ITEX-AON Arctic Phenocam Synthesis

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What are Phenocams?

- Digital cameras can be used to monitor plant life growth stages and development (phenology)

- Autonomous method for image data collection (timelapse capacity)

- Camera options include cheap webcams to expensive surveillance systems

- Allows for the analysis of optical properties of regions of interest within a fixed field of view

- Can quantify daily to seasonal changes and inter-annual variability in phenomenon such as vegetation greenness, climatic state and other variables

- Analysis output has been shown to correlate with satellite greenness, land-atmosphere carbon fluxes, biomass and other variables

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International Synthesis Opportunity

- New NSF grant supports US ITEX-AON collaboration opportunity

- International synthesis of phenocam imagery and repeat plot level photography during 2022-24

- Include as many ITEX sites as possible + other sites (e.g. INTERACT, state/national agency efforts, other networks)

- Early stages, all suggestions regarding questions, analysis, reporting, welcomed

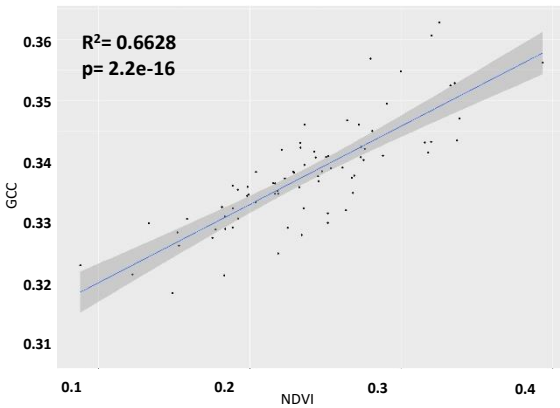- Additional opportunity for new SEL's phenocams to be deployed in summer 2020
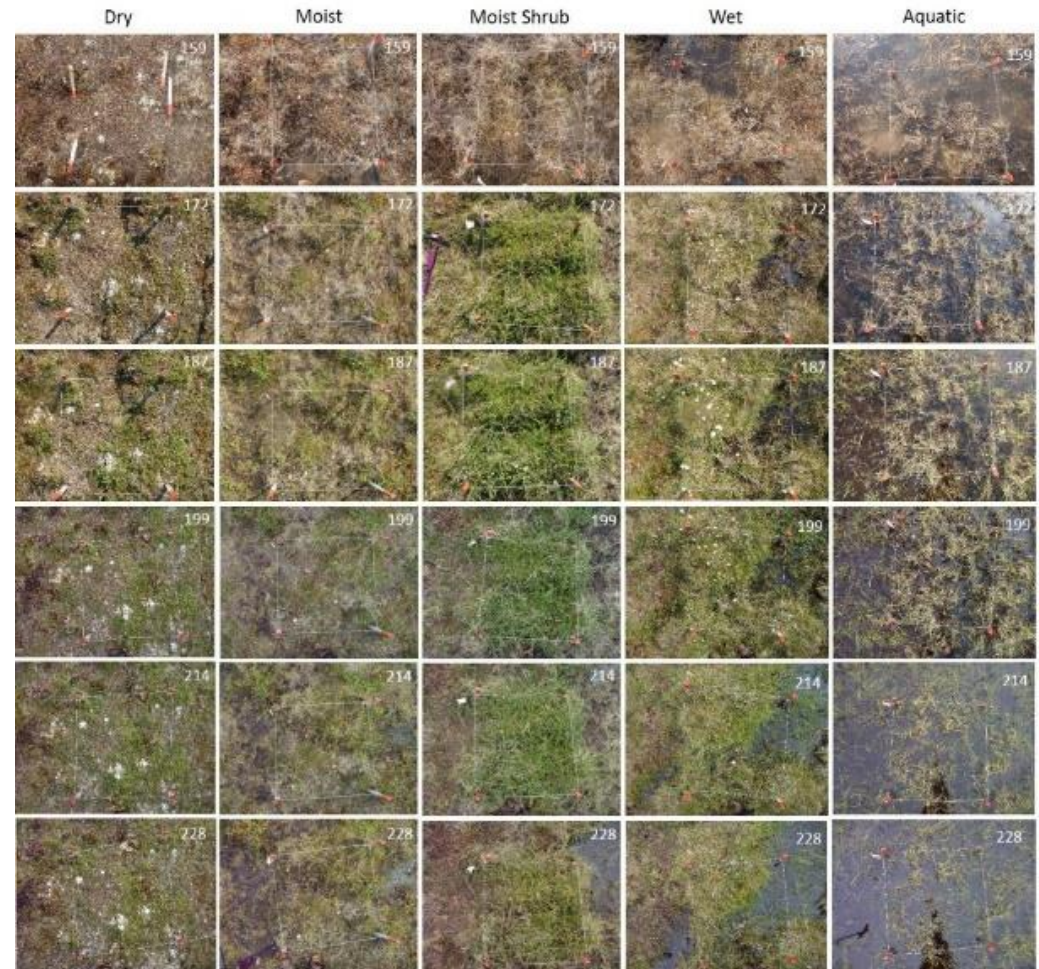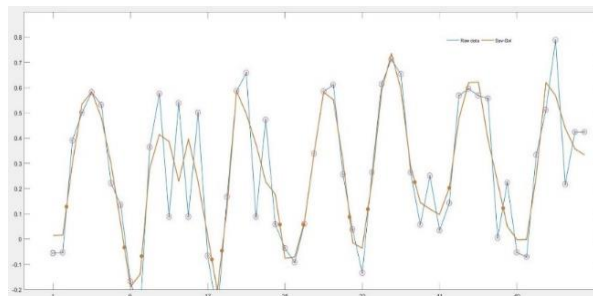
Sampling Design

1. Camera Setup and maintenance

2. Image analysis


4. Correlations with other indices and variables

$R^2 = 0.6628$
$p = 2.2e-16$

3. Time series analysis

Scalability and Preliminary Results

Proposed Approach and Topics for Synthesis

- Hope to synthesize 200+ site years of data
  - Circumarctic, multiple land cover types and international involvement

- Aiming to centralize image analysis and include analysis spanning multiple color spaces (e.g. RGB, HSV, L*A*B*) and indices

- ROIs (Regions Of Interest) chosen in cooperation with site managers to ensure improved potential for synthesis whilst optimizing benefits for site-level science

- Aim for 3+ years data per site, work with sites to determine ROIs, include site-level questions of interest where possible
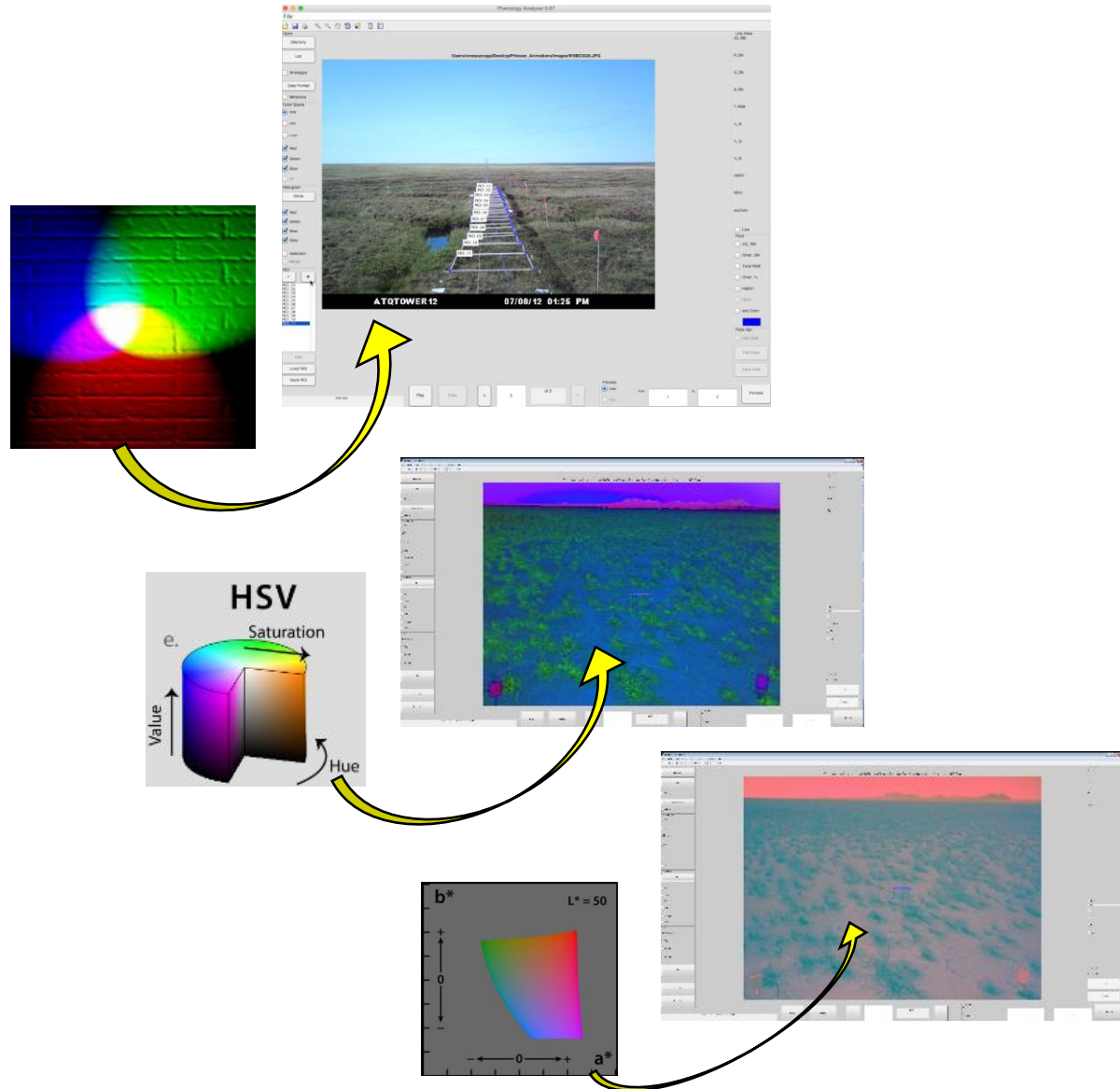
Potential Questions to be Addressed

- What are landscape level trends across different sites/ low-high arctic?

- How has greenness and other optical properties changed over time?

- What are implications of trends and variability (c-flux, biomass, faunal habitat etc)?

- Are phenological differences between plant community types and interannual variability consistent across sites and over time?

- Do phenocam trends align with those from space based platforms across sites?

- What are the biophysical controls of phenology?

- What other environmental phenomenon can be detected with phenocams – fog, cloud, mosquitos, snow on/off dates, lake ice, surface water inundation, wildlife?

- What addition does alternate color space bring to phenocam analyses?

- Are observations consistent across sites?

- How is phenology related to landscape geomorphic types?
  - What are the patters across continuous/discontinuous permafrost?

- What are best practices for the establishment, maintenance, and analysis of phenocam imagery in tundra environments;

- Other ideas?? Open discussion…

Call for Participation and Partnership

- Current comparable efforts underway or planned we should know about?

- What sites have phenocam imagery and associated data that should be involved?

- Where could we add cameras over the next 3 years to ensure improved representation of different ecosystem types?

- We hope to automate the delivery of site-relevant products (e.g. time lapse movies, site-specific analysis etc)
  - What other products might benefit site-level science and the involvement in this synthesis?

- Time series data (perhaps not imagery) will be archived as a publicly available data suite

- Please email Sergio Vargas (savargas@utep.edu) if you wish to be added to our synthesis email list

Proposed Time line

- Fall 2019- site choice and inclusion
- Spring 2020- gap analysis
- Summer 2021- deployment of camera systems to help gap fill site representation
- 2021-22- image acquisition, ROI determination, pilot ROI extractions and analysis, synthesis workflow development, preliminary synthetic analysis, integration of ancillary data, site-level analysis and manuscript submission
- 2023- synthesis workshop, publication of the dataset, synthesis manuscript preparation and submission

Next steps...

- Plan to announce synthesis soon (look for email on listserv)
- Please share your thoughts, concerns, hesitations, ideas
- Points of contact:

  - Sergio Vargas- savargas@utep.edu
  - Craig Tweedie- ctweedie@utep.edu
  - Bob Hollister- hollistr@gvsu.edu

Questions