



# Quantifiable impact: leveraging satellite climate records for ecosystem accounting



Mendy van der Vliet · ESA EO4EA Workshop · November 29, 2022

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# Our mission

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To image the whole world every day, making change **visible, accessible, and actionable.**



# How to quantify the impact of landscape greening?

## The ESA EO4Society project Restore-IT results case study 1

**Restore-IT aim:** *to provide an impact monitoring tool, based on the existing long-term and consistent ESA CCI datasets in combination with reliable near real-time satellite data streams*

**Case study 1:** To restore degraded lands, Justdiggitt digs bunds to improve rainwater collection and vegetation growth which is expected to lead to a further increase of rainwater collection (due to plant roots) and a local decrease in temperature (due to increased transpiration).







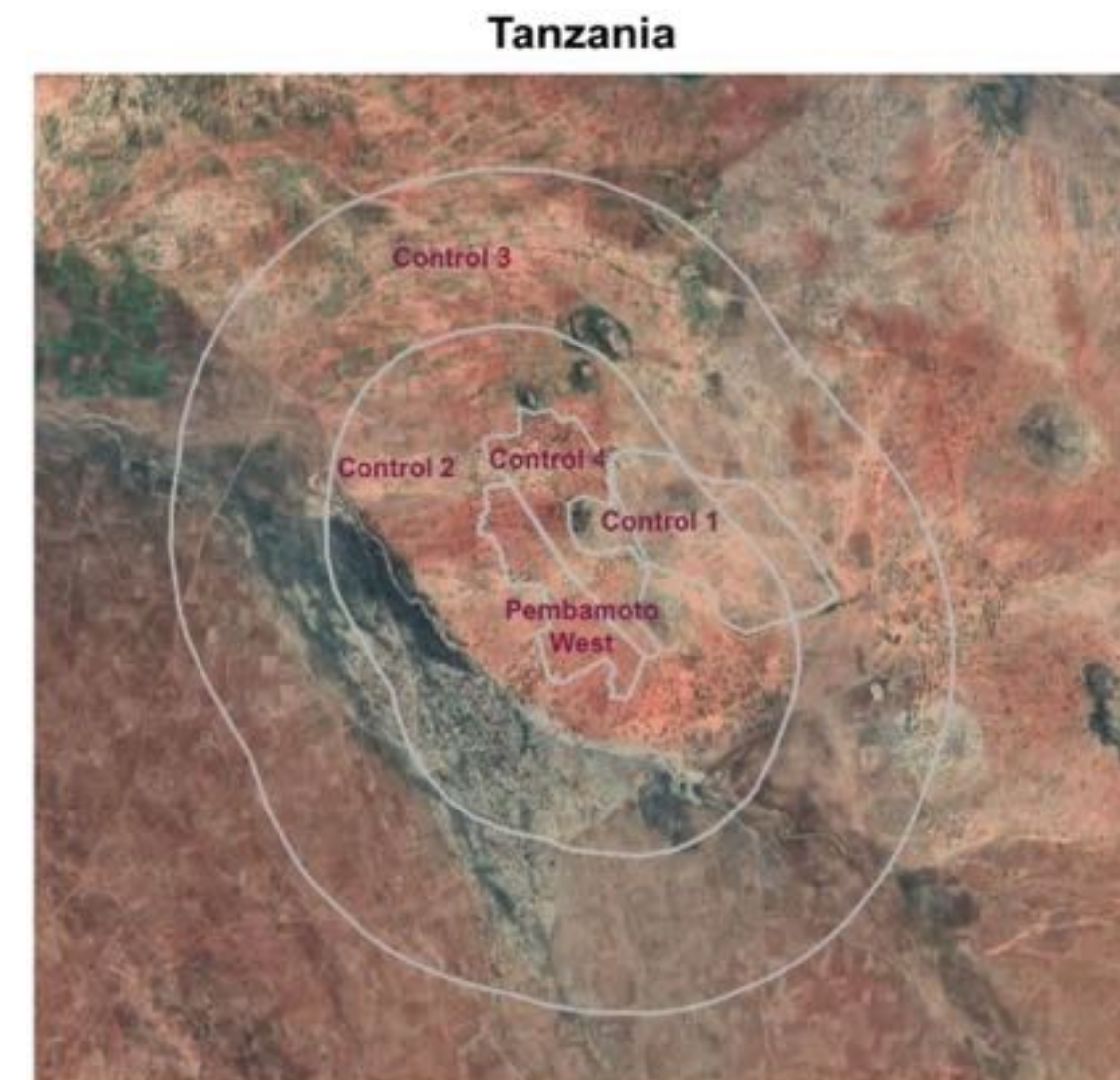
# How to quantify the impact of landscape regreening?

## The ESA EO4Society project Restore-IT results case study 1

### Data sources studied

1. True color composites
  - a. PlanetScope at 3.7 m (daily)
2. Normalized-Vegetation Index (NDVI)
  - a. Sentinel 2 resampled to 100 m (daily)
3. Soil Water Content (SWC)
  - a. C3S Soil moisture 25 km (daily)
  - b. Planet Soil Water Content 1 km (daily)
  - c. Planet Soil Water Content 100 m (daily)
4. Land Surface Temperature (LST)
  - a. ESA CCI Land Surface Temperature 1 km (twice daily)
  - b. Planet Land Surface Temperature 1 km (daily)
  - c. ESA CCI Land Surface Temperature 100 m (twice daily)
  - d. Planet Land Surface Temperature 100 m (twice daily)

### Control area selection





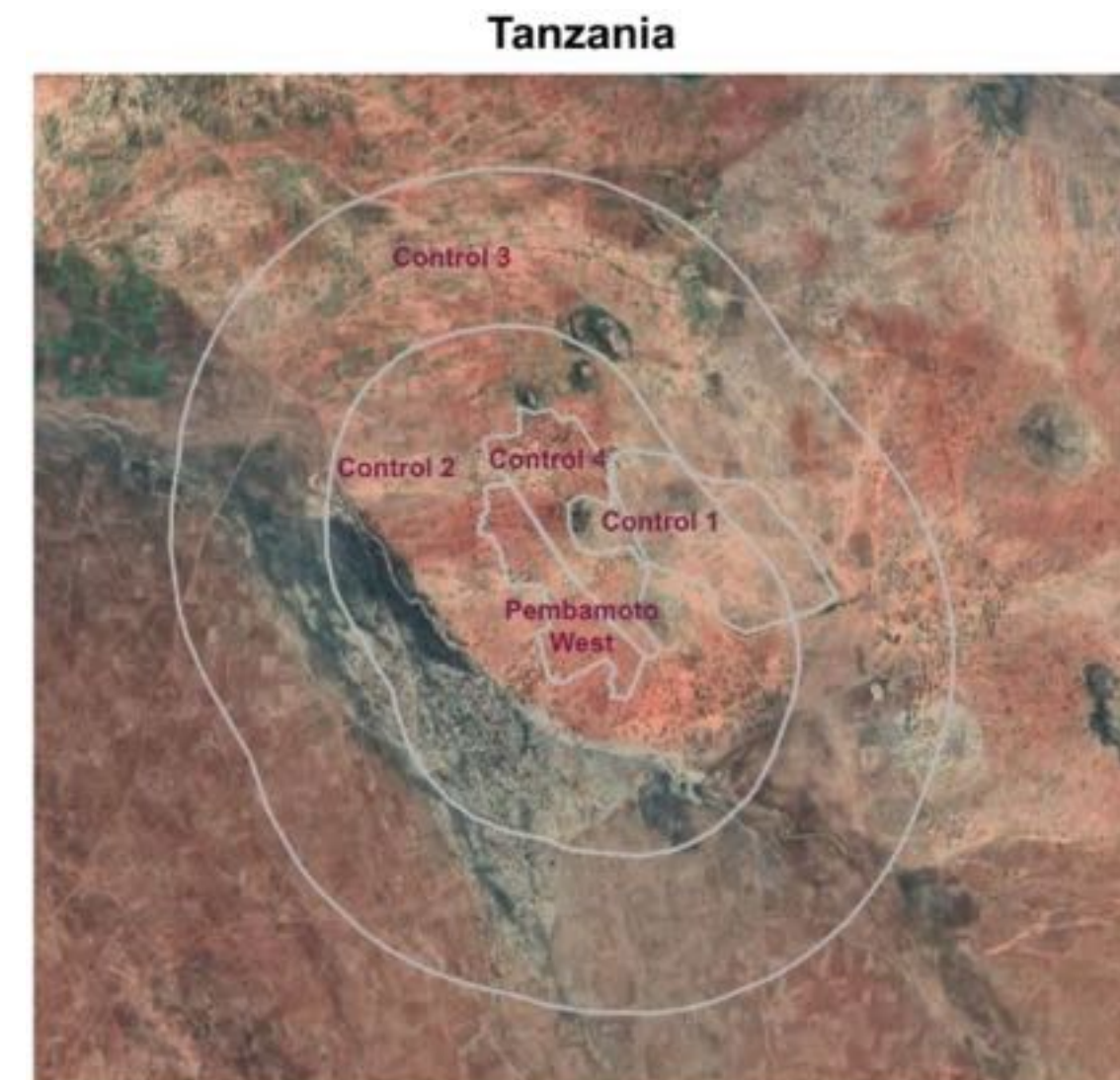
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### Control area selection







# Scanning the surface for regreening

PlanetScope True Color Composites of bund area and surrounding area

VEGETATION RESTORATION • Pembamoto, Tanzania



May 27, 2018



May 28, 2020



May 11, 2022

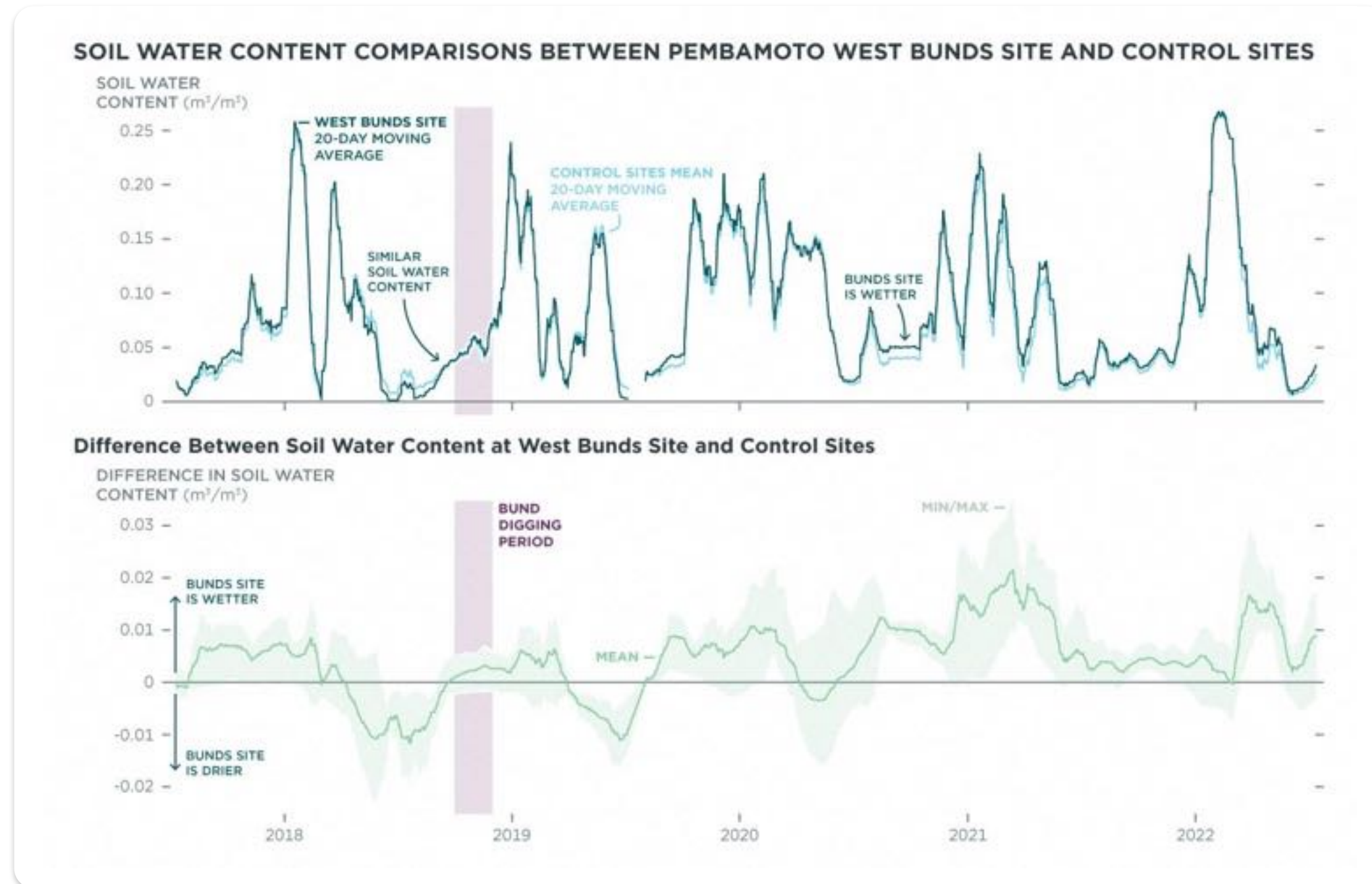
*PlanetScope true color daily composites for May 2018, 2020 and 2022*





# Temporal analysis

## Planet Soil Water Content (SWC) of bund area vs control mean



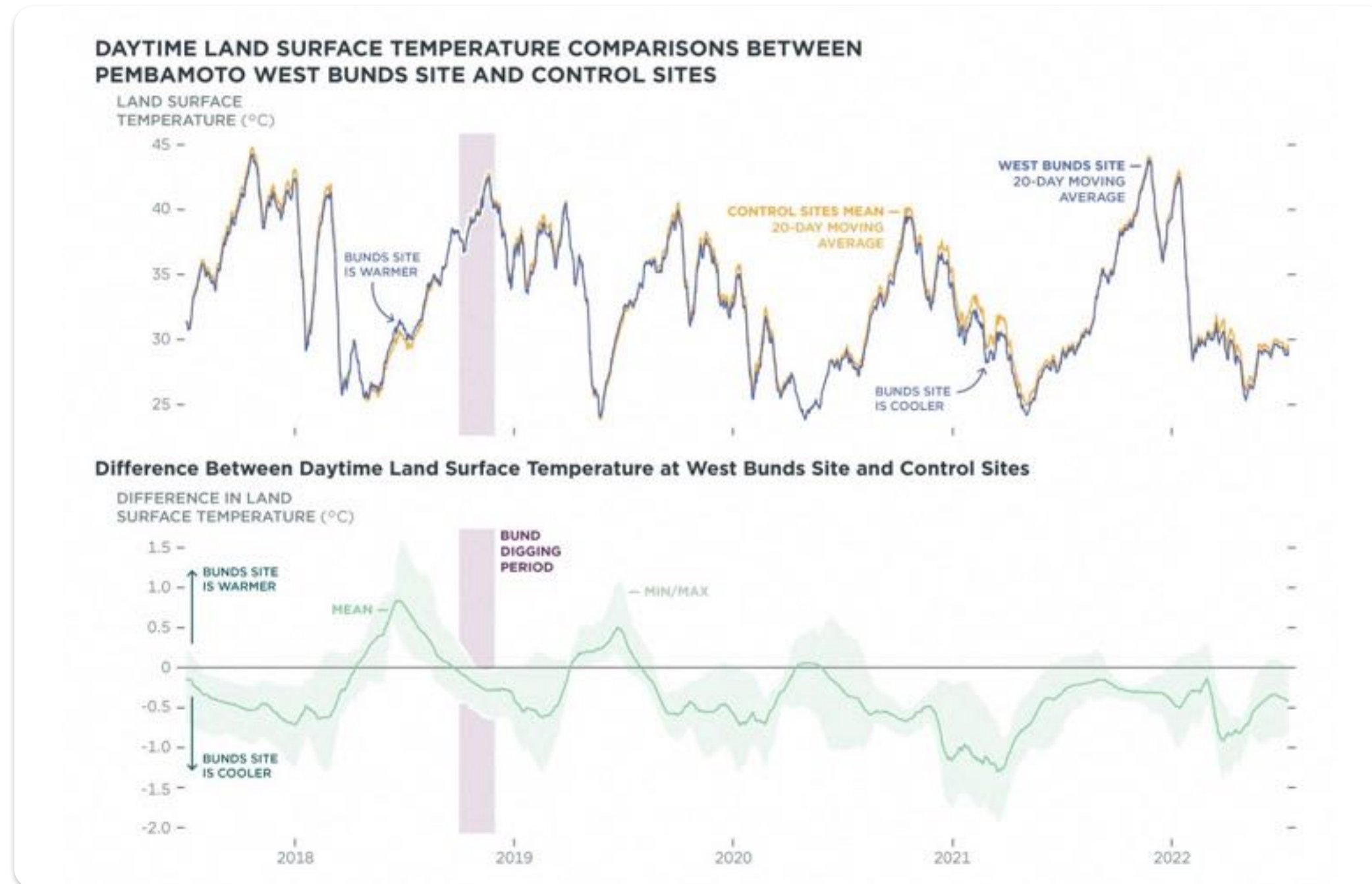
The top graph visualizes the average SWC of the bund site (dark blue) and the mean of the nearby control sites (light blue line) in time.

The bottom graph shows the differences in SWC with respect to the control area mean (solid green line) over the years. The minimum-maximum range of all project-control area comparisons is marked by the half-transparent light green color.



# Temporal analysis

## Planet Land Surface Temperature (LST) of bund area vs control mean



The top graph visualizes the average LST of the bund site (dark purple line) and the mean of the nearby control sites (orange line) in time.

The bottom graph shows the differences in LST with respect to the control area mean (solid green line) over the years. The minimum-maximum range of all project-control area comparisons is marked by the half-transparent light green color.



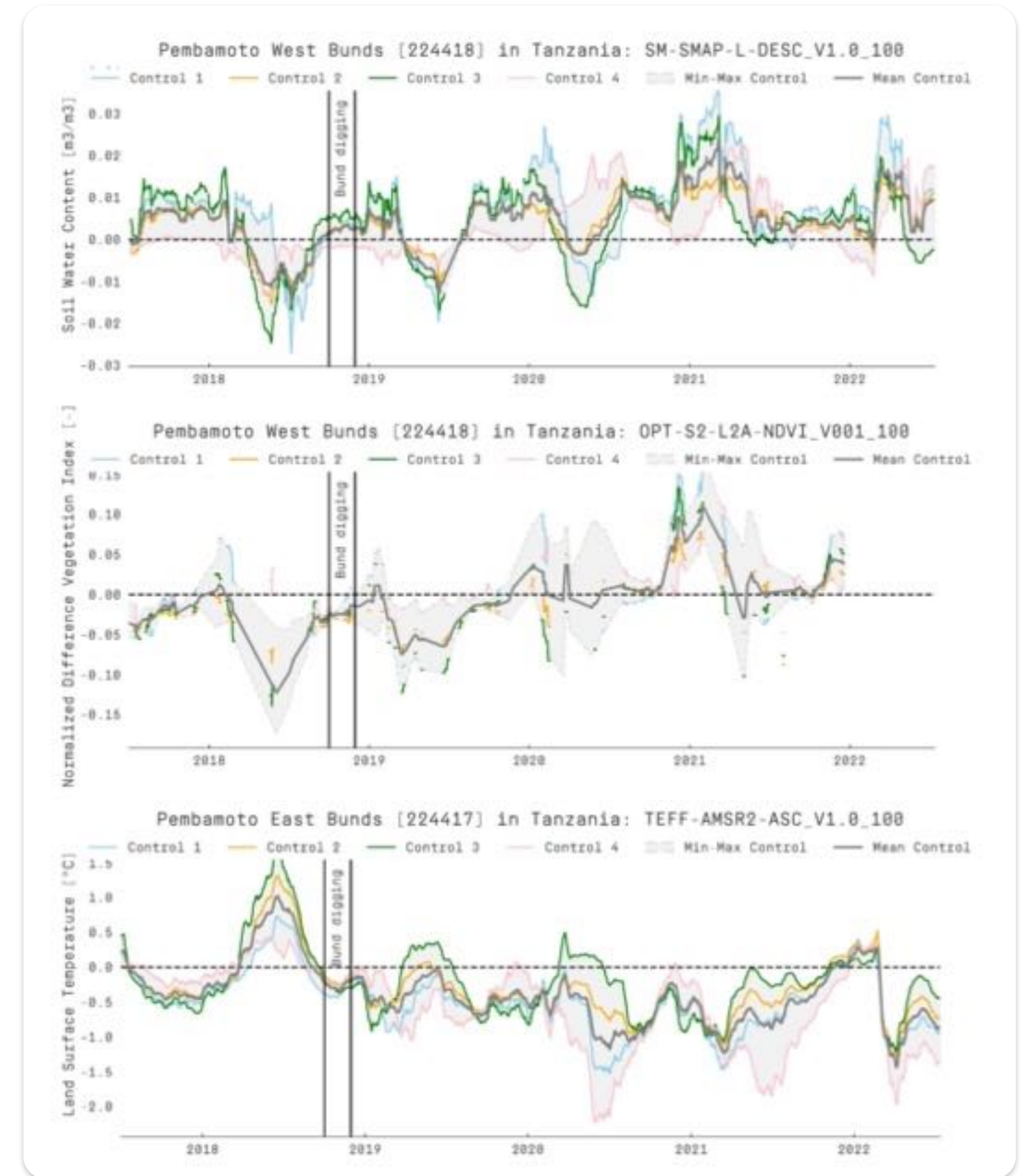


# Temporal analysis

## Project-control comparisons

Similar patterns in Planet SWC, Sentinel-2 NDVI and Planet LST for Pembamoto West Bunds (Tanzania)

- > Modified MK trends in differences for both bund areas:
  - ◆ Increasing SWC
    - $P=0.03-0.10$
    - on average 7-13% wetter
  - ◆ Increasing NDVI
    - $P=0.01-0.10$
    - On average 23-41% greener
  - ◆ Decreasing daytime LST
    - CCI LST at  $P=0.06-0.14$  & Planet LST at  $P=0.08-0.09$ ,
    - on average 0.3-0.6 °C (1-2%) cooler







# Summary

## Recommendations

- Improve the baseline assessment
- Expand across scales to better study functionality of CCI datasets
- Extend statistical testing and addition uncertainty estimation
- Further study how these results can support decision and policy making

## Conclusions

- This work has shown the potential of the satellite products to quantify and monitor the amount of water retained by the soil, the temperature changes and the regreening of the restored lands.
- More research is needed to to increase the confidence in the scalability of the presented methodology.



More details will be provided in:

***Van der Vliet, M., Restore-IT Consortium (in prep)***

Thank You.  
Questions?



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