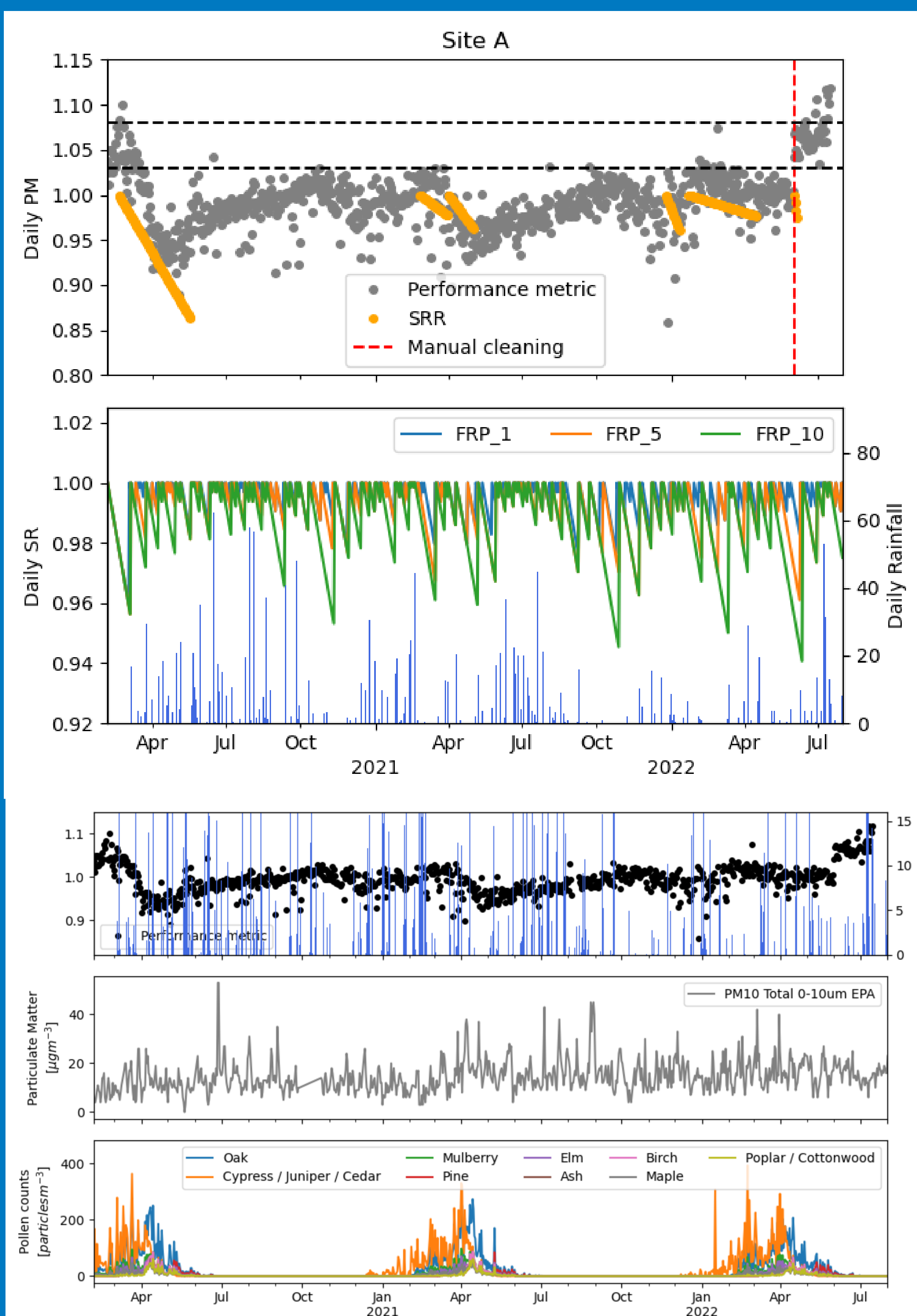


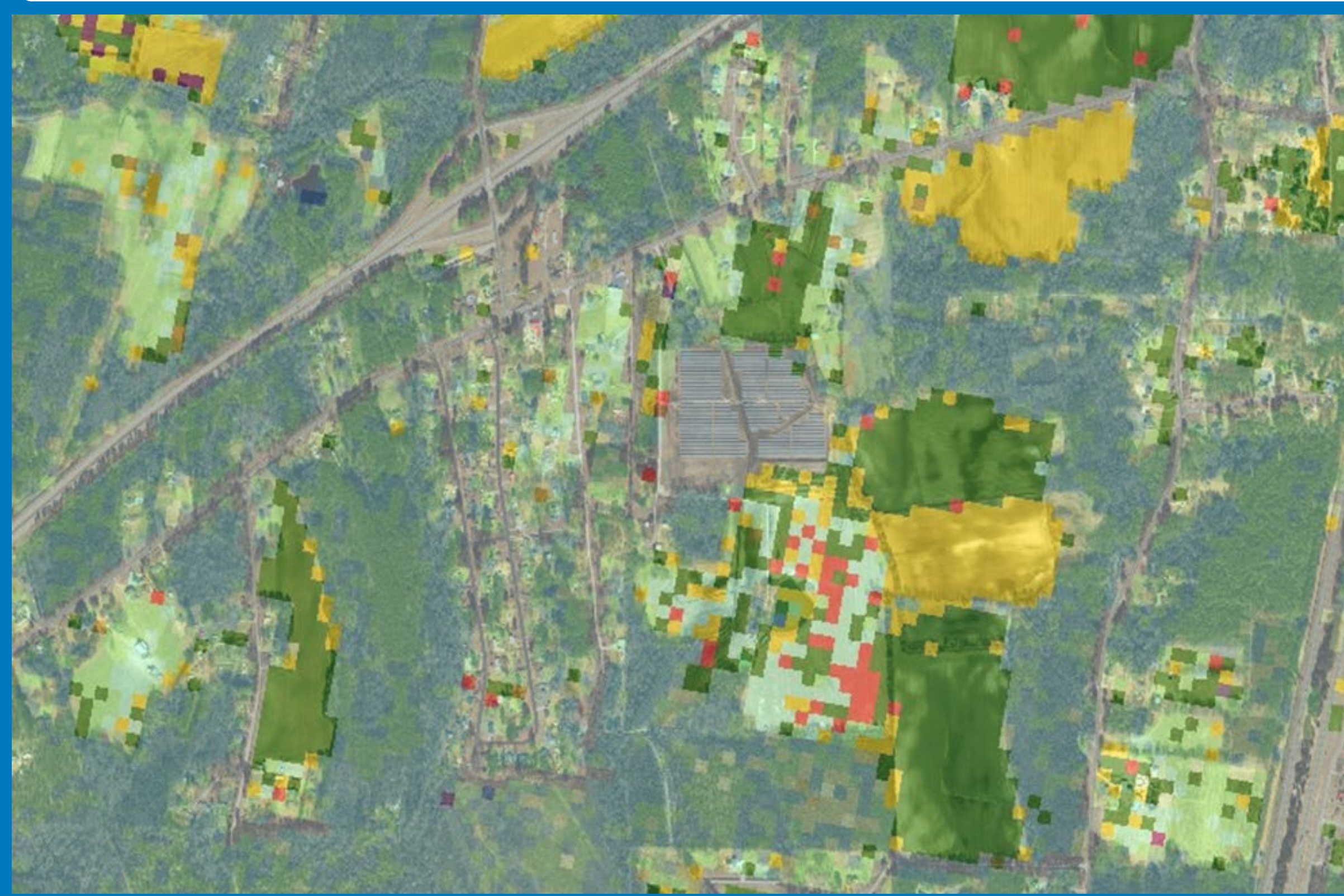
**PROBLEM:** Typical PV soiling models presume that soiling follows a sawtooth pattern: linear soiling during dry periods followed by abrupt recovery or cleaning during rainfall events. Due to frequency of rainfall in the eastern U.S. sawtooth soiling models report near zero soiling losses in this region. Alternatively, through work with system owner/operators per PV Fleet Performance Data Initiative it has become clear that there are systems in the Southeast that have soiled as high as 10% which are not recovering with regular rainfall.

**HYPOTHESIS:** Rain persistent adhesion is due to sticky pollen, mechanisms resulting from pollen break down and/or interaction with other contaminants, or inherent attachment mechanisms existing with of mold or algae .

**MECHANICAL CLEANING AT SEVERAL SITES IN THE S.E. DEMONSTRATES PERFORMANCE IMPROVEMENT FROM 5-12%, LEADING TO AN ONGOING POLLEN SOILING INVESTIGATION**



**EXAMINATION OF LAND USE DATA**  
National Agricultural Statistic Service <https://croplandcros.scinet.usda.gov>



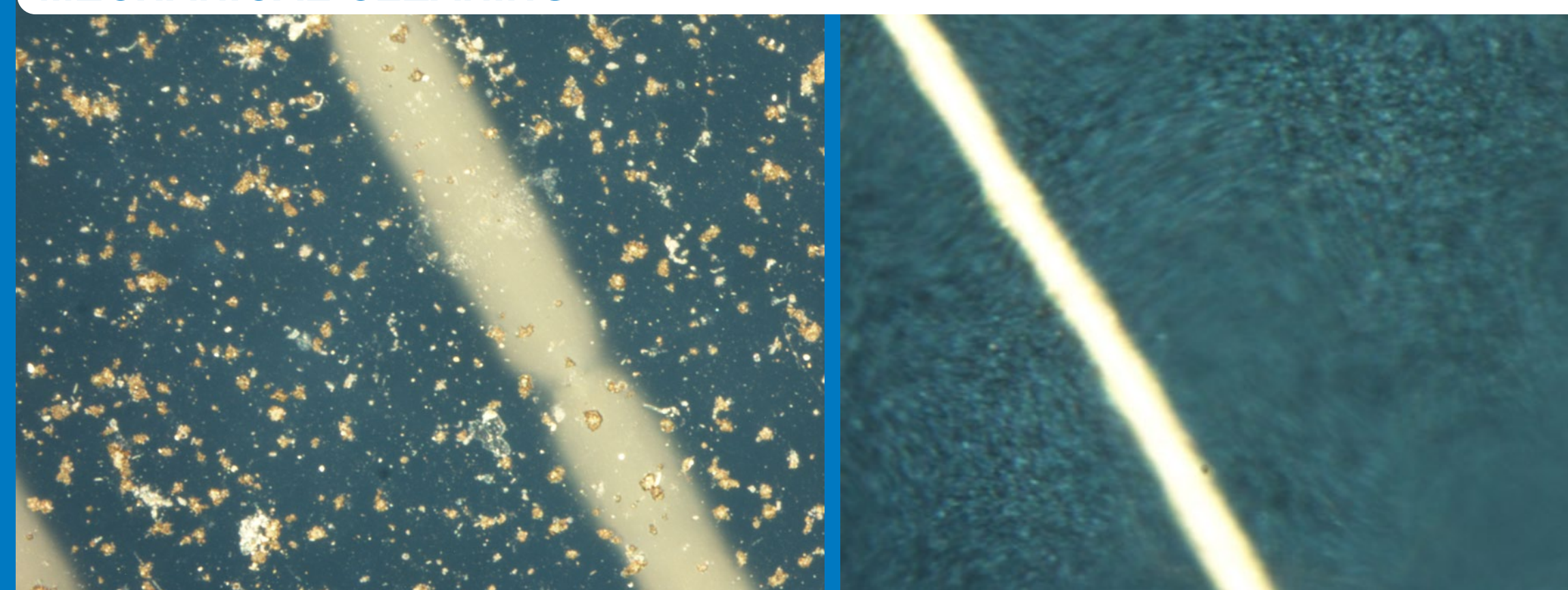
**SYSTEMS REQUIRE MECHANICAL CLEANING FOR RESTORING PERFORMANCE DUE TO ADHESION OF MOLD (FILAMENTOUS FUNGI)**



**MODULES SENT TO NREL FOR ANALYSIS FROM ALABAMA DUE TO SOILING PERSISTENT TO RAINFALL CLEANING, I-V CURVES WERE 13-14% BELOW NAMEPLATE**



RUBBING WITH DI WATER AND SOFT CLOTH RESTORES CLEAN SURFACE WHILE PRESSURIZED GARDEN HOSE DID NOT. MOLD IN EARLY STAGES DON'T HAVE SIGNIFICANT FILAMENTOUS FUNGI. PAST WORK AT NREL SHOWED FILAMENTOUS FUNGI WERE TENACIOUS TO MECHANICAL CLEANING



**RESULTS AND ONGOING WORK**

- Soiling in the Southeastern U.S. can be persistent to rainfall.
- Systems can reside at a sustained 5-12% soiling loss if mechanical cleaning is not initiated.
- One fleet owner in this region has concluded that it is necessary and economical to clean at least 1 time per year
- At one site mold has been demonstrated to be the cause of the rainfall resistant soiling.
- Pollen is a potential cause of rainfall resistant soiling at other sites but further data is needed to prove pollen is the component that is rainfall resistant
- NREL, Solar Unsoiled, PV fleet partners and the University of Jaen are collaborating to gather more data on pollen soiling and to understand why some sites appear to have rainfall persistent soiling while others appear to be performing with near zero soiling.

**EFFORTS UNDER WAY FOR A SPRING MEASUREMENT CAMPAIGN WHERE MICROSCOPIC IMAGES ARE CAPTURED SIDE-BY-SIDE WITH SOILING LOSS MEASUREMENTS**

