Understanding and managing a key pest (*Lygus hesperus*) in cotton using community based maps of crop assemblages

Peter B. Goodell[1], Kris Lynn-Patterson[1], Robert J. Johnson[1],and Luis Gallegos[2]

1 University of California, Statewide IPM Program and Cooperative Extension, Kearney Agricultural Center, Parlier, CA 2 Sustainable Cotton Project, Winters CA

Background and Problem

There are many factors which influence the movement of polyphagous insects into a field. Of key importance is the relationship between plants that act as sources (those crops or places from which arthropods originate) or sinks (those crops into which they move). When managing a key pest in which the landscape assemblage is a source of infestation, it is important to:

1. Be able to identify key crops that act as sources or sinks
2. Have knowledge about the strength of a crop to attract or release pests and timing of that release relative to crop susceptibility.
3. Understand the role of distance in pest movement and the mosaic of fields providing alternative hosts between source and cotton field
4. Understand the type of management employed to source fields (population control or habitat preservation.)

A prime example of this pest/crop relationship is *Lygus hesperus*, a key pest of cotton in the San Joaquin Valley of California. A polyphagous and highly mobile insect, L. hesperus moves between fields in search of stable habitat in a landscape constantly shifting as one crop after another is prepared for harvest.

Since cotton is produced as an annual crop, all *L. hesperus* populations must migrate into a cotton field from 250 potential, but ephemeral, sources in order to build damaging populations.

Which of these hosts are the most significant source and at what distance do they influence an individual cotton field were questions addressed by recent research. Our objective in this study was to increase our capacity to predict how much of a *L. hesperus* threat surrounding crops pose to an individual cotton field within the context of a community based solution.

Field Sampling

As part of a farm demonstration program to encourage more sustainable farming practices, weekly field samples were gathered from 17 focus cotton fields in western Fresno, Merced and Madera Counties during the period from 10 June to 19 August 2011. Each sample consisted of 50 sweeps across the top third of the cotton plants using a standard 1 m sweep net. *L. hesperus* were counted in the field and reported as adults or nymphs per 50 sweeps. Four samples were taken from each field but the average of total *L. hesperus* (adults and nymphs) for the four samples will be reported.

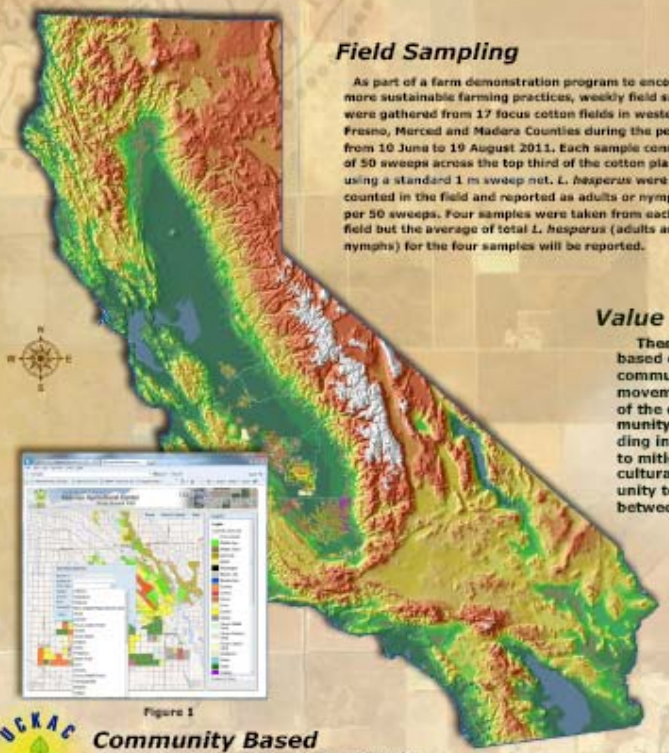

Figure 1

Value and Future Direction

These fields illustrate the complexity of predicting infestation based on surrounding crops and the commitment required of a community to confront this complexity. Key to understanding movement is the availability of mapping to inform landowners of the degree of risk which might surround them. Once a community understands the risk posed by the landscape surrounding individual fields, management preparations can be done to mitigate the movement into the susceptible field through cultural, biological or chemical control. Maps allow the community to visualize landscape and appreciate the connections between their fields and farms and those that surround them.

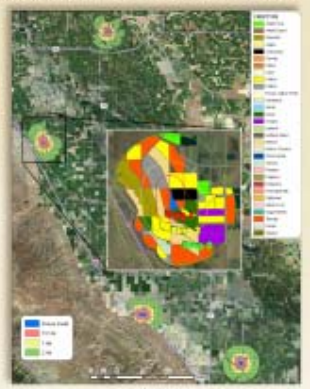

Figure 2.

Community Based GIS Mapping and Analysis

There is no public mapping of crops within the area of this study so a publicly available web based GIS service was provided for participants to create a community based landscape map. This mapping resource provided drop down menus for ease of data input (Figure 1) and was available from mobile smart devices.

Using ArcGIS 10, spatial analysis buffer tools were used to create three concentric rings; field boundary to 804m (ring 1), 804 m to 1609 m (ring 2) and 1609 to 3218 m (ring 3) (Figure 2).

Field information was extracted from fields within those buffer rings and summarized as a histogram. Only five representative cotton fields were utilized to review *L. hesperus* and crop landscape surrounding the fields.

Results

In the three rings surrounding the 17 cotton fields, there were a total 33,791 ha containing 21 different crops or settings (Figure 3.) The most common crops included cotton, tomato, winter grain, alfalfa hay, almonds, corn, melons, pomegranates and fallow land (Figure 2). *L. hesperus* population densities ranged from 4.5 to 10.7 per 50 sweeps and all fields were treated at least once for this pest.Five fields (Table 1) are highlighted that represent the range of *L. hesperus* infestation and insecticide applications. Focus cotton fields in which crop assemblages contained abundant alfalfa or cotton (B31 and 10) had lower *L. hesperus* populations than fields surrounded by uncultivated areas or safflower (9) in close proximity. Some assemblages released *L. hesperus* early (Field 31 and 9) when cotton fruit development was more susceptible or late (B31 and 10) when yield was at much less risk due to maturity of fruit.

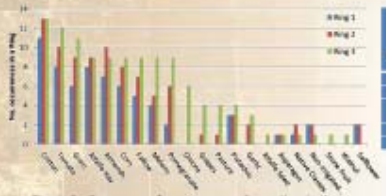

Figure 3. Frequency of crops surrounding cotton in the San Joaquin Valley of California. Ring 1 = 0 – 804 m, Ring 2 = 804 – 1609 m, Ring 3 = 1609 – 3218 m.

Field Id	Peak Density (Insect/50sweep)	Date of Peak	No. of Insecticide Applications	Top Three Surrounding Crops (Average of 3 rings)		
B31	4.5	17-Aug	1	Cotton	Alfalfa	Tomatoes
10	4.7	19-Aug	2	Cotton	Alfalfa	Tomatoes
31	9.0	15-Jul	3	Cotton	Fresh Corn	Safflower
33	7.7	29-Jul	2	Almond	Melons	Tomatoes
9	10.7	15-Jul	4	Uncultivated	Cotton	Safflower

Table 1. Peak Lygus population densities and crops surrounding cotton field. Number of insecticide applications is for Lygus only.

The authors wish to thank all the farmers and Pest Control Advisors who contributed to this project and especially the cooperation of M. Gibbs of the Sustainable Cotton Project. This project was funded in part by Cotton Incorporated, CA Cotton Alliance and through an agreement with the State Water Resources Control Board and U.S. EPA - Clean Water Act Section 319. Partially supported by a grant from USDA-NIFA-RAMP program.