REGIONAL CROPPING AND LANDSCAPE ANALYSIS APPLIED TO COTTON PEST MANAGEMENT: *RISK ASSESSMENT OF A SUCKING BUG*

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Abstract

The sucking bug verde plant bug (Hemiptera: Miridae) feeds on and damages cotton bolls in the coastal cotton growing area of South Texas. This plant bug is a major boll-feeding sucking bug, often occurring during mid-bloom when cotton bolls are vulnerable to injury. In a two year survey, verde plant bug was highly variable in abundance across 15 cotton fields, as was the damage to cotton. Where should pest managers look for this pest in this very large production area? Mapping and landscape analysis tools are available to address the question. A spatially referenced crop data layer of South Texas, available from USDA, National Agricultural Statistics Service, was input into a Geographic Information System (ESRI, ArcMap10). Landscape metrics in the area of our 15 cotton fields were calculated from the Crop Data Layer, and selected metrics were regressed on verde pant bug densities from these fields. A positive linear relationship between increasing pest density and increasing agricultural diversity was detected. These results can help direct verde plant bug monitoring on high risk fields: cotton fields located where many crops are grown near the coast and major rivers.

Introduction

In conjunction with consultants and growers in South Texas, we have been collecting cotton insect pest data for the past several years with a focus on boll-feeding sucking bugs. For the last 15 years cotton fields have suffered losses from boll-feeding sucking bugs in the southern U.S. In South Texas, relationships between pest abundance, boll damage, and yield decline have been found for several species, including the verde plant bug, *Creontiades signatus* (Hemiptera: Miridae). Its pest potential has been verified in cage studies, including its ability to introduce bacteria causing cotton boll rot. Results from a two year insect survey along the Texas Coastal Bend to the Rio Grande Valley found 99% of the boll-feeding sucking bugs to be this species. It was highly variable in abundance across 15 cotton fields, as was the damage to cotton. Which begs the question, "Where do pest managers look for this pest?"

New mapping and spatial data analysis technologies combined with pest abundance surveys may help us answer this question. The USDA National Agricultural Statistics Service (USDA NASS) has been building digital cropping maps called crop data layers for the continental US, which are available online at www.nass.usda.gov/research/Cropland/SARSla.htm. These maps show crops being grown annually very high accuracy especially for field crops like cotton (>95%). By comparing our observed insect abundance data from field scouting with the already created USDA crop data layer, we can be more efficient in identifying pest risk areas and help steer the allocation of our management resources, like pest monitoring, regionally.

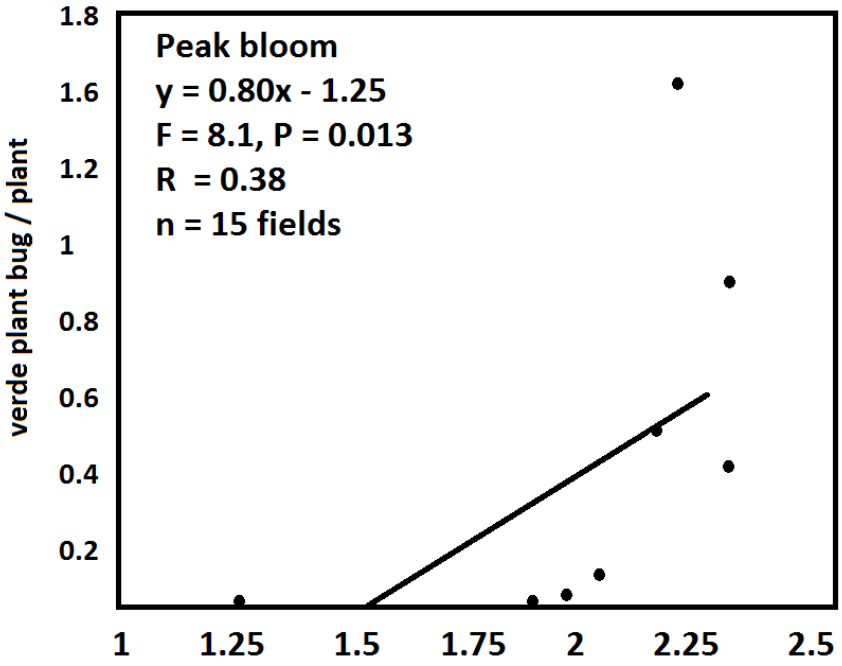
Methods

When a new pest appears geospatially variable across the landscape, like the verde plant bug, pest risk assessment mapping using a geographic information system (GIS) can help address the 'Where to look' question'. For our South Texas cotton pest, we used ArcMap 10, a GIS program, to cut segments of the crop data layer (downloadable

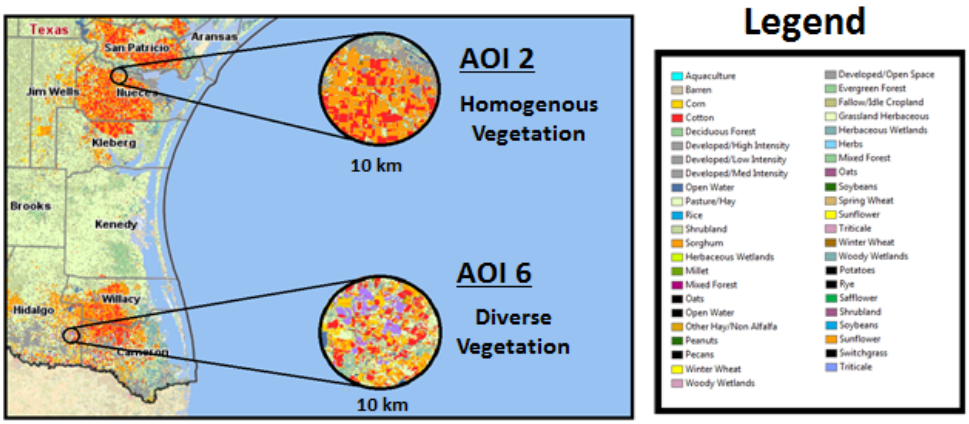
from USDA NASS) to create comprehensive raster-based maps of 6 areas of interest (AOI), each containing 2 to 3 of our 15 cotton fields where we scouted verde plant bug during mid-bloom. We were working with a wide range of insect densities, including damaging ones at > 0.5 verde plant bug per plant. We used spatial analysis tools to generate many landscape statistics of 1 sq. km sections around our 15 cotton fields and 10 sq. km sections around our 6 areas of interest. Verde plant bug densities were regressed on corresponding landscape statistics associated with the same fields.

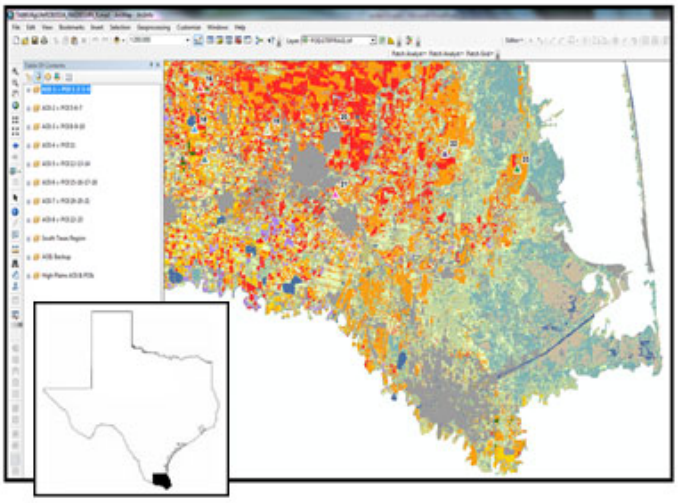
Results and Discussion

Using Shannon's Diversity Index, we looked at the relationship between crop diversity in 10 sq km sections surrounding our cotton fields to verde population density per plant (the same was found using 1 km sections). A positive linear relationship was detected, revealing that cotton in the more diverse cropping areas had higher populations of verde plant bug.



These areas were concentrated near the coast and major water bodies like the Rio Grande River by inspection of the map. Notice that area of interest (AOI) 2 has low cropping diversity, and these fields have relatively low verde plant bug densities (a low risk region). This is the case for all the cotton fields inspected for verde plant bug in this area. In contrast, cotton fields in AOI 6 had a higher crop mix and usually more verde plant bug. A second year of insect survey in 2011 and the corresponding 2011 Crop Data Layer was consistent with this pattern.





This approach allowed us to manipulate the crop data layer from USDA NASS and focus on specific cropping areas. For South Texas, cropping and landscape analysis revealed that diverse cropping areas are more prone to verde plant bug. By inspecting the map, these high pest risk areas occur more toward the coastline and major water bodies like the Rio Grande River.

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