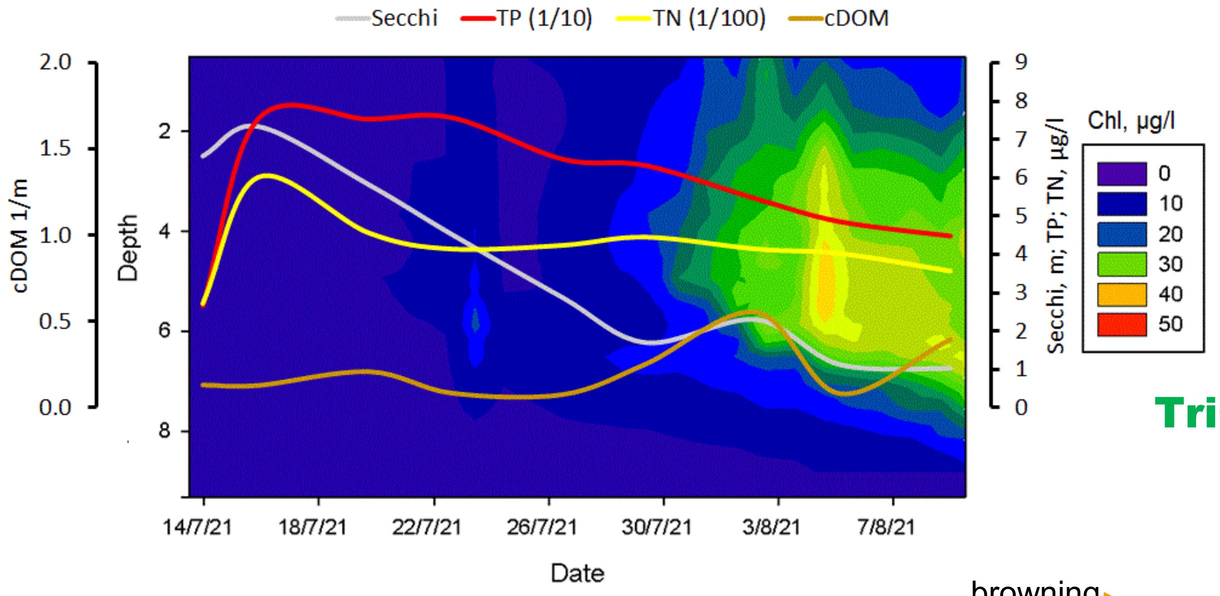

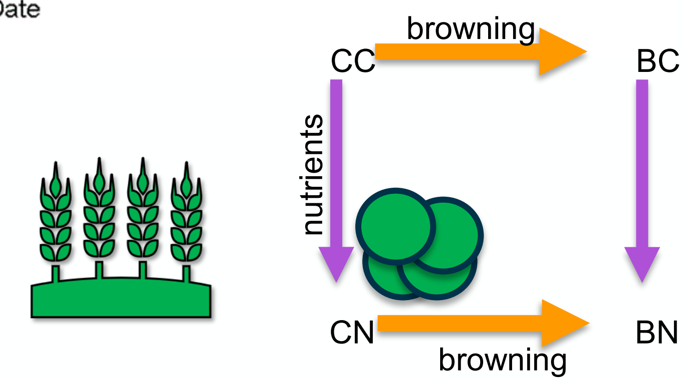

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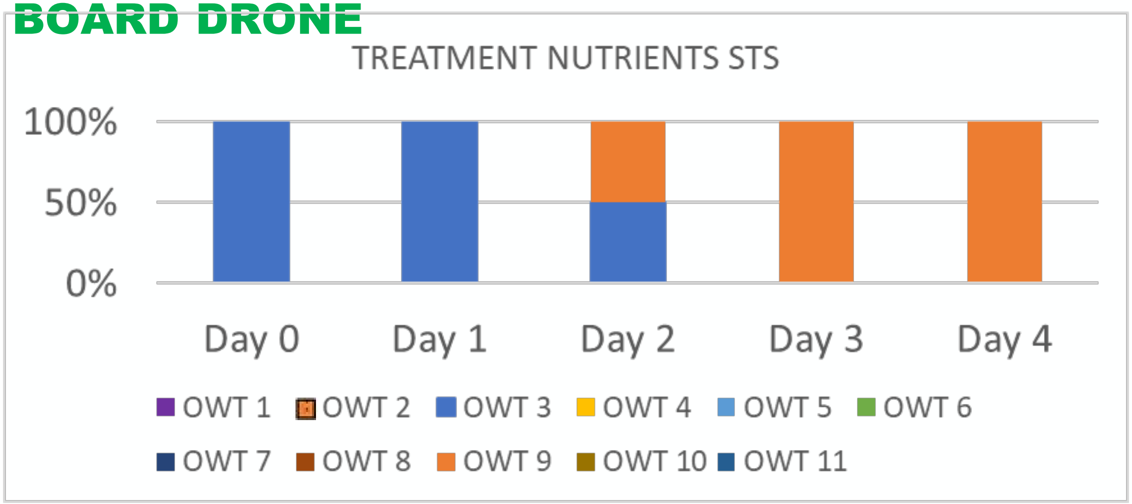

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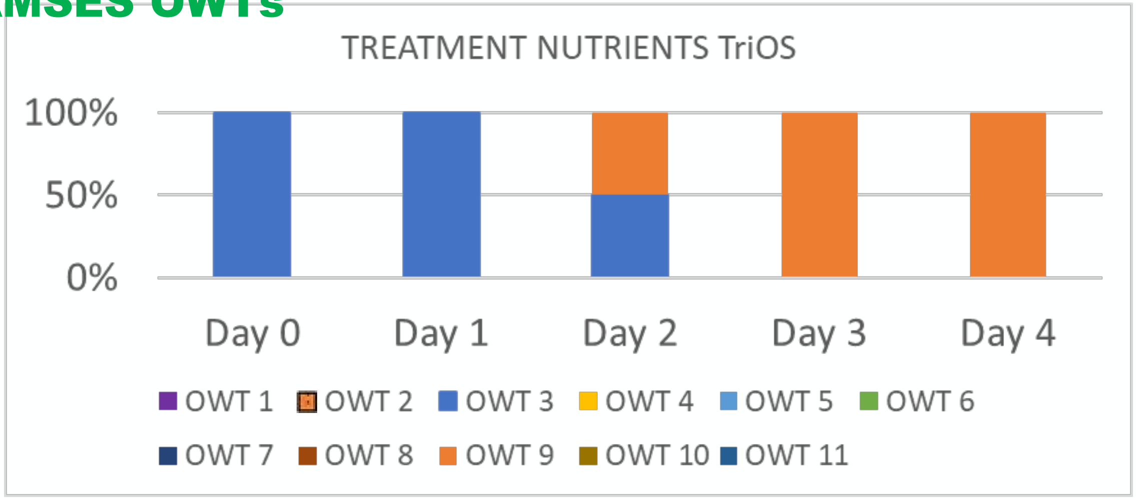

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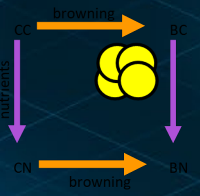

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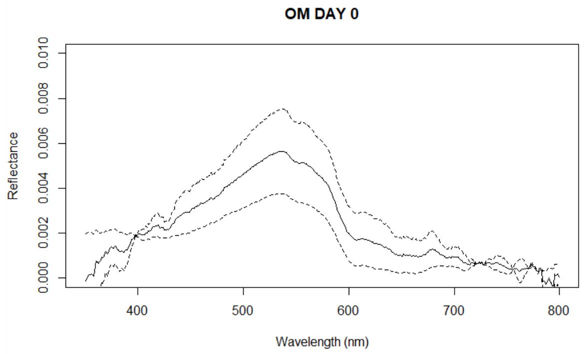

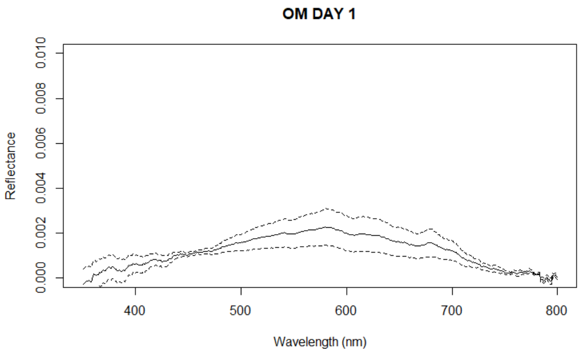

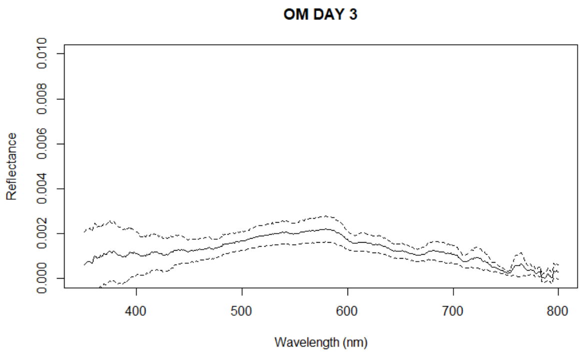

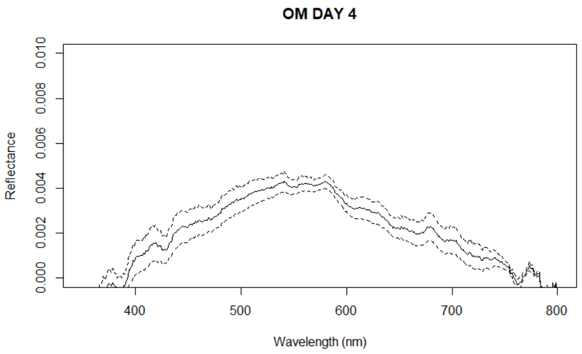

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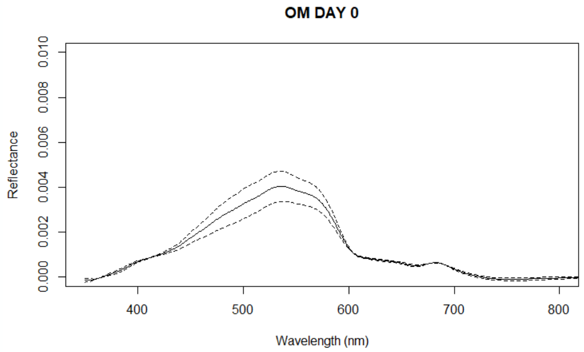

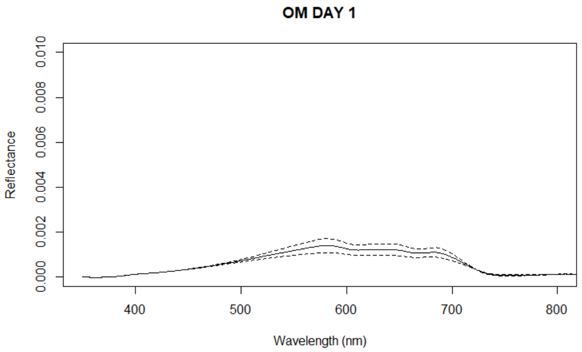

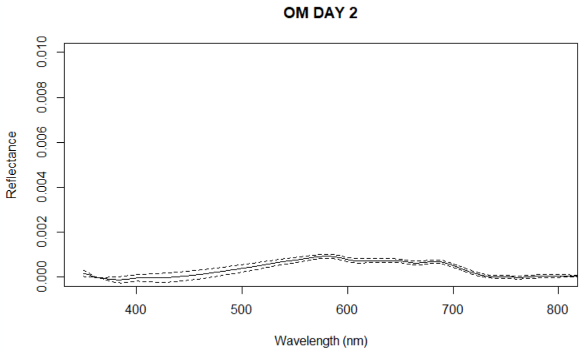

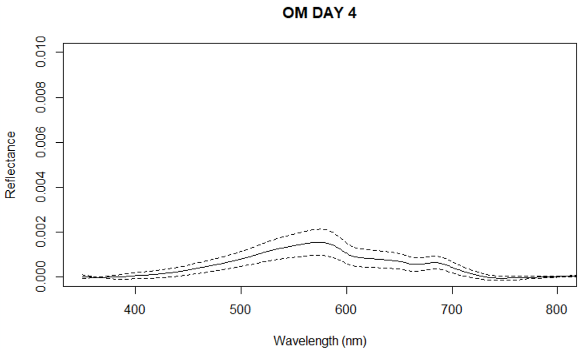

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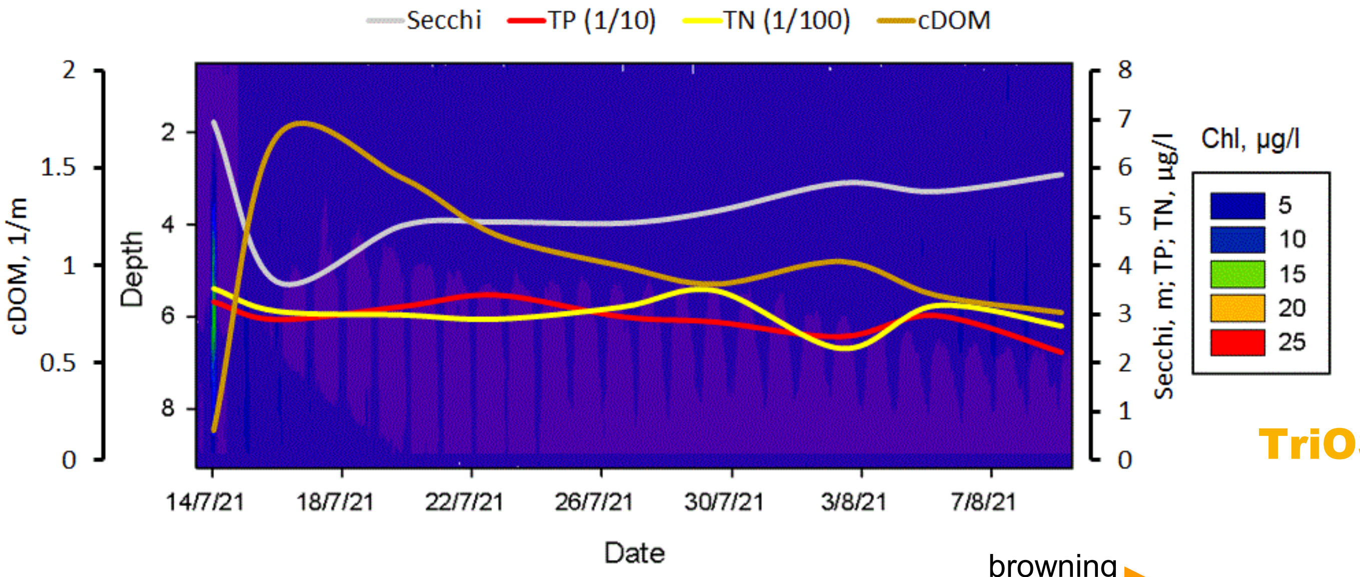

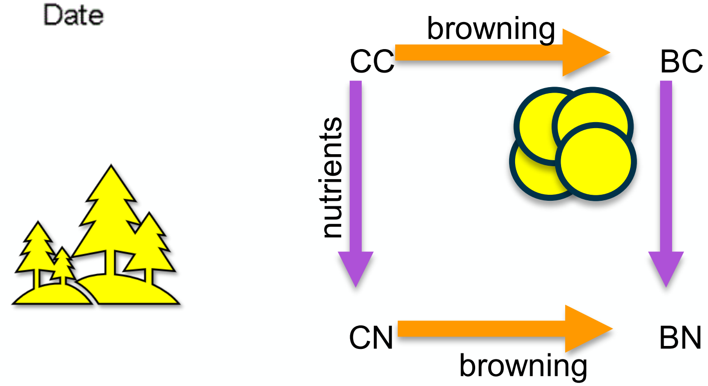

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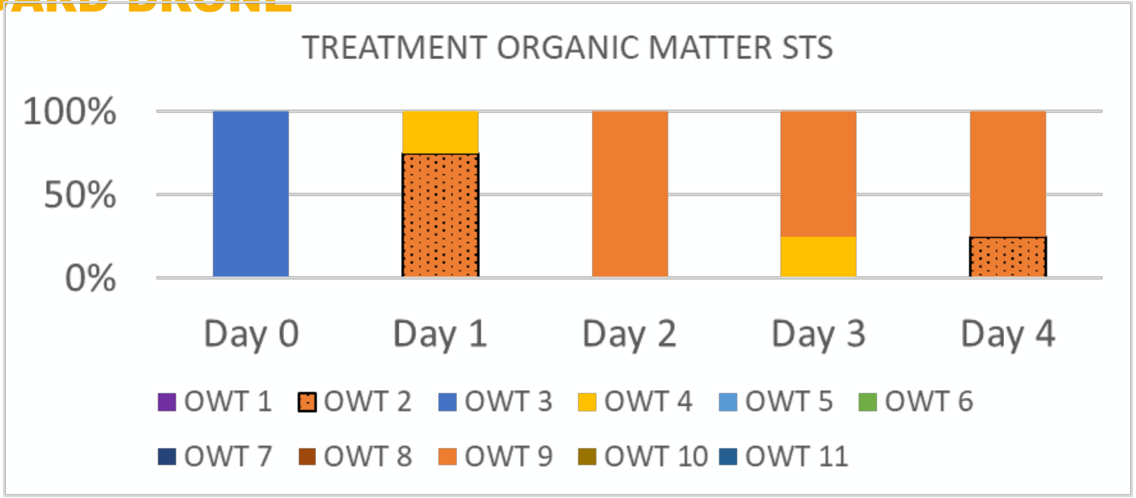

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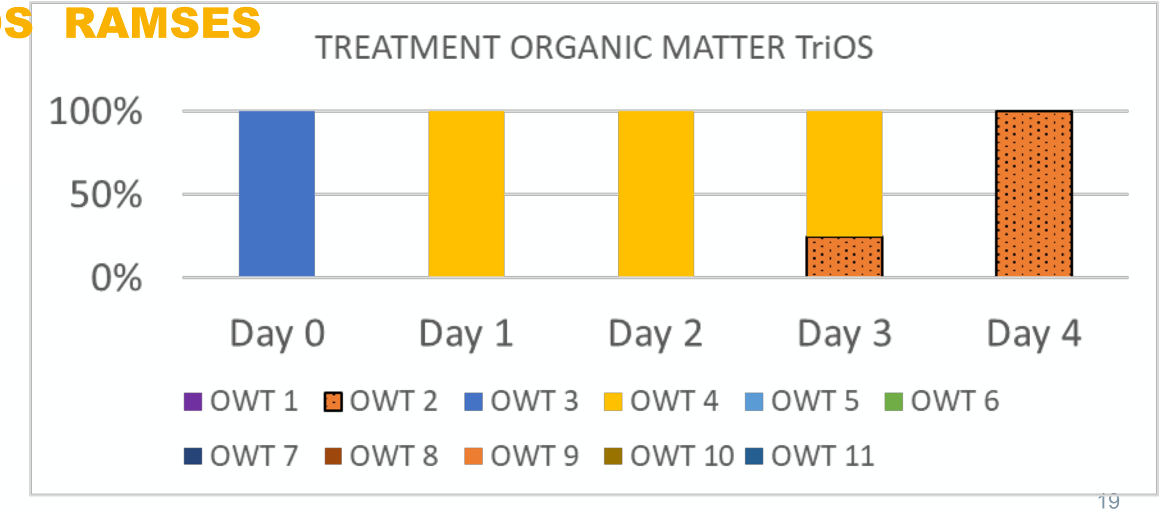

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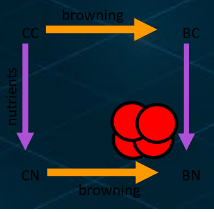

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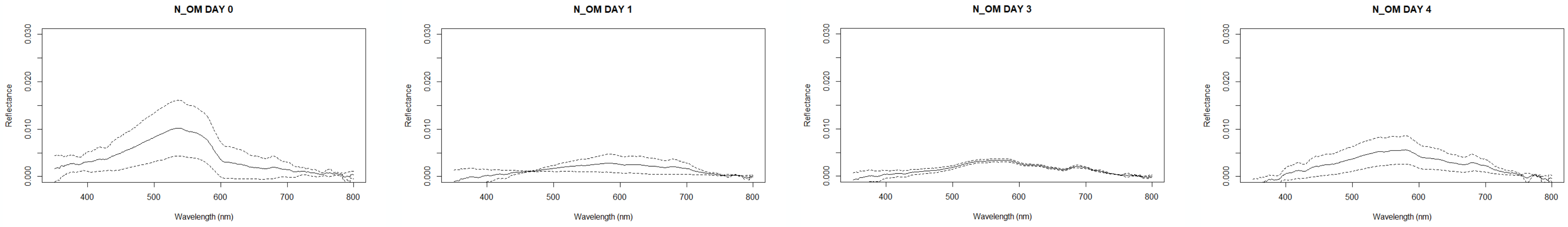

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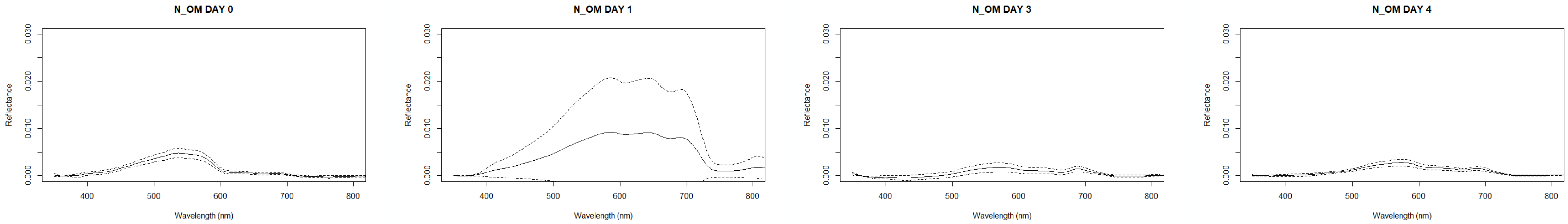
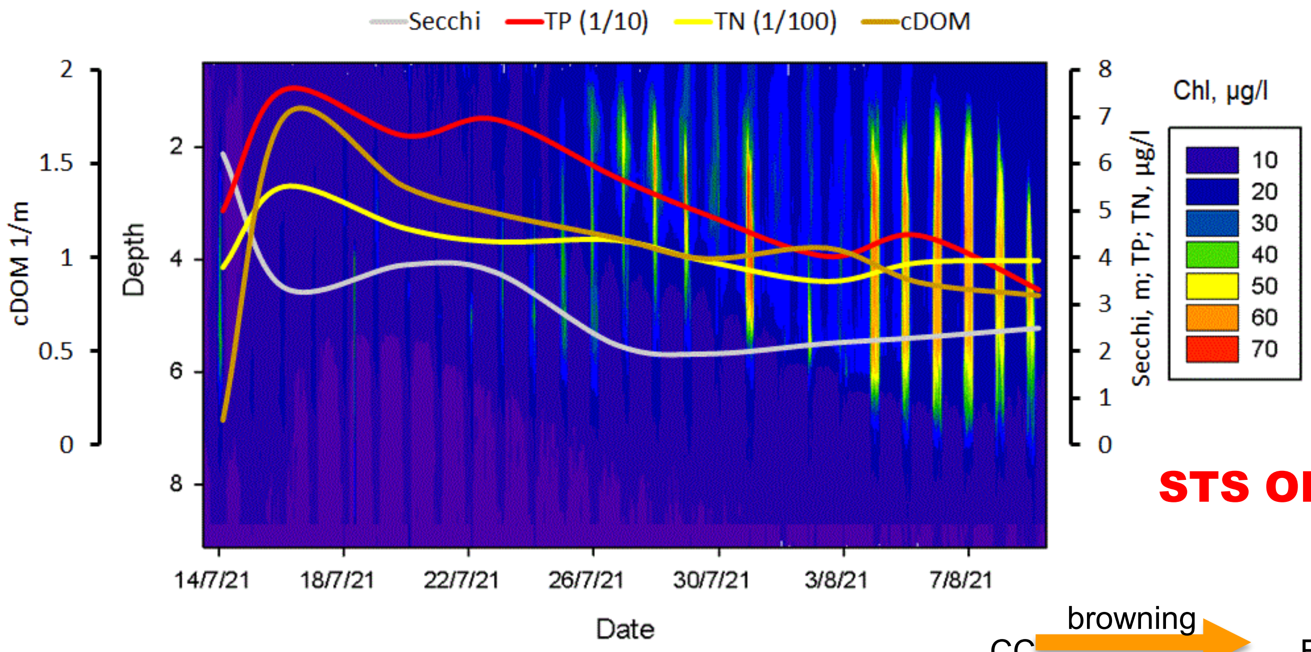
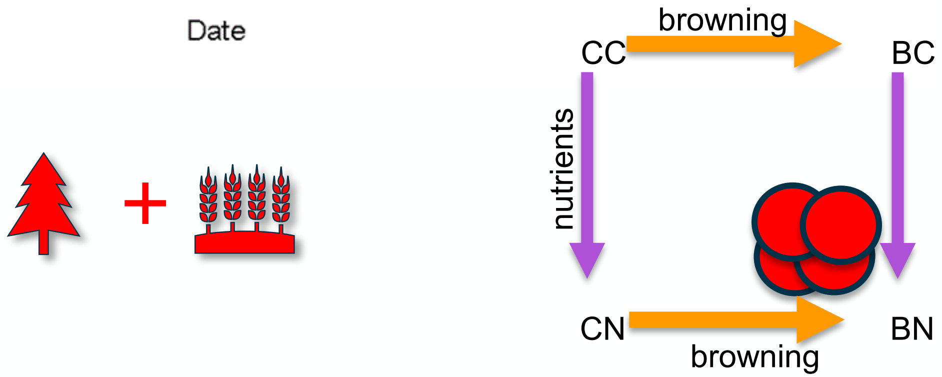
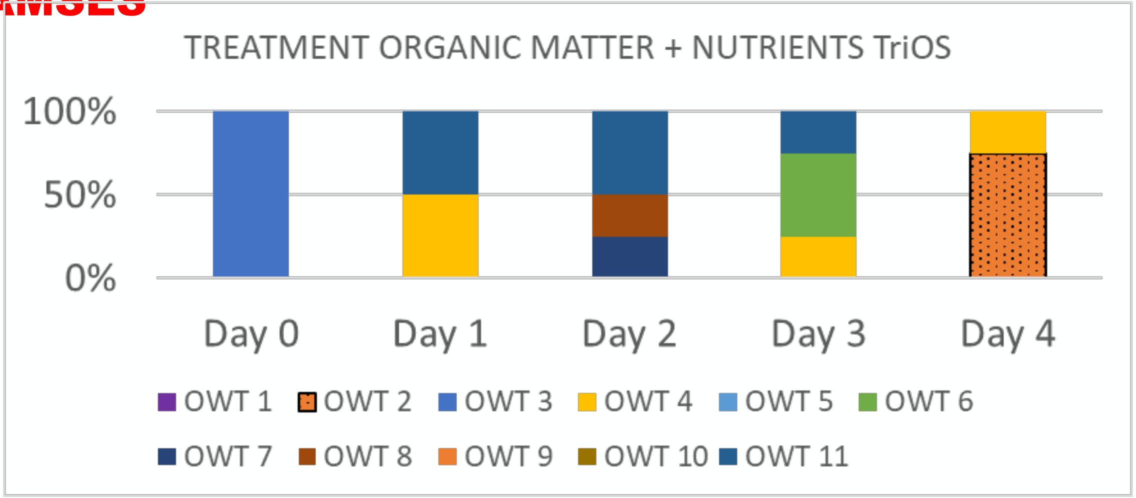


Results and Discussion

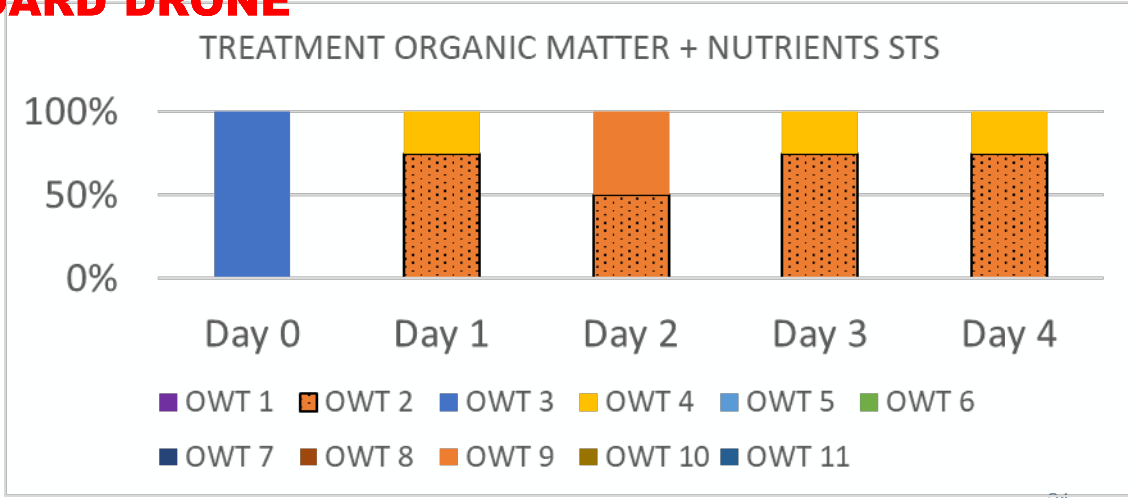




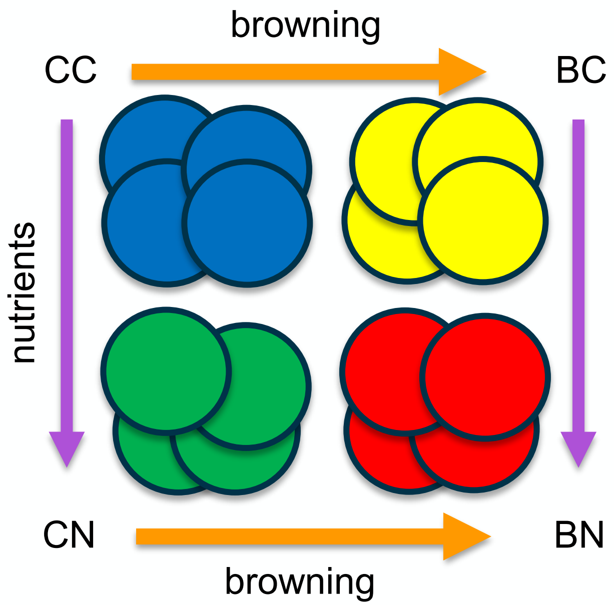
TriOS RAMSES

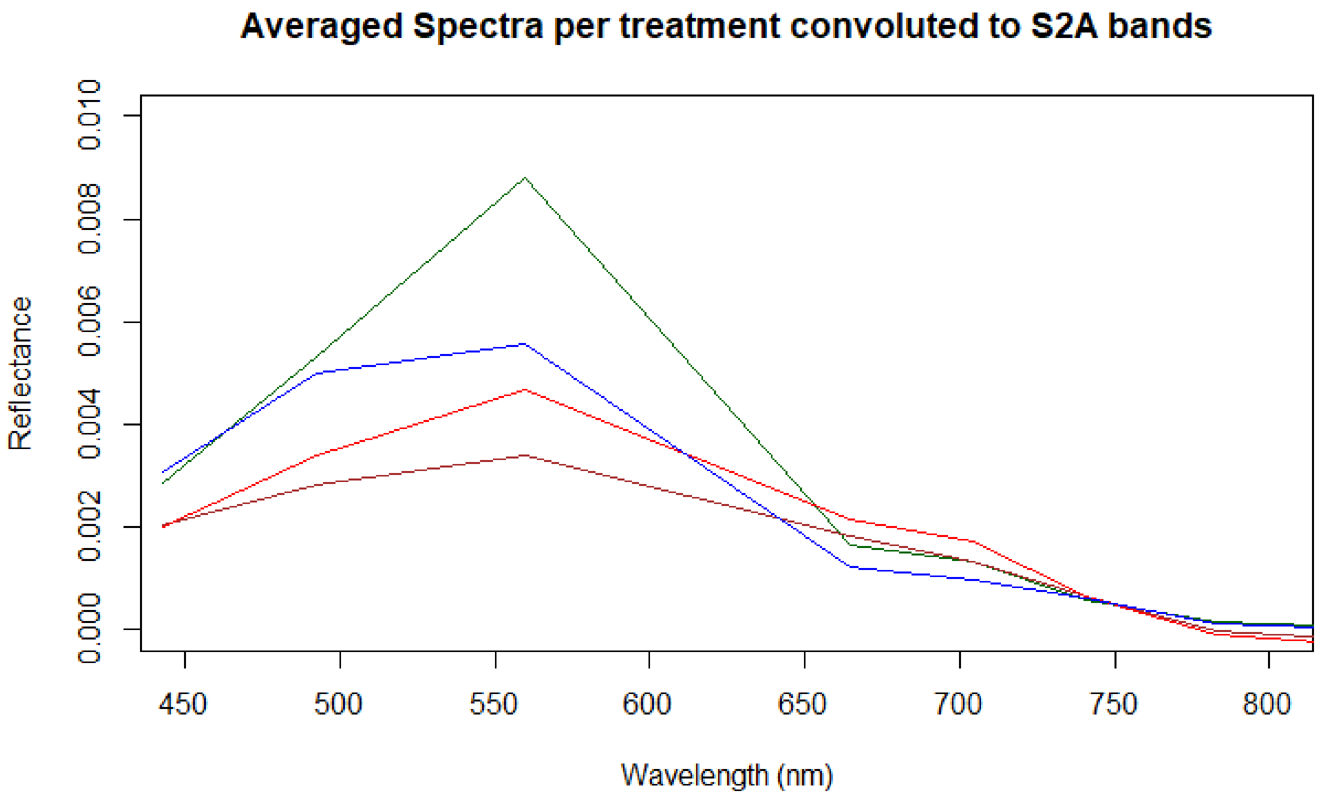


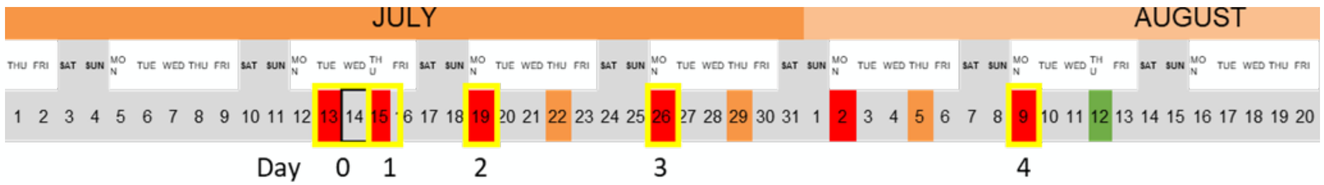
STS ON BOARD DRONE



Results and Discussion

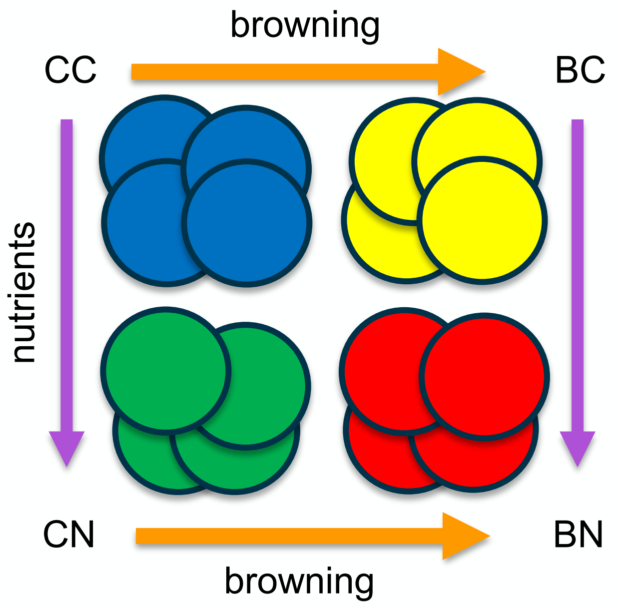


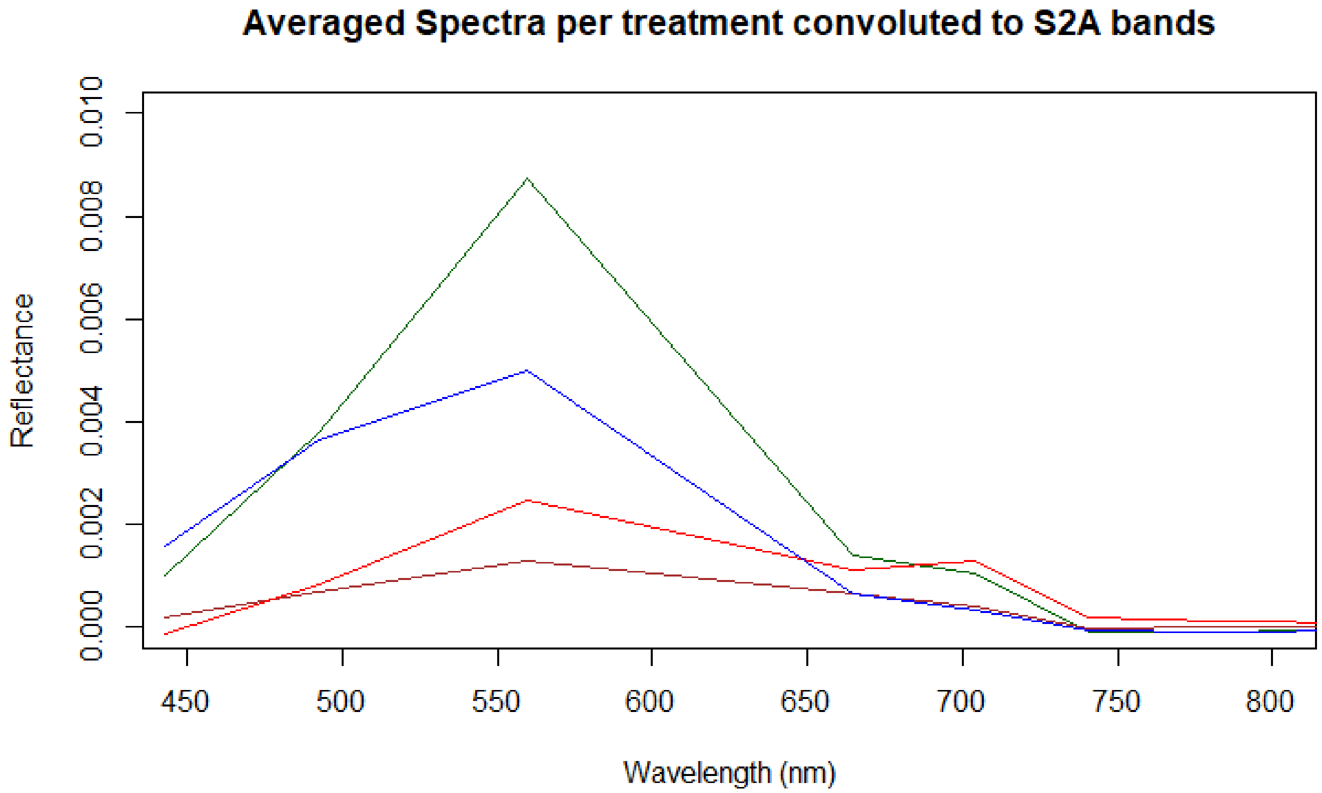




STS ON BOARD DRONE

Results and Discussion





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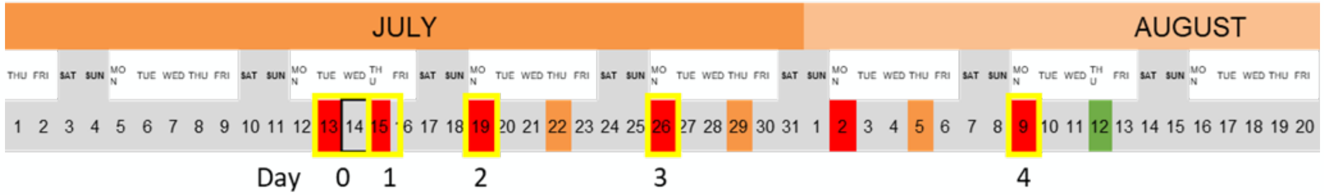
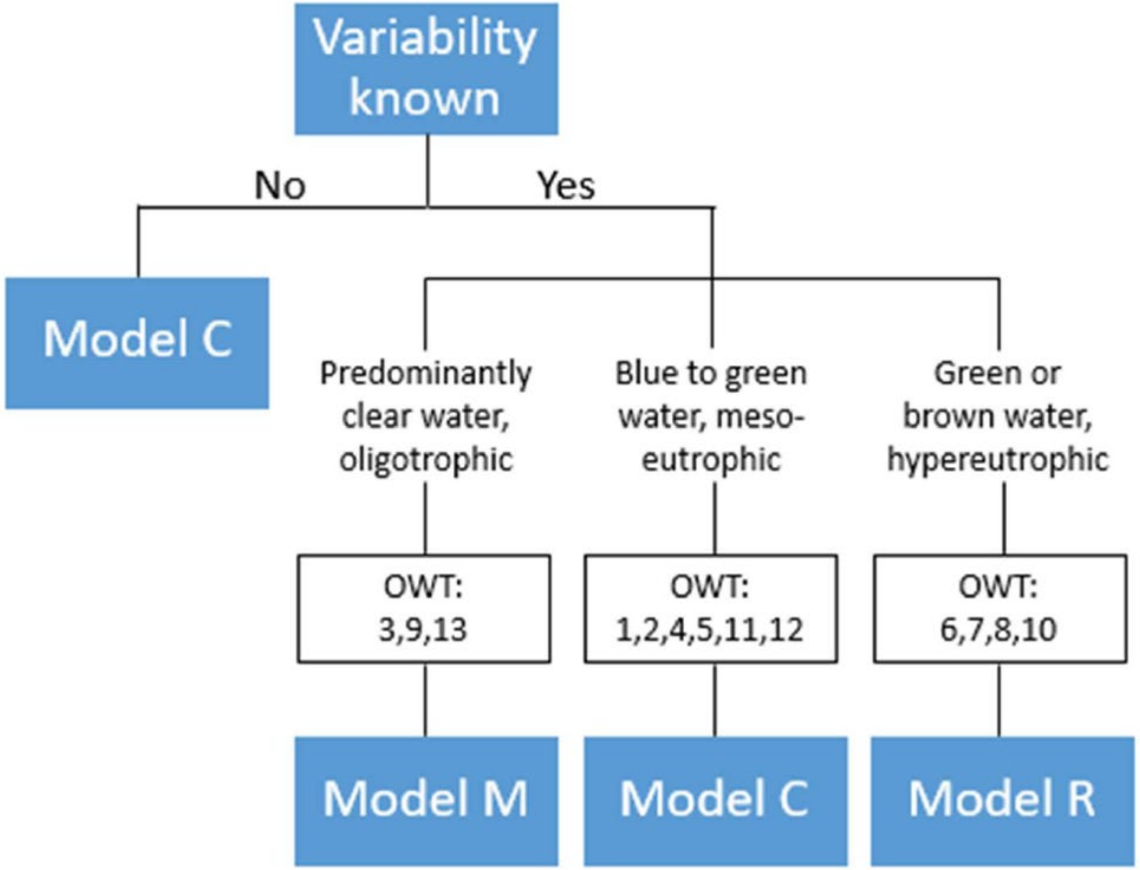


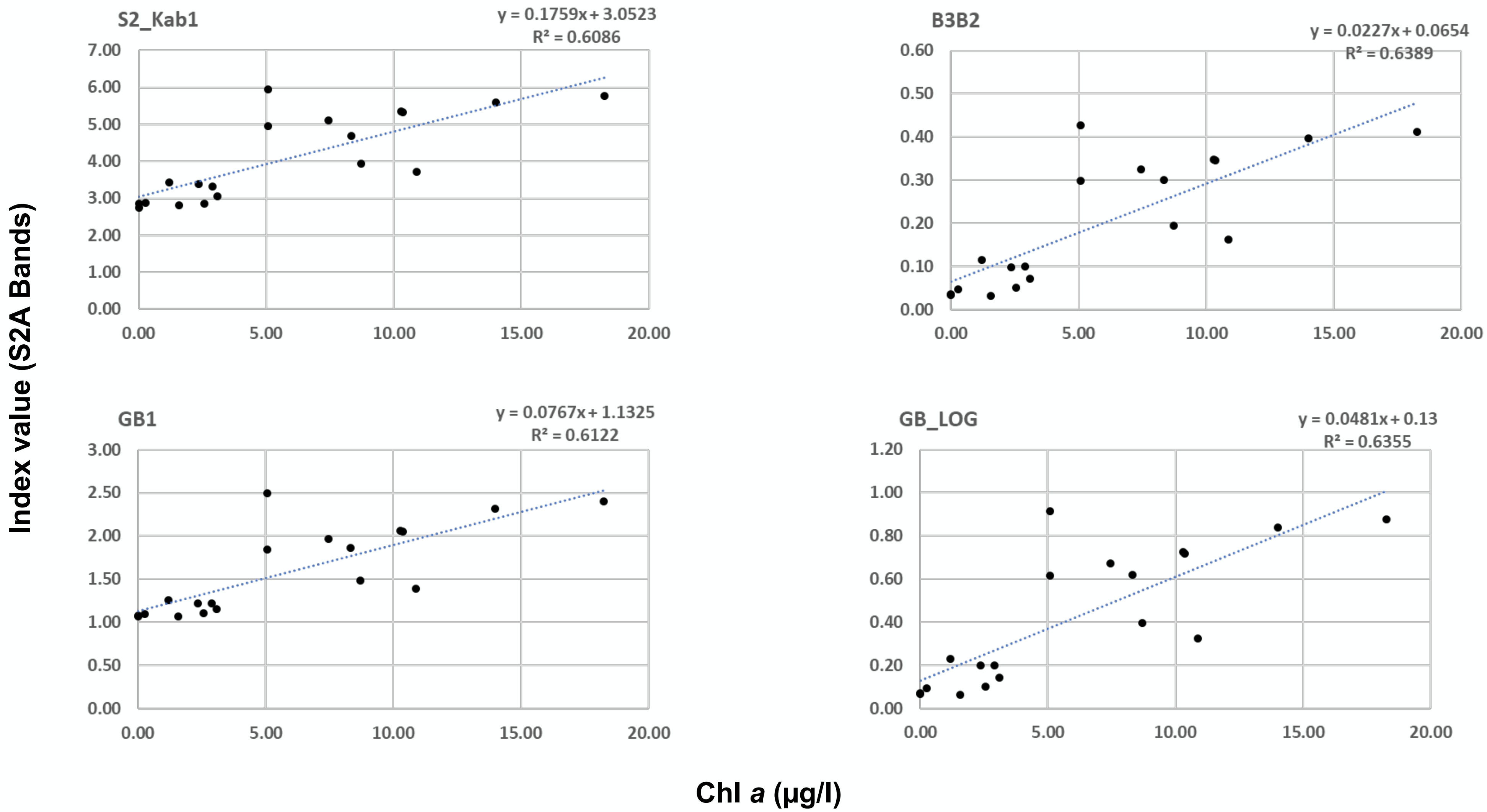
Results and Discussion



Neil *et al.* (2019)

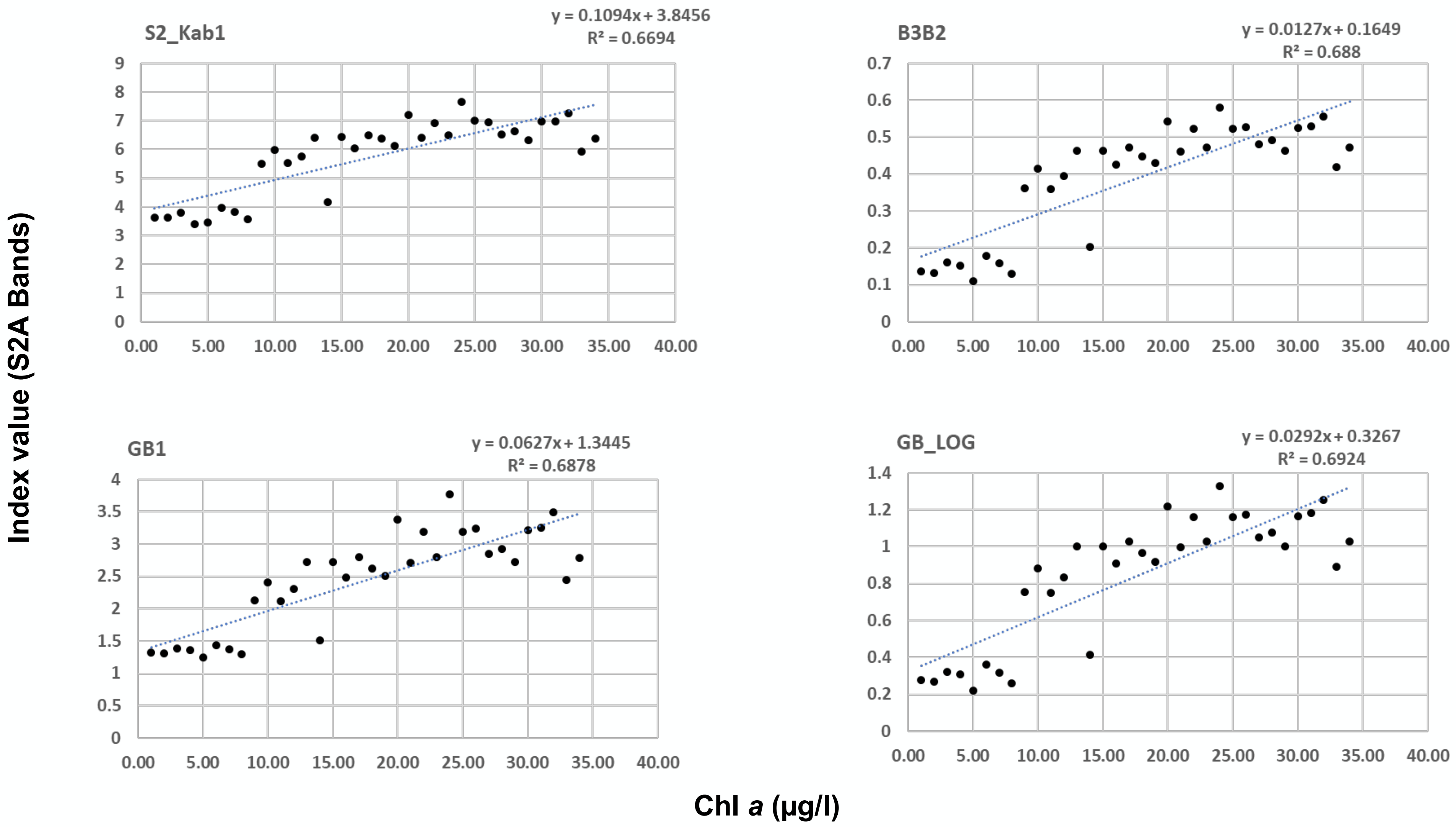
Results and Discussion

STS ON BOARD DRONE Chl *a*



Results and Discussion

TriOS RAMSES Chl *a*



Conclusions

- ✓ During an artificially simulated extreme rainfall event, the OWTs of the waterbodies changed over time.
- ✓ The timing of OWTs change was different under the 3 different simulated catchment land cover (forest, agricultural, mixed forest & agricultural)
- ✓ A lower cost sensor on board a drone has shown to be an accurate technological option to describe the above-water Rrs and to derive OWTs
- ✓ Sentinel 2 MSI band configuration could be used to describe and monitor Chl *a* concentration under a extreme rainfall event in an agricultural dominated catchment during the whole event progress without needing a blended algorithm approach.
- ✓ This experiment presents the advantage of testing RS algorithms under controlled conditions with dedicated in situ data available

Thank you!!

esa

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