No. 142, Original

In the

Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

STATE OF FLORIDA'S REPLY IN SUPPORT OF ITS MOTION *IN LIMINE* TO EXCLUDE THE EXPERT TESTIMONY BY DR. SUAT IRMAK

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October 7, 2016

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INTRODUCTION

The State of Florida's Motion *in Limine* (the "Motion") to exclude the testimony of Dr. Suat Irmak was narrowly tailored to demonstrate that three of his proposed opinions lacked the foundational support required by *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), and related case law. The State of Georgia's response suggests broadly that Dr. Irmak is "qualified" as an agricultural engineer, but it fails to engage with and specifically refute those three particular grounds for exclusion of his proposed testimony.

First, Florida sought to exclude Dr. Irmak's opinion at pages 48-63 of his expert report that Georgia's irrigation-related regulatory programs are, as a whole, "reasonable," "proactive," and "responsible." Dr. Irmak's opinions were simply *ipse dixit* statements without even a cursory explanation for how or why he reached those conclusions. Mot. at 11-16 (Dkt. No. 473). Georgia now admits that the reasonableness of its regulatory policies must be assessed based on the "totality of the circumstances," Opp'n at 15 (Dkt. No. 492), but *Georgia does not point to even a single line of text in Dr. Irmak's expert report or in his deposition testimony where he explains why Georgia's policies are indeed reasonable under the circumstances*. In fact, Dr. Irmak repeatedly testified that he did not fully understand the circumstances in which he was rendering his opinion, nor did he appear to have even a passing familiarity with the substance of many of the issues in dispute in this litigation (and was ill-equipped to address those issues in any event). Mot. at 11-16; *see also* Attachment 15, Irmak Dep. 484:12-17[1] ("Q: Your report did not evaluate whether the State of Georgia's regulations and agricultural policies were reasonable and proactive in relation to environmental issues in the Flint River Basin? A: No, sir."); *id.* at

[1] Attachments 1 through 17 are attached to Florida's Motion, and any additional attachments cited in this reply will be numbered continuously. Attachment 20 contains the deposition testimony of Dr. Irmak cited in this reply memorandum.

529:12-530-23 (admitting he did not know whether FRDPA was ever funded or whether Georgia even implemented FRDPA during severe droughts in 2007 and 2008). In its own motion *in limine* in this case, Georgia argues that courts bar "*ipse dixit*" expert opinions. *See* Ga. Mot. to Exclude Lake Seminole Model at 5 (Dkt. No. 472) ("An expert's opinion may be unreliable because 'there is simply too great an analytical gap between the data and the opinion proffered.' *General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997) ('[N]othing in either Daubert or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert.')."). Yet that is precisely what Georgia defends here.

Second, Florida moved to exclude Dr. Irmak's opinion that "the soil-water holding capacity of *most* agricultural soils in the Georgia portion of the Apalachicola-Chattahoochee-Flint River Basin ("ACF Basin") is also very low (*e.g.*, 0.5-0.7 inch per ft of soil layer or less)." Attachment 2, Expert Report of Suat Irmak, Ph.D. at 12 (May 20, 2016) ("Report") (emphasis added). This point is important because soil water-holding capacity is a foundation for Dr. Irmak's later opinions that the amount of irrigation water applied to crops across Georgia's Flint River Basin ("FRB") cannot be reasonably reduced (by, for example, applying the types of irrigation restrictions Florida already applies in its portion of the ACF Basin). Georgia's brief is an effort at misdirection: it does not once cite Dr. Irmak's actual opinion regarding the specific water-holding capacity of Georgia soils. Instead—essentially admitting Dr. Irmak's fundamental mistake—Georgia argues that other types of soils in Georgia are indeed somewhat "sandy." *See* Opp'n at 18 (arguing that soils in the Georgia ACF Basin are "sandy loam or sandy clay loam"). But those other types of soils—sandy loam and sandy clay loam—have ***more than twice the water-holding capacity than that identified in Dr. Irmak's opinion!*** Dr. Irmak's opinion was based on an erroneous conclusion that was *supported by no explanation or scientific analysis at all.* Thus, this opinion, and all other opinions that rely upon it, should be excluded. *See Daubert*, 509 U.S. at 589 (expert testimony not admissible unless it is both relevant and scientifically "reliable").

Third, Florida also moved to exclude Dr. Irmak's opinion regarding the feasibility of reducing irrigation applications, because Dr. Irmak admitted in his deposition that he did not study whether Georgia farmers could feasibly limit the amount of irrigation water used during the growing season. *See* Attachment 20, Irmak Dep. 650:3-12 ("I don't think limited irrigation was mentioned in my report in these kind[s] of context."). Georgia's response—suggesting that Dr. Irmak actually did do such an analysis—simply ignores what Dr. Irmak actually said in his own sworn testimony. In fact, other portions of Dr. Irmak's Report demonstrate that a number of Georgia's FRB irrigators already do use less irrigation water than Dr. Irmak posits is necessary to avoid crop failure, while many others use *far greater amounts* than even Dr. Irmak's flawed analysis suggests could be needed.

In sum, Georgia's brief does not provide any basis to deny Florida's motion to exclude the three specific expert opinions at issue.

ARGUMENT

A. Georgia Still Cannot Identify The Analytical Framework Underlying Dr. Irmak's Reasonableness Opinion

Georgia's opposition provides no explanation of, or citation to, any analysis conducted by Dr. Irmak to reach his conclusion that Georgia's agricultural water use polices are reasonable. Instead, Georgia says that a reasonableness opinion requires only an "objective, multi-factored analysis of the *totality of the circumstances* that considers a number of concepts." Opp'n at 15 (emphasis added). Florida wholeheartedly agrees. The problem for Georgia is that Dr. Irmak's sworn testimony makes it clear he did not analyze the totality of the circumstances. Dr. Irmak's conclusion is the equivalent of an expert opinion that a driver in an automobile accident tort case acted reasonably, *without evaluating* his speed, his potential intoxication, whether the car was functioning properly, the weather conditions, and so on. For example, Dr. Irmak did not evaluate the effectiveness of Georgia's policies in the context of their environmental impacts on the FRB or the Apalachicola River—*the key issue in this case*. Attachment 15, Irmak Dep. 484:12-17. He did not, and admitted he could not, evaluate Georgia's sustainability criteria for the Lower FRB. *Id.* at 464:10-19, 478:3-20. He did not analyze whether the Georgia policies he listed were implemented, funded, or effective. *Id.* at 473:14-476:6, 479:5-24, 480:5-17, 530:6-23; *see also id.* at 272:9-273:4. He did not, and admitted he could not, evaluate Georgia's programs and policies in comparison to those of any other state. *Id.* at 583:17-584:3; Mot. at 11-16. Nor could he articulate any other objective criteria by which the reasonableness of Georgia's policies could be measured. *See, e.g.,* Attachment 2, Report at 48-63.

An evaluation of the totality of the circumstances would also require Dr. Irmak to compare Georgia's current policies to other policies and programs Georgia could enact or expand, yet Dr. Irmak repeatedly refused to answer questions on these subjects, claiming he was not qualified to make such policy evaluations or recommendations. *See* Attachment 15, Irmak Dep. 291:4-18, 309:18-310:14, 379:11-381:11. Georgia attempts to justify Dr. Irmak's repeated inability to answer such questions by claiming that he "explained that such evaluations were outside the scope of his expert testimony." Opp'n at 17. Tellingly, Georgia did not provide a citation to Dr. Irmak making this explanation. And, of course, Dr. Irmak gave no such explanation at his deposition, but instead *repeatedly stated that he was not qualified* to make policy judgments. Attachment 15, Irmak Dep. 291:19-292:22 ("I don't make a recommendations for policies."); *see also* Mot. at 15.

Against this backdrop, Georgia makes four primary arguments for why Dr. Irmak's flawed opinion should not be excluded. None save the opinion.

First, Georgia claims that Dr. Irmak spent a lot of time reviewing documents and interviewing policymakers and stakeholders. *See* Opp'n at 14. But Georgia is confusing the *collection* of data and information with the *analysis* of that data and information. Dr. Irmak's opinion is not that Georgia *has* agricultural water use policies and programs, but rather that those policies and programs are reasonable and proactive under the circumstances. While it was *necessary* for Dr. Irmak to familiarize himself with some of the policies and programs on which he attempts to opine, that is not *sufficient* for him to offer an expert opinion of this nature without also setting out some sort of analysis.[2] *See Amorgianos v. Amtrak*, 303 F.3d 256, 266 (2d Cir. 2002) ("Thus, when an expert opinion is based on data, a methodology, or studies that are simply inadequate to support the conclusions reached, Daubert and Rule 702 mandate the exclusion of that unreliable opinion testimony."); *see also Durkin v. Equifax Check Servs., Inc.*, 406 F.3d 410, 420-21 (7th Cir. 2005) (upholding exclusion of English professor and linguist from testifying on whether language in a letter was confusing when he had "not sufficiently articulated the manner and method by which he determined the [challenged] language was confusing" (alteration in original) (citation omitted)). Dr. Irmak should have articulated some analytical strategy or framework to reach a conclusion, but he admitted that his Report contains no analysis, testifying that the descriptions of programs that he lists were merely "some of the examples … that [he] wanted to highlight" and that listing examples was the "sole purpose of [that] section of the

[2] Dr. Irmak included *no* interview transcripts with the documents produced with his Report, making it impossible for Florida to verify the accuracy of any conclusions based on those interviews.

report." Attachment 15, Irmak Dep. 585:110-586:14.

Second, Georgia asserts that Dr. Irmak "***did*** consider many of the facts Florida identifies," citing only *two pages* of the Report that discuss the importance of the Upper Floridian Aquifer to Georgia agriculture. Opp'n at 16 & n.47 (emphasis in original). This reference distorts Dr. Irmak's Report: the cited pages are unrelated to the reasonableness opinion, merely describe the Upper Floridan, and contain no analysis at all of Georgia's water use policies in light of the Upper Floridan's sustainable yield or any other factor. *See* Attachment 18, Report at 13-14. The distortion is not surprising, however, because Dr. Irmak admitted he could not perform this type of analysis. *See* Attachment 15, Irmak Dep. 461:23-465:11 (admitting, *inter alia*, that he is "not a hydrologist").

Third, Georgia claims that Dr. Irmak did not conduct any cross-state comparison because such comparisons are often misleading and inappropriate. Opp'n at 14 & n.39. That is false. In reality, in the testimony Georgia cites, Dr. Irmak said that "[i]n [his] mind, maybe there's an implicit comparison" to other states' water policies and, *in the very next answer*, Dr. Irmak admitted he is not qualified to make such a comparison. Attachment 15, Irmak Dep. 585:15-586:17. That is, Dr. Irmak admitted that there is an implicit cross-state comparison that exists only in his mind—thus conceding the relevance of such a comparison—but acknowledged that he is not qualified to evaluate that comparison. And Dr. Irmak did not evaluate Florida's efforts to limit agricultural irrigation in its part of the ACF. *See id.* at 289:19-291:3 (admitting that he is not "familiar" with Florida's Mobile Irrigation Lab program).

Finally, Georgia asserts that, in other sections of his Report, Dr. Irmak properly evaluated the reasonableness of proposals *by Florida's experts* from an "agricultural management perspective." Opp'n at 17 n.52. None of these sections of the Report are relevant to the subject of Florida's Motion or Dr. Irmak's opinion on the reasonableness of *Georgia's existing policies*. In any event, the examples Georgia cites, Dr. Irmak does actually set out the *methodology he is using to critique Florida's experts and then applies it to support his opinion*. Attachment 1 to Opp'n, Report at 14-19, 45, 87, 90-91. Although his analysis on those irrelevant issues is deeply flawed, it is not the subject of Florida's *Daubert* motion.

In sum, Dr. Irmak's deposition testimony makes clear that he did not engage with a single relevant "circumstance," much less the totality of them. This reflects Dr. Irmak's failure to employ a proper methodology to reach his conclusions, which justifies exclusion under *Daubert*. Georgia knows that an expert's opinion cannot rely solely on *ipse dixit*. *See* Ga. Mot. to Exclude Lake Seminole Model at 5. Yet Dr. Irmak's reasonableness opinion is precisely that: a list of policies and appropriations, without any evaluation of *why* they are reasonable.

B. Georgia's Post-Hoc Invention Of A Methodology For Dr. Irmak's Soil Type Conclusion Is Refuted By The Record

Dr. Irmak opined that "most agricultural soils" in the Georgia ACF Basin are "extremely sandy," and therefore have a "very low" average soil water-holding capacity ("0.5-0.7 inch per [foot] of soil layer or less"). Attachment 2, Report at 12,18. However, he employed no verifiable methodology to reach a conclusion that "most agricultural soils" are "extremely sandy"—indeed, he seems to have plucked this conclusion out of thin air. This issue is important, because Dr. Irmak's flawed soil type conclusion (and its corresponding soil water-holding capacity) is a building block for a number of his other conclusions, including on the need for irrigation in the Georgia ACF Basin and the inability of Georgia farmers to limit the amount of irrigation water applied. For example, Dr. Irmak purported to establish "irrigation [water] requirement[s]" for showing the optimal amount of irrigation on cotton, peanuts, soybeans, and corn in five Georgia ACF Basin counties based in part on his average soil water-holding capacity assumption. *See* Attachment 18, Report at 122-23.

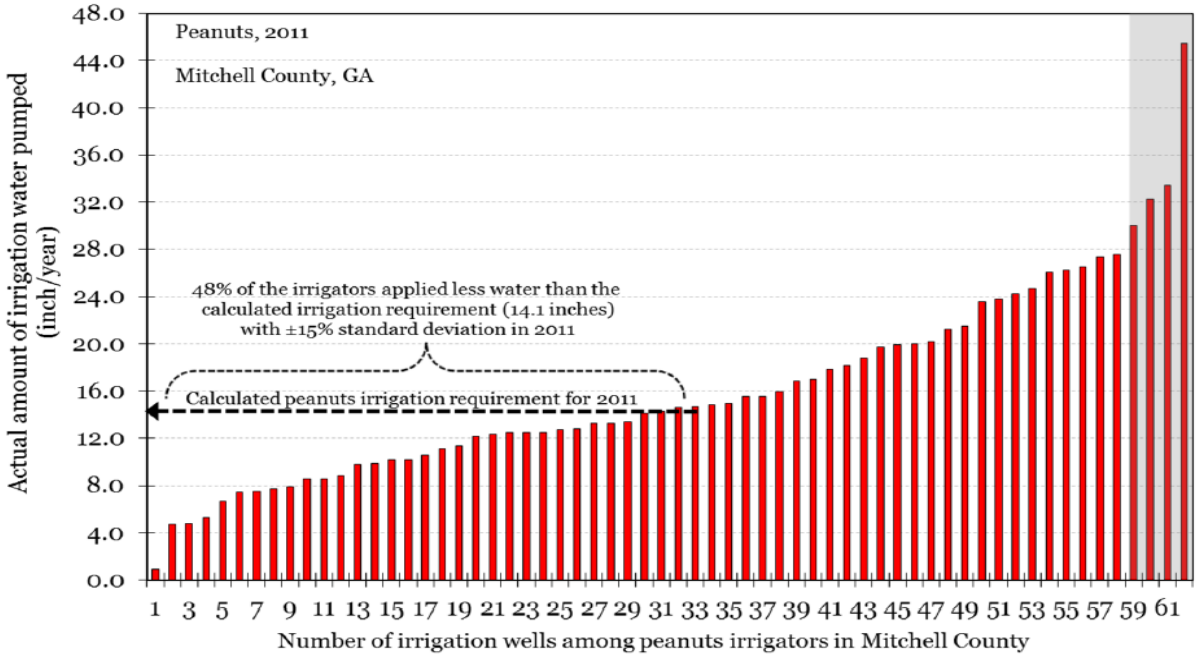

Figure 38b. Comparison of calculated minimum irrigation requirement vs. actual amount of irrigation water pumped for peanuts in 2011 in Mitchell County, Georgia.

For example, Dr. Irmak's county figure above for 2011—a severe drought year—shows 48% of peanut irrigators use less than his supposed "irrigation requirement" and 52% irrigate more. *Id.* Had Dr. Irmak used a proper methodology to reach his soil-type opinion, he would have found (even under his own flawed methodology) that the optimal amount of irrigation is actually substantially lower; in other words, *many* Georgia farmers can feasibly reduce irrigation water usage.[3]

Georgia first claims that Dr. Irmak employed a reliable methodology because "he relied

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[3] According to Dr. Irmak, his "irrigation requirement" is based on conditions such as climate, soil, agronomic characteristics, and irrigation application efficiency. *See* Attachment 18, Report at 112. The requirements found by Dr. Irmak would also be significantly lower had Dr. Irmak used accurate precipitation data from so-called gridded precipitation sets in reaching his conclusions, a showing Florida anticipates making at trial should Georgia actually seek to present testimony on that issue.

on the same sources on which Florida's own experts relied." Opp'n at 18. But that does not answer the critical question here of *what methodology Dr. Irmak employed.* Georgia once again conflates information and data with analysis and methodology. The U.S. Department of Agriculture ("USDA") Natural Resources Conservation Service's Web Soil Survey, which Dr. Irmak claims he used, is a *tool* to visualize granular field-level soil data. It cannot itself be used to draw conclusions about basin-wide soil types without applying some sort of methodology. *Florida's experts* developed a methodology for using this data to determine the soil type and corresponding soil water-holding capacity of agricultural land in Georgia's ACF Basin, and then applied that methodology to reach their conclusions that the most common types of soil were loamy sands, sandy loams, and sandy clay loam with average soil water-holding capacities between 1.10 and 2.00 inches per foot. *See, e.g.*, Attachment 19, Expert Report of Dr. David Sunding at 27-29, A-4-A-5 (Feb. 29, 2016) ("Sunding Report"). Georgia cannot point to any similar methodology or calculations that Dr. Irmak used to do the same with the Web Soil Survey data, because none exist.[4] *See* Attachment 15, Irmak Dep. 192:9-194:9.

Georgia next cites Dr. Irmak's visit to the FRB and "evaluat[ion] of the texture of the soil in person" as evidence of Dr. Irmak's "analysis." Opp'n at 18. Again, there is no information in Dr. Irmak's Report or production regarding this visit and any particular findings. And Georgia's argument is misleading: Dr. Irmak himself admitted ***it was not possible*** to "quantify how much moisture the soil profile has or what is the sand content of the soil just by feeling. So that requires a laboratory analysis." Attachment 20, Irmak Dep. 180:6-181:12. Of course, no such "laboratory analysis" was conducted by Dr. Irmak, so it is difficult to see how a site visit could produce any reliable information. Dr. Irmak's own description of his visit is particularly

[4] Indeed, there is no reference, much less a citation, to the Web Soil Survey in Dr. Irmak's Report, or any data from the Web Soil Survey in his expert production.

revealing—he could not even remember where he stopped because those stops were "totally random," and he kept no records, and he did not undertake any systematic effort to investigate soil types or anything else. *Id.* at 314:12-323:14.

Georgia's final Hail Mary is essentially an argument that Dr. Irmak's lack of methodology should be excused because his soil opinion is "not controversial." Whether or not his conclusion is controversial has no bearing on Florida's argument, *i.e.*, that he applied no analytical framework or methodology to reach his conclusion. But in any event, the sources Georgia marshals to prove that Dr. Irmak's conclusion is uncontroversial actually show that his conclusion is demonstrably wrong. In particular, Georgia cites work done by Florida's expert, Dr. Gerrit Hoogenboom, that found "soils in ACF Georgia are 'sandy loam or sandy clay loam soils.'" Opp'n at 18. But sandy loam and sandy clay loam have *average soil water-holding capacities of 1.25-1.40 inches per foot, over twice what Dr. Irmak opined was the "average"*:

Textural class	*Water holding capacity, inches/foot of soil*
Coarse sand	0.25 - 0.75
Fine sand	0.75 - 1.00
Loamy sand	1.10 - 1.20
Sandy loam	1.25 - 1.40
Fine sandy loam	1.50 - 2.00
Silt loam	2.00 - 2.50
Silty clay loam	1.80 - 2.00
Silty clay	1.50- 1.70
Clay	1.20 - 1.50

Table 1 – Range Soil Water Holding Capacities of Different Soils[5]

[5] Univ. of Nebraska-Lincoln, Plant & Soil Sciences eLibrary, "Soils - Part 2: Physical Properties of Soil and Soil Water," https://passel.unl.edu/pages/informationmodule.php?idinformationmodule=1130447039&topicorder=10&maxto=10 (last accessed Oct. 2, 2016)

Georgia also cites testimony by Dr. James Hook purporting to show that agricultural soils in southwest Georgia are sandy. *See* Opp'n at 18. But what Dr. Hook actually testified was that soils in the Dougherty Plain in Southwest Georgia "vary a fair amount."[6] Attachment 22, Hook Dep. 173:4-15. Georgia's misleading reliance on Drs. Hoogenboom and Hook therefore fails as a factual matter.

In sum, nothing in the opposition demonstrates that Dr. Irmak applied any methodology, calculation, or analytical framework to reach his soil water-holding capacity conclusion. Exclusion of both this specific opinion and any opinions reliant on these findings is warranted.

C. Georgia's Attempt To Establish The Relevance Of Dr. Irmak's Deficit Irrigation Conclusion Is Inconsistent With Dr. Irmak's Own Testimony

Dr. Irmak's opinion that "deficit irrigation" is "not feasible or profitable" is irrelevant because he opined on the wrong topic. Dr. Irmak was attempting to refute a perceived argument about a highly specific irrigation technique while Florida's expert, Dr. Sunding, was discussing a different concept—the marginal yield impacts of reducing irrigation water usage (what Dr. Irmak later called "limited irrigation"), including by reducing excessive irrigation. *See* Mot. at 17-19; Attachment 2, Report at 18. Georgia's attempt to deflect blame for its expert's mistake by claiming that Dr. Sunding caused the error by misusing the term "deficit irrigation" is specious. Dr. Sunding used the term in the same way it is used in the academic literature and by international bodies, *including the United Nations.*[7]

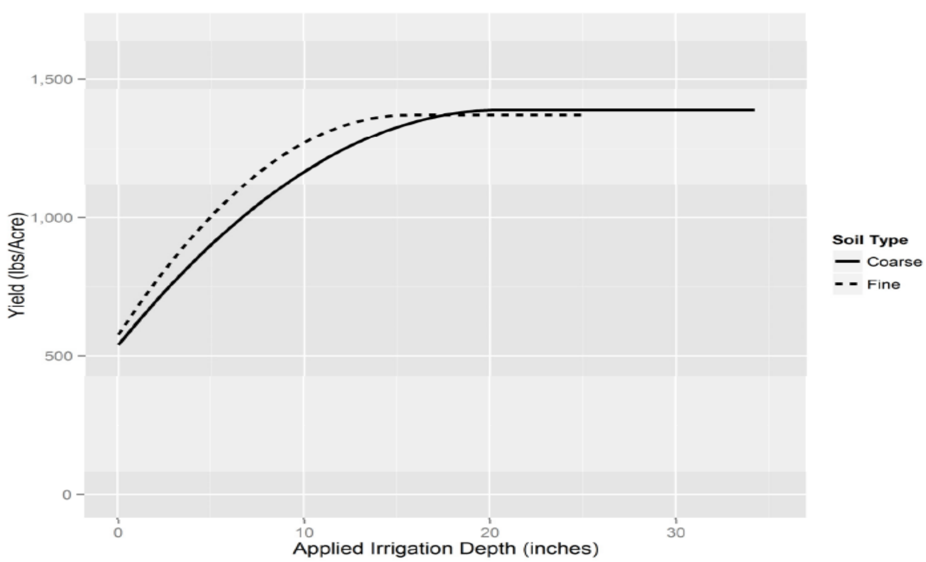
(Table 2.6). Dr. Irmak is a professor in the University of Nebraska-Lincoln's Department of Biological Systems Engineering.

[6] In light of his actual testimony, it is not surprising that Georgia will not call Dr. Hook as a witness at trial. Georgia's reliance on him here is further misplaced because Dr. Irmak did not rely on Dr. Hook for his opinion regarding soil types and soil water-holding capacity.

[7] The United Nations defines "deficit irrigation" precisely as Dr. Sunding does (at pages 4 and 42 of his report): "an irrigation practice whereby water supply is reduced below maximum levels

The specific issue upon which Dr. Sunding was opining was described in detail in his report and would have been obvious to an expert in the field carefully evaluating his testimony. Attachment 19, Sunding Report at 4-5, 42-43. The substance of Dr. Sunding's proposal is clear: Georgia farmers can cut excessive irrigation, and further, can even "reduc[e] irrigation depths below those that generate maximum yields" without crop failure. *Id.* at 4, 42. Dr. Sunding further notes that "the cost of deficit irrigation is the reduction in yields from a reduction in applied water." *Id.* at 51. As shown in Figure 13 from Dr. Sunding's report, decreasing irrigation water application at some levels can have an impact on yield. *Id.* But for many reductions in irrigation amounts, yield impacts are in fact minimal. *Id.* at 52.

Figure 13: Crop-Water Production Functions for Cotton in Dry Years



Dr. Irmak, by his own admission, did not engage with the substance of Dr. Sunding's testimony. *See* Attachment 20, Irmak Dep. 643:13-649:2, 650:3-12; Attachment 21, Shellman Farm Deficit Irrigation Yields (Irmak Dep. Ex. 65); Mot. at 17-19.

While Georgia now claims that the difference between "deficit irrigation" and "limited

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and mild stress is allowed with minimal effects on yield." Food & Agric. Org. of the U.N., "Deficit Irrigation Practices" at iii (2002), ftp://ftp.fao.org/agl/aglw/docs/wr22e.pdf.

irrigation" as understood by Dr. Irmak is a "thin read," unfortunately for Georgia, its own expert disagrees. *See* Opp'n at 19. Dr. Irmak explicitly testified that, for him, the two terms describe very different things, that the distinction is important, and that he *did not study the issue on which Dr. Sunding opined*. *See* Attachment 20, Irmak Dep. 648:20-649:2, 650:3-12 ("I don't think limited irrigation was mentioned in my report in these kind of context."); Mot. at 17-18.

Despite Dr. Irmak's admission that he was talking past Dr. Sunding, Georgia now points at page 19 of its brief to three topics that Dr. Irmak *did* analyze in an attempt to suggest that "limited irrigation"—just like his discussion of "deficit irrigation"—would also result in wide-scale crop loss. The problem for Georgia here is that the specific pages its brief identifies do not show any analysis of "limited irrigation" to justify Dr. Irmak's conclusion that reducing irrigation amounts is not feasible. Indeed, other sections of his report (which are not the subject of this motion) actually show the opposite. For example, section VI of Dr. Irmak's Report establishes, based on data from the USDA, that hundreds of thousands of acres of corn, peanuts and cotton were grown successfully in Georgia's portion of the ACF for many decades before irrigation was even first adopted in the 1970s and 1980s. *See* Attachment 18, Report at 139, 141, 143. Likewise, Georgia's brief mentions, but does not supply any citation to or text of, Dr. Irmak's consideration of "seasonal irrigation requirements for different crops." This is because that analysis also contradicts Dr. Irmak's purported opinion that reducing irrigation is *not feasible*. Although flawed in several key respects (*see supra* p 8), Dr. Irmak's "seasonal irrigation requirement" analysis shows that farming with smaller applications of irrigation water *is actually feasible in the ACF, and that a number of Georgia farmers already do so*. *See* Attachment 18, Report at 122, 123, 130.

In sum, Dr. Irmak admitted that his response to Dr. Sunding addressed the wrong issue. His opinion is therefore irrelevant and should be excluded.

CONCLUSION

For the foregoing reasons, and as set forth in Florida's Motion, the identified opinions of Dr. Irmak do not meet the standards set forth in *Daubert* and its progeny and should be excluded.

Dated: October 7, 2016

Respectfully submitted,

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October 7, 2016

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Attachment 19: Excerpts from the Expert Report of David Sunding, Ph.D. (Feb. 29, 2016)

Attachment 20: Excerpts from the Deposition Transcript of Suat Irmak, Ph.D. (Aug. 2-3, 2016)

Attachment 21: Shellman Farm Deficit Irrigation Yields in Dry Years and All Years (Irmak Dep. Ex. 65)

Attachment 22: Excerpts from the Deposition Transcript of James E. Hook, Ph.D. (Feb. 23, 2016)

ATTACHMENT 18

Excerpts from the Expert Report of Suat Irmak, Ph.D. (May 20, 2016)

State of Florida v. State of Georgia,
No. 142, Original

Expert Report of
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losses mean that sustaining crop productivity requires irrigation multiple times a day. Even during the rainy periods, climatic conditions can still result in fast evaporation rates of soil moisture from sandy soils, and in many cases irrigation can be necessary even a day or two after precipitation events.

Sandy soils have very high saturated hydraulic conductivity values due to large pore sizes as compared to the silt-loam or similar fine-textured soils. For example, agricultural soils in the Midwestern and western USA have hydraulic conductivity values ranging from 0.05 inch/hr to 1.5 inch/hr whereas soils with 85% sand content has a 4.5 inch/hr saturated hydraulic conductivity value. After a precipitation event, the water would infiltrate into sandy soils and percolate below the crop root zone in a much faster time than water in silt-loam soils. Thus, the crop may not have the ability or opportunity to uptake precipitation water due to very low water holding capacity, thus requiring additional irrigation applications even between two close precipitation events. Florida's claims about the reasonableness and efficiency of Georgia's irrigation practices must be considered in light of these soil conditions.

C. The Highly Productive Floridan Aquifer System Is a Vital Resource to Irrigators in the Lower ACF Basin

The Floridan Aquifer system, one of the most productive groundwater sources in the USA, underlies the entire state of Florida and parts of Georgia, Alabama and South Carolina. The Floridan Aquifer, particularly the Upper Floridan Aquifer (UFA), is an important source of water because of its abundant quantity of stored water, its proximity to the surface,[9] its good quality water, its very high hydraulic conductivity, and its relatively fast rechargeability rate.[10]

Unlike most other aquifer systems in the world, the Floridan Aquifer is a "karst system," which means the carbonate rocks of the aquifer system are readily dissolved where they are exposed at land surface or are overlain by only a thin layer of confining material. This karst system can have a significant effect on water movement. The karst system means that the Upper Floridan Aquifer is highly permeable in most places. As a result, water is able to enter, move through, and discharge from the Floridan Aquifer system more readily and rapidly where it is unconfined or where the upper confining unit is thin. As a result, the Upper Floridan Aquifer is quickly rechargeable with precipitation events, unlike other slow recharging aquifer systems that take hundreds of years to recharge. Given the Upper Floridan Aquifer's significant rechargeability, even large

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9 The thickness of the aquifer ranges from 250 ft. in south central Georgia to 3,000 ft. in southern Florida.

10 FL USGS/DNR, 1990. Transmissivity and Well Yields of the Upper Floridan Aquifer in Florida. ISSN 0085-0624. For more detailed discussion of groundwater in the ACF Basin, see the Expert Report of Sorab Panday, Ph.D. (May 20, 2016).

withdrawals of water from the aquifer system, particularly in Subarea 4 of the Flint River Basin, do not cause long-term declines or depletions in aquifer storage.[11]

Not only does the Upper Floridan Aquifer recharge quickly, it is also an abundant water source for irrigation and public supply due to the the natural geology of the karst system and the deep sandy soils of the coastal plain. The Upper Floridan Aquifer stores and transmits large quantities of water, mainly in a zone of high permeability in the lower part of the aquifer. The transmissivity of the aquifer, or measure of volume of groundwater that will flow through it, can be as high as 1 million ft^2/d (FL USGS/DNR, 1990) in the karstic areas of central and northern Florida. In comparison, the average transmissivity of the High Plains Aquifer in eastern Colorado and eastern New Mexico is only about 4,500 ft^2/day.[12] As a result of the aquifer's thickness and transmissivity, irrigation wells in the Upper Floridan Aquifer can have substantial capacity. Well yields can range from several hundred to more than 10,000 gal/min (gallons per minute), depending on the well construction features, depths, and the location of wells.[13] Wells that yield several thousand gal/min are very uncommon and considered extremely high productivity wells in the USA. Thus, the Upper Floridan Aquifer has proven to be a viable and sustainable water source for irrigation.

D. Florida's Assertions that Irrigation Is "Largely Discretionary" and that Georgia Can Switch to Dryland Farming Are Unfounded; Irrigation Plays a Critical Role for Agricultural Productivity in Georgia's ACF Basin

Dr. Sunding states that "agricultural water use remains largely discretionary and is not a necessity for crop production." Similarly, Dr. Bottcher recommends "[c]onversion to alternative, less water-demanding crops or dryland farming" as a method to achieve water savings. Those claims are unfounded and are not practicable options for farmers in the Georgia portion of the ACF Basin. In fact, irrigation plays a critical role in crop production in the ACF Basin.

At the outset, in Georgia, there is no "dryland farming." Dryland farming is defined as farming under conditions of moderate to severe moisture stress during a substantial part of the year, and is generally understood to apply to regions that receive less than 500-750 mm of precipitation annually.[14] Georgia has a humid climate and, during a normal year, receives substantially more precipitation than dryland regions; therefore, "rainfed agriculture" is the correct scientific term.

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[11] FL USGS/DNR, 1990.

[12] USGS Publication HA 730-C; 2009. GROUND WATER ATLAS of the UNITED STATES: Arizona, Colorado, New Mexico, Utah.

[13] FL USGS/DNR, 1990.

[14] United Nation Food and Agriculture Organization, "Definitions of Drylands and Dryland Farming," available at http://www.fao.org/docrep/012/i0372e/i0372e08.pdf.

IV. TEMPORAL TRENDS IN CROP IRRIGATION REQUIREMENTS

After determining long-term reference evapotranspiration, crop coefficients, crop ET, and effective precipitation, I determined seasonal irrigation requirements for each crop by accounting for local conditions such as climate, soil, and agronomic characteristics and assuming a typical irrigation application efficiency. Growing season length for cotton was taken as May 15 to October 31; for peanuts, April 15 to October 15; for corn, March 1 to October 15 (long-season corn); and for soybean, May 1 to October 31. While the majority of corn in Georgia is planted in March and harvested in the end of July to early August (short season corn), some acreage is also planted with long-season corn. To calculate the crop water requirement for the highest water use scenario, long-season corn was used in this report.

Temporal distribution of seasonal irrigation requirements of cotton, peanuts, corn, and soybean for individual years from 1990 to 2013 is presented in Figure 37a, Figure 37b, Figure 37c, and Figure 37d, respectively. The long-term average irrigation requirements were 260 mm (10.2 inches), 233 mm (9.2 inches), 231 mm (9.1 inches), and 148 mm (5.8 inches) for cotton, peanuts, corn, and soybean, respectively. The highest irrigation requirement for cotton was 476 mm (18.7 inches) in 2006; it was 505 mm (20 inches) in 2006 for peanuts; it was 465 mm (18.3 inches) in 1998 for corn; and it was 303 mm (11.9 inches), also in 2006, for soybean. In some years, there was no estimated irrigation requirement. This was due to the precipitation amount exceeding the ET amount. This is expected because, when seasonal precipitation is summed for calculating the seasonal irrigation requirement, precipitation timing is not taken into account, and this can cause substantial underestimations of seasonal irrigation needs. While the seasonal irrigation requirement may not show seasonal irrigation need, depending on the precipitation timing, there will be substantial irrigation needs within the growing season.

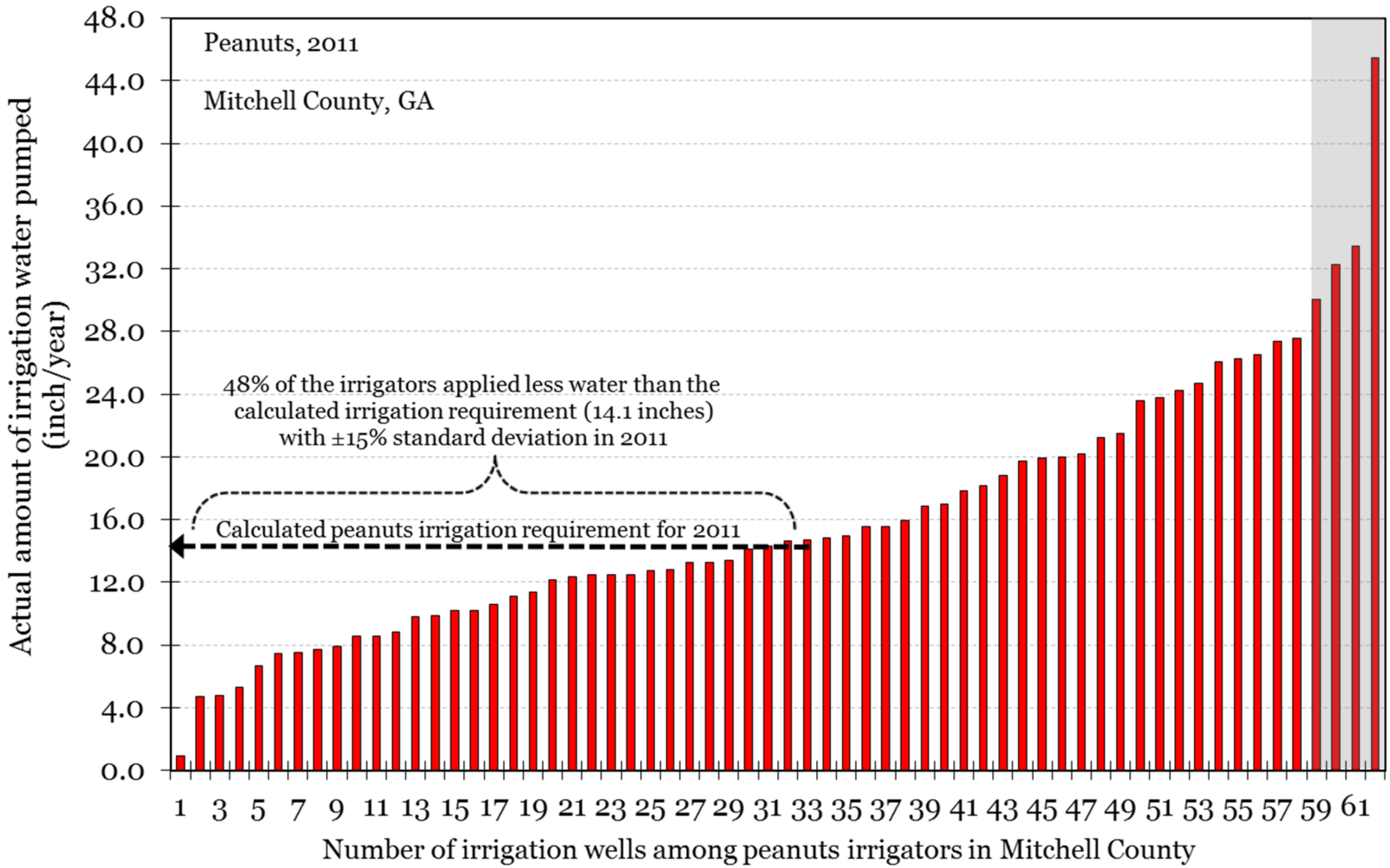


Figure 38b. Comparison of calculated minimum irrigation requirement vs. actual amount of irrigation water pumped for peanuts in 2011 in Mitchell County, Georgia.

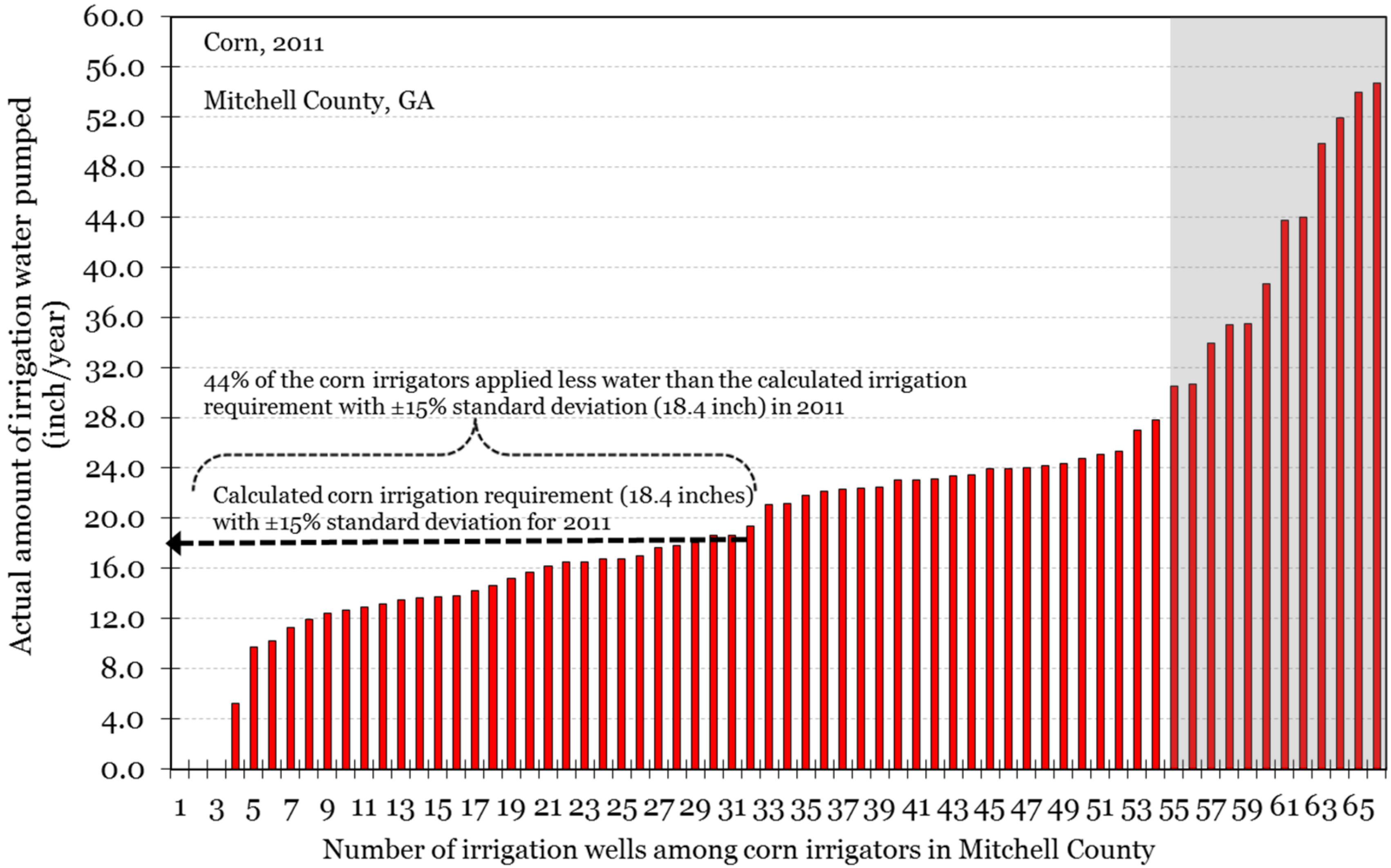


Figure 38c. Comparison of calculated minimum irrigation requirement vs. actual amount of irrigation water pumped for corn in 2011 in Mitchell County, Georgia.

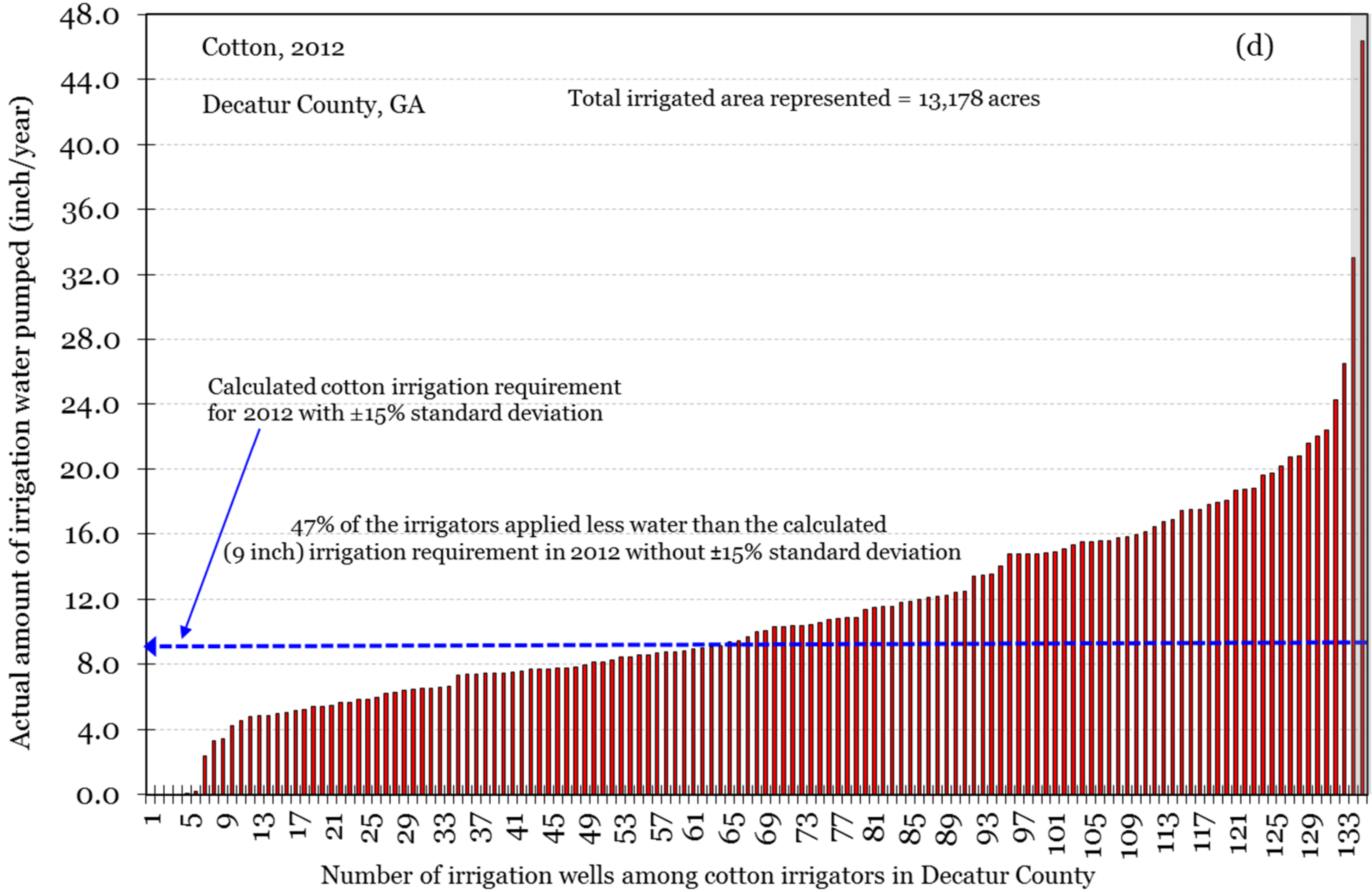


Figure 39d. Comparison of calculated seasonal irrigation requirement with those actual amounts of water pumped for cotton based on on-farm measured flowmeter data in Decatur County, GA.

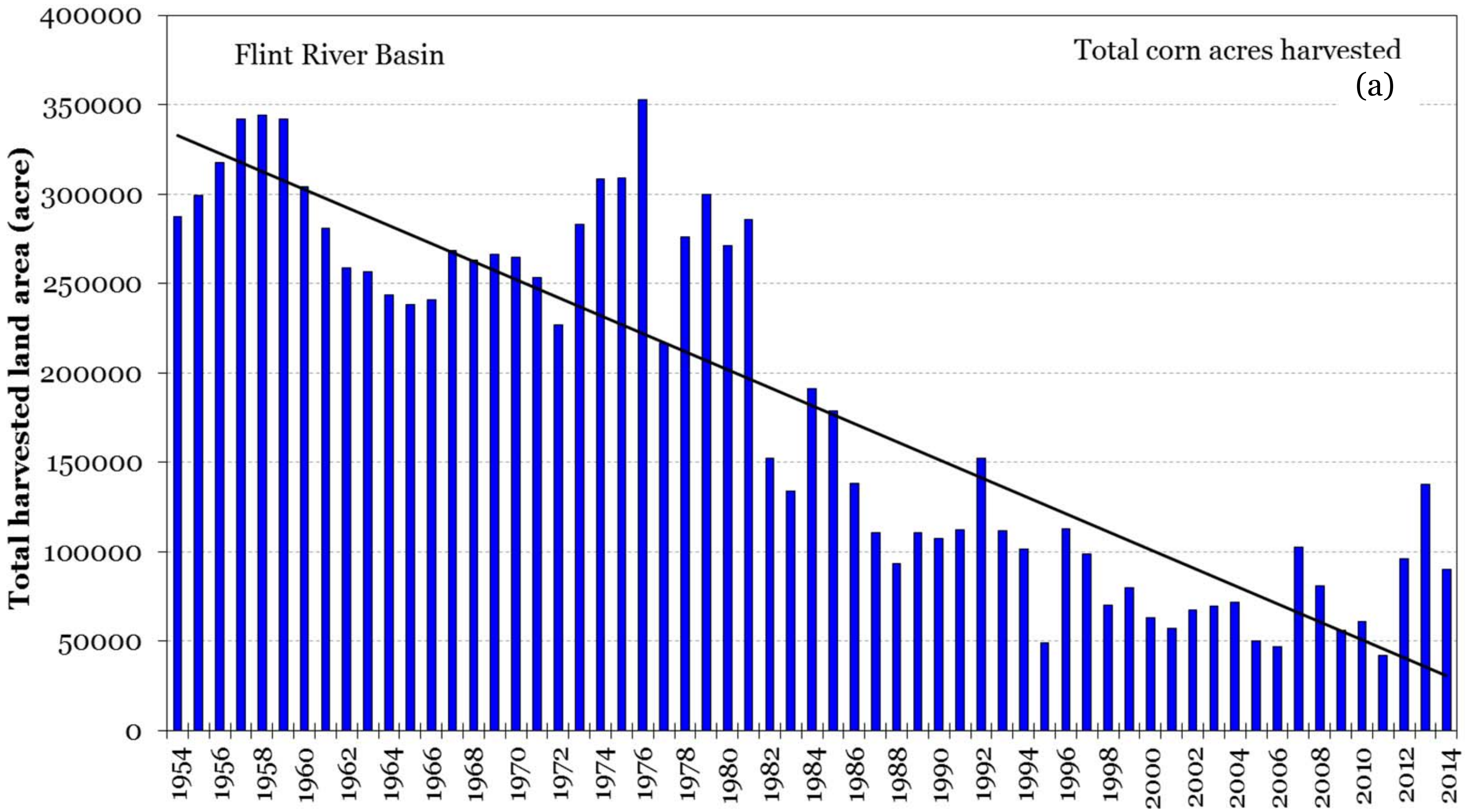


Figure 42a. Progression of corn acreage in the Flint River Basin (Upper, Middle and Lower; 28 counties) from 1954 through 2014.

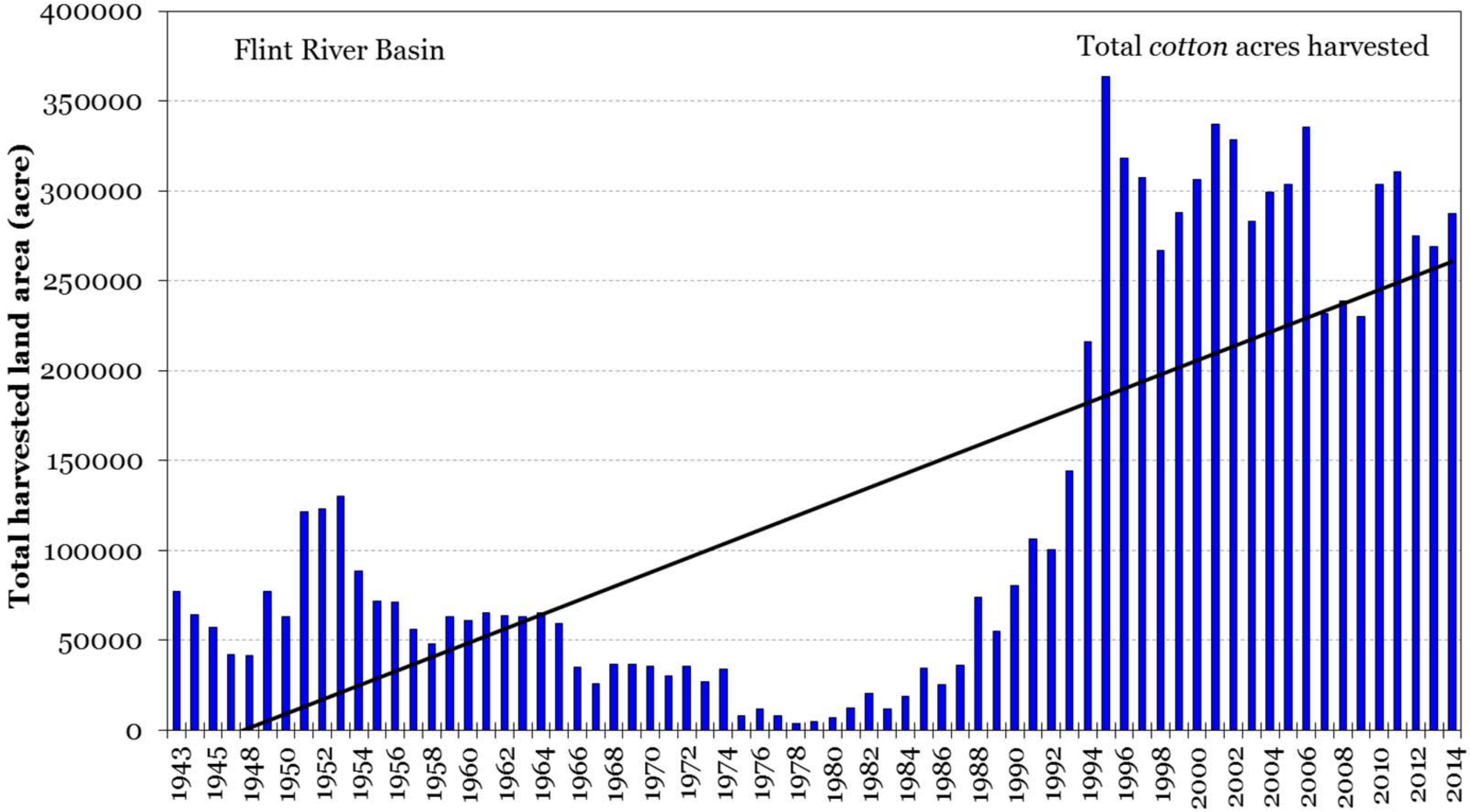


Figure 42c. Progression of cotton acreage in the Flint River Basin (Upper, Middle and Lower; 28 counties) from 1943 through 2014.

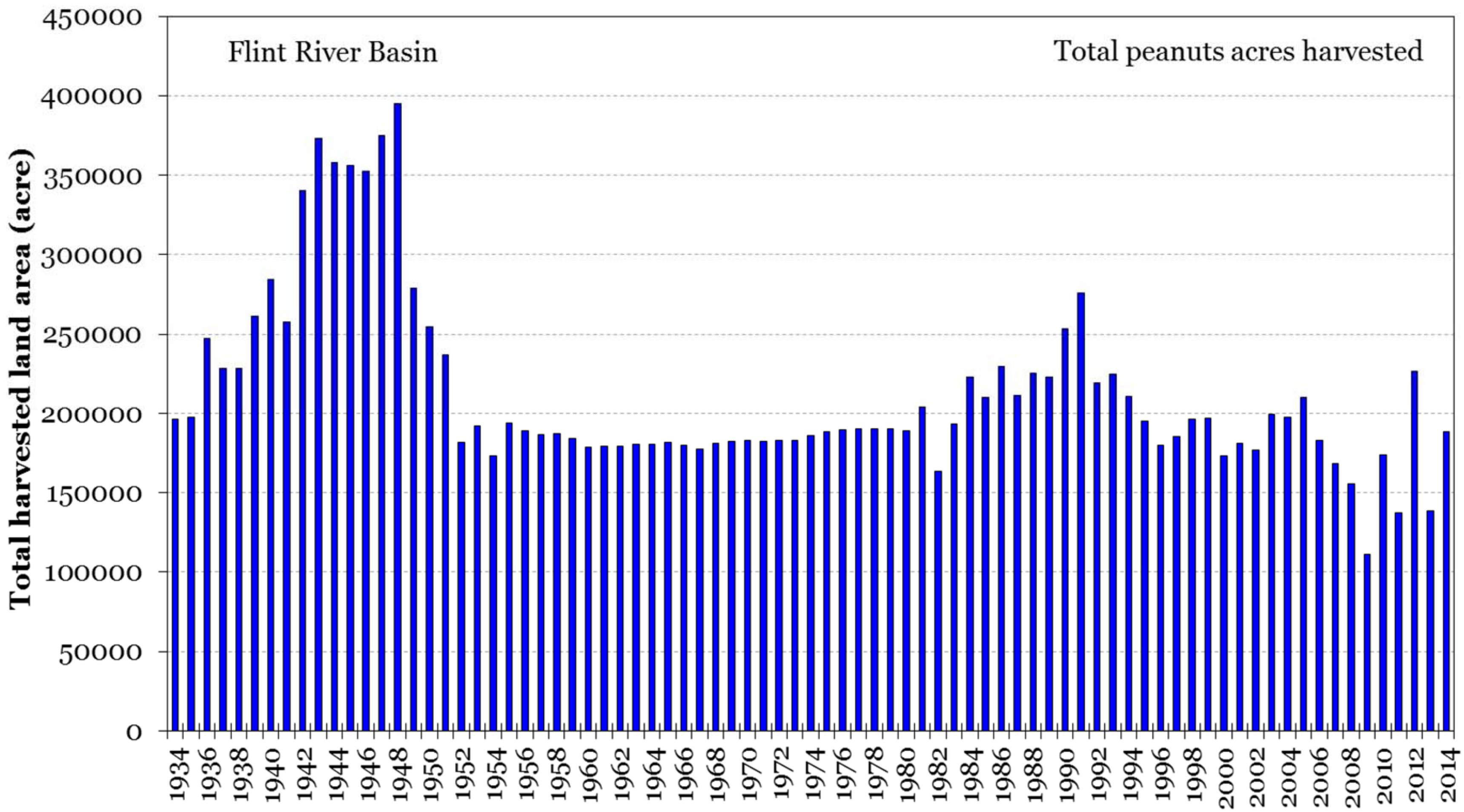


Figure 42e. Progression of peanuts acreage in the Flint River Basin (Upper, Middle and Lower; 28 counties) from 1934 to 2014.

ATTACHMENT 19

Excerpts from the Expert Report of David Sunding, Ph.D. (Feb. 29, 2016)

Report of Dr. David L. Sunding

Economic Impacts of Reducing Water Consumption in the Chattahoochee and Flint River Basins of Georgia

Prepared for the State of Florida, Through Its Department of Environmental Protection and Its Counsel, Latham & Watkins LLP

February 29, 2016

THE Brattle GROUP

Confidential – S. Ct. 142

water supplies for years, and have developed various techniques to address those shortages in an economically feasible way. Some common techniques include limitations on agricultural water use and irrigated acreage, encouraging groundwater substitution, adoption of more efficient irrigation technologies, reducing urban consumption (especially in the residential sector), water reclamation and reuse, effective use of surface water and groundwater storage, and other strategies. These measures can be implemented via different mechanisms, including through direct regulation, price incentives and rebates, or market-based mechanisms that establish an equilibrium price for water that incorporates the environmental effects of water consumption.

Many states incur considerable expenditures to implement environmentally responsible water policies. In California, for example, water users and taxpayers have borne costs in the tens of billions of dollars to conserve scarce water resources especially in times of drought, to enhance streamflows, and to recover aquatic habitats. Georgia would hardly be in uncharted territory if it were to materially increase its presently nominal expenditures to more effectively manage its use of ACF water resources.

As I explain below, Georgia could readily reduce its consumptive use of water to levels that would be less damaging to Florida's unique ecology. Legislatures and policy makers do not always choose to implement conservation policies in the most economically efficient ways, because other social and political values are important considerations. Georgia has a wide variety of conservation options available, and I do not analyze every conceivable one. Instead, I demonstrate that Georgia has a number of feasible conservation approaches that it can implement to significantly reduce streamflow depletions at reasonable cost.

Specifically, I address the following potential conservation measures:

Deficit irrigation on corn, cotton, peanuts, and soybeans: One common conservation measure employed by states during times of drought is deficit irrigation, that is, temporary reductions in irrigation below the agronomic optimal amounts. In the case of Georgia, deficit irrigation is a particularly low-cost conservation measure because, as the data shows, many farmers are not making optimal use of water to begin with and are in essence wasting water. I am able to reach this conclusion by first determining the optimal quantity of water applied during irrigation as a function of the amount and timing of precipitation during the growing season, the soil characteristics of the underlying farmland, and the particular crop being grown. With that knowledge in hand, I am able to evaluate actual farmer practices in Georgia and estimate the degree of departure from the optimum, which I find to be significant. Using hydrological data provided by Dr. David Langseth, I am able to determine the contribution to streamflows from reductions in irrigation applied to specific crops in the ACF basin. Using data provided by Dr. Gerrit Hoogenboom, I am able to determine the impact to yield, and thus economic cost, of those reductions in irrigation.

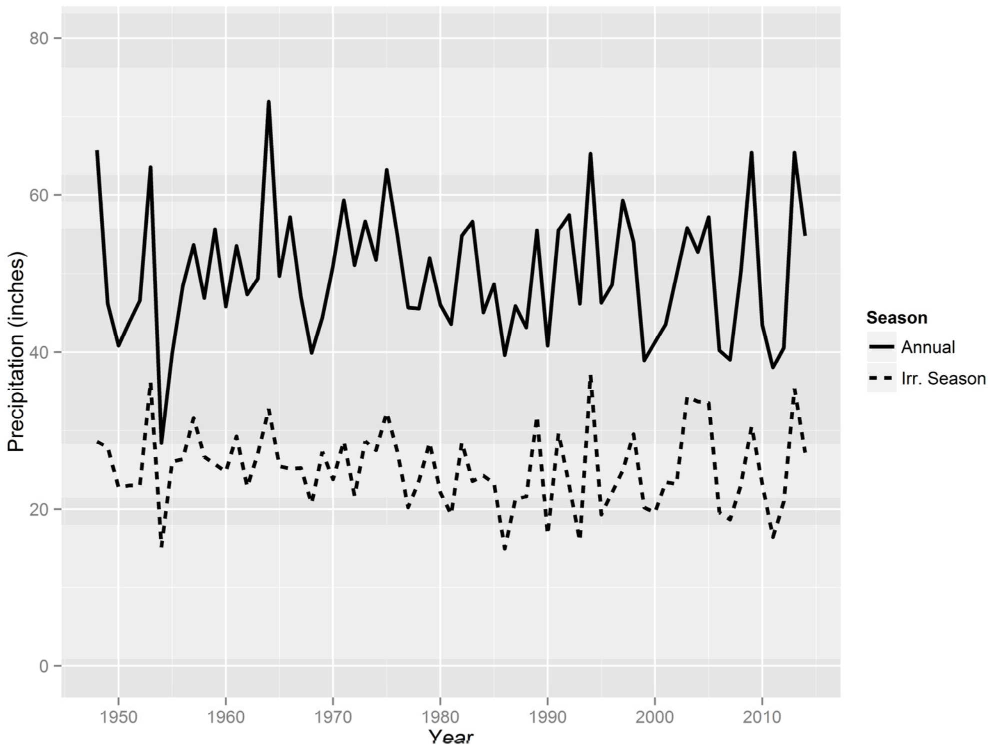
Efficiency improvements on irrigation equipment: Center pivot irrigation systems were introduced in Georgia in the 1970s and currently account for about 77% of Georgia's irrigation systems. Center pivot systems work by pumping water to a node at the center of a circular apparatus, which then runs through an elevated pipe that rotates around a field applying water to the underlying crops through spray or drip nozzles. As Dr. Del Bottcher explains, and as Dr. James Hook testified, these systems have inefficiencies due to evaporative loss that can be improved by retrofitting older equipment with newer technology. Using data provided by Dr. Bottcher, I estimate the cost and streamflow impact of retrofitting existing center pivot systems.

Deeper aquifers: Much of the groundwater used for irrigation in the ACF is drawn from the Floridan aquifer, which has a significant impact on surface flow due to the high degree of hydrologic connectivity to the Flint River. However, by installing deeper wells, ACF farmers can draw from deeper aquifers with sustainable supplies of water and less hydrologic connectivity to the Flint River. Even considering only a single of those deeper aquifers, the Claiborne, it is apparent that moving water intensive, high-value crops such as pecans, produce, nurseries and sod to these deeper aquifers would result in cost-effective reductions in streamflow depletions, particularly during drought.

Leak abatement: All municipal water systems have some degree of system loss through leaky pipes, but systems with losses exceeding twenty percent, such as the Atlanta Department of Watershed Management, can adopt leak abatement measures to reduce losses at relatively low cost.

Reductions in municipal outdoor water use: Outdoor water use is one of the primary consumptive uses of municipal water demand. I am able to estimate the value for each unit of outdoor water, which in turn represents the economic cost of conservation, or the value lost due

Figure 6: Annual Precipitation in Flint River Basin, 1948-2014[31]



Source: NOAA National Climatic Data Center, Global Historical Climatology Network (GHCN) Daily Data series for select weather stations in Flint River Basin, Georgia

34. Irrigation decisions – both the threshold decision of whether to invest in an irrigation system as well as the amount of water to apply in a year – are impacted by the soil characteristics of the underlying farmland. In addition to slope and soil depth, soil composition influences how water moves from the surface to the root system. Soils with larger particles, such as those dominated by sandy and loamy components, generally permit water to flow more easily. This means that water drains through the soil profile quicker, requiring farmers to apply water more frequently to achieve the same yields as on soils

31 Irrigation season defined as April through September. Values represent average precipitation across 42 Flint River Basin counties.

with smaller particles. Soils with smaller particles, such as those dominated by clay and silt components, drain less quickly and hold water in the root zone for a longer period of time.

35. The irrigated agricultural land in the ACF contains 53 individual dominant soil types or series. For the purposes of this report, I classify these soils into "coarse" and "fine" according to the particle size reported in the NRCS Soil Series Classification database.[32] Coarse soils include those with coarse-loamy, loamy, and sandy particles as well as "thermic" soils with unspecified particle size. Fine soils include those with clayey, fine, and fine-loamy particle size. Based on observations of water use in the Agricultural Metering Database, described in detail in subsequent sections and in Technical Appendix A to this report, this classification appropriately reflects observed irrigation depths across the ACF. Generally, farmers irrigating crops on fine soils used less water than those irrigating the same crops on coarse soils.[33] Figure 7 shows the distribution of coarse and fine soils for two representative counties in southwestern Georgia. The map reveals a substantial amount of detail in the spatial pattern of soil types across the landscape.

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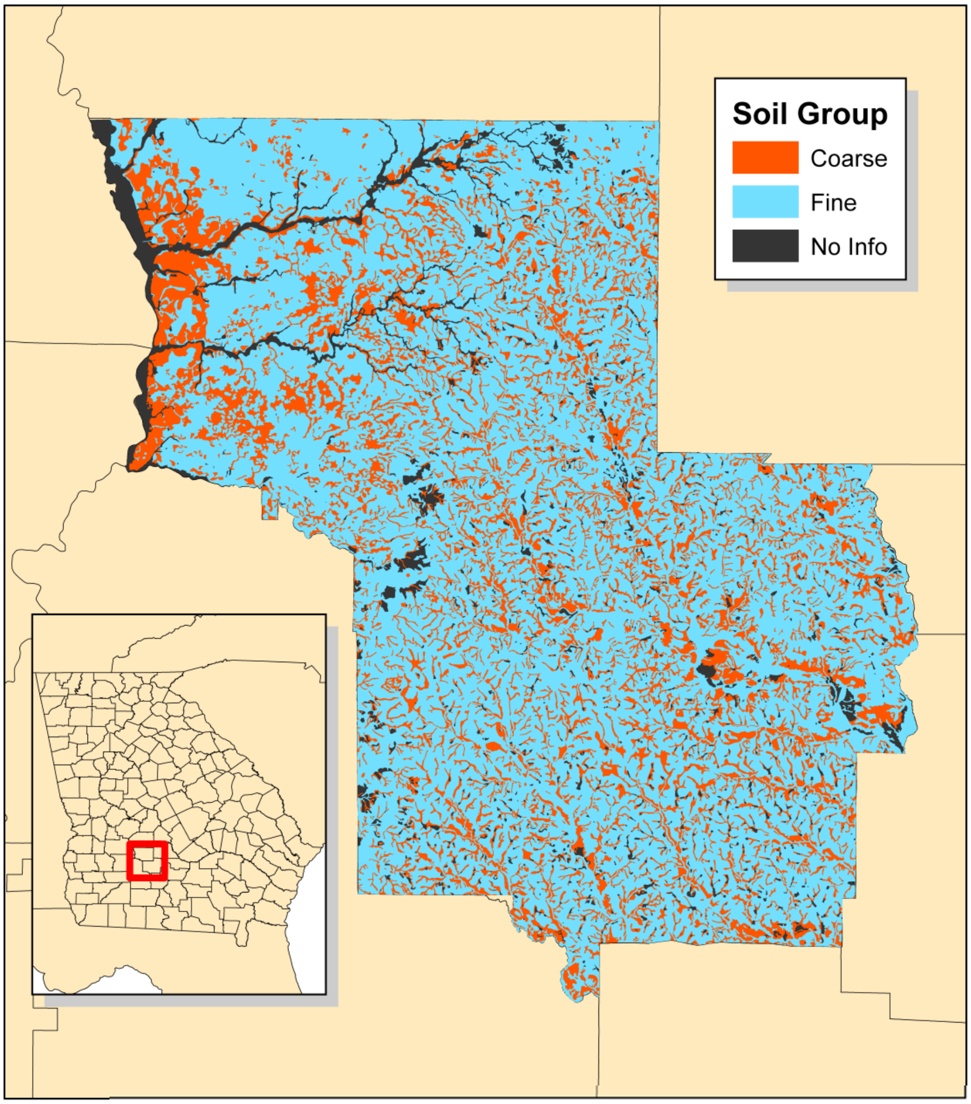
32 Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/class/?cid=nrcs142p2_053583

33 In two instances, I reclassified two relatively minor soil series where the pattern of applied water use in the ACF did not match expectations based on particle size. Fuquay and Pelham soils are classified as "fine" despite having loamy particle size, on the basis that observed irrigation depths tended to be more similar to other fine soils.

Figure 7: Map of Soil Types in Crisp and Turner Counties, Georgia



Source: SSURGO Soil Database, USDA Soil Series Classification Database

B. MAJOR CROPS

36. One of the main drivers of farmers' irrigation decisions is of course the crop being grown. According to projections made by the National Environmentally Sound Production Agriculture Laboratory (NESPAL) at the University of Georgia, for example, an acre of pecans uses almost six times the amount of water as an acre of soybeans in an average year. Given this variability, it is important to understand the pattern of irrigated land use in the

IV. Agricultural Water Productivity

56. As discussed above, a number of factors influence farmers' decision to irrigate, and the quantity of water they apply. These factors include the crop planted, characteristics of the soil, the irrigation technology used, and the amount of rainfall during the growing season. Thus, the value of irrigation water to farmers is also conditioned by these same factors.

57. Understanding the value of irrigation water to farmers is critical to assessing the economic costs of reducing irrigation depths below those that generate maximum yields, a conservation strategy commonly known as deficit irrigation. In this section, I present a detailed simulation-based analysis of the effects of irrigation on crop yields and resulting estimates of the value of irrigation water in the ACF Basin of Georgia.

A. DSSAT Model

58. The relationship between irrigation and yield can be understood as a "crop-water production function", where the depth of irrigation water is modeled as a production input and crop yield per acre is the output. A certain yield can be achieved under dryland production and yields increase, up to a point, as more irrigation is applied. To model this relationship for the "big three" crops of the ACF—namely corn, cotton, and peanuts—as well as soybeans, I rely on the Decision Support System for Agrotechnology Transfer (DSSAT). DSSAT is a software application comprised of several crop simulation models, developed and maintained by researchers at the University of Florida, the University of Georgia, and numerous other academic and research institutions.[52]

59. DSSAT may be used to determine optimal irrigation and other management regimes, or it may be used conversely to estimate crop yields under a given set of growing conditions. For purposes of my analysis, it is reasonable to assume that the water productivities resulting from the DSSAT analysis overestimate actual productivities achieved by farmers in real-

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[52] Jones, et al., "The DSSAT Cropping System Model," *European Journal of Agronomy* 18 (2003): 235-265.

world conditions where their behavior may deviate from the optimum. In this sense, my analysis of water productivity based on the DSSAT model is conservative.

60. Indeed, in the technical appendix, I present the results of two corroborating analyses to infer the value of water used by farmers in the ACF Basin. One analysis looks at the market value of farmland with and without a groundwater withdrawal permit attached. The other analysis estimates a groundwater demand function based on the AMD database, explaining irrigation depths as a function of lift costs, soil conditions, rainfall and other covariates. The results of these analyses, which use actual market behavior as opposed to a simulated optimum, are inferred values of irrigation water that are somewhat below the estimates presented in this section, thus corroborating my assumption that the DSSAT-generated costs of deficit irrigation are conservative (i.e., likely to be larger than actual costs).

61. In order to recover the crop-water production relationships embedded in the DSSAT model, I rely on the series of model runs described in the expert report of Dr. Gerrit Hoogenboom. For a selection of important soil types and over a number of historical weather years, Dr. Hoogenboom ran the DSSAT model for corn, cotton, peanuts, and soybeans at various irrigation thresholds. These runs generated the predicted yield for a crop on a particular soil type, under given weather conditions, over a range of different irrigation depths.

62. To translate the DSSAT simulation output into the production functions of interest, I first limited the points to only those relying on years with total irrigation season precipitation in the bottom 30 percent of the distribution. The relationship between crop yield and irrigation depends on precipitation, and dry-year crop-water production functions are the relevant relationships for the subsequent analysis of conservation costs. I then fitted a quadratic curve to all points for a given crop and soil group using linear regression.[53] Due to the quadratic functional form, the resulting fitted curves turned downwards at high irrigation depths. Although it is reasonable to expect that over-watering would have a

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[53] I use the same soil grouping described in section III.B, with Faceville, Greenville, Norfolk, Orangeburg, and Tifton comprising the soil types that represent the "fine" soil group; and Lucy, Troup, and Wagram the "coarse" soil group. Individual crop-water production functions fitted separately for each soil type further confirmed that this grouping is appropriate for modeling irrigation use.

details about the installation and permit application dates, as well as the depth to the water table, for use in my econometric analyses presented in Section VI.[150]

Due to gaps in the metered water use records, I adjusted parcel groupings to ensure consistency over time. Specifically, I split parcels with different numbers of meters reporting water use from year to year. As an example, consider parcel A, which is served by meters 1 and 2. Meter 1 reports total water use for 2007-2009 and 2012-2014, but omits data for 2010 and 2011. Meter 2 reports water use for 2007 to 2014. Since it is unclear whether the missing meter 1 data is a result of error (i.e., actual water use was incorrectly reported) or actual conditions (i.e., the farmer did not irrigate his parcel during 2010 and 2011), I split parcel A into 2 parcels (A1 and A2) based on which meters were active during the reporting period. Parcel A1 is served by meters 1 and 2 and contains information for 2007-2009 and 2012-2014. Parcel A2 is served by meter 2 and contains information for 2010 and 2011.

I combine information about water use from the AMD with land use information from the Cropland Data Layer (CDL) and soil data from the SSURGO Dataset. Since these data contain spatial information, I construct a spatial boundary for each irrigated area according to the acreage and centroid coordinates reported in the AMD irrigated parcel dataset. I assume that each irrigated parcel has a circular shape, based on my observation that central pivot irrigation systems are common in the ACF basin. Using a Geographic Information System (GIS), I intersect each irrigated area with the CDL raster file and tabulate the percent of each area represented by various crops. I also intersect each grouped parcel with the appropriate SSURGO spatial file. Using the unique map unit identifier ("mukey") from the soil spatial data, I merge the tabular information from the "component" table of the SSURGO database. This table contains information about soil composition, drainage classes, representative slopes, and other taxonomic information about each soil type.

I removed grouped parcels where the resulting dominant land use (crop area divided by total parcel area) was unreported or accounted for less than 50 percent of the total parcel area, as my

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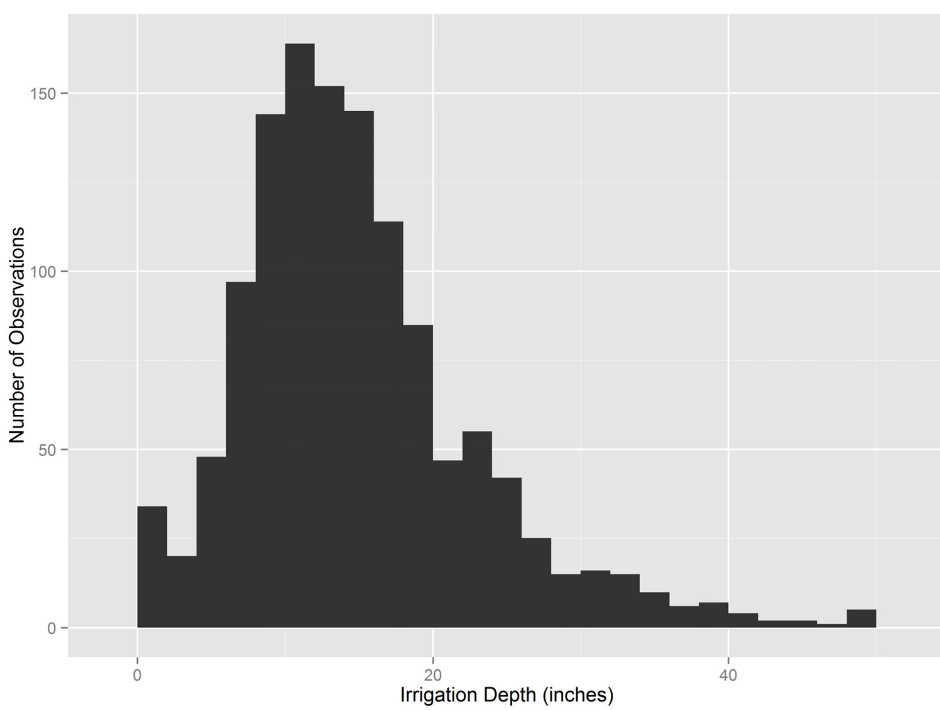
150 The EPD permit data reports total depth, casing depth, and intake depth in addition to the permit application date for each well. I assumed the intake depth represented the depth to the water table as of the application date of the permit.

analyses rely on crop-specific measures of irrigation. My final dataset includes 6,987 observations over the period 2008 to 2013. It contains information for 1,991 unique irrigated areas. Corn, cotton, and peanut irrigated areas account for 1,320, 2,557, and 2,077 observations respectively.

II. Estimation of Irrigation Depths in the ACF

Using the combined dataset described above, I calculate irrigation depths for each irrigated area in each year as water use divided by total reported irrigated acreage. The distribution of irrigation depths across years is illustrated for corn, cotton, and peanuts in Figure A-22 through Figure A-24. Note that the three distributions feature a common shape with a long right-hand tail. This shape is typical of distributions of water and energy use. I calculate average depths for each crop and soil group in each year using the acreages of the irrigated areas as weights. I limit the calculation of average irrigation depths to corn, cotton, and peanuts, the three crops with sufficient data in the AMD.

Figure A-22: Distribution of irrigation depths for corn



ATTACHMENT 20

Excerpts from the Deposition Transcript of Suat Irmak, Ph.D.
(Aug. 2-3, 2016)

SUAT IRMAK, Ph.D.

NO. 142, Original

In the

Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

VIDEOTAPED DEPOSITION OF

SUAT IRMAK, Ph.D.

Volume 1

August 2, 2016

10:03 A.M.

Reported by: Michele E. Eddy, RPR, CRR, CLR

JOB NO. 109595

SUAT IRMAK, Ph.D.

August 2, 2016
10:03 A.M.

Videotaped Deposition of SUAT IRMAK, Ph.D., held at the offices of Latham & Watkins, LLP, 555 Eleventh Street, Northwest, Suite 1000, Washington, D.C., pursuant to notice, before Michele E. Eddy, a Registered Professional Reporter, Certified Realtime Reporter, and Notary Public of the states of Maryland, Virginia, and the District of Columbia.

SUAT IRMAK, Ph.D.

APPEARANCES:

Latham & Watkins
Attorneys for Plaintiff
555 Eleventh Street, Northwest
Washington, D.C. 20004
BY: PHILIP PERRY, ESQUIRE
GEORGE CHIPEV, ESQUIRE
BENJAMIN LAWLESS, ESQUIRE

Kirkland & Ellis
Attorneys for Defendant
655 Fifteenth Street, Northwest
Washington, D.C. 20005
BY: K. WINN ALLEN, ESQUIRE

ALSO PRESENT:
John C. Allen, Deputy Director
Jordan Mummert, Videographer

SUAT IRMAK, Ph.D.

(Exhibit 1, Exhibit 2, Exhibit 3, Exhibit 4, and Exhibit 5 were marked for identification.)

THE VIDEOGRAPHER: This is the start of the deposition of Suat Irmak in the matter State of Florida versus State of Georgia.

This deposition is being held at 555 11th Street, Northwest, Washington, D.C., on August 2nd, 2016, at approximately 10:03 a.m.

My name is Jordan Mummert from TSG Reporting, Inc. I'm the legal video specialist. The court reporter is Michele Eddy in association with TSG Reporting.

Will the counsel please introduce yourselves.

MR. PERRY: Phil Perry, representing Florida.

MR. LAWLESS: Benjamin Lawless, representing Florida.

MR. CHIPEV: George Chipev, representing Florida.

MR. WINN ALLEN: Winn Allen, on

SUAT IRMAK, Ph.D.

behalf of the State of Georgia.

MR. JOHN ALLEN: John Allen, on behalf of the State of Georgia.

THE VIDEOGRAPHER: The court reporter may swear in the witness.

\- - -

SUAT IRMAK, Ph.D.,
having been duly sworn, testified as follows:

EXAMINATION

BY MR. PERRY:

Q Dr. Irmak, is that how I pronounce it?

A Sure.

Q Can you please tell me if I've mispronounced it as we go --

A No.

Q I don't want to make a mistake, particularly not over and over. So thank you.

On behalf of the State of Florida, welcome, and thank you for your attendance. I ask you in advance for your patience. This is going to take a few days, and it will be grueling to some extent. If you need a break at any time, just ask. I apologize in advance

Page 178

SUAT IRMAK, Ph.D.
Q Okay. So --
A Now, plus minus, you can add 5 percent, maybe.
Q All right, sir, and that's why you put on page 12 of your report a notation that "Most agricultural soils in the Georgia part of the ACF Basin have .5 to .7 inches per foot soil layer or less," right?
A That's correct.
Q So, sir, have you been on SSURGO ever before, the SSURGO website?
A I use Web Soil Survey.
Q And use the linked or other option, right?
A Actually, SSURGO was linked to Web Soil Survey.
Q Okay.
A So the mother, if you will, database is Web Soil Survey.
Q Okay. Do you know where Miller County is?
A If I have a map.
Q I think there's a map in your report. Maybe it's page 51 if I'm correct.

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SUAT IRMAK, Ph.D.
Are you with me on page 51?
A Yes.
Q Do you see that Miller County is in the Spring Creek subbasin?
A Yes, sir.
(Exhibit 16 was marked for identification.)
Q So, sir, Exhibit 16 is an exhibit we created from SSURGO information. You should have three pages there. Do you?
A I have two.
MR. WINN ALLEN: I have one. I only picked up one. I'm sorry.
Q So, sir, I'd invite your attention to the first of the two pages.
A Should I have three or two?
Q I'll give you another one in just a moment.
So the second of the pages has irrigated acreage imposed upon a representation of the average water holding capacity inches per foot from SSURGO data. Do you see that?
MR. WINN ALLEN: Object to foundation.
A I am not following. It has inches

Page 180

SUAT IRMAK, Ph.D.
per foot, inches of water per foot but doesn't say for which layers of soil profile.
Q We're getting to that, sir.
A Okay.
Q So have you been to Miller County?
A Let's see. I need to --
Q You can look on your map.
A Yes, because I drove in the basin. I need to remember where I went, I mean, which highway or -- I do believe I did.
Q Okay. Did you do any evaluation of the soil while you were there?
A Oh, yes, absolutely.
Q What did you do?
A I stopped by. I talked to people. I took the soil and felt the soil.
Q Okay. What was your -- did you have a sense of the water holding capacity of the soil throughout the basin -- throughout Miller County?
A If you would allow me one minute to provide feedback by providing a background on that. My late professor was one of the best scientists, and this hand feel method of soil

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SUAT IRMAK, Ph.D.
texture properties, I don't know if you are familiar, but many people use hand feel method to estimate soil moisture.
So we are all for technology. We do not -- in my discipline, we don't do feeling of soil moisture. So when I was traveling, I stopped by, I checked the soil texture, but I cannot quantify how much moisture the soil profile has or what is the sand content of the soil just by feeling. So that requires a laboratory analysis.
Q Yes, yes. You remember when I was reading the notes from the SSURGO database where they were talking about laboratory analysis?
A Before you said that, I am very familiar with Web Soil Survey database. I know that a big quantity of soil data or properties that are reported by Web Soil Survey, not all of them are laboratory analyzed values.
Q So is it your view that the soil in the northern part of Florida is similar to the soil in Southwest Georgia in Flint River Basin?
A Which part of Northern Florida? I've

SUAT IRMAK, Ph.D.

NO. 142, Original

In the

Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

CONTINUED VIDEOTAPED DEPOSITION OF

SUAT IRMAK, Ph.D.

Volume 2

August 3, 2016

9:34 A.M.

Reported by: Michele E. Eddy, RPR, CRR, CLR

JOB NO. 109596

SUAT IRMAK, Ph.D.

August 3, 2016
9:34 A.M.

Continued Videotaped Deposition of SUAT IRMAK, Ph.D., held at the offices of Latham & Watkins, LLP, 555 Eleventh Street, Northwest, Suite 1000, Washington, D.C., pursuant to notice, before Michele E. Eddy, a Registered Professional Reporter, Certified Realtime Reporter, and Notary Public of the states of Maryland, Virginia, and the District of Columbia.

SUAT IRMAK, Ph.D.

APPEARANCES:

Latham & Watkins
Attorneys for Plaintiff
555 Eleventh Street, Northwest
Washington, D.C. 20004
BY: PHILIP PERRY, ESQUIRE
GEORGE CHIPEV, ESQUIRE
BENJAMIN LAWLESS, ESQUIRE

Kirkland & Ellis
Attorneys for Defendant
655 Fifteenth Street, Northwest
Washington, D.C. 20005
BY: K. WINN ALLEN, ESQUIRE

ALSO PRESENT:
John C. Allen, Deputy Director
Jordan Mummert, Videographer

SUAT IRMAK, Ph.D.

THE VIDEOGRAPHER: This is the start of the continuation of the video deposition of Suat Irmak in the matter State of Florida versus State of Georgia. The time is approximately 9:34 a.m. The date is August 3rd, 2016. We are on the record.

\- - -

SUAT IRMAK, Ph.D.,

having been previously duly sworn, testified as follows:

EXAMINATION

BY MR. PERRY:

Q Good morning, sir. Welcome back.
A Good morning. Thank you.
Q Could you please turn to page 64 of your report, which is Exhibit 1. And I would invite your attention on page 64 to the section titled "Georgia Mobile Irrigation Laboratory."
Do you see that section, sir?
A Yes.
Q Is this a section you prepared personally?
A This section, yes, I did prepare this personally, yes.

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Q And if you'll note with me, the section spans pages 64 through 71; is that correct?
A That's correct.
Q Did you prepare personally the charts on pages 70 to 71?
A I created all the charts myself, yes.
Q Okay. And the data came from what source?
A The data came from Georgia Soil and Water Conservation Commission. I believe it was in Dawson, Georgia.
Q Dawson, Georgia.
Do you remember the individual who supplied you with this information?
A I do believe that came from Dave Eigenberg.
Q Eisenberg; is that right?
A Eigenberg.
Q Eigenberg. I'm sorry, I'm just trying to make sure. You mentioned him in your report elsewhere, right?
A Yes.
Q In a footnote.

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MR. WINN ALLEN: Objection. Asked and answered.

A In my analysis, in my judgment, opinion, vast majority of irrigation systems in Georgia are operating in a reasonable, responsible, effective way. Again, this is one single system that may have been irrigating six hours. By the way, during that six hours, not all water went to the trees, by the way. A portion of that water will still come back to the field.

So I cannot -- I cannot say one way or another just one single system without knowing what happened in this case, why it stayed there for six hours.

Q Sir, if Georgia state law allows a traveler system to be positioned such that it sprays the trees for six consecutive hours, is Georgia state law, in your expert opinion, reasonable and proactive?

MR. WINN ALLEN: Objection. Asked and answered.

Q All you have to do is say yes or no.

MR. WINN ALLEN: Objection. Asked

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and answered. Misleads the witness as to how he can answer questions.

A Most of the systems that I analyze, I seen on the ground, and based on all the documents, materials that I studied and analyzed in detail, most of the irrigation systems do operate in a responsible, reasonable way that, in fact, implements some good, very good, some of the best technologies in irrigation discipline.

Q How many irrigation systems have you visited in Georgia?

A I didn't count.

Q How many?

A 100, maybe.

Q 100 out of 8,900 or more?

A I don't think it's reasonable to expect me to visit 8,900 systems.

Q Sir, did you base your opinion, in part, on a visit to maybe 100 systems in ACF Georgia?

A No. No, no, absolutely not.

Q Did you keep records of those visits?

A I was driving --

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Q Did you rely --

A -- multiple times.

Q Did you rely upon what you observed while you were driving?

A This was -- these were trips for me, just me myself, to drive in the basin. As a responsible scientist researcher, if I'm working on any project, that's what I do. I go check the terrain out, check the soils out, check the crops out, look at the planting practices, look at finish practices, look at general field sizes, look at what kind of center pivots existed, whether it's T-L, whether it's Valmont or Valley or Reinke, or Zimmatic, whether they have whole new systems, whether they have end gun. I look at the nozzle packages. I look at other things. And if I get the -- if I am fortunate to find farmers on the way, and I will enjoy talking to them. The fact that I did 100-plus pivots in that detail assessment, I don't think we should discount that. It's not an easy task.

Q Where are the records of your detailed assessment, sir?

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MR. WINN ALLEN: Objection. Assumes facts not in evidence.

A In my brain, I guess.

Q You didn't take any notes?

A No.

Q Did you take any photographs?

A I did take a couple of pictures of cotton irrigated with center pivot.

Q Have you supplied those pictures to us, sir?

A I honestly don't remember, but I'll be happy to supply it.

Q Did you make any other records of any of your observations in Georgia in connection with this project?

MR. WINN ALLEN: In connection with opinions that made its way into your expert report. With that instruction, you can answer.

A When I -- you know, I am a good observer. I would like to see myself as a good observer. Many, many other top scientists mentioned that to me many, many times. I really observe things, and when I am in the

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field, I make assessments. I don't take notes. The reason that I took the picture for cotton was I used to grow cotton myself personally as a little boy. That's the main reason I took that picture.

But when I go to the fields, I usually do not take pictures -- notes because I know what I am looking at, I know how to make assessment without writing five pages of notes, and that's what I did.

Q Sir, can you show me on the map on page 53 where you did this assessment. This is page 53 of Exhibit 1 of your report.

A Do we have -- I don't know if I can find the interstate that was from Atlanta to Albany, and then I -- from Atlanta, I, from a small town, I went to the highway, county roads, and then that's how I found my way to Albany. But I cannot tell you exactly where I traveled, but it was in the ACF Basin.

Q Were you driving when you made these observations?

A I drove, I stopped, I drove, I stopped, I drove, I stopped.

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Q Where did you stop?

A Sir, I don't know. I cannot remember where I stopped.

Q How many times did you stop?

A Many times.

Q Did you see any traveler systems?

A Honestly, I don't recall seeing any travelers. But that doesn't mean they don't exist.

Q So, sir, if Georgia state law allows a traveler system to spray trees in the road for six hours, is Georgia state law reasonable and proactive?

MR. WINN ALLEN: Objection. Asked and answered.

A You know, I honestly -- I go back to my answer. The vast majority of the systems operate in a reasonable, responsible way.

Q Would you recommend that Georgia impose a restriction on that type of practice I described in my question?

A You know, again, I work with thousands and thousands of irrigators, and I can speak to you from my personal knowledge.

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Vast majority of those people are responsible. The fact that there is one system that sprayed water six hours based on the assumption or the observation you mentioned, this is just a single system out of many, many. Most people, farmers, irrigators, this is their land. This is their livelihood. This is what they make the living on -- from. They do practice very good conservation practices. They want to be good stewards of their land. They want to protect the land. It was -- it was perhaps handed down to them from their grandfather or father or they purchased it. So they make a living from this field. And I have seen thousands and thousands of people who really want to protect their land and conserve and do the right thing.

Just one single system in this picture putting some water beyond the field boundaries will not change my opinion because I have seen thousands and thousands of people, educated thousands of people. So it will be unreasonable for me to make a judgment based on just one single system.

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Q Sir, have you worked with thousands of irrigators in the ACF Basin?

A No, sir.

Q How many irrigators have you worked with in the ACF Basin?

A The irrigators in the ACF Basin or in any other place don't differ too much.

Q How many irrigators have you worked with in the ACF Basin?

A Directly, I didn't -- I had a conver- -- I had conversations with them, but I didn't --

Q How many?

A A few.

Q What were their names?

A I do not know their names.

Q Did you take any notes?

A No, sir. This was during my travel, I stopped and talked to a couple farmers. I am fortunate to find two people.

Q How many people did you encounter while you were driving?

A I wasn't looking for people. I was looking for terrain, for center pivots, for

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cropping systems, for any other information for me to get a -- to get familiar with the area, with the soils, with the ...

Q Was it happenstance that you ran into the farmers you just mentioned when you were driving through Southwest Georgia?

A I apologize. Could you restate that.

Q Was it happenstance? Did it happen by accident, or did you go visit particular farms?

A No, it was totally random.

Q Totally random.

A Yes.

Q What types of farms were those farmers working with? What were they growing?

A Corn. And I believe it was cotton in the second case.

Q Did you inspect their irrigation systems with them?

A No, sir, I didn't inspect them.

Q Did you set foot on their property?

A Yes. Well, on their field.

Q On their field.

Did you see their irrigation systems

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operating?

A One was operating. One was not. One field was dry. I mean it -- dry means like it wasn't irrigated.

Q Yes.

A And the other one was operating.

Q So this is two farmers we're talking about?

A Sir, I want to reinstate that I was not looking for farmers. I was trying to get myself familiarized with the area, with the terrain, with the cropping systems, irrigation methods, technology, soil type. I wanted to check the area out.

Q Most of that activity was done from your car; is that right?

A When I stop, I get out of the car. I look at the soil. I feel the soil. I look at crop and irrigation system. If I can see the pivot point, I wanted to see that, but I didn't make an effort to walk all the way to the pivot point.

Q For how many fields did you undertake the activity you just mentioned?

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A I didn't count exactly, but many.

Q How many?

A I've seen probably more than 100 fields.

Q You stopped your car at 100 fields?

A No, I apologize. I apologize. I've seen many, over 100 fields, and I stopped, looked at probably 15, 20. Can't remember the number.

Q You have no record of the location, the crop, the irrigation system, or your observations, correct?

A I don't have any record.

Q Sir, back to Exhibit 23, please. I think you testified earlier that you've used traveler systems in the past; isn't that right?

A Yes, sir.

Q Now, when you set up a traveler system personally, when you are doing it, do you set it up so the system sprays off the field and into a neighbor's yard or trees?

A You do your best to -- now, if you are familiar with traveling gun system, you will agree with me that a traveling gun system

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is not as autonomous or technologically oriented system as other systems.

So it is more challenging to automate that system to do certain things. You do your best to -- to let the system to irrigate only the field boundaries, but it is almost, almost, not all, almost impossible to let the traveling gun to irrigate 100 percent within the field boundaries due to the engineering principles, operational principles of that given specific system.

Q Sir, when you set up a traveler system, in your experience, do you set it up so that it will spray into a neighbor's trees, or do you set it up so that it will principally spray your crop?

A I never owned a farm. I did this in research settings.

Q In research settings, when you set up a traveler system, did you set it up so that it would spray principally your crop, or did you allow it to spray the trees of a neighbor's field?

A We will set it up principally to

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NO. 142, Original

In the

Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

CONTINUED VIDEOTAPED DEPOSITION OF

SUAT IRMAK, Ph.D.

Volume 3

August 4, 2016

9:04 A.M.

Reported by: Michele E. Eddy, RPR, CRR, CLR

JOB NO. 111100

SUAT IRMAK, Ph.D.

August 4, 2016
9:04 A.M.

Continued Videotaped Deposition of SUAT IRMAK, Ph.D., held at the offices of Latham & Watkins, LLP, 555 Eleventh Street, Northwest, Suite 1000, Washington, D.C., pursuant to notice, before Michele E. Eddy, a Registered Professional Reporter, Certified Realtime Reporter, and Notary Public of the states of Maryland, Virginia, and the District of Columbia.

SUAT IRMAK, Ph.D.

APPEARANCES:

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GEORGE CHIPEV, ESQUIRE
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Kirkland & Ellis
Attorneys for Defendant
655 Fifteenth Street, Northwest
Washington, D.C. 20005
BY: K. WINN ALLEN, ESQUIRE

ALSO PRESENT:
John C. Allen, Deputy Director
Jordan Mummert, Videographer

SUAT IRMAK, Ph.D.

THE VIDEOGRAPHER: This is the start of the continuation of the video deposition of Suat Irmak in the matter State of Florida versus State of Georgia. The time is 9:05 a.m. The date is August 4, 2016. We're on the record.

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SUAT IRMAK, Ph.D.,
having been previously duly sworn, testified as follows:

CONTINUED EXAMINATION

BY MR. PERRY:

Q Good morning, sir.
A Thank you.
Q Welcome back for your third and final, hopefully, day.
A Hopefully.
Q I appreciate your patience.
A Thank you so much. Good morning.
Q Sir, I believe we were on page 50 in your report, which is Exhibit 1, when we left off yesterday.
Do you see page 50 is titled "Permitting Moratoriums in the Flint River

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Basin"?
A Yes, sir.
Q The last paragraph on that page begins "In 2012." Do you see that?
A Yes.
Q So I'm interested in talking with you a little bit about the next to last sentence in that paragraph, which reads "The suspension also applies to any applications to modify existing permits to increase withdrawals or to increase the number of irrigated acres associated with an existing withdrawal in these areas."
Do you see that, sir?
A I see that, sir.
Q Is that something that you determined yourself, or were you working with EPD personnel in preparing this section of your report?
A For that specific section, I honestly don't remember, but I think this might be a combination of my own readings and summarizing, but also with my -- from my discussions with the colleagues also.

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Dr. Stavins supplied us. But my understanding is that this information is the result of roughly 14 years of testing by USDA. And what we've done, sir, is we have analyzed the percent of yield at each level of sprinkler less than 100. So we've looked at the 66 percent sprinkler scenario and the 33 percent sprinkler scenarios there, both for peanuts and cotton. So let me share that with you.

A Sure.

(Exhibit 65 was marked for identification.)

Q So, sir, on page -- excuse me, Exhibit 65 and the related pages, we lay out what we found when we looked at scenarios where not 100 percent of sprinkler water is applied but, instead, 66 or 33 percent, to cotton and peanuts. Do you see that chart on the first page?

A Table, you mean?

Q Table.

A Yes.

Q I'm not as good with distinguishing chart versus table.

A I just want to make sure I'm looking

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at the right thing.

Q Yes, that's fair. I'm happy to call it a table.

First, let me ask you, I know you mentioned that you were aware of this data, but have you analyzed it in this fashion ever?

A No, sir, I was -- I think I -- when I said I was aware, I think I seen a few data points. I have never -- I didn't see this complete data set before.

Q Well, the interesting thing about the Shellman farm data from USDA is that you can track and see how much 66 percent was in every year and how much 33 percent was in terms of irrigation depths. And you can also see what 100 percent was. So we feel like it provides, at least to some extent, an interesting picture.

Are you familiar at all with the yield curves that Dr. Sunding published in his report?

A I looked at them, but, honestly, I don't remember the details of those.

Q Okay. Well, then let me just kind of

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cut to the chase. Do you see where it says "Sprinkler 66 Percent"?

A Yes.

Q What we found is that you -- from this USDA testing, that you could obtain a significant amount of yield even when you use a third less water on peanuts. And, in particular, the drought year application -- the worst drought year in this record for peanuts, either 2011 or 2012, was 9 inches, and you obtained 95 or 96 percent of the same yield that you would in another dry year.

So for cotton, it was a little bit less, and the inches at 66 percent were about 10 inches and 8 inches in 2012 and 2011, but you still obtain a high, nearly 90 percent yield for those years.

Is this data surprising to you -- to you, sir?

MR. WINN ALLEN: Object to the form of the question.

A Can I ask, has there been any publication from this data?

Q Sir, I'm just showing you what

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Dr. Stavins showed us. It may be that USDA has other publicly available materials that can be found either by corresponding with them or on the website. I believe there is a website for the Shellman farm. So that can be evaluated.

A I have --

MR. WINN ALLEN: Just to be clear, Dr. Stavins didn't create Exhibit 65.

MR. PERRY: That's right. He created -- or he supplied to us Exhibit 64 and the data behind it.

MR. WINN ALLEN: Right. I just don't want him to be confused by that.

MR. PERRY: Yes, Exhibit 65 is what we created, and I think I tried to say that.

A So could I ask also, because I work with similar data sets from other -- from my studies every single day. This is titled as "Deficit Irrigation." I want to find out if this really was a deficit irrigation trial.

Q Well, that would be a good question for USDA. I think what they'll tell you is they applied less water than they did in other

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scenarios. I don't know.
A I bet it was not a deficit irrigation research.
Q Well, let's talk about that. What -- I suppose it depends on who's calling it deficit irrigation as to what deficit irrigation means, but how do you define that term, sir?
A Okay. You know, in my discipline, not everybody can come up with their own definition, wake up one day and say, oh, I'm going to call this this. It doesn't happen that way.
As a scientific community, we need to have some level of standardization on certain things, and I think that exists in every other discipline.
For deficit irrigation, that means, as I described earlier, if I'm growing corn, I'm going to wait -- if I am limited in terms of the amount of water I have, then I'm going to apply that water at specific growth stages. I'm going to wait to a certain -- I'm going to stress the crop and then apply an inch at

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tassel stage, apply inch and a quarter at silking stage. And then I'm not going to stress the crop during that critical stage. Before and after, I will stress the crop.
So applying water, a certain amount of water at certain growth and development stages to a different cropping system is called deficit irrigation. This seems to me, since they say 66 percent, 33 percent -- and I assume 66 percent of the full irrigation, 33 percent of the full irrigation, which is a concept that I developed myself 14, 15 years ago. And I am glad that Georgia is implementing that. That's very nice to see.
But this is not deficit irrigation. I don't have any indication in this document that tells me that this really was a deficit irrigation.
Q That's very helpful, sir, because I think part of your report criticizes Dr. Sunding for using the term "deficit irrigation," but as far as I know, from the Shellman material, it's just the application of less water.

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A That's limited irrigation.
Q Okay, limited irrigation.
A Yes.
Q So is it your position that limited irrigation is not possible in the state of Georgia?
A It will be challenging.
Q But not impossible.
A I really have to study that, sir. I honestly, I have to study -- you know, if I may say this, every time, you know, I say I really have to study, I really have to study, you know, I am known in -- I promise you, I am not bragging about myself whatsoever, but I am known as a person who really studies first before I make any comment. If I am not able to make a comment, I will say that. That's the reason I was humbled, honored to be invited to U.S. Congress to talk about different things. So I will honor my reputation in my discipline.
I don't see any evidence that this was a deficit irrigation, and since I see 66 percent of the full, 33 percent of the full irrigation, 99.9 percent I'm confident that

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this is not a deficit irrigation research.
Q Okay, sir. So let me just make sure I understand. So nothing in your report offers an opinion about limited irrigation. It's about deficit irrigation.
A I am scanning my report through my brain now, see if I -- I cannot remember exactly if I mentioned limited. I know I talk about deficit. I don't think limited irrigation was mentioned in my report in these kind of context.
Q Okay, sir. That's helpful, because I want to understand precisely what you've said.
(Exhibit 66 was marked for identification.)
Q Sir, we created Exhibit 66. I just want to make sure that there's no doubt about that. And we've created it by using maps of the Claiborne aquifer created by USGS.
Do you see the brown area on the map?
A I apologize. I need some help about the brown.
MR. WINN ALLEN: Are you color-blind?
THE WITNESS: Yes.
MR. WINN ALLEN: He will help you.

ATTACHMENT 21

Shellman Farm Deficit Irrigation Yields in Dry Years and All Years (Irmak Dep. Ex. 65)

Shellman Farm Deficit Irrigation Yields in Dry Years and All Years

	Cotton – 66% Sprinkler	Cotton – 33% Sprinkler	Peanuts – 66% Sprinkler	Peanuts – 33% Sprinkler
Yield (Dry Years) as Percentage of Yield for 100% Irrigation	87%	59%	95%	77%
Yield (All Years) as Percentage of Yield for 100% Irrigation	91%	70%	96%	85%

Calculations:

- Dry Years = 2001, 2002, 2006, 2007, 2008, 2011, 2012
    - Cotton (100%)
        - 2001: 1070.4
        - 2002: 1149.7
        - 2006: 1433.1
        - 2007: 1575.2
        - 2008: 1216.2
        - 2011: 1551.4
        - 2012: 1484.7
        - Total: 9480.7. Divided by seven years = 1354
    - Cotton (66%):
        - 2001: 970.5
        - 2002: 966.5
        - 2006: 1241
        - 2007: 1436.1
        - 2008: 1012
        - 2011: 1346.7
        - 2012: 1279.2
        - Total: 8252. Divided by seven years = 1179
        - 1179 divided by 1354 = .87
    - Cotton (33%)
        - 2001: 917
        - 2002: 792.8
        - 2006: 846.4

    - 2007: 710.4
    - 2008: 753.5
    - 2011: 697.1
    - 2012: 902
    - Total: 5619.2. Divided by seven years = 803
    - 803 divided by 1354 = .59
  - Peanuts (100%)
    - 2001: 4694
    - 2002: 4499
    - 2006: 4905
    - 2007: 4869
    - 2008: 4377
    - 2011: 5834
    - 2012: 4266

      Total: 33,444. Divided by seven years = 4,778
  - Peanuts (66%)
    - 2001: 4857
    - 2002: 4605
    - 2006: 4647
    - 2007: 4012
    - 2008: 4417
    - 2011: 5183
    - 2012: 3993
    - Total: 31,714. Divided by seven years = 4,530
    - 4530 divided by 4778 (100%) = .948

- Peanuts (33%)
  - 2001: 4440
  - 2002: 4219
  - 2006: 3557
  - 2007: 2023
  - 2008: 4778
  - 2011: 3230
  - 2012: 3584
  - Total: 25,381. Divided by seven years = 3690
  - 3690 divided by 4778 (100%) = .772

- All Years
  - Cotton (66%)
    - 1,184 divided by 1308 (100%)) = .905
  - Cotton (33%)
    - 920 divided by 1308 (100%)) = .703
  - Peanuts (66%)
    - 4494 divided by 4675 (100%) = .961
  - Peanuts (33%)
    - 3968 divided by 4675 (100%) = .849

ATTACHMENT 22

Excerpts from the Deposition Transcript of James E. Hook, Ph.D. (Feb. 23, 2016)

JAMES E. HOOK, Ph.D.

NO. 142, Original

In the

Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

VIDEOTAPED DEPOSITION OF JAMES E. HOOK, Ph.D.

FEBRUARY 23, 2016

9:06 A.M.

Reported by: Michele E. Eddy, RPR, CRR, CLR

JOB NO. 103650

JAMES E. HOOK, Ph.D.

January 23, 2016
9:06 A.M.

Videotaped Deposition of JAMES E. HOOK, Ph.D., held at the offices of Latham & Watkins, LLP, 555 Eleventh Street, Northwest, Suite 1000, Washington, D.C., pursuant to notice, before Michele E. Eddy, a Registered Professional Reporter, Certified Realtime Reporter, and Notary Public of the states of Maryland, Virginia, and the District of Columbia.

JAMES E. HOOK, Ph.D.

APPEARANCES:

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BY: PAUL SINGARELLA, ESQUIRE

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Attorney for Plaintiff
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Washington, D.C. 20004
BY: BART KEMPF, ESQUIRE

Kirkland & Ellis
Attorney for Defendant
655 Fifteenth Street, Northwest
Washington, D.C. 20005
BY: K. WINN ALLEN, ESQUIRE

ALSO PRESENT
Jordan Mummert, Videographer

JAMES E. HOOK, Ph.D.

THE VIDEOGRAPHER: This is the start of the tape labeled number 1 of Dr. James Hook in the matter of State of Florida versus the State of Georgia.

This deposition is taking place at 555 11th Street, Northwest, Washington, D.C., on February 23rd, 2016, at approximately 9:06 a.m.

My name is Jordan Mummert from TSG Reporting, Inc. I'm the legal video specialist.

The court reporter is Michele Eddy in association with TSG Reporting.

Would counsel please introduce yourselves.

MR. SINGARELLA: Good morning, Dr. Hook. Paul Singarella for the State of Florida.

MR. KEMPF: Good morning. I'm Bart Kempf with the State of Florida.

MR. ALLEN: Winn Allen, from Kirkland & Ellis, on behalf of the State of Georgia.

JAMES E. HOOK, Ph.D.,
having been duly sworn, testified as follows:

JAMES E. HOOK, Ph.D.

EXAMINATION

BY MR. SINGARELLA:

Q Good morning, Doctor. Let me thank you for accommodating my request for the venue here today. It's really helpful that we're here in Washington, D.C. Winn can tell you, we're going through quite a busy stretch here. I suspect it was helpful to Winn, too, so this is all good. We're glad to have you here this morning.

I'm going to spend just a few minutes going over, kind of, the rules of the road of a deposition just to make sure you're comfortable with all of that, and then we'll launch into a discussion that will focus largely on farming and irrigation. I'm sure you're not surprised by that.

So I obviously know who you are. You've introduced -- we've had our introduction. But just for the record, could you state your name and spell your name.

A It's James Edward Hook, and J-A-M-E-S. Edward is E-D-W-A-R-D, and Hook, H-O-O-K.

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up and buffer the growth of the plant, correct?

A That you cannot apply large amounts of water at a time as you might in the western U.S. where pivots had originally been used. So you had to modify the irrigation regime to a more frequent, lighter application.

Q You go on to say that "The more frequent application had to be frequent enough to completely replace crop use every three to four days." Do you see that?

A Yes.

Q Was that accurate when written?

A Yes.

Q Is that still true today?

A Yes, it is.

Q It sounds like it's almost like a turnover concept of some sort. Could you describe --

A Turnover?

Q You irrigate the plants and then every three to four days something happens with that water. What happens with that water?

A The water evaporates.

Q It goes up --

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A If you look at a typical evaporation scenario with a full crop canopy, you're going to lose a quarter inch, approximately, sometimes slightly more per day, so that if you think about I just put an inch of water onto a field, four days later you need to put an inch of water onto the field. That's what brings about this every three to four days.

If you're in a heavy clay soil, as you might be in west Texas, and you applied water, you might be able to apply 3 inches and then go for several more days before that quarter inch per day uses up all of that water that you applied. So it's a matter of how frequently you apply, not necessarily how much difference in evaporation there is.

Q Then you go on in that sentence to say, "The farmer has to do that continuously for 20 to 30 days between drought-spaced rainfall."

A Right.

Q What does that mean?

A Okay. If you -- the system itself has to be designed to be capable of sustaining

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that practice of every three to four days I'm going to return to this field and apply that application of water or the soil will run out of water, the evaporation will have taken out all of the water and the crop will begin to suffer.

Q You go on in the next sentence to say, "Over time, farmers learned this lesson." Was the lesson about figuring out how to properly adapt the technology from one part of the country to Southwest Georgia?

A Yes.

Q And so what did farmers learn in time in Southwest Georgia?

A That frequent, light applications were the way that was necessary to deal with sandy soils to sustain production.

Q Can we go back to the first page.

In that next paragraph, "In Southwest Georgia," are you with me?

A Yes.

Q By the way, just so I understand, our discussion we were just having, that, I understand, is applicable to sandy soils,

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correct?

A Sandy soils, correct.

Q Are all the soils in the Dougherty Plain in Southwest Georgia sandy?

A No, they vary a fair amount, but the sandiest soils would certainly be the ones that were the first to get irrigation. And then as people found that technology was starting to boost yields in those farms, it started spreading to areas further north of the Dougherty Plain, which had heavier textured soils, not heavy in the same way that we think of Texas, but certainly with subsoils which had clay loams or sandy clay loams.

Q Why would the sandy soils be the first to be targeted for irrigation?

A Simply because of the land areas that were available for large irrigation. They were not the first place to get irrigation to Georgia, though.

Q What was the first place to get irrigation?

A Tobacco growing areas is a very high-value crop and the quality of the crop was

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In the
Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

CERTIFICATE OF SERVICE

This is to certify that the STATE OF FLORIDA'S REPLY IN SUPPORT OF ITS MOTION *IN LIMINE* TO PRECLUDE EXPERT TESTIMONY BY DR. SUAT IRMAK has been served on this 7th day of October 2016, in the manner specified below:

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