Cotton Type

BT	(green)
NON-BT	(yellow)
PIMA	(red)

Sterile PBW - Week of June 25

0	(white)
1 - 5	(blue)
5 - 15	(cyan)
15 - 25	(yellow)
25 - 50	(orange)
< 50	(red)

Peoria
Phoenix
Tempe   Mesa
Chandler
Tucson

0 10 20 40 Miles

0 20 40 80 Kilometers

Map by: David Bartels

Date: 31 July 2006

Datum: NAD 1983

Source: Arizona PBW Eradication Program 2006 Field Boundaries & Trapping Data
Surface: Ordinary Kriging with spherical model limited to
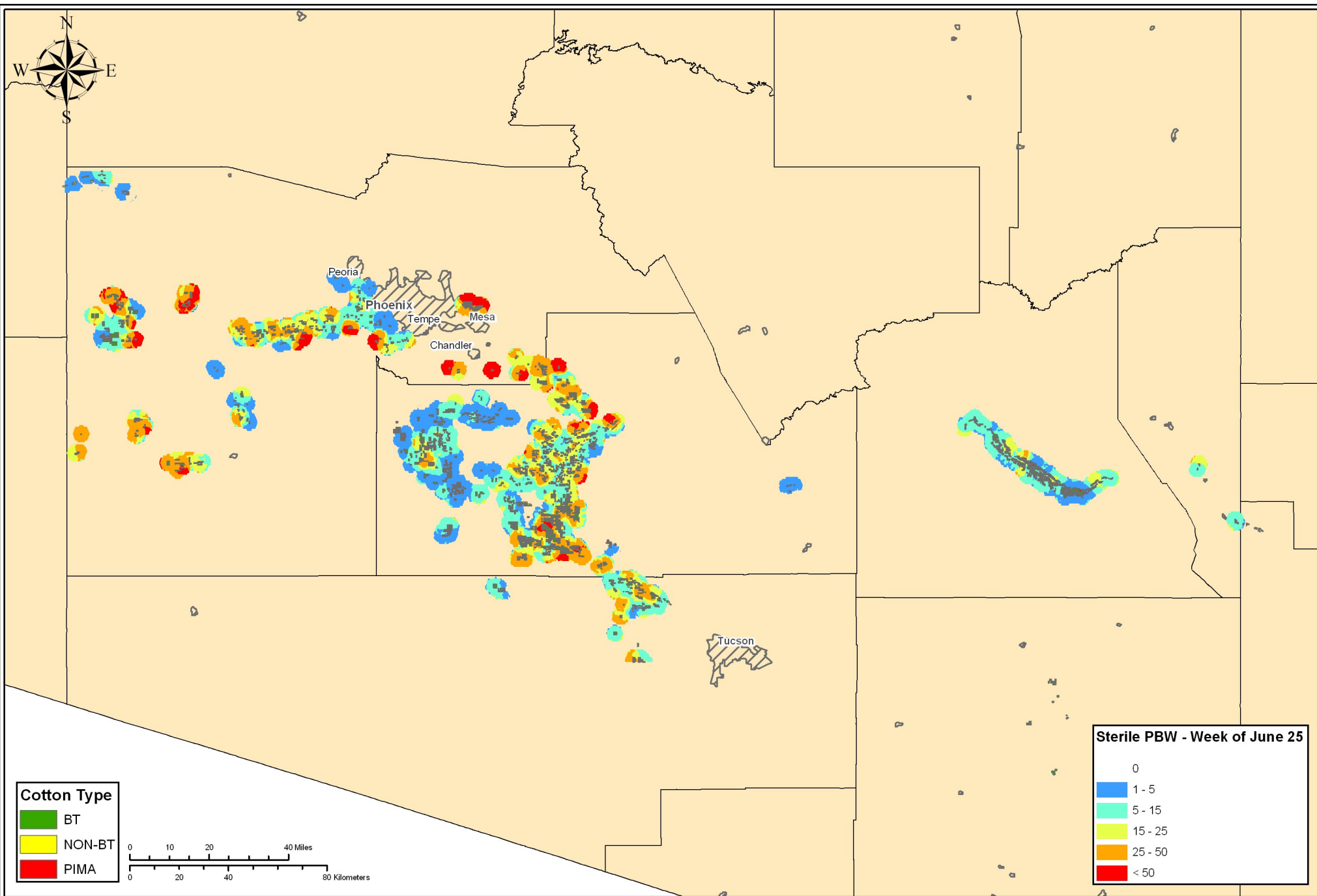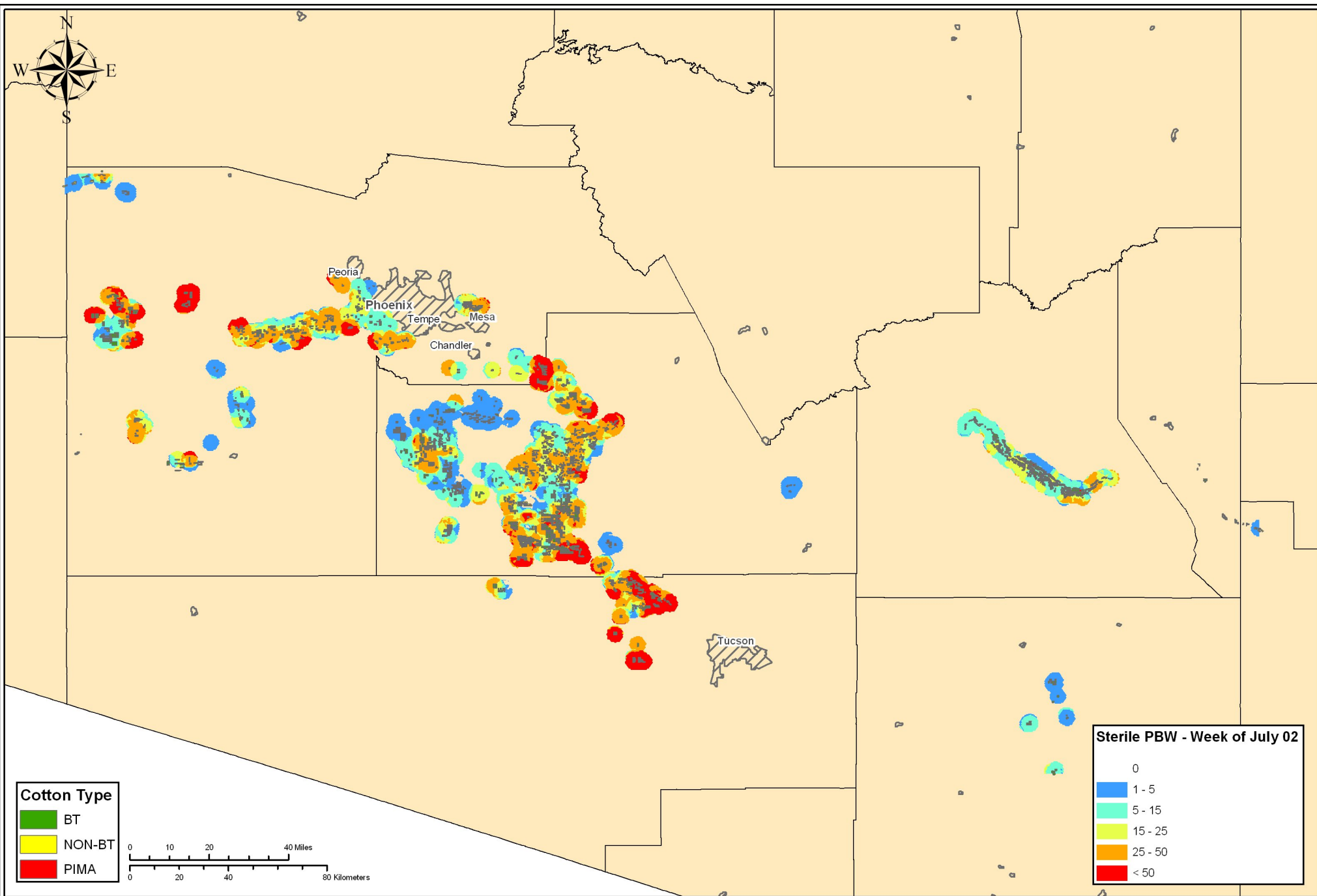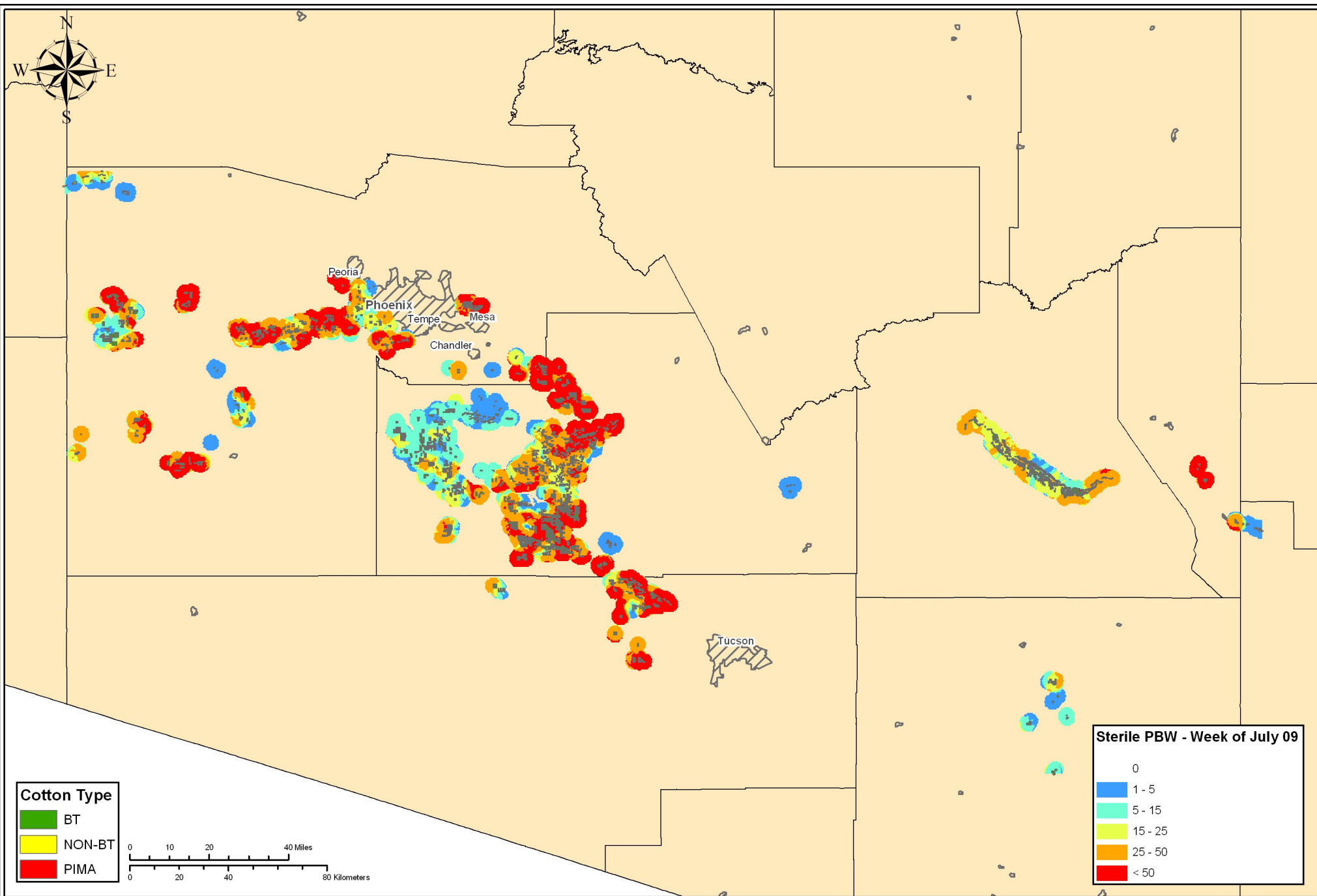2.5km search around field centroid.

Arizona Pink Bollworm Trapping Data
Predicted Levels - 2006 Growing Season

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Arizona Pink Bollworm Trapping Data
Predicted Levels - 2006 Growing Season

Peoria

Phoenix

Tempe Mesa

Chandler

Tucson

Cotton Type
- BT
- NON-BT
- PIMA

0 10 20 40 Miles

0 20 40 80 Kilometers

Sterile PBW - Week of July 02
- 0
- 1 - 5
- 5 - 15
- 15 - 25
- 25 - 50
- < 50

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Cotton Type
- **BT** (green)
- **NON-BT** (yellow)
- **PIMA** (red)

0 10 20 40 Miles

0 20 40 80 Kilometers

Sterile PBW - Week of July 09
- 0
- 1 - 5
- 5 - 15
- 15 - 25
- 25 - 50
- < 50

Peoria
Phoenix
Tempe Mesa
Chandler
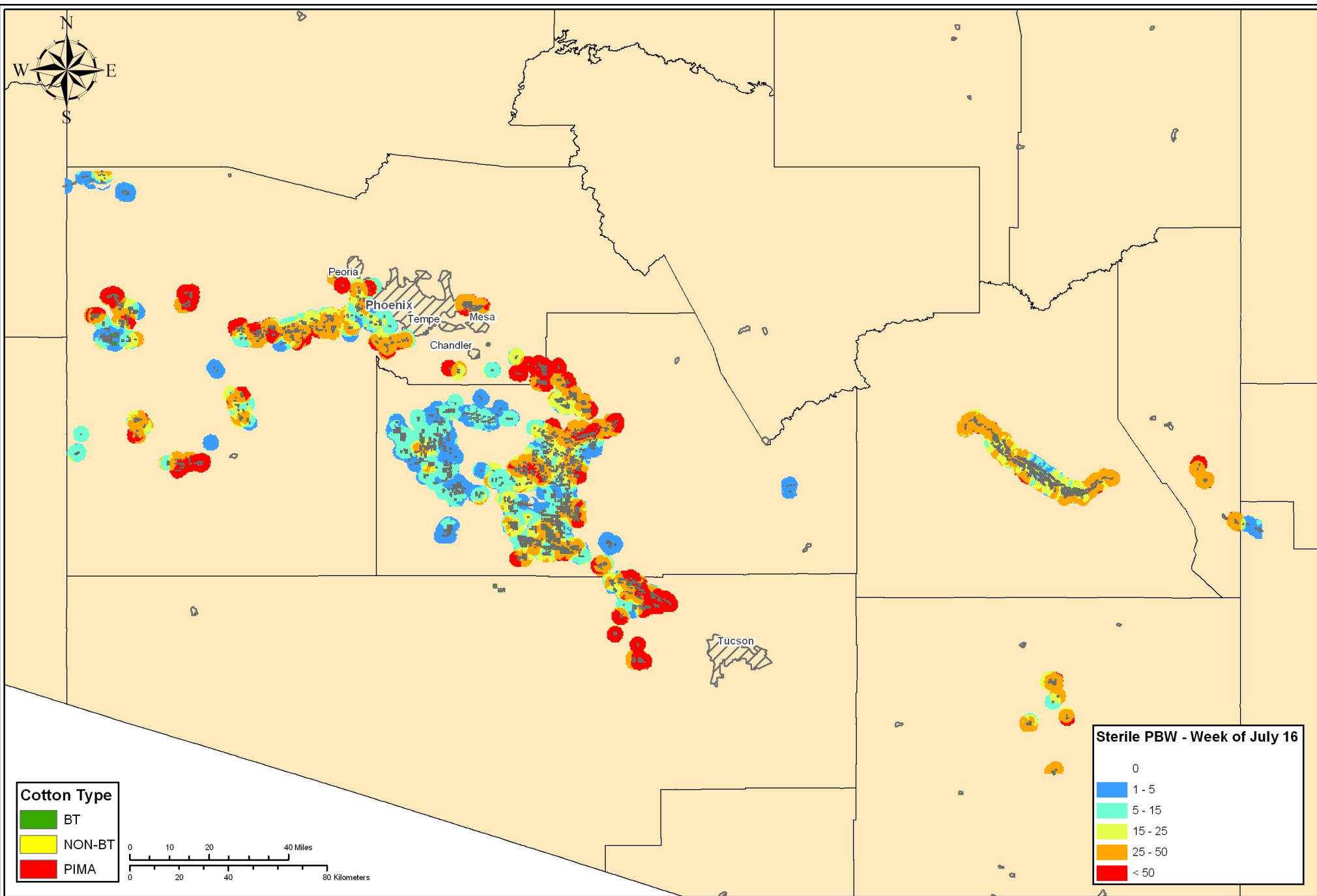Tucson

Map by: David Bartels
Date: 31 July 2006
Datum: NAD 1983
Source: Arizona PBW Eradication Program 2006 Field Boundaries & Trapping Data
Surface: Ordinary Kriging with spherical model limited to
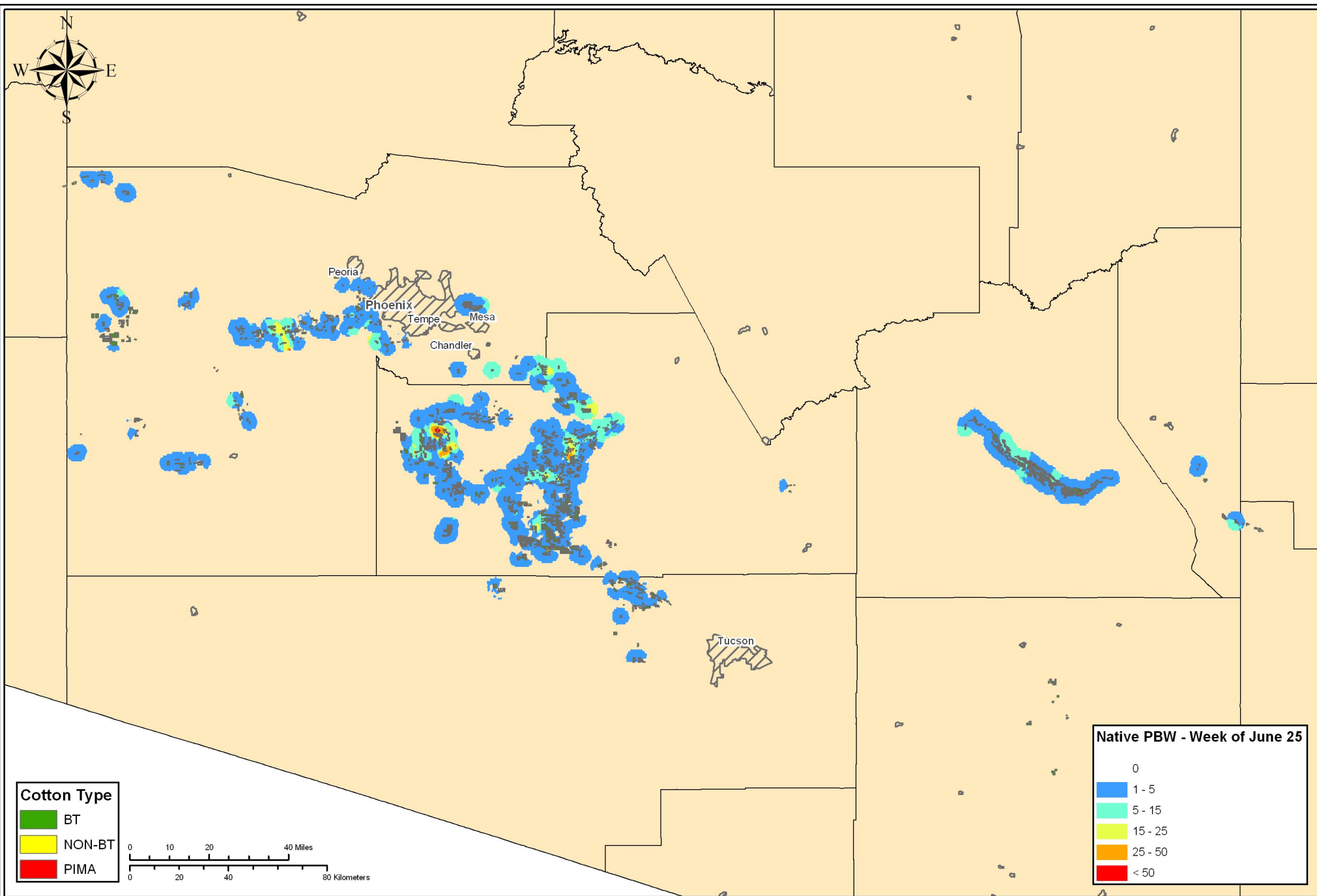2.5km search around field centroid.

Arizona Pink Bollworm Trapping Data
Predicted Levels - 2006 Growing Season

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Arizona Pink Bollworm Trapping Data
Predicted Levels - 2006 Growing Season

Cotton Type

BT
NON-BT
PIMA

Sterile PBW - Week of July 16

0
1 - 5
5 - 15
15 - 25
25 - 50
< 50

Map by: David Bartels
Date: 31 July 2006
Datum: NAD 1983
Source: Arizona PBW Eradication Program 2006 Field Boundaries & Trapping Data
Surface: Ordinary Kriging with spherical model limited to
2.5km search around field centroid.

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Peoria
Phoenix
Tempe   Mesa
Chandler
Tucson

0   10   20   40 Miles
0   20   40   80 Kilometers

Native PBW - Week of June 25

0
1 - 5
5 - 15
15 - 25
25 - 50
< 50

Cotton Type

BT
NON-BT
PIMA

0   10   20   40 Miles

0   20   40   80 Kilometers

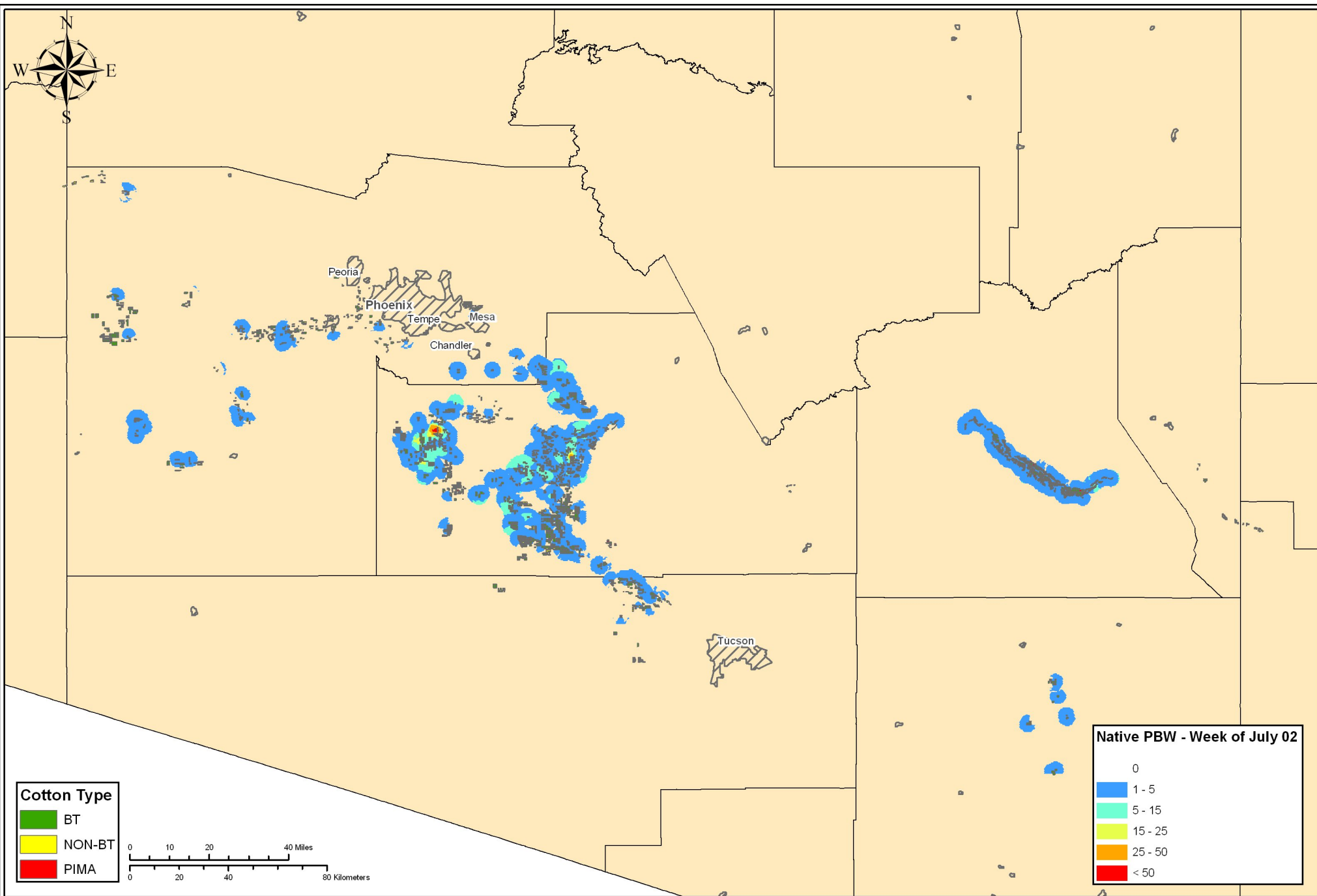Map by: David Bartels

Date: 31 July 2006

Datum: NAD 1983

Source: Arizona PBW Eradication Program 2006 Field Boundaries & Trapping Data
Surface: Ordinary Kriging with spherical model limited to
         2.5km search around field centroid.

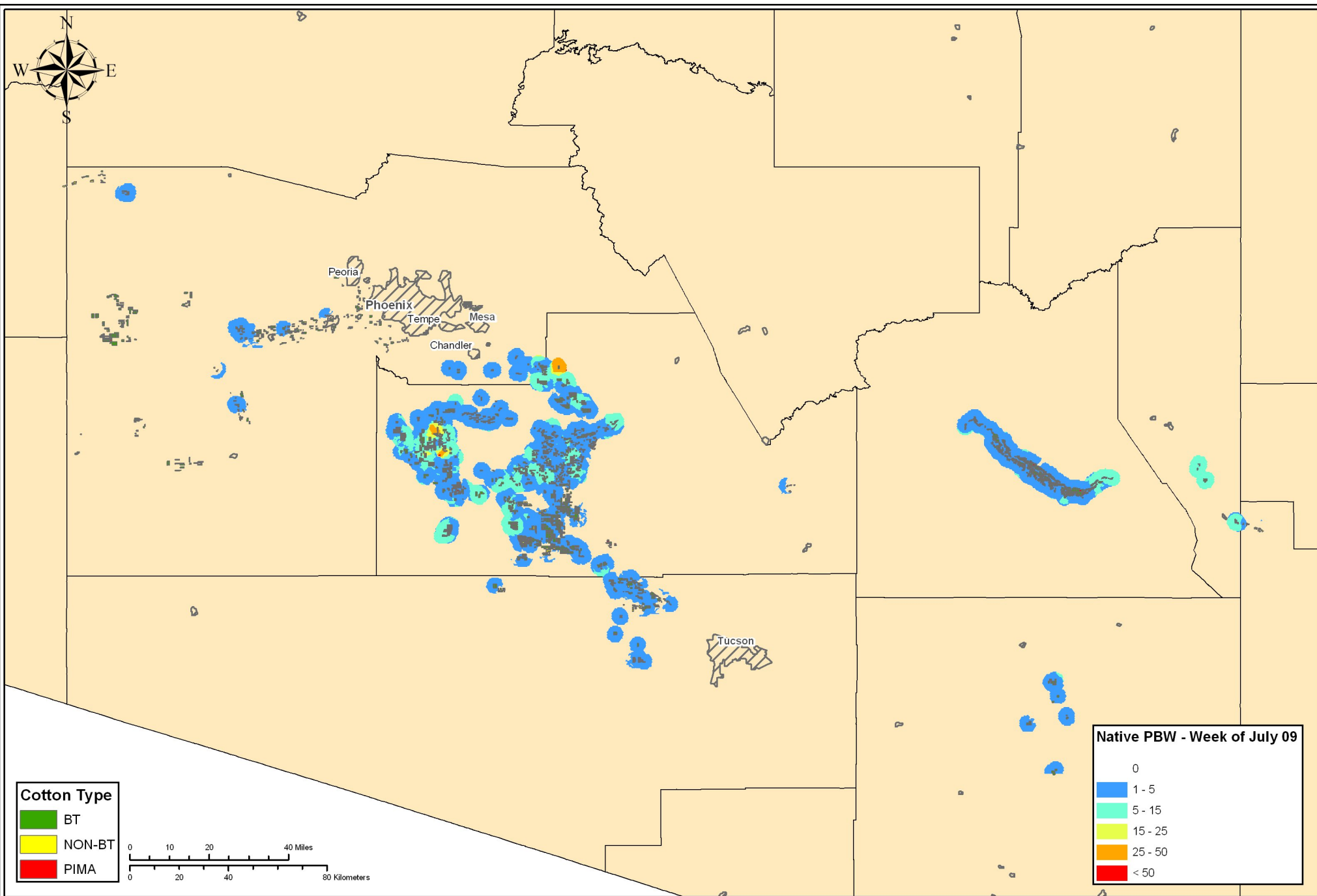Arizona Pink Bollworm Trapping Data
Predicted Levels - 2006 Growing Season

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Management Laboratory
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Peoria
Phoenix
Tempe   Mesa
Chandler

Tucson

N
W E
S

Peoria
Phoenix
Tempe Mesa
Chandler

Tucson

Native PBW - Week of July 02
0
1 - 5
5 - 15
15 - 25
25 - 50
< 50

Cotton Type
BT
NON-BT
PIMA

0 10 20 40 Miles

0 20 40 80 Kilometers

Map by: David Bartels
Date: 31 July 2006
Datum: NAD 1983
Source: Arizona PBW Eradication Program 2006 Field Boundaries & Trapping Data
Surface: Ordinary Kriging with spherical model limited to
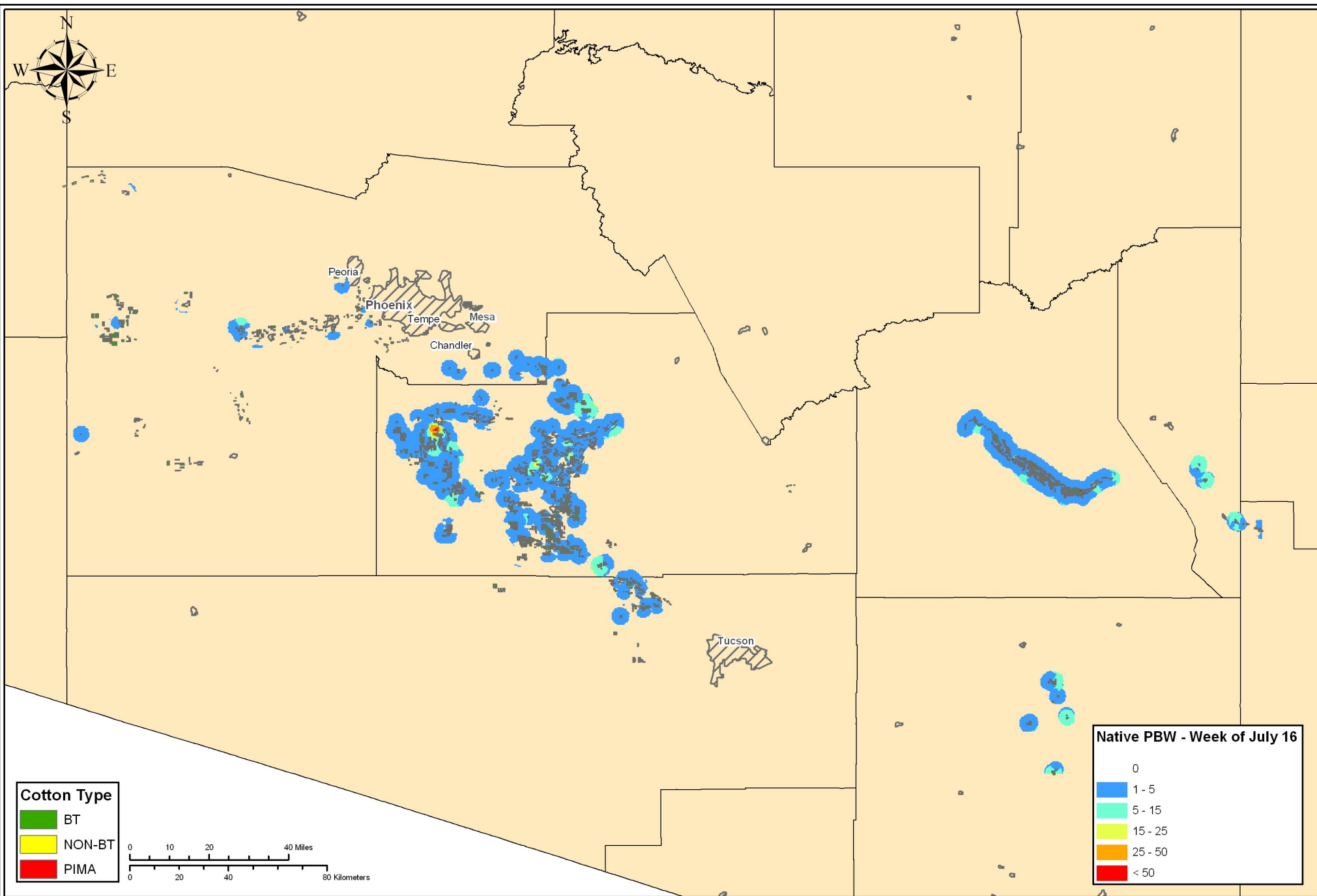2.5km search around field centroid.

Arizona Pink Bollworm Trapping Data
Predicted Levels - 2006 Growing Season

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Native PBW - Week of July 09

- 0
- 1 - 5
- 5 - 15
- 15 - 25
- 25 - 50
- < 50

Cotton Type
- BT
- NON-BT
- PIMA

0 10 20 40 Miles

0 20 40 80 Kilometers

N
W E
S

Peoria
Phoenix
Tempe   Mesa
Chandler

Tucson

Map by: David Bartels

Date: 31 July 2006

Datum: NAD 1983

Source: Arizona PBW Eradication Program 2006 Field Boundaries & Trapping Data
Surface: Ordinary Kriging with spherical model limited to
2.5km search around field centroid.

Arizona Pink Bollworm Trapping Data
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N
W — E
S

Peoria
Phoenix
Tempe   Mesa
Chandler

Tucson

Native PBW - Week of July 16

- 0
- 1 - 5
- 5 - 15
- 15 - 25
- 25 - 50
- < 50

Cotton Type

- BT
- NON-BT
- PIMA

0 10 20   40 Miles

0   20   40   80 Kilometers

Map by: David Bartels

Date: 31 July 2006

Datum: NAD 1983

Source: Arizona PBW Eradication Program 2006 Field Boundaries & Trapping Data
Surface: Ordinary Kriging with spherical model limited to
2.5km search around field centroid.

Arizona Pink Bollworm Trapping Data
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Spatial Analysis of Native and Sterile Pink Bollworm in the Arizona PBW Eradication Program area, June 25 – July 22, 2006

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Michelle Walters, Ph.D., USDA, APHIS, PPQ, CPHST, Decision Support and Pest Management Systems Laboratory, 3645 E. Wier Avenue, Phoenix, AZ 85040

Materials and Methods

Native and sterile adult *Pectinophora gossypiella* (Saunders) (pink bollworm or PBW) were monitored in the Arizona PBW Eradication Program cotton fields using standard Delta traps baited with PBW sex pheromone. Traps were checked weekly by program personnel and numbers of male moths (native and sterile) were recorded. For each field, we were presented with the number of traps per field and the total number of moths counted each week from June 25th – July 22nd, 2006. The number of traps per field varied based on the size of the field, and the type of cotton being grown. There were up to 14 traps/field. The average number of moths per trap was calculated for each cotton field by dividing the total capture by the number of traps. To create a point for the trap captures, the center of each cotton field containing a trap was calculated using its geographic boundary.

To present the trapping data as a predicted surface of PBW numbers, geostatistics was used to calculate a predicted value for areas between the known values of each field. Ordinary Kriging using a spherical model was applied to trap counts for each week to develop a predictive surface model surrounding the cotton fields. Kriging is a technique for the optimal interpolation of points across the spatial domain. Kriging handles spatial autocorrelation and it is not sensitive to preferential (uneven) sampling in specific areas, such as the distribution of cotton field in the eradication program. Kriging constructs a weighted moving average equation that estimates the value of a spatially distributed variable from adjacent values while considering the interdependence. This equation minimizes the effect of the relatively high variance of the sample values by including knowledge of the covariance between the estimated point and other sample points within the range. Kriging results in a smoothing effect with high original values being underestimated and low values being overestimated. There is also less variation than in the original points. Kriging is a best linear unbiased estimator because it minimizes the variance of the estimation errors.

The Kriged surfaces were generated from a total of 3,476 center points from the cotton fields. We used a 2 kilometer range of influence from the center point of the field, so that each field's data is affected only by other fields within approximately 1 kilometer of the outside border of the field. The 1 km limit reflects the perceived day to day movement of PBW adults in green cotton fields and limits the undue mathematical influence of a "hot" field on a large area. In addition to limiting the area of influence, we truncated trap values to 100 moths/field/week as this indicates a "hot" field biologically and also, because a weighted average is used in Kriging, capping the high values limits undue graphical influence of a single field. A trap with greater than 100 PBW moths also represents a unreliable count as the efficiency of the trap declines quickly once the trap fills with moths. The uppermost range on the map is 50 or above, to simplify the number of ranges to the most common and significant ranges and also that best explain the insect populations, graphically.

Discussion

The maps below illustrate the two pink bollworm populations, native and sterile, across Arizona eradication program fields. The analysis indicates that the sterile PBW adult population is more abundant, consistent and widely distributed than the native population.