

No. 141, Original

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In the  
SUPREME COURT OF THE UNITED STATES

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STATE OF TEXAS,

Plaintiff,

v.

STATE OF NEW MEXICO and  
STATE OF COLORADO,

Defendants.

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OFFICE OF THE SPECIAL MASTER

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**DECLARATION OF JOEL KIMMELSHUE, Ph.D., CPSS, IN SUPPORT OF  
THE STATE OF TEXAS'S CONSOLIDATED RESPONSE IN OPPOSITION  
TO THE STATE OF NEW MEXICO'S MOTIONS IN LIMINE**

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August 5, 2021

I, Joel Kimmelshue, Ph.D., CPSS, declare as follows:

1. I am an agricultural scientist, specializing in soil, crop, irrigation and other on-farm production practices. I am a principal and lead agricultural scientist for Land IQ, located at 2020 L Street, Suite 210, Sacramento, CA 95811.

2. I have been retained as an expert by Somach Simmons & Dunn to provide expert opinions and testimony on behalf of the State of Texas (Texas) as to agricultural and other on-farm production practices, including land use and crop consumptive use, concerning the Rio Grande Compact of 1938 (“Compact” or “Compact of 1938”).

3. I have a Ph.D. in Soil Science (Water Resources concentration) from North Carolina State University. I have 25 years of professional experience in agricultural and water resources consulting, including in land use assessment and crop identification.

4. Under my direction and supervision, Land IQ determined land use acreages over the study period of 1936-2018 for land uses in the Compact area, as well as changes in consumptive use over the same time period.

5. In order to generate comprehensive estimates of consumptive water use, accurate historical land use information was required. We used proven methods to generate both historical spatial land use mapping for eleven years over the study period of 1938-2018, as well as non-spatial land use determinations for years in which we did not identify adequate imagery. Among other sources, we used suitable satellite and/or aerial images from sources including the United States Geological Survey satellite data (called Landsat) and aerial images from the United States Department of Agricultural National Agriculture Imaging Program (NAIP), as well as images taken during a privately flown survey of the study area in 2014 and other sources.

6. As part of our methodology, we used ground-truthing to calibrate our satellite and aerial image crop classification models to actual, on-the-ground crops. We conducted the ground-truth survey by deploying a team of trained and experienced agricultural scientists to drive the Elephant Butte Irrigation District region by car in 2014 in June and September, and in August of 2018 identifying crops. This ground-truth method was also used by New Mexico's experts in this litigation, and it is a peer-reviewed methodology.

7. Another element of our crop classification procedure included developing training data in order to calibrate our remotely sensed methods. We used the calibrated analytical models that extract data from the remotely sensed images to develop a pattern (or a fingerprint) that is unique to specific crops and then used to evaluate the remainder of the image to "match" similar fingerprints. To accomplish this, we used a method called random forest, as well as other machine learning techniques. All the methods employed were peer-reviewed.

8. Following the remote sensing step, we further conducted a visual manual refinement of the remotely sensed results, which is also a peer-reviewed procedure. Multiple lines of evidence are used in this manual process including crop calendars, color and textural observations, crop report acreages, multiple images, time-series images, United States Department of Agriculture (USDA) Crop Data Layer (CDL), and other resources in order to validate or modify the remotely sensed classifications. The visual manual review is used to refine the initial remote sensing classification. If the visual manual review reveals that remotely sensed -predicted crop type classification for a particular parcel is incorrect, it is revised as part of this classification step.

9. In order to assess the accuracy of our overall determination, we create an accuracy table using peer-reviewed procedures. Our accuracy table compared the field

predicted by our crop classification procedures with the same field from ground-truthing data. The accuracy table for this project showed an error rate of about 3%. Of that 3%, some involved human error and others involved machine error.

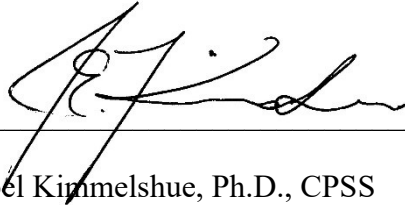
10. A large number of entities in the West and throughout the United States employ Land IQ and our crop classification results derived using the peer-reviewed methods outlined above. The following government agencies and academic research entities use Land IQ crop classification: United States Department of Agriculture, California Department of Water Resources, United States Bureau of Reclamation, California Regional Water Board, Sacramento-San Joaquin Delta Water Master, California Department of Food and Agriculture, California Air Resources Board, University of California Davis, NASA's Ames Research Center, Cal Poly Irrigation Training & Research Center, various irrigation districts, and 18 separate Groundwater Sustainability Agencies in the State of California.

11. Numerous commodity groups and/or trade organizations use or have used Land IQ crop classifications. This includes: Administrative Committee for Pistachios, Almond Board of California, California Avocado Commission, California Prune Board, California Wild Rice Advisory Board, and the Walnut Board of California. Land IQ crop classification data are also utilized by numerous private engineering and environmental consulting organizations.

12. Land IQ has specifically mapped pecans for the American Pecan Council in 15 states, including Alabama, Arizona, Arkansas, California, Florida, Georgia, Kansas, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, South Carolina, and Texas. Land IQ has also mapped all pecan orchards throughout Mexico.

13. In 2019, Land IQ mapped a total of 10,486,594 acres in the United States. In 2020, Land IQ mapped a total of 11,177,716 acres in the United States and Mexico.

I declare under penalty of perjury that the foregoing is true and correct. Executed this 5th day of August 2021, at Sacramento, California



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Joel Kimmelshue, Ph.D., CPSS

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OFFICE OF THE SPECIAL MASTER


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CERTIFICATE OF SERVICE

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This is to certify that on this 5th day of August 2021, I caused a true and correct copy of the Declaration of Joel Kimmelshue, Ph.D., CPSS, in Support of the State of Texas's Consolidated Response in Opposition to New Mexico's Motions in Limine to be served upon all parties and *amici curiae*, by and through the attorneys of record and/or designated representatives for each party and *amicus curiae* in this original action. As permitted by order of the Special Master, and agreement among the parties, service was effected by electronic mail to those individuals listed on the attached service list, which reflects all updates and revisions through the current date.

Dated: August 5, 2021

Respectfully submitted,  
  
Yolanda De La Cruz

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(Service via Electronic Mail)

**SPECIAL MASTER**

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