Sentinel-2 based Land Surface Phenology in complex Southern African Landscapes

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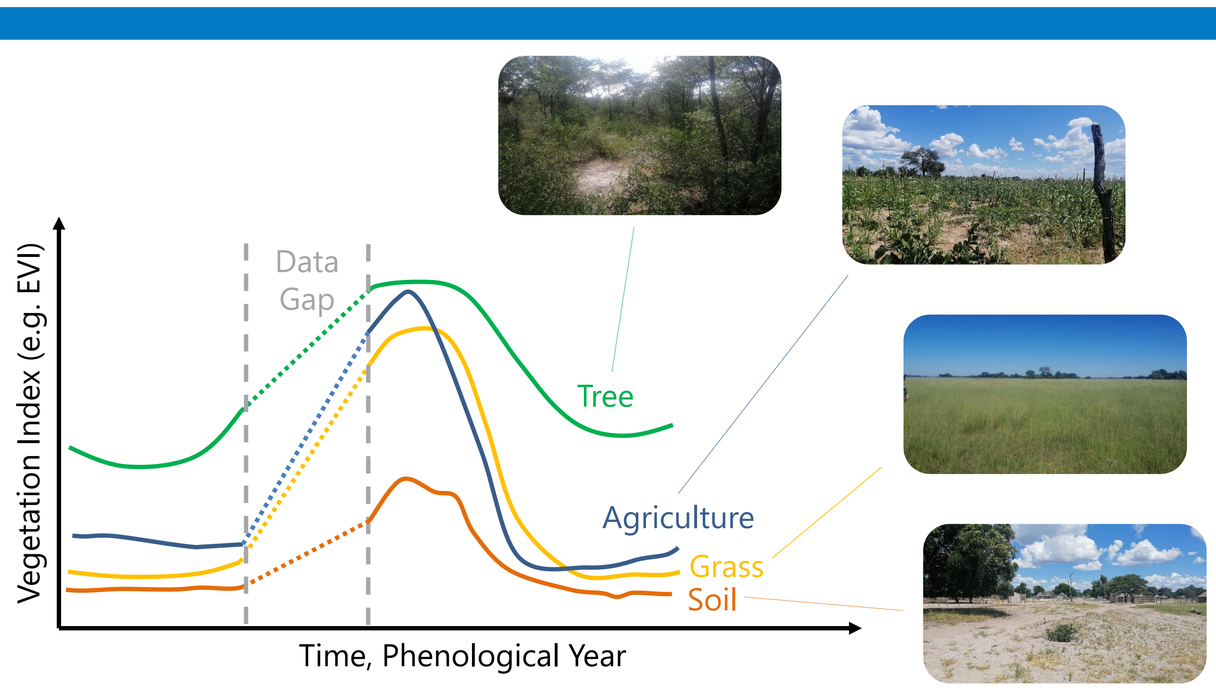
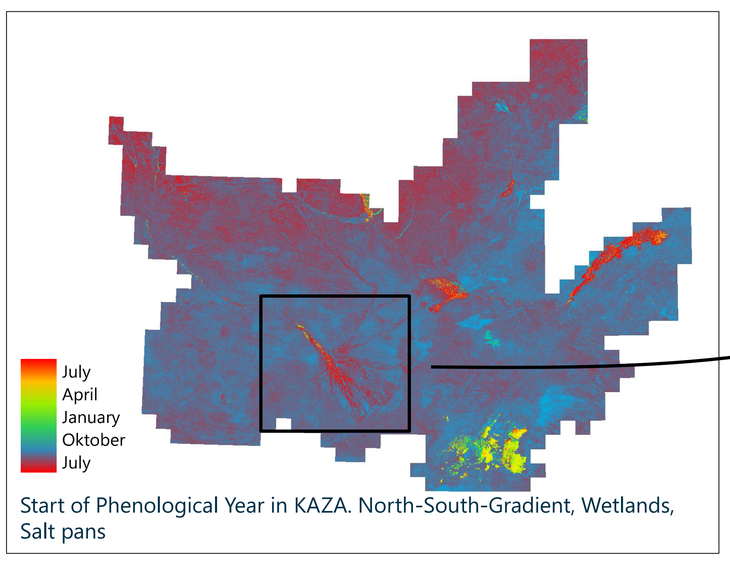
Land Surface Phenology

- Phenology is the study of timing and magnitude of ecological events (e.g. dormancy, leaf emergence and growth, peak photosynthetic activity, senescence)
- Land Surface Phenology (LSP) is understood as the temporal change of a vegetation index (e.g. EVI) of a vegetation composite in a pixel (e.g. dense forest or shrub-grass-soil-mix)
- LSP as a reduction of Sentinel-2 time series to a set of parameters describing the EVI curve
- Intuitively understandable ecological parameters
- 39 Yearly parameters and Multi-year statistics (e.g. inter-annual variability, long-term average,…)
- 10m Resolution

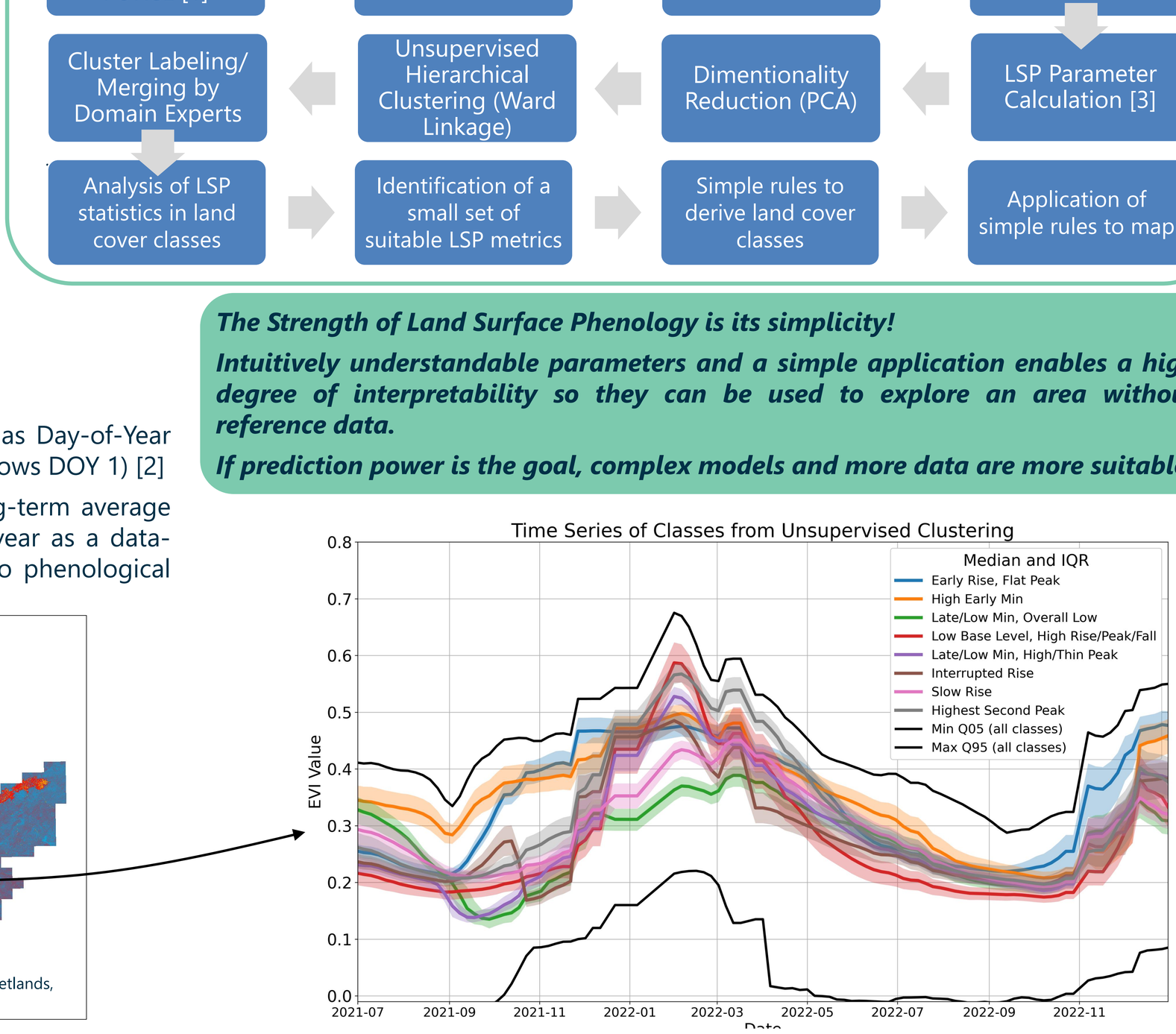


Study Area KAZA

- The **Kavango-Zambezi Transfrontier Conservation Area (KAZA)** is the worlds largest network of environmental protection areas
- It has a large climatic gradient and heterogeneous ecosystems
- North, south, savannah und wetlands have different phenological timings and require a individual pixel-specific calculation
- **Polar-based Transformation** transforms time as Day-of-Year (DOY) into a circular variable (after DOY 365 follows DOY 1) [2]
- This is used to calculate the pixel-specific long-term average start and yearly start [3] of the phenological year as a data-driven method to partition the time series into phenological years



Start of Phenological Year in KAZA. North-South-Gradient, Wetlands, Salt pans



The Strength of Land Surface Phenology is its simplicity!

Intuitively understandable parameters and a simple application enables a high degree of interpretability so they can be used to explore an area without reference data.

If prediction power is the goal, complex models and more data are more suitable.

Next Steps

- Rollout to whole KAZA area
- Expert-based labeling and merging of unsupervised clusters. Assisted by the hierarchical structure of clusters, times series plots and LSP statistics of classes
- Comparison to MODIS and Landsat Satellite Data

References

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[3] Frantz, D.; Hostert, P.; Rufin, P.; Ernst, S.; Röder, A.; van der Linden, S. (2022): Revisiting the Past Replicability of a Historic Long-Term Vegetation Dynamics Assessment in the Era of Big Data Analytics. Remote Sens. 2022, 14, 597. https://doi.org/10.3390/rs14030597

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