APPENDIX B1

UNUSUAL FIELD STUDY RESULTS

> *It is frankly impossible to be absolutely certain how long distance movement of inoculum occurs.*

Dr. Schubert et al, Plant Disease, April 2001

> *It is easier to get into trouble than to get out of it.*

Curtis E. Sahakian

1. INTRODUCTION

This appendix discusses unusual results found in field study results prior to the publication in published article in April 2002. This is not a trivial problem, as the usual values were consistently found in six presentations of field results.

The first problem is the value of "distances of spread" are larger than the study site from which they were derived, which will be called "large distance problem." The second problem is the number of previous infected trees (PI trees) appears incorrectly calculated in numerous temporal periods. This will be referred to as "tree count problems."

The problems and explanation for the large distance problem were sent to FDACS for their comments. It is suffice to say at this point that the Department disagrees with our interpretation of problems and conclusions.

But, in support of the "science based policy" the Department stated it had relied on the January 2001 peer reviewed article in Phytopathology and numerous other presentations made in 1999. Mr. Gaskalla wrote to me in a personal letter [9]:

> *The results of the study have been presented several times to scientific audiences: the annual meeting of the American Phytopathology Society [APS], risk assessment groups and interested parties, and to the International Citrus Canker Workshop held in Fort Pierce this past June.*

Of course, except for the risk assessment group presentation on May 11, 1999, field results in these presentations were not made public. Mr. Gaskalla does not mention the Task Force

meeting of May 14, 1999 and the November 9, 2000 Broward Court presentation. However, these might be the interested parties.

All presentations of results were examined. In all six documents listed below, there were large distance problems. Further, in the first 5 documents, there were also tree count problems.

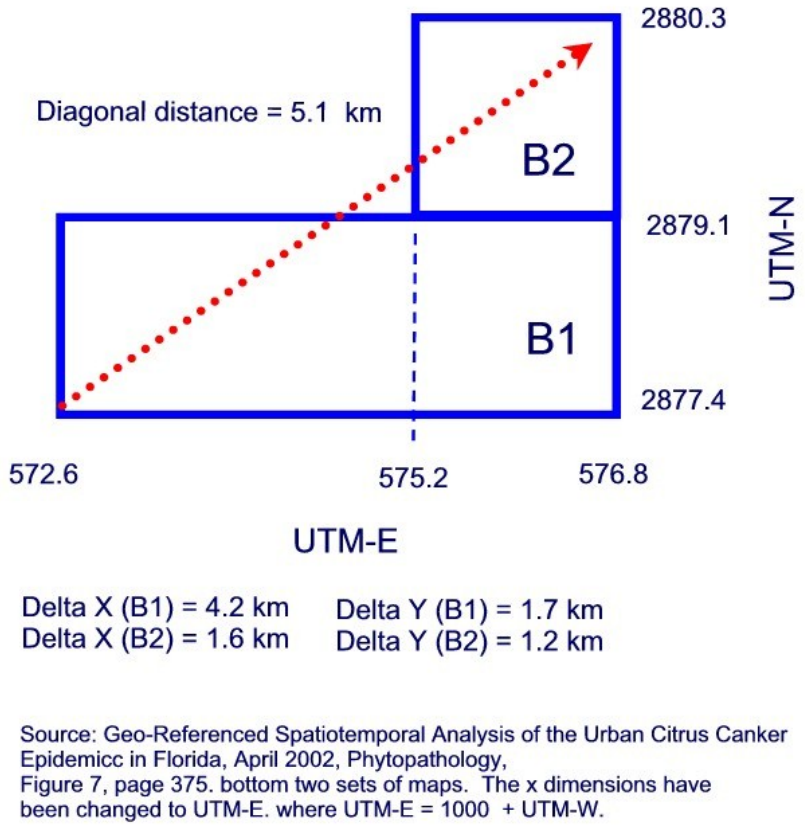
1. May 11, 1999 CC Risk Assessment Group Meeting
2. May 14, 1999 General Task Force Meeting
3. October 13, 1999 Interim Report
4. Broward Court presentation on November 9, 2000
5. Manuscript submitted to the Broward Court in year 2000
6. January 2001 Letter to the Editor (LTE) in Phytopathology.

It is likely the Broward Court presentation was the same as at the International Citrus Canker Workshop presentation in June 2000 as the footnote at the bottom of each viewgraph reads, " Canker Workshop June 2000 Epidemiology.ppt." Dr. Gottwald made a presentation on May 14, 1999 to the General Citrus Canker Task Force, which is the same as the CCRAG May 11, 1999 presentation.

Our theory of why these problems have occurred will be discussed first, then it will be demonstrated that it is impossible for the "tree count" error to be attributed to carelessness, as Mr. Gaskalla stated in a personal letter to me. It will be then demonstrated that tree count errors occurred in many presentations.

2. Unusual Distance and Tree Count Values - Possible Explanations

The Broward Site 4 is a combination of Site B1 and B2 as shown in the published 2002 Article. The maximum diagonal distance is calculated the 2002 published article [1, Fig 7] is 5.1 km or 3.2 miles (16,730 ft) as shown below. Thus, any distance greater than 16,730 ft must be the result of associating infected trees inside the site to those outside the site.



Source: Geo-Referenced Spatiotemporal Analysis of the Urban Citrus Canker Epidemicc in Florida, April 2002, Phytopathology,
Figure 7, page 375. bottom two sets of maps. The x dimensions have been changed to UTM-E. where UTM-E = 1000 + UTM-W.

Figure 1. Maximum Distance estimation based on UTM Coordinates as given in the 2002 Article, by Gottwald et al.

The distance results from the 2001 article (Table 1 in article) are as follows:

Table 1: Site 4, distance results (Distances in feet):

Period 1-mo	90% Distance	95% Distance	99% Distance	Max Distance
1	1140	19450	19700	19700
2	1100	10750	20800	20800
3	1350	2700	2700	2700
4	2950	58850	58850	58850
5	900	1400	3150	3200

From: Gottwald, T.R., Hughes, G., Graham, J.H., Sun, X., Riley, T., 2001. The Citrus Canker Epidemic in Florida: The Scientific Basis of Regulatory Policy for an Invasive Species, Phytopathology, Vol 91(1).

The values of 19,450, 19700, 20,800, and 58,850 ft must be outside of the study area. All values exceed the maximum distance of 16,730 ft, so physically it is impossible to use tree locations from within the site to calculate these distances.

As discussed in Appendix B, the distance values are calculated by the DNC procedure. All discovered infected trees within the site are parsed into specific time periods, based on their IIDs and then the distance between an NI tree and the nearest PI is calculated. In the next time period, all NI trees in the prior period become PI trees.

Consider what is inferred when an infected tree far outside of the site is used in the distance calculations. As shown in Figure 2, given a newly infected (NI) tree located 11.1 miles from a source trees within the Broward site, then all infected trees within 387 square mile circle could be considered potential source or PI trees. All infected trees inside the circle would be at a distance less than 11.1 miles, thus all infected trees would be potential candidates as the source tree for the NI tree. Of course, the DNC methodology would require the identification of the initial data of infection, based on the oldest lesion age, to properly which trees are valid source trees.

Using the approximate estimate of 2,000 citrus trees per square mile, then field study must examine an incredible 774,000 citrus trees (2000 citrus/acre x 387 sq miles), to determine if a source tree is within this circle. Of course, this is not done. The distance calculation is likely based on the fact that inspectors went to a new area and found an infected tree that was 11.1 miles from the study site.

If this distant tree in the next time period, is considered a source (PI) tree, the study site has suddenly increased from about 4 square miles to 387 square miles. Ever NI tree located outside the site would result in more expansion of the site. So, the newly infected trees do not turn to PI trees and join the rest of the pool of source trees. This is why there is erroneous tree counts occur in the various presentations.

I call this the “Use them and lose them” procedure.

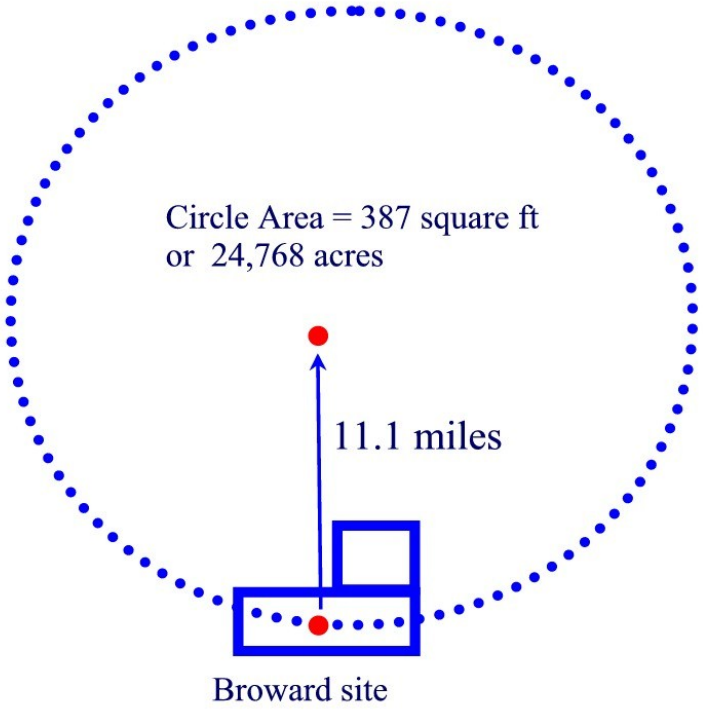


Figure 2: The 11.1 mile distance from Broward Site 1.

But, the problem of using CCEP data is that citrus canker had been discovered on the west coast of Florida, so the "distances of spread" could be any value up to perhaps 100 miles from the study sites.

The science aspect of the study is lost, when the researcher can arbitrarily decide which infected trees are included in the study.

3. 1999 - 2001 PRESENTATIONS

Prior to the publication of field results in 2002, there were a series of presentations by Dr. Gottwald . These presentations are listed in Table 1 and copies are posted on the website. A co-presenter was Dr. Sun , plant pathologist with FDACS/DPI at the May 11, 1999 meeting. Dr. Gottwald is one of the co-authors of the 2001 article.

On May 11, 1999, Dr. Gottwald presented the results of the field study to the Citrus Canker Risk Assessment Group. It was a key meeting, as the group formally voted to recommend the 1900-ft rule. The group had been established since the onset of the epidemic in October 1995 and its members included the USDA, FDACS and UF/IFAS. According to the agenda, this was a presentation of the final results of the field study. The table of results include only Site 1.

Three days later, Dr. Gottwald made another presentation to the General Task Force Committee on May 14, 1999. Likely, the same table of results were included in the

presentation. It is noted in both of these tables, there is a footnote with “Updated May 26, 1999.

On October 13, 1999, Dr. Gottwald sent the interim report on the field study to FDACS/DPI showing the results of four sites in the study. The results of Site 1 were identical to those presented on May 11, 1999. Within the report, it is stated that additional spatial analysis of the collected data would supplement these results. There was no indication in this report that the results were preliminary.

On November 9, 2000, Dr. Gottwald made a presentation to the Broward Court. The results of the field study, with values identical to the October 13, 1999 report.

There are really only 3 different sets of data as shown in Table 1. Sets 1 - 3 have large distance problems and Set 1 presentations have tree count problems.

Table 2: Presentations of Field Results

	Presentations	
Set #1	May 11, 1999 CC Risk Assessment Group	Site 1
	Oct 13, 1999 Interim Report	Site 1, 2, 3, 4
	Nov 9, 2000 Broward Court *	Site 1,2, 3
Set #2	2001 Letter to the Editor Article	Site 1, 2, 3, 4
Set #3	2002 Article published in Phytopathology	Site D1, D2, D3, B1, B2

* Likely the same presentation as June 2000 Presentation at the International Citrus Canker Research Workshop.

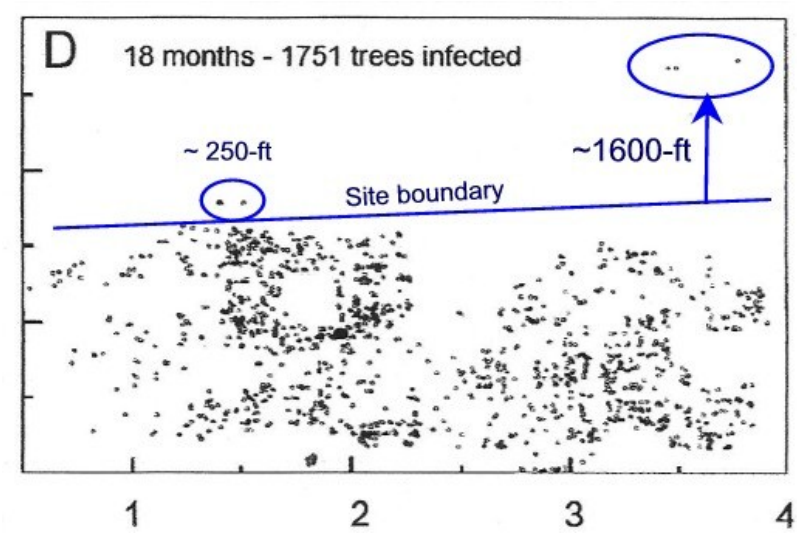
4. Large Distance Problems

While the large distance problems are most evident in Set 1 and 2, the evidence shows that all five presentations of results used infected trees outside of the designated boundaries including the 2002 article as published in Phytopathology. It was not as evident at the time the 2002 article was published because all calculated distances would fit within the boundaries of the sites.

- Presentation of Results in Letter to the Editor, January 2001, Phytopathology

Several trees outside of the study site 1 were also used in the calculations as shown in Figure 1D of the article (see overlay with street map, Appendix A, figure 6):

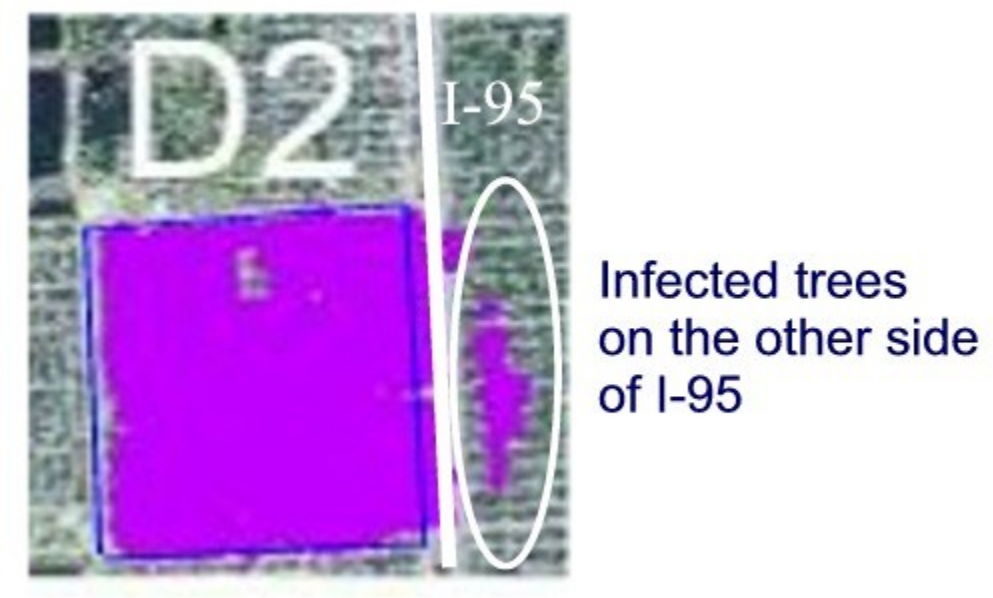
Figure 2: 2001 Article showing infected tree locations in Study Site 1 with locations outside of the study site.



It is likely that the 2002 published article also used trees outside of the study site. The blue area is shows the location of infected trees. The figure was published in 2014 by Neri et al [7] showing the citrus canker "epidemiology" data on a street map. Dr. Gottwald was a co-author of the article.

Figure 3: Site D1 with infected citrus trees outside of the boundaries.

Figure 4: Site D2 with trees on the other side of I-95 (Reference 2014 Neri et al, reference 7)



Interstate I-95 is a high speed, highway and in the general area of Site D2, there are 8 lanes in each direction as shown in Figure 4. It is therefore impossible that the inspectors would not know they were surveying outside of the area.

The disease incidence curves from the 2014 article matched the 2002 article, so the same data must have been used for the D1 and D2 sites.

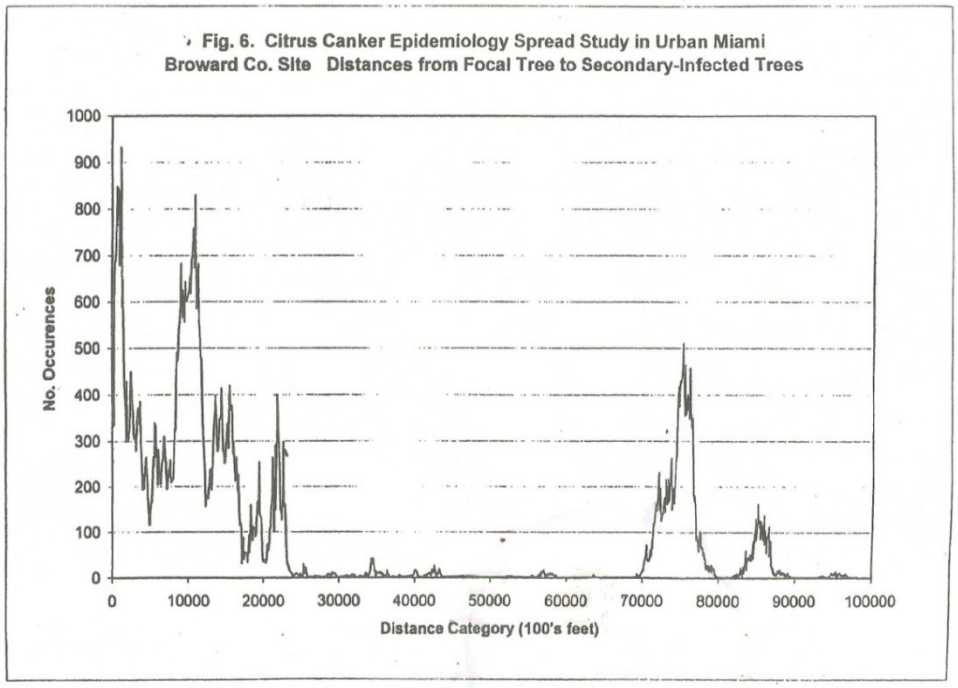
Figure 5: I-95 in vicinity of Site D2

5. Additional Unusual Results in Distances

Even more extreme distances are shown in Figure 6 of the 1999 interim report. This figure is produced by associating all PI trees with NI trees within the 30 day time periods, and calculating their respective distances. The procedure is referred to as the "inter-point distance analysis" or IPDA, which is reviewed in Appendix D and D1.

In the figure below, a maximum distance of 98,000 ft (18.5 miles) is observed on the x-axis.

Figure 6: Distances from Focal Trees to Secondary Infected Trees, Broward County Site, Interim Report, 1999.



6. INCONSISTENCIES IN TREE COUNTS

The methodology of the DNC procedure begins with the calculation of the initial infection date (IID) for every infected tree in the site, and then parses each tree into one month or 30 day periods to create sets of NI trees in each time period. If the tree has an IID less than the start date of the first period, then it is a PI tree for the first period. The calculations are different for the 90-day and 120-day scenarios. The template given in Table 5, Appendix B. This template was sent to FDACS in year 2001 as proof that the calculations were being made incorrectly. They had no comment on the template.

Consistency test: For the 30-day windows, the sum of NI and PI trees in the prior period must equal the PI trees in the next group, because all NI trees become PI trees after 30 days.

Field study results as presented in May 11, 1999 meeting, interim report of Oct 13, 1999 and Nov 2000 Broward Court presentation were examined. As shown in Table 3, the number of PI trees in the subsequent period was one or two trees less than the correct number of trees. The above table shows that every one of the calculated values that could be checked, is inconsistent with the DNC method. A total of 22 incorrect calculations were made. Note the differences (PI trees, presented - PI trees, calculated) in 30-day set are all a minus one. This means one infected tree, classified as an NI or PI tree, was not included in the next period.

In simple terms, this is the case of the "disappearing infected trees." They appear in one time period, as NI trees, then vanish for the table of results. Differences are calculated as the tree count as presented minus the tree counts as calculated.

The set of results in the May 11, 1999 CRAG meeting, the November 2000 presentation and the results of the 2001 published article are shown at the end of this appendix. Only Site 1 and 2 are presented, but similar discrepancies occur in Site 4, as given in the October 13, 1999 report as posted online.

Table 3: Site 1 Results (Set #1) - Incorrect tree counts

Site 1	**As Presented**		**Calculated**	**Difference**
1-Mo Window Period	PI trees	NI Trees	PI Trees	PI Trees
1	38*	15*	NC	
2	52	39*	53	1
3	90	73*	91	1
4	162	235*	163	1
5	396	124*	397	1
6	519	32*	520	1

* = Input data to scenarios, as obtained by parsing infected trees according to IID's.

The 24 time periods of 30 days each for sites 1 - 4 in the 2001 published article showed no inconsistent tree counts.

THE EXPLANATION FOR THE INCONSISTENT TREE COUNTS

In an apparent violation of procedure, newly infected (NI) trees far outside of the sites 1, 2 and 4 were associated with source or PI trees inside the site. But on the next time step, it was inconvenient for these trees to become PI trees. If they continued to be sources throughout the study, the study area would increase several fold and repeat inspections would be impossible. It is alleged that to avoid this situation, these trees were removed from the tables. It is believed this issue came up during court testimony (Broward Court case #2) and Dr. Gottwald remarked that the calculation procedure had changed.

In the 30 day periods, each site is lacking one tree, because just one tree is needed to identify the maximum distance. But, the error of one tree in the 30-day periods, becomes a discrepancy of two, four and six trees in the 2 month windows and other higher windows. How does one explain the 39 trees error in the 3-month window period? This is hard to explain, but it could be a typographical error.

7. COMPARISON BETWEEN PRESENTATIONS (SETS 1 AND 2)

In table 1, three sets of results are listed. The first peer-reviewed article providing field results was published in Phytopathology in January 2001. Set 1 consists of the Nov 2000 presentation, and two other presentations of results.

The tree counts in the published article was very different from prior results as presented in October 13, 1999 were presented by Dr. Gottwald on November 8, 2000. The table of results (Table 4) for Site 2 showed identical results, with very different input data.

Table 4: Comparison of Presentations,

Broward Court, Nov 2000 and January 2001 LTE

	Input Data was changed				**Results remained unchanged**		
	Nov 2000 Presentation		Jan 2001		Distance to Circumscribe (ft)		
Period	PI Trees	NI Trees	PI Trees	NI Trees	90%	95%	99%
1	21	17	4	17	2050	3400	3400
2	28	7	21	7	950	950	950
3	30	1	28	2	450	450	450
4	53	23	30	21	450	500	500
5	130	31	51	31	450	1050	2050
6	253	48	82	48	400	450	550

The November 2000 results does not pass the consistency test, (i.e. 21 + 17 = 38, not 28). But the January 2001 article is completely consistent (i.e. 4 + 17 = 21). NI trees are very similar, with a difference of one tree in period 3, and two trees in period 3.

What is particularly strange about these results, is that both of these results (November 2000 presentation viewgraphs) and the manuscript for the January 2001 article in Phytopathology were submitted in open court in November 2000, and the nobody saw the differences.

8. SELECTED COMMENTS BY FDACS/ DPI

The analysis in this appendix is certainly not new to the Department. Much of this analysis was posted to my website in 2001. Their overall criticism of this work, was the 2001 published article was a Letter to the Editor, and therefore should not the considered the final results of the study.

However, there is no mention in the 2001 article that these results are preliminary or subject to change. I obviously felt the 1999 - 2000 presentations could not be disregarded or even given lesser importance. These were the results presented to the decision makers at the time of the 1900-ft rule.

It seemed hypocritical to first state that the program was on a sound basis because of presentations to the American Phytopathology Society in August 1999 and International Citrus Canker Research Workshop, in June 2000 and then seemingly lower their importance, when I raised questions in regard to their validity.

The Department was extraordinarily responsive to many of my queries. Two of their responses are listed below:

1. Issue: As shown in Tables 1 and 2, the tree counts were inconsistent in Sites 1 and 2.

FDACS response: Our understanding is that there was an arithmetic error and not surprising with very preliminary analyses. Data verification and correction was done in the normal scheme of work preparation.

2. Issue: The Department responded to statements that 58,850 ft distance demonstrates that infected trees far outside of the study site were being associated with trees within site 4. It was impossible to survey such a large area and confirm this distance. Further, it was inconceivable that windblown rain from one tree could carry bacteria 11.14 miles away. Finally, the 2002 article does not contain this distance and the maximum distance is 2.2 miles.

FDACS response: **"**Some newly infected trees related to the experimental sites may been incorporated into the data set to calculate maximum distance of spread in the early analyses of the data. These data were removed later which effectively lessened the maximum distance." (Page 12 of Mr. Gaskalla's memo)

Later, Mr. Gaskalla writes, "The 58,850 ft was removed to have a more conservative distance spread. Dr. Gottwald believes 10-mile spread was an accurate observation; however if windblown or human intervention is not clear. The data points were under observation as the whole Broward County environ was being surveyed." (Page 12 of Mr. Gaskalla's memo).

SUMMARY OF COMMENTS

Initially, this "earlier analysis" includes what Mr. Gaskalla wrote me in November 22, 2000, stating how multiple presentations of the results prior to January 2001, gave them high

confidence in the field study. When the "earlier analysis" was published, again, the Department praised the work, as being peer reviewed worldwide, when in fact, two reviewers likely within the US had deemed the article acceptable for publication. Most importantly, the Department did not contest my assertion that the various presentations of results in the period 1999 to 2001 used infected trees far outside the site. Obviously, this opens Pandora's box, because if two trees 11 miles away can be associated and distances calculated, why not 20 miles, or 50 miles? Why not associate trees from Miami-Dade to trees in Manatee, Hendry or Collier counties. Science is not based on wild, unsupported conjectures.

9. CONCLUDING REMARKS

Perhaps it's best to end where this chapter began, with the quote from Dr. Schubert, "It is frankly impossible to be absolutely certain how long distance movement of inoculum occurs." And it should also be realized that without knowledge of all infected trees in a designated site and determination of oldest lesion age, the calculation of distances falls apart. An infected tree in Miami-Dade could be associated with one in Manatee county- why not?

The presentations of field results prior to the enactment of the 1900-ft policy in January 2000, are critical in understanding the origins of the 1900-ft policy. This appendix explains why inconsistent tree counts in tabulated are a product of creating relationships between distant infected trees outside the site with infected trees within the site. Due to the multiple presentations, by Dr. Gottwald, this problem can not explained by arithmetic errors.

Distances necessary to circumscribe as high as 58,850-ft (11.14 miles) were presented in an interim report submitted to FDACS/DPI on October 13, 1999, and published in a 2001 peer-reviewed article in Phytopathology. This distance greatly exceeds the dimensions of the site. It can only be explained by using infected trees far outside of the study site.

If causal relationships and disease gradients can be calculated over a distance of 11.14 miles, why stop there? In October 13, 1999, Dr. Gottwald submitted a report showing a potential inter-tree distance of 18 miles. This estimate was not based on near neighbor relationships, so it was not considered the a highly conservative estimate, as was the case with 11.14 miles.

These results were presented as final results of the study, in the May 11, 1999 presentation to the Risk Assessment Group. The same results were presented multiple times: May 14, 1999 presentation to the Task Force, the October 13, 1999 Interim Report, the International Citrus Canker Research Workshop, June 20, 2000, the November 9, 2000 presentation to the Broward Court and finally the January 2000 publication in Phytopathology.

The Department was in an impossible position, simultaneously touting the 1999 to 2001 research as both accurate and highly conservative analysis, due to the near neighbor requirement and multiple surveys of the same designated areas and then calculating distances over areas not intensely surveyed outside of designated areas.

The 2001 article appearing in Phytopathology is a Letter to the Editor, and as such, there can be less stringent requirement on describing the study by the reviewers. The APS should never have accepted the 2002 article for publication, without a clear explanation of the obvious differences between the two publications.

Finally, it is true that infected trees can be transported hundreds or even thousand of miles, by truck from contaminated nurseries, but this is not the conceptual basis of the DNC procedure. The premise of the procedure is that only the trees subject to multiple inspections within the site can are related to each other.

REFERENCES

1. Gottwald, T.R., X. Sun, Riley, T. Graham, J.H., Ferrandino, F. and Taylor, E., 2002. Geo-Referenced Spatiotemporal Analysis of the Urban Citrus Canker Epidemic in Florida, Phytopathology, Vol 92, No. 4.

2. Gottwald, T.R., Hughes, G., Graham, J.H, Sun, X., Riley, T., 2001. The Scientific Basis of Regulatory Eradication Policy for an Invasive Species, Phytopathology, 91:30-34.

3. Gottwald, T.R. , 1999, Citrus Canker Spread Study in Urban Miami, internal document submitted to the Broward Court, in Case 00-18394 (08) CACE. The report is undated, but a transmittal cover letter from Dr. Gottwald to Dr. Dixon of FDACS/ DPI is dated October 13, 1999.

4. November 8, 2000, Presentation by Dr. Gottwald, Broward District Court, Case 00-18394 (8) CACE. Viewgraphs were submitted into evidence.

5. May 11, 1999, Citrus Canker Risk Assessment Group 9th Meeting Report, Citrus Citrus Canker in Dade and Broward Cos. 1999, Report No. CCRAG-9, May 11, 1999, Submitted into evidence in Broward 17th District Court, in November 2000 (Case 00-18394 (08).

6. May 14, 1999, Citrus Canker Technical Advisory Task Force Meeting Minutes. Provided by FDACS.

7. Neri F.M., Cook A.R., Gibson G.J., Gottwald T.R., Gilligan C.A. (2014) Bayesian Analysis for Inference of an Emerging Epidemic: Citrus Canker in Urban Landscapes. PLoS Comput Biol 0(4): e1003587. doi:10.1371/journal.pcbi.1003587

8. Correspondence, Mr. Richard Gaskalla to David Lord, November 22, 2000.

REFERENCE DOCUMENTS:

Site 1 Results (Set #1)

Site 1	As Presented		Calculated	Difference
1-Mo Window Period	PI trees	NI Trees	PI Trees	PI Trees
1	38*	15*	NC	
2	52	39*	53	(1)
3	90	73*	91	(1)
4	162	235*	163	(1)
5	396	124*	397	(1)
6	519	32*	520	(1)

* = Input data to scenarios, as obtained by parsing infected trees according to IID's.

Site 1	As Presented		Calculated		Difference	
2-Mo Window Period	PI trees	NI Trees	PI Trees	NI Trees	PI Trees	NI Trees
1	38*	53	38	54	NC	(1)
2	90	307	92	308	(2)	(1)
3	396	155	400	156	(4)	(1)
4	550	490	556	NC	(6)	NC

Site 1	As Presented		Calculated		Difference	
3-Mo Window Period	PI trees	NI Trees	PI Trees	NI Trees	PI Trees	NI Trees
1	38*	125	38	127	NC	(2)
2	90	430	92	391	(2)	(39)
3	396	420	400	156	(4)	(4)

Site 1	As Presented		Calculated		Difference	
4-Mo Window Period	PI trees	NI Trees	PI Trees	NI Trees	PI Trees	NI Trees
1	38*	359	38	362	NC	(3)
2	90	461	92	NC	(2)	NC
3	396	644	400	NC	(4)	NC

Citrus Canker Urban Epidemiology -Site 1

Total trees: 6051 Diseased: 1752 (29%)

- Focal to secondary infected tree distances were calculated via a VB routine.
- Distances are presented to the nearest 50 ft.
- Possible distance of spread diminishes with each successive window examined.
- CCEP regulatory agency decided to us the 99% level.

Temporal Window	No. Focal (Alpha) Trees	No. 2ndary-Infected Trees	% Captured at 125 ft	90%	95%	99%	Max Distance
1st 1-Mo Window	38	15	13	800	4150	4150	4150
2nd 1-Mo Window	52	39	33	1450	1450	1650	1650
3rd 1-Mo Window	90	73	41	1200	1600	1900	1900
4th 1-Mo Window	162	235	30	700	800	1450	1450
5th 1-Mo Window	396	124	36	350	500	700	750
6th 1-Mo Window	519	32	69	250	950	950	950
1st 2-Mo Window	38	53	24	1450	1450	4150	4150
2nd 2-Mo Window	90	307	22	1050	1400	1650	2100
3rd 2-Mo Window	396	155	39	350	600	950	950
4th 2-Mo Window	550	490	56	300	350	700	850
1st 3-Mo Window	38	125	24	1400	1450	3200	4150
2nd 3-Mo Window	90	430	22	950	1250	1600	2100
3rd 3-Mo Window	396	420	45	350	350	450	950
1st 4-Mo Window	38	359	14	1400	1650	2150	4150
2nd 4-Mo Window	90	461	21	950	1300	1800	2250
3rd 4-Mo Window	396	644	46	350	650	850	950

Note: Due to the poor quality of the original viewgraphs, reproductions were made to Site 1, 2 and 3 results. Every effort was made to make these copies as accurate to the original as possible.

Citrus Canker Urban Epidemiology -Site 2

Total trees: 6019 Diseased: 971 (16.1%)

- Focal to secondary infested tree distances were calculated via a VB routine.
- Distances are presented to the nearest 50 ft.
- Possible distance of spread diminishes with each successive window examined.
- CCEP regulatory agency decided to us the 99% level.

Temporal Window	No. Focal (Alpha) Trees	No. 2ndary-Infected Trees	% Captured at 125 ft	90%	95%	99%	Max Distance
1st 1-Mo Window	21	17	17.8	2050	3400	3400	3400
2nd 1-Mo Window	28	7	14.3	950	950	950	950
3rd 1-Mo Window	30	1	0	450	450	450	450
4th 1-Mo Window	53	23	39.1	450	500	700	700
5th 1-Mo Window	130	31	48.4	450	1050	2050	2050
6th 1-Mo Window	253	48	68.8	400	450	550	550
1st 2-Mo Window	21	24	12.5	2700	3050	3400	3400
2nd 2-Mo Window	30	23	39.1	450	500	700	700
3rd 2-Mo Window	82	80	52.5	400	500	2050	2050
4th 2-Mo Window	253	205	38.5	800	800	1900	1950
1st 3-Mo Window	21	24	12.5	2750	3050	3400	3400
2nd 3-Mo Window	30	54	39.1	450	700	2050	2050
3rd 3-Mo Window	82	179	62.5	550	1050	3050	3050
4th 3-Mo Window	253	210	38.5	800	1000	1000	1950
1st 4-Mo Window	21	47	12.7	2150	2750	3400	3400
2nd 4-Mo Window	30	102	35.3	450	800	1800	2050
3rd 4-Mo Window	82	283	30	1500	2250	3050	3100
4th 4-Mo Window	253	278	36.7	750	1000	1950	2200

Citrus Canker Urban Epidemiology -Site 3

Total trees: 1094 Diseased: 32 (2.9%)

- Focal to secondary infected tree distances were calculated via a VB routine.
- Distances are presented to the nearest 50 ft.
- Possible distance of spread diminishes with each successive window examined.
- CCEP regulatory agency decided to us the 99% level.

Temporal Window	No. Focal (Alpha) Trees	No. 2ndary-Infected Trees	% Captured at 125 ft	90%	95%	99%	Max Distance
1st 1-Mo Window	2	2	0	200	200	200	200
2nd 1-Mo Window	8	6	33.3	1950	1950	1950	1950
3rd 1-Mo Window	15	10	20	900	900	900	900
4th 1-Mo Window	18	5	0	850	850	850	850
1st 2-Mo Window	2	4	0	650	650	650	650
2nd 2-Mo Window	4	3	0	200	200	200	200
3rd 2-Mo Window	7	7	28.6	1950	1950	1950	1950
4th 2-Mo Window	15	15	6.7	900	900	900	900
1st 3-Mo Window	2	2	0	650	650	650	650
2nd 3-Mo Window	3	3	0	200	200	200	200
3rd 3-Mo Window	7	7	0	1950	1950	1950	1950
4th 3-Mo Window	15	16	6.3	2000	2200	2200	2200
1st 4-Mo Window	3	4	0	650	650	650	650
2nd 4-Mo Window	7	3	0	200	200	200	200
3rd 4-Mo Window	7	7	0	1950	1950	1950	1950
4th 4-Mo Window	9	16	6.3	2200	2200	2200	2200

May 11, 1999 Meeting of th
Canker Risk Assessment Group

Citrus Canker Urban Miami Epidemiology Spread Study Site 1

Tempora! V.ndow	No Focal (Alpha) Trees	No 2ndary-Infected Trees	% Captured at 125 ft	90%	95%	99%	Max D.stance
1st 1-Mo Window	38	15	13	800	4150	4150	4150
2nd 1-Mo Window	52	39	33	1450	1450	1650	1650
3rd 1-Mo Window	90	73	41	1200	1600	1900	1900
4th 1-Mo Window	162	235	30	700	800	1450	1850
5th 1-Mo Window	396	124	36	350	500	700	750
6th 1-Mo Window	519	32	69	250	950	950	950
1st 2-Mo Window	38	53	24	1450	1450	4150	4150
2nd 2-Mo Window	90	307	22	1050	1400	1650	2100
3rd 2-Mo Window	396	155	39	350	600	950	950
4th 2-Mo Window	550	490	56	300	350	700	850
1st 3-Mo Window	38	125	24	1400	1450	3200	4150
2nd 3-Mo Window	90	430	22	950	1250	1600	2100
3rd 3-Mo Window	396	420	45	350	450	700	950
1st 4-Mo Window	38	359	14	1400	1650	2150	4150
2nd 4-Mo Window	90	461	21	950	1300	1800	2250
3rd 4-Mo Window	396	644	46	350	650	850	950

[1] Recalc 5/26/99 T. R Gottwald

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Table of Results from January 2001 Letter to the Editor

TABLE 1. Results of the epidemiology study of citrus canker dispersal[a]

Area	Assessment period (30 days)	Trees		Distance (ft) necessary to capture			% Captured at 125 ft	% Captured at 1,900 ft
		Focal	Newly infected	90%	95%	99%		
1	Apr/May 1998	38	14	800	4,150	4,150	13	93
	May/Jun 1998	52	38	1,450	1,450	1,650	44	100
	Jun/Jul 1998	90	72	1,200	1,600	1,900	44	100
	Jul/Aug 1998	162	234	700	800	1,450	36	100
	Aug/Sep 1998	396	123	350	500	700	44	100
	Sep/Oct 1998	519	31	250	950	950	72	100
2	Nov/Dec 1997	4	17	2,050	3,400	3,400	18	88
	Dec 1997/Jan 1998	21	7	950	950	950	14	100
	Jan/Feb 1998	28	2	450	450	450	50	100
	Feb/Mar 1998	30	21	450	500	700	44	100
	Mar/Apr 1998	51	31	450	1,050	2,050	52	97
	Apr/May 1998	82	48	400	450	550	75	100
3	Mar/Apr 1998	5	2	200	200	200	50	100
	Oct/Nov 1998	9	6	1,950	1,950	1,950	33	83
	Feb/Mar 1999	16	10	900	900	900	10	100
	Mar/Apr 1999	26	5	850	850	850	20	100
4	Nov/Dec 1997	3	41	11,140	19,450	19,700	7	12
	Dec 1997/Jan 1998	44	49	1,100	10,750	20,800	44	92
	Jan/Feb 1998	93	14	1,350	2,700	2,700	13	93
	Feb/Mar 1998	107	14	2,950	58,850	58,850	40	67
	Mar/Apr 1998	121	108	900	1,400	3,150	53	98
	Apr/May 1998	229	62	700	2,050	2,350	63	94

[a] Repeated surveys of over 19,000 citrus trees in four study areas in Dade and Broward Counties, Florida, identified the location of trees via GPS, their disease status and, for infected trees, age of the oldest lesion. In each successive time period, the distances from all trees newly infected to the nearest identified previously infected (focal) tree were calculated. The results thus provide conservative estimates of dispersal distances for the citrus canker pathogen. All measurements are shown in feet rather than meters because this is the unit of measure used by the eradication program in Florida. Time periods are 30 days in duration but are not necessarily consecutive. Instead they represent periods when new disease increase was sufficient to allowdispersal measurements.