

Montana In-Lieu Fee Wetland & Stream Mitigation Program

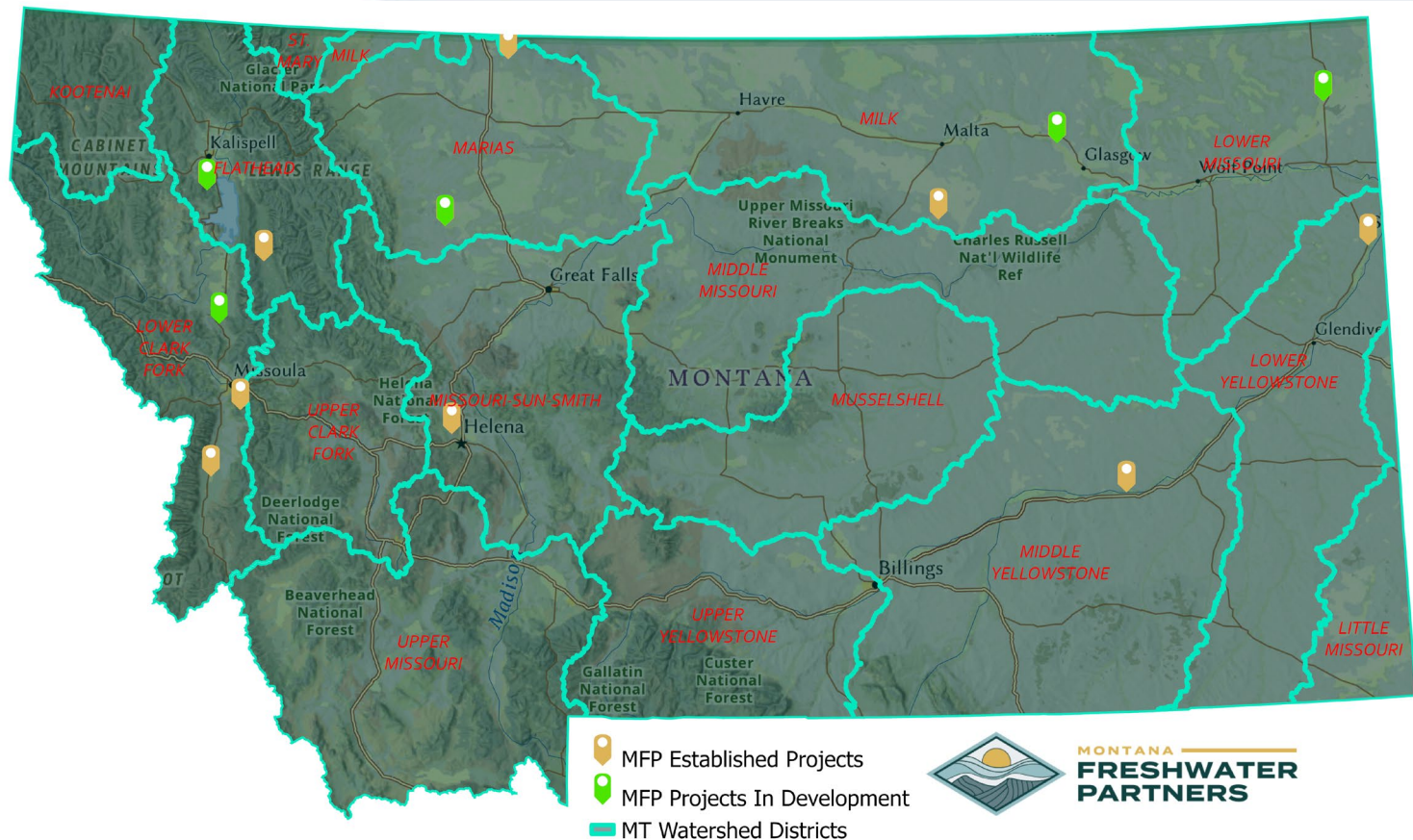
Remote Sensing Tools
For Monitoring & Long-Term Performance



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Statewide Impact: In Lieu Fee Program

Regulatory wetland and stream mitigation program through US Army Corps of Engineers





REMOTE SENSING TOOLS FOR MONITORING:

- **Aerial Imagery**
 - Historic imagery (USGS Earth Explorer)
 - NAIP and Commercial Satellite Imagery
 - Use of false color filters for vegetation and hydrology
 - Drone imagery
- **LiDAR Data**
 - Conceptual Designs
 - Streamline wetland delineation mapping
 - Streamline topographic surveys
- **Climate Data**
 - USDA Palmer Drought Index data
 - EPA Antecedent Precipitation Tool

Example # 1–Using imagery to track temporal & spatial variability at remote saline wetland site:

- Commercially available aerial imagery is used to track early season vs. late season and year-to-year changes over time
 - Construction progress & site conditions
 - Vegetation cover change
 - Vegetation/wetland community conversion
 - Surface water inundation extent

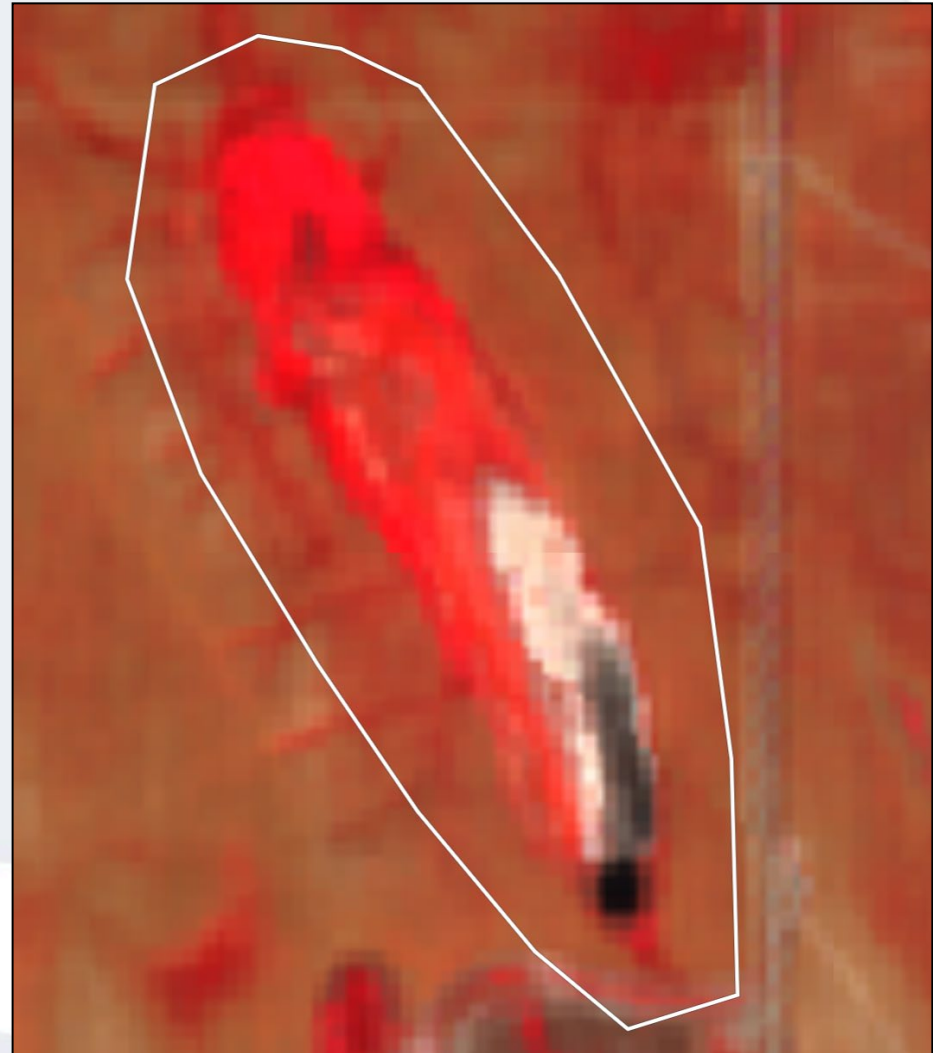
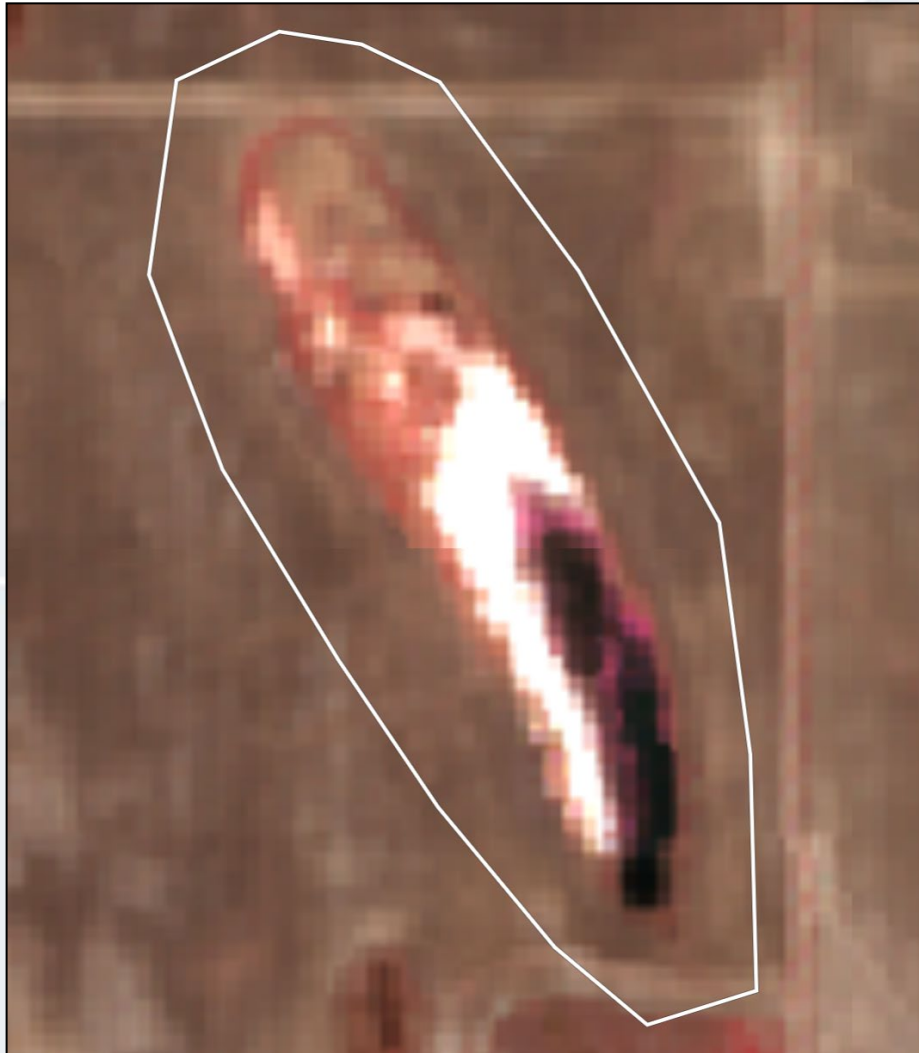


Example # 1–May vs. June vs. August Vegetation Cover



Photo 15 (above), May 2020 forb spp. 5% cover. Photo 16 (top, right), June 2020, forb spp ~60% cover. Photo 17 (bottom right) August 2020, forb spp 95% cover.

Example # 1–May 2020 vs. August 2020 Vegetation Cover using commercially available imagery with a near-infrared filter



Example #2 – Using imagery, LiDAR, drought indices, and antecedent precip data to evaluate dynamic wetland sites during extended periods of drought:

- Prairie pothole wetland site experienced drought for 4 out of 5 monitoring years.



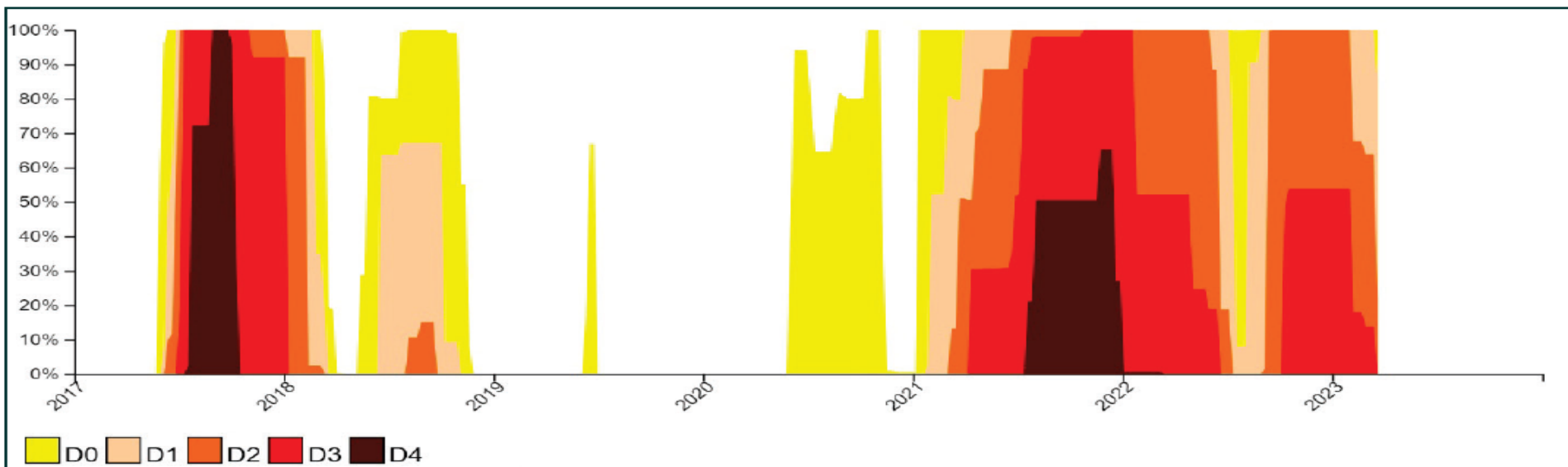
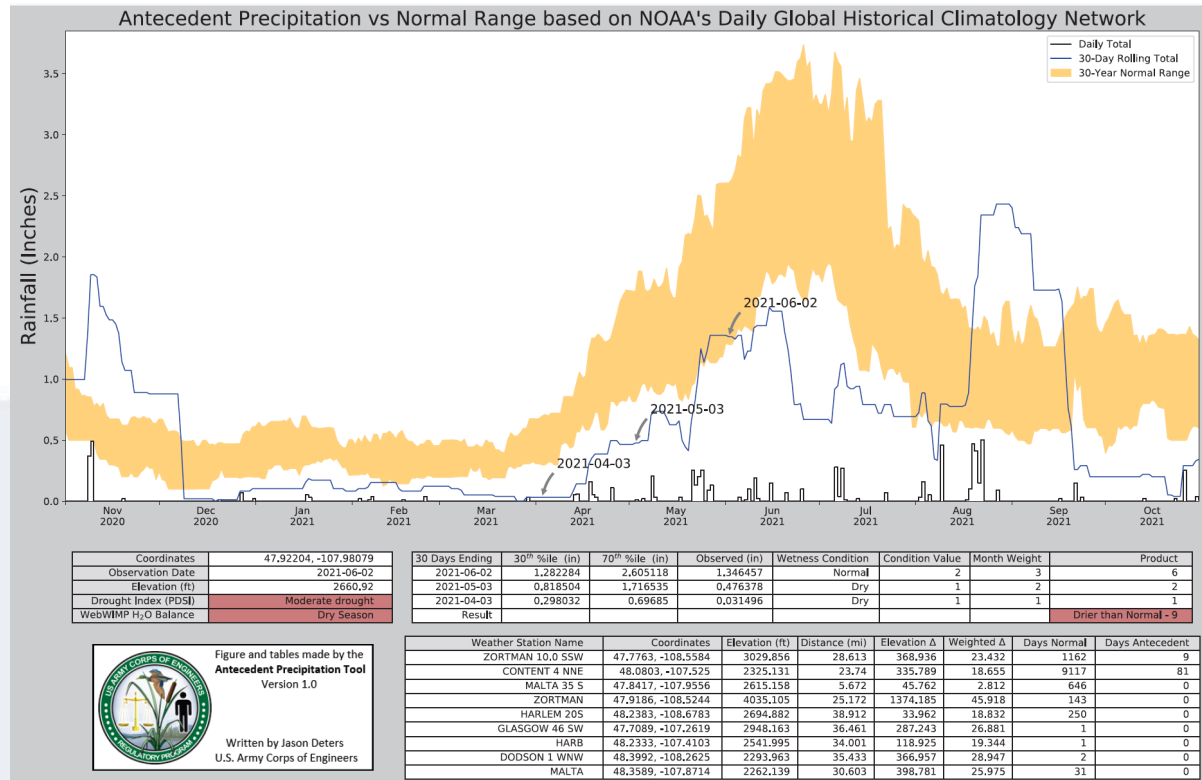
Example #2 – what is ‘normal’ during extreme events

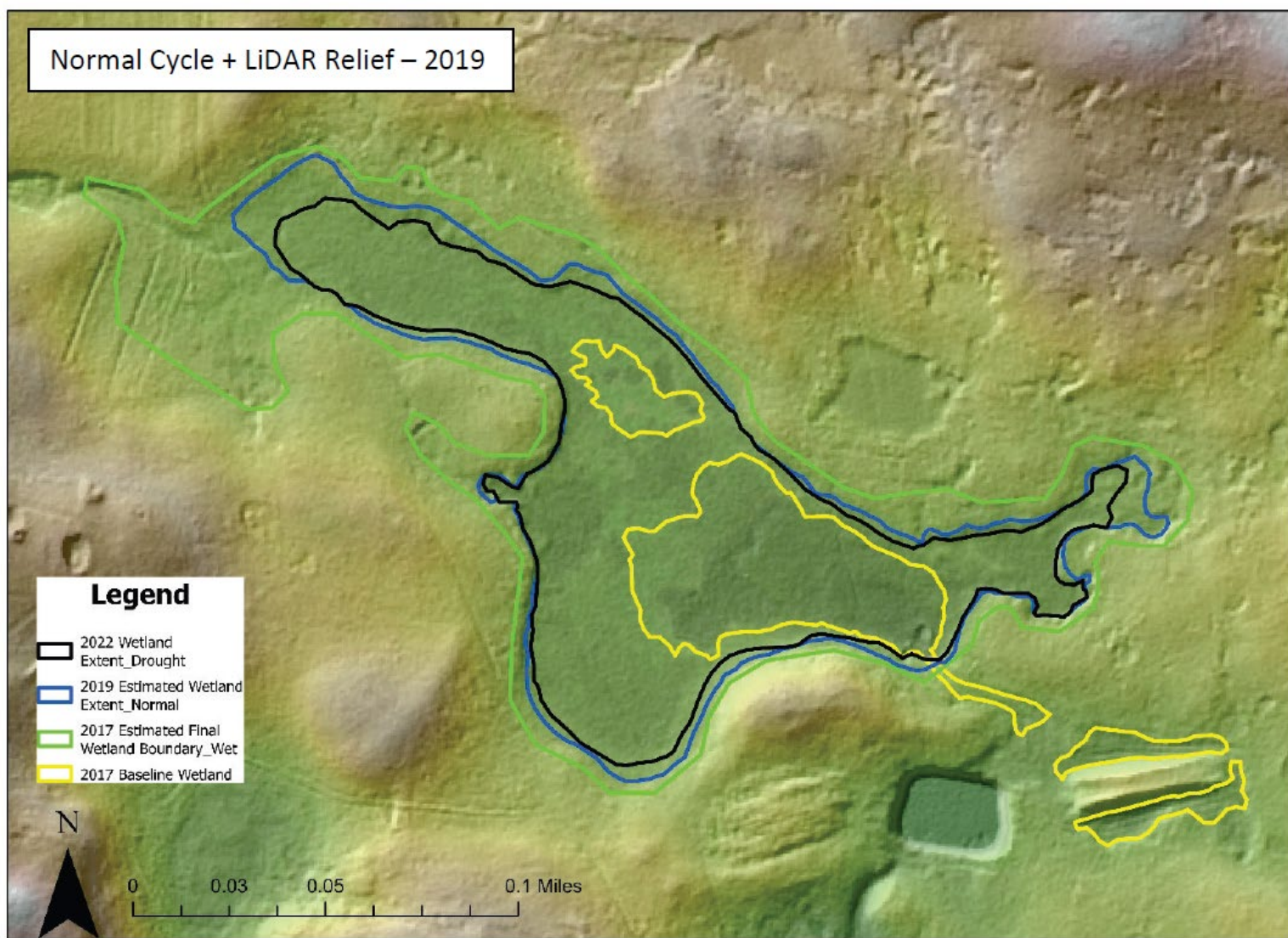
- Final credit determination based on Year 5 wetland extent – however Year 5 (2022) was an extreme drought year.



June 2022 (right) extreme drought vs. June 2023 (left) normal conditions

Example #2:
 Drought index data confirms level of drought for each monitoring year. Antecedent precip data correlates drought index with onsite observations.





Green boundary = estimated Year 5 wetland extent in site plan

Blue boundary = estimated 'normal' year wetland extent based on 2019 data and LiDAR data

Black boundary = Year 5 wetland extent in Year 5 (2022) during extreme drought conditions.

Key Resources:

- USGS EarthExplorer:
<https://earthexplorer.usgs.gov/>
- Upstream Lens Program: www.upstream.com
- Antecedent Precipitation Tool:
<https://www.epa.gov/wotus/antecedent-precipitation-tool-apt>
- USDA Drought Monitoring Data:
<https://droughtmonitor.unl.edu/>



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thank you.



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