June 30, 2022

Garden Club of Virginia

Final Project Report

Jordan Martin

As the solar energy industry grows, many hundreds of thousands of acres of land will be transformed into solar panel facilities. With this large change in land use, there is the opportunity to promote biodiversity and support pollinators by using pollinator-friendly management practices at the solar facilities. This project explored the ecological and economic effects of a pollinator-friendly solar facility compared to a turfgrass solar facility.

I hypothesized that a pollinator-friendly solar facility would be functionally equivalent in pollinator support and overall insect diversity to a pollinator-friendly non-solar field and that both sites would have far greater pollinator support and insect diversity than a turfgrass solar field. To test this hypothesis, vegetation and insect sampling were conducted and the resulting data were analyzed for differences in vegetative and insect diversity and pollinator abundance at a pollinator-friendly solar facility, a turfgrass solar facility, and a reference non-solar pollinator-friendly field. The diversity analysis revealed that the pollinator-friendly solar site was overall functionally equivalent to the non-solar pollinator-friendly site and the turfgrass solar site had low insect and vegetative diversity, but high insect abundance.

Photovoltaic solar panel energy production is negatively affected by high temperatures. Therefore, to maximize energy production and promote biodiversity native forbs may be incorporated into a solar facility landscape to cool the solar panels by the cooling effect of transpiration and produce more energy than a traditional turfgrass

landscaped solar facility throughout the growing season. This study tested that hypothesis by analyzing environmental and vegetation data from two solar facilities, one with a turfgrass landscape and one with a pollinator-friendly forb-dominated landscape. Irradiance, ambient temperature, panel temperature, and percent forb ground cover were recorded for a section of solar panels at each site throughout the 2021 growing season. This data was used to create generalized linear models (GLMs) for predicting panel temperature and humidity based on irradiance, ambient temperature, site, and the interactions between each of them. The predictions made by the panel temperature predicting model supported the hypothesis that the pollinator-friendly landscape had a greater cooling effect than the turfgrass landscape under high and medium irradiance conditions. But this cooling effect was not seen under low irradiance conditions. This suggests that the negative effect of high temperatures on energy output is only significant under high and medium irradiance conditions. Overall, this study supports the idea that pollinator-friendly landscapes could be more economically viable, as pertaining to energy output, and more ecologically beneficial compared to turfgrass. More research is necessary to further investigate and test the patterns seen at only these two solar sites, but these results are encouraging for the future widespread implementation of pollinator-friendly management practices in solar facilities across the Mid-Atlantic.

This project also included an educational outreach portion at Cople Elementary School. I worked with Sun Tribe Solar to create their pollination and insect diversity curriculum. This curriculum will be taught at all of their future pollinator-friendly solar sites in school systems. I spent two days at Cople Elementary School teaching the 4th graders about pollination and insect diversity. The students learned about the mechanism

of pollination and how having a variety of native flowering plants supports pollinators, which in turn supports our food supply as well as the natural ecosystem. The students also interacted with actual insect specimens that I collected earlier in the year from the Cople solar site and identified the different body parts of the creatures. The lesson plans and worksheets from these activities were also shared with Cople Elementary so that this learning experience exploring their school's pollinator-friendly solar facility can continue for years to come.