October 24, 2024

SUCCESS!! NTEP® and Univ. of Minnesota awarded federal grant!

NTEP® and the University of Minnesota have been awarded a $297,000, two-year grant from the USDA, National Institute for Food and Agriculture (NIFA) to improve the analysis and reporting of NTEP® data. This allows us to build and improve upon the recently developed NTEP® database & Turfgrass Trial Explorer search engine https://maps.umn.edu/ntep/#thetitle.

More information on the grant and its purposes:

Introduction The turfgrass industry is one of the fastest-growing segments of U.S. agriculture. While turfgrasses are commonly appreciated for their aesthetic and recreational value, they also deliver notable environmental benefits, e.g., soil erosion prevention, heat island mitigation, carbon sequestration, pollutant absorption, and noise reduction. Collaborating with 100+ public and private turfgrass breeders and companies worldwide, the National Turfgrass Evaluation Program (NTEP®) conducts cultivar evaluations in 50+ sites across North America (Fig.1), providing timely, publicly accessible research at www.ntep.org. Since 1981, NTEP® has curated an extensive data repository of more than 75 traits for 20 turfgrass species (Morris and Shearman, 2000), making it a globally recognized industry standard of turfgrass information. NTEP® data comprises mainly visual ratings. Although plant phenotyping technologies have made substantial strides, the complete replacement of visual ratings remains formidable. Many traits of interest encompass intricate characteristics that automated methods often struggle to quantify precisely. Additionally, the

discernment of consumer preferences and market demands continues to necessitate human judgment. While valuable, visual rating does have its limitations. Raters may interpret traits differently, leading to inconsistencies in rating, especially when there is no process to address rater bias. With the growing availability of molecular and genomic data, integrating visual ratings with these datasets offers additional challenges. Addressing these challenges is becoming increasingly vital for turfgrass research. As Dr. Leah Brilman noted in her support letter, “We need new ways to analyze and report our data for both the seed, sod, golf, sports and landscape industries and for the average homeowner. With easily understood data the benefits of new genetics can be utilized. This will make our goals of utilizing improved turfgrasses for their environmental benefits but with less hidden carbon costs easier”.

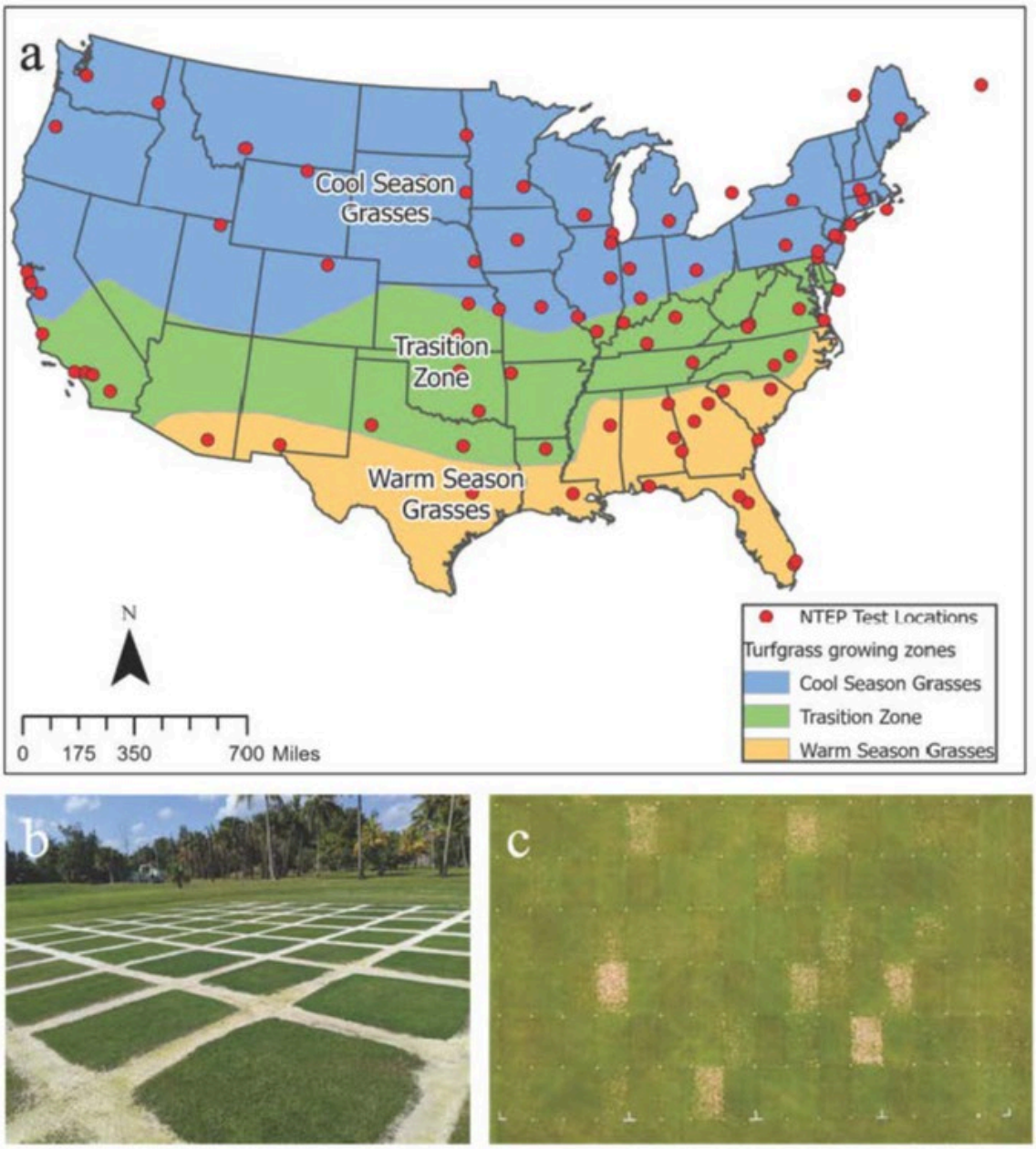

Figure 1. NTEP® led trial locations (a) for warm-season (b) and cool-season (c) turfgrass species across the northern, southern, and transition regions of the US.

Goal and Objectives The project's overall goal is to develop novel and advanced machine-learning models to improve the reliability and consistency of the visual assessment process. Specific project objectives are:

1. Develop novel machine learning models for visual cultivar ratings;
2. Validate the model framework and visualize model outputs;
3. Evaluate the developed model on both warm- and cool-season turfgrasses;
4. Enhance computational efficiency for cheaper, faster execution and improved scalability.

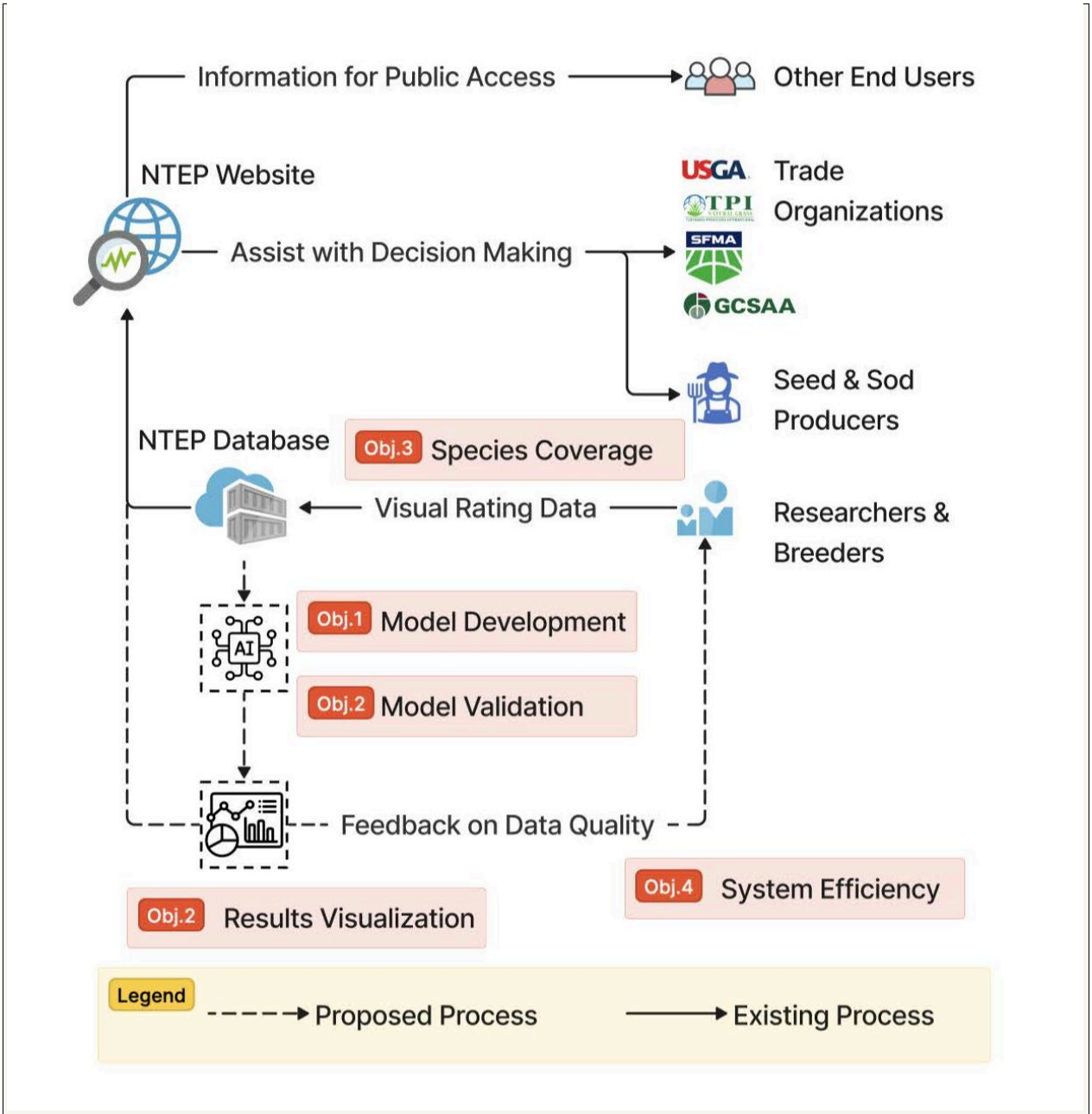

Figure 2. Existing and proposed trial evaluation process and data flows at NTEP®

Expected Outcomes and Communication Plan The expected result of this project is the development of a proof-of-concept cultivar evaluation system leveraging artificial intelligence to guarantee the testing process's fairness, reliability, and validity. By addressing rater bias and eliminating spatial confounders within trials, the system will facilitate the comparison of cultivars evaluated by different researchers across

various spatial and temporal contexts. Additionally, the outcome of this project will enhance the functionality of the existing NTEP® database, offering more comprehensive features and improved analytical accuracy. Ultimately, the project will deliver timely feedback to data-collecting researchers, thereby enhancing data quality. The NTEP® governing board consists of a diverse group of stakeholders, including university educators, the United States Golf Association, the Golf Course Superintendents Association of America, the Sports Field Managers Association, American Seed Trade Association, Turfgrass Producers International (sod producers) and the Turfgrass Breeders Association. NTEP® has been and will continue to inform and consult with its governing board members semi-annually on this project. Organizations such as EPA WaterSense™, the Alliance for Water Efficiency, and Safe Healthy Playing Fields, Inc. will also be informed and consulted on this effort, as each is interested in accurate turfgrass evaluations. Journal articles, presentations, and conference papers will be prepared and delivered during conferences, NTEP® social media, and NTEP® website.

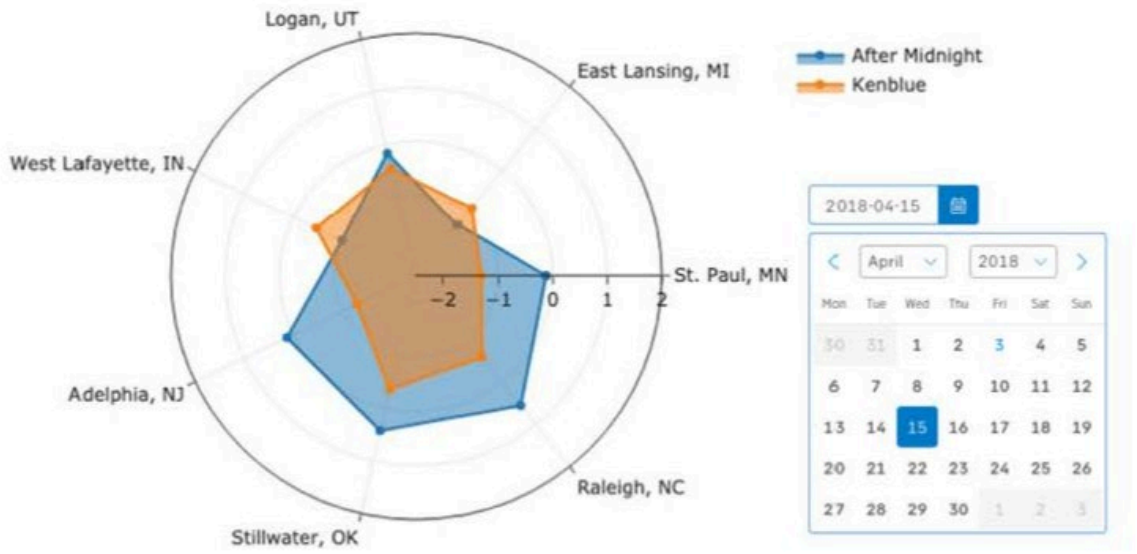

Figure 3. Radar plot, a potential new graphical approach to display data, uses 'optimized' NTEP® Kentucky bluegrass data to compare performance of 'Kenblue' (tan) and 'After Midnight' (blue) cultivars at

seven locations. In the graphic, colors that expand to the '1' (positive) or beyond circles demonstrate better performance, and '-1' (negative) circles are poorer performers.