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Background



Forest disturbance

- Abrupt change (Trimming, Fire, Wind)
- Subtle change or Stress (Drought, Diseases, Insects)
- Disturbances can cause canopy loss and impact forest structure and health condition.
- Unhealthy trees are major risks to the electric infrastructure.
 - Preventive tree trimming
 - Improve the outage prediction model



Tropical Storm Isaias leaves behind downed trees at Union Street, Manchester. Photo by <u>Bryan Futoma</u>.



Hynes Avenue, New London. Photo credit: Sean D. Elliot/The Day.









- Task1 Near real-time monitoring of roadside and right-of-way (ROW) forest disturbances.
- Task2 Near real-time characterization of forest disturbance type.
- Task3 Evaluate risks of disturbed forests on powerlines.









Landsat-8



Credit: USGS

Sentinel-2



Credit: Airbus DS

Harmonized Landsat Sentinel-2 (HLS) Data

- All available Landsat-8 and Sentinel-2A&B imagery
- Spectral bands: RGB, NIR, SWIR1&2
- Spatial resolution: 30 m

UCONN

• Temporal resolution: ~3days



Method



COntinuous Monitoring of Land Disturbance (COLD) Algorithm (Zhu et al., 2020)

$$\widehat{\rho}_{i,x} = a_{0,i} + \sum_{k=1}^{3} \left\{ a_{k,i} \cos\left(\frac{2\pi}{T}x\right) + b_{k,i} \sin\left(\frac{2\pi}{T}x\right) \right\} + c_{1,i}x$$



ROW Density Map (Aggregate proximity pixel raster to 30 m grids)



utilities. Electric Power Systems Research, 146, 236-2

HLS Land Disturbance Map (30 m)



ROW Forest Disturbance Map (30 m)





Example A. Tree Removal (Storrs 2019)











Example B. Gypsy Moth (Litchfield 2021)















- 1. 30 m Harmonized Landsat and Sentinel-2 (HLS) data can produce useful roadside and ROW forest disturbance maps in near real-time.
- 2. Time series characteristics provide potential to distinguish different disturbance agents. Ongoing work uses detected disturbance results (time, magnitude, change vector) to characterize disturbance agents.
- Some defoliation patches are still missing. To develop a comprehensive forest disturbance database, enhanced HLS data (10 m) is needed.



