Can Wet Areas Mapping (WAM) be Used to Predict Invasive Species in Dry Mixed Grass Prairie?

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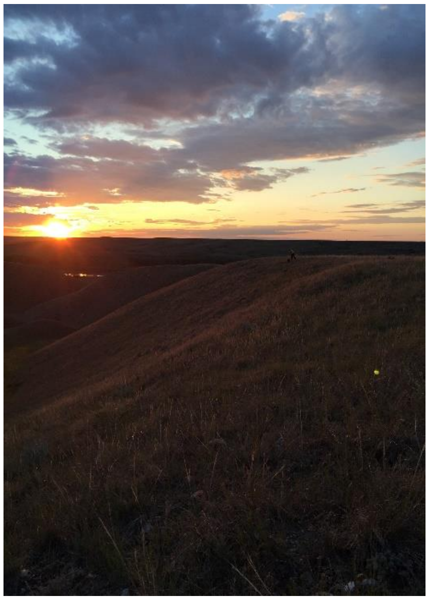
Invasive species have been identified as one of the most serious threats to ecosystem health and to the conservation of biodiversity and endangered species. As such, the presence and abundance of invasive species is often used as an indicator of ecosystem health and of critical habitat, as defined under Endangered Species legislation. The rate of invasion of non-native species into ecosystems, however, often exceeds our ability to document their presence and, thus, protect vulnerable ecosystems. With less than 50% of Alberta's native grasslands remaining intact, their persistence, along with that of the high proportion of endangered species they contain, is of particular concern. For this reason, there is an urgent need to develop efficient and cost-effective tools to help identify areas where invasive species are likely to occur.


Mattheis Research Ranch. Photo by Lori Schroeder.

The Wet Areas Mapping (WAM) tool uses remotely sensed Airborne Laser Scanning data [or Light Detection and Ranging (LiDAR) data] to characterize fine-scale topography. It then calculates an index of relative site wetness at 1m spatial resolution, which is an approximation of depth-to-water (DTW) at or below the surface (Fig. 3). We are exploring whether WAM can be used to predict patterns of invasion of non-native vascular plant species in grassland ecosystems of Alberta.

To test WAM's ability to predict the abundance and richness (number of species) of invasive plants, 18 transects (Fig. 3; average length = 873m) were established on the Mattheis Research Ranch in the Dry Mixedgrass prairie of south-eastern Alberta in summer 2015. In 2016 an additional nine transects were established in the nearby Dinosaur Provincial Park. Transects were designed to: i) be distributed as widely as possible across all uncultivated areas of the Ranch; ii) cover the greatest variation in depth-to-water values; iii) cover the greatest variety of ecosites; iv) cover a range of distances from known disturbance sources (pipelines, roads, etc.); and v) represent a range of variation in grazing histories. In total, 467 plots were established (at ~35m intervals) along these transects; within these, we collected information on the plant community, including invasive species.

We found that invasive species richness and abundance were both positively related to site wetness (decreasing depth-to-water) and inversely related to distance from disturbance. The strongest explanatory model for both invasive abundance and richness included depth-to-water (WAM) along with proximity to oil and gas well sites; both predictors had a significant effect. The results also showed that grazing was an important predictor of invasive species, with the highest levels of grazing being associated with a higher abundance and richness of invasive species.

Fidget assists Lori with plant community and species assessments along a transect. Photo by Lori Schroeder.

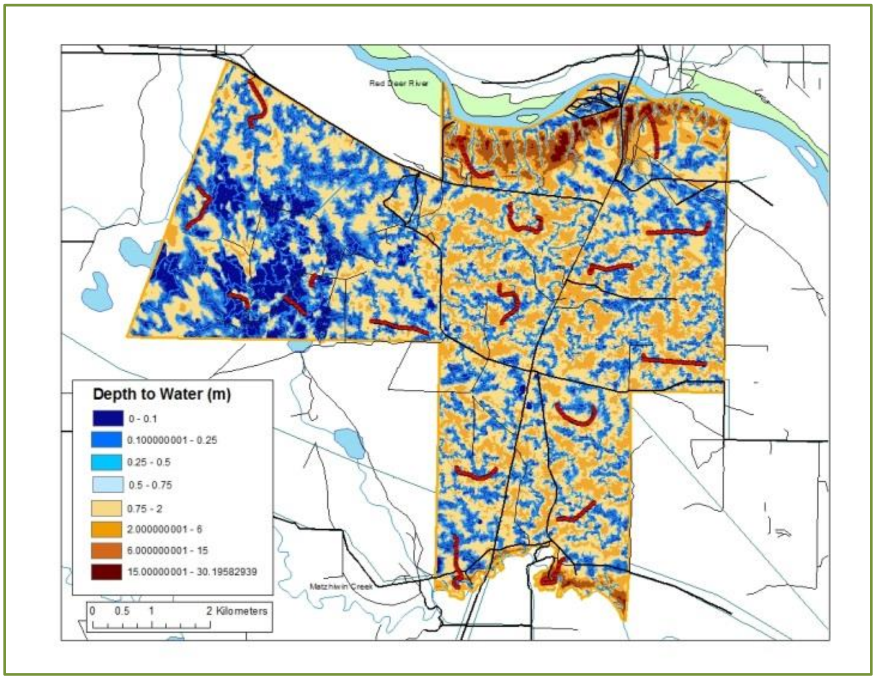


Figure 3. Map of the Mattheis Research Ranch showing depth-to-water and the transects (red lines) sampled for plant community and invasive species occurrence.

At a species level, Kentucky bluegrass (*Poa pratensis*), the most common invasive species in our study and a dominant species in 20% of our plots, was positively related to site wetness. On the other hand, for the noxious weed perennial sow thistle (*Sonchus arvensis*), grazing was a more important predictor, while the abundance of Canada thistle (*Cirsium arvense*) was most consistently related to the close proximity to well sites. Preliminary results indicate that plant communities also reflect the moisture gradient predicted by WAM. However, the dominance of invasive species in some communities in our study area complicates the interpretation of local community data as a predictor of the presence of invasives.

From a management perspective, our results suggest that WAM has the potential to become a useful and relatively cost-effective tool to predict hotspots of invasive species occurrence at a landscape scale, but promises to be more effective for some species than others.

The authors gratefully acknowledge Jae Ogilvie, University of New Brunswick and Barry White, Alberta Agriculture & Forestry, for providing the WAM outputs used in this project. Funding was provided by the Rangeland Research Institute, Alberta Parks, and the Alberta Conservation Association.