Science Societies

Kirkham Conference 2025: Reflections and review

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Kirkham Conference Video Recap

The 2025 Kirkham Conference brought leading soil physicists from around the world to Fukushima, Japan, to explore cutting-edge research and real-world environmental challenges under the theme of advancing soil physics through digital innovation and environmental solutions. Through keynotes, posters, and immersive field tours of Fukushima's contaminated soil sites, the conference highlighted how soil physics informs responses to complex global crises. This article reflects on the science, experiences, and human connections that made the meeting both scientifically rigorous and deeply impactful.

The Kirkham Conference is one of the most prestigious gatherings focusing on emerging soil physics topics. After being hosted in South Africa in 2022, the 2025 conference convened in Fukushima, Japan, August 18–22 with a theme of "Advancing Soil Physics: From Digital Innovation to Environmental Solutions."

The conference was co-hosted by the Soil Science Society of America (SSSA) and the Japanese Society of Soil Science and Plant Nutrition with support from partners in Japan and the USA. The 100+ attendees came from 11 countries (Figure 1).

Figure 1. Kirkham Conference attendees. Photo courtesy of Taro Noborio.

The conference centered on four key themes:

- Cutting-edge Technologies for Soil Management and Digitized Agriculture,
- Soil Structure as a Nexus of Biogeochemical and Hydrological Processes,
- Landscape-Scale Soil Hydrology: Bridging Scales and Systems, and
- Environmental Fate and Transport of Soil Contaminants.

The conference is significantly supported by the Don and Betty Kirkham Fund and the Lena and Maria van der Ploeg Fund within the Agronomic Science Foundation. In addition, the conference received support by the two Societies, Mary Beth Kirkham,

METER, F-REI, Uizin, Daiki, A.R.P., Campbell Scientific Japan, and the Obayashi Corporation.

To kick things off, a two-hour pre-conference get-together for students and early career attendees took place the day before the official start. Attendees were able to meet, get to know each other, have a bit of fun, and meet the conference organizers. Eleven students received travel scholarships, supported by the Don and Betty Kirkham Fund and the Lena and Maria van der Ploeg Fund within the Agronomic Science Foundation.

Day 1 highlights: Keynote presentations, posters, and welcome

On the first day, the conference opened with warm welcomes from Dr. Yan Jin, Kirkham Conference Chair (University of Delaware), Dr. Masaru Mizoguchi (University of Tokyo), and Dr. Kosuke Noborio (Meiji University) (Figure 2), whose collaborative efforts were instrumental in making the 2025 conference a success.

Keynote presentations

The morning session began with Theme 1: "Cutting-Edge Technologies for Soil Management and Digitized Agriculture" and featured keynote presentations from Dr. Jingyi Huang, University of Wisconsin–Madison (Machine Learning–Enhanced Remote and In Situ Sensing for Smart Soil Water and Nutrient Management) and Dr. Tarin Paz-Kagan, Ben-Gurion University of the Negev (Advancing Soil Health Mapping: Cutting-Edge

Figure 2. Dr. Kosuke Noborio welcoming attendees. Photo courtesy of Taro Noborio.

Spectroscopy for Smart Agriculture).

The conference then shifted focus to Theme 2: “Soil Structure as a Nexus of Biogeochemical and Hydrological Processes” and featured keynote presentations from Dr. Alexandra N. Kravchenko, Michigan State University (Diverse Perennial Vegetation and Soil C Gains: Interactions Between Plant Identities, C Inputs, and Soil Pore Structure) followed by Dr. Teamrat A. Ghezzehei, University of California–Merced (The Dynamic Stage: How Physical Soil Architecture Shapes Microbial Habitat and Carbon Sequestration)

These presentations generated passionate engagement and constructive discussions.

Posters

The afternoon featured two rapid-oral sessions followed by poster presentations and discussions. The rapid-oral format proved inspiring with 60 presenters from more than 20 institutions worldwide delivering one-minute overviews of their posters, covering the broad spectrum of the conference's first two themes. Attendees then engaged in discussions during both poster sessions (Figure 3) with conversations running well beyond the scheduled time. This was a testament to the conference's mission of fostering in-depth disciplinary and interdisciplinary exploration of soil physics topics in an intimate setting that encourages scientists to develop new ideas and form relationships that are difficult to achieve at larger meetings.

Figure 3. Poster discussions. Photo courtesy of Taro Noborio.

Welcome

Figure 4. Reception kicking off the conference. Photo courtesy of Taro Noborio.

After the talks and poster sessions, attendees were energized and engaged and ready for a welcome reception (Figure 4) and dinner. Highlights included welcomes from local executives, local beer and sake tasting, and cheers by a group of cheerleaders who performed in litate Village to encourage the villagers when they returned home after a six-year forced evacuation.

Day 2 highlights: Interim storage facility and museum tour

The second day of the Kirkham Conference began with a tour to visit the interim soil storage facility for contaminated soils. The tour allowed attendees to observe the storage operations firsthand.

Upon arrival at the facility and museum, managed by the Tokyo Electric Power Company (TEPCO), and with translation assistance from Dr. Chihiro Kato-Dixon, attendees learned about the devastating tsunami that occurred on Mar. 11, 2011 and how it led to the nuclear contamination disaster. After receiving an overview of the facility's background, the group visited the actual storage site and viewed the nuclear station (Figure 5), located a few miles away at the overlook station. From the overlook point, attendees could directly see the nuclear station where ongoing work continues to repair damage and mitigate nuclear waste from the event (Figure 5). TEPCO employees thoroughly explained what happened in each reactor following the tsunami and detailed the subsequent consequences.

Figure 5. Top: Nuclear station. Bottom: Attendees at overlook point with Geiger counters. Photos courtesy of Taro Noborio.

Following the visit and introduction to the Fukushima Daiichi Nuclear Power Plant site, the group then visited the interim storage facility for contaminated soil. The contaminated soil, defined as the top 5 cm of soil from affected regions, was removed and is temporarily stored at the site. Each attendee received a meter for measuring cesium intensity. Through hands-on measurements and detailed explanations, attendees learned about the mitigation strategies currently employed and future plans for managing the contaminated soil.

After the first overlook point, the group rode to an abandoned nursing home (Figure 6) situated a few miles from the nuclear station. It was evacuated immediately after the tsunami and subsequent nuclear incident occurred. Cars, personal belongings, and documents were left behind (as seen from the windows) and remain preserved in the condition they were in when the nuclear disaster unfolded. This sobering scene clearly illustrated the urgency and desperation of the situation at that time.

Attendees reflect on touring site of nuclear incident

Dr. Aaron Daigh, 2026 President of SSSA:

“Even if you have worked in large-scale remediation, the experience is eye-opening and resonates to the human soul by being on site of where the nuclear incident occurred, and where people's lives changed in an instant. In my mind, I can still see the nuclear reactor, peoples’ belongings left from 14 years ago just as they were when told they must leave, and the damage when we drove down below the tsunami line next to the reactor. While being on site, you left trying to imagine what it felt like for those who experienced the incident firsthand ... the confusion, the rush to evacuate, the uncertainty, and how everything in life probably felt like it reduced down to that moment.

"*I did not expect we would have the opportunity to actually walk out onto the stockpile of contaminated soil. We were given Geiger counters and personal protective equipment by staff on the site. They explained how there was approximately 14 million cubic meters of soil below, and around us which was within their highest category of contamination and deemed as too hazardous to leave in-situ. It was comforting to have the Geiger counters which indicated we were within the safe range. However, we were not allowed to go near the tree lines since those areas have not been decontaminated due to the challenges of remediation in forests and steep slopes."*

Dr. Mary Beth Kirkham of Kansas State University:

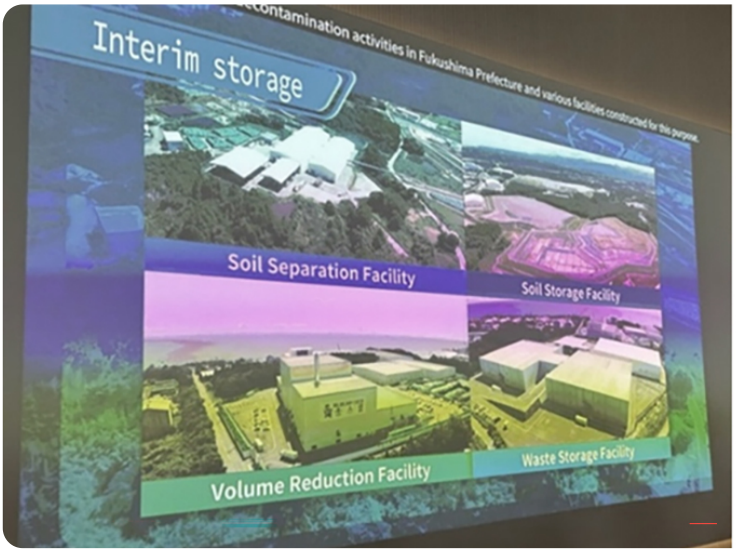
"*The group was solemn, as we stood at the overlook site to see the damaged nuclear reactors. We learned how families were split as they fled the contaminated area. However, we were heartened by the determination of the local people in recovering from the triple disaster—the earthquake, the tsunami, and the radioactive fallout. Over 2 million truck runs have removed the contaminated soil, which is stored in thousands of black plastic bags at storage areas dotted across the landscape*."

Figure 6. Evacuated and abandoned nursing home. Photo courtesy of Samira Daroub.

The group also visited the Tsunami and Nuclear Accident Museum to view the comprehensive history and documentation of the event including the soil decontamination and interim storage facilities (Figure 7).

After returning to J-Village, Dr. Masaru "Mizo" Mizoguchi of the University of Tokyo presented "Unraveling Fukushima's Recovery through Soil and People: A Guide to the Iitate Village Tour," (Figure 8) on how radio cesium contamination affected people's

lives. Dr. Mizoguchi was one of the first scholars to visit the region after the nuclear incident to determine ways to support local residents and farmers in mitigating soil contamination. His presentation featured his 15 years of experience visiting the area, listening to residents, planning mitigation strategies, and conducting education and outreach with the aim of reclaiming prosperity in litate Village.



Left: *Figure 7. Interim storage overview. Photo courtesy of Samira Daroub.* ***Right:*** *Figure 8. Dr. Masura Mizoguchi. Photo courtesy of Taro Noborio.*

This day-long tour definitely fulfilled the Kirkham Conference's goal of connecting soil science research with real-world environmental challenges. By witnessing Fukushima's contamination management and mitigation efforts firsthand, attendees gained invaluable insights into applying soil physics principles to address critical environmental disasters.

"As I interacted with the group, I was reminded that the Fukushima Kirkham Conference was reinforcing the broad goal of the conferences by bringing together

scientists from around the world to communicate knowledge of soil physics and how it can be applied to solve global environmental problems," noted Dr. Kirkham

Day 3 highlights: Iitate Village tour

Morning site visits

The second tour day started with a field tour to Iitate Village, approximately 40 km northwest of the Fukushima Daiichi Nuclear Power Plant. While Iitate Village was outside of the radiation exclusion zone, wind patterns carried radioactive material from the reactor and Iitate Village was found to have serious levels of radioactive contamination. These conditions forced the evacuation of the entire town and the evacuation order remained until 2017.

The first visit was to the Nagadoro District Environmental Restoration Project (Figure 9) operated by the Japan's Ministry of the Environment. Here, participants explored a burial site for radio cesium-contaminated soil with direct inspection of soil cross-sections followed by detailed explanations at Information Square.

The second visit was to Mr. Yoshito Kanno's farmland (Figure 10) in the Hiso District where attendees observed a detailed soil profile from agricultural fields that had undergone radio cesium contamination and partial restoration. Mr. Kanno shared some documents to discuss issues such as culvert pipe clogging due to iron oxide deposits.


Left: *Figure 9. Nagadoro District Environmental Restoration Project. Photo courtesy of Taro Noborio.* ***Right:*** *Figure 10. Agricultural farmland profile.*

Afternoon talks

Lunch was prepared by locals, and in the afternoon, two talks were given at Fureai Hall:

Dr. Noriko Yamaguchi (NARO)–Radio Cesium Behavior in Soil: As Dr. Yamaguchi explained, radio cesium (RCs) released during the Fukushima accident has remained in soil for almost 15 years. It is strongly retained by clay minerals, especially weathered mica with frayed edge sites (FES), and by plant-derived organic matter forming mineral–organic aggregates. Some RCs were also released as insoluble radioactive microparticles composed of silicate glass.

Kirkham Conference in the news!

The Kirkham Conference was of great interest to the local news media. In addition, the conference was honored to welcome staff from the Ministry of the Environment for the Fukushima Prefecture to the conference. Links to the article and additional resources may be viewed here.

Because RCs are largely immobile, mild decontamination methods are ineffective. In Fukushima, topsoil removal reduced contamination but damaged soil fertility. To restore agriculture, Japan promotes “Tsuchizukuri,” a long-term soil-building approach that enhances fertility and resilience. Beyond radiological recovery, this method has the potential to be applied globally for sustainable soil restoration.

Mr. Muneo Kanno (Sasu District Chief)—Life After Evacuation: Mr. Kanno’s presentation was focused on the psychological and social challenges that litate residents experienced during the evacuation and subsequent return. His talk highlighted the difficulty of regaining public trust in agricultural products and the importance of community resilience.

Day 4 highlights: Award presentation, keynotes, and farewell

The fourth and final day brought together a distinguished award presentation, cutting-edge science, and a heartfelt farewell.

Don and Betty Kirkham Soil Physics Gold Medal

The day opened with the presentation of the Don and Betty Kirkham Soil Physics Gold Medal, awarded once every eight years to honor outstanding contributions to soil physics. Dr. William A. Jury received the award virtually (Figure 11) as its third honoree. The award was presented virtually by Dr. Mary Beth Kirkham with personal reflections by Dr. Yan Jin. His lecture, “Random Thoughts From One Long Since Retired,” blended personal reflections with scientific insight, tracing his journey as a mentor and researcher. Dr. Jury revisited his influential work on water instability in sandy soils and discussed its continuing implications while providing experimental and modeling future recommendations.

Keynote presentations, posters, and student/travel awardee discussions

Figure 11. Virtual awards presentation and talk. Photo courtesy of Taro Noborio.

Morning and afternoon sessions highlighted the diversity of modern soil physics. After the Gold Medal presentation, it was time for Theme 3: Landscape-Scale Soil Hydrology—Bridging Scales and Systems. Invited speakers were Dr. James Kirchner, ETH Zurich (Landscape-Scale Manifestations of Soil Physics, As Reflected in High-Frequency Chemical, Isotopic, and Hydrologic Time Series), and Dr. Naoya Masaoka, Kyoto University (Analyzing Heterogeneous Hydrological Processes in Mountainous Watersheds Based on Intensive Observations), who explored how hydrological processes link field-scale and watershed-scale behavior.

The conference continued with Theme 4: Environmental Fate and Transport of Soil Contaminants. Dr. Markus Flury, Washington State University (Environmental Fate and Transport of Soil Contaminants: From Radionuclides to Plastics), and Dr. Taku Nishimura, University of Tokyo (Needs of Considerations of Solid Material in Reactive Chemical Transport in Soil), discussed contaminant transport in soils and lessons from Fukushima and other global nuclear contamination events.

A rapid poster session then occurred and subsequent student travel awardee discussions energized the day, allowing young scientists to share their perspectives and research experiences. The session wrapped up with a video compilation (see above) of the event.

The Kirkham Conference Committee sponsored a student poster contest, and congratulations go to the winners (Figure 12):

- First place: Leah Kocian, Texas A&M University
- Second place: Kehinde Fawibe, Chiba University
- Third place: Ruan Gomes, Oregon State University

Figure 12. Poster Winners with Mary Beth Kirkham. Photo courtesy of Taro Noborio.

Farewell reception and closing ceremony

The conference concluded with a farewell reception and dinner at J-Village. Attendees enjoyed traditional Japanese cuisine, a celebration performance by Japanese cultural performers (Figure 13), and closing reflections the conference leadership (Figure 14)

including Dr. Samira Daroub, SSSA President, and Dr. Yan Jin, Kirkham Conference Committee Chair, celebrating the week's success and the community's ongoing collaboration.

Left: *Figure 13. Closing celebration performance. Photo courtesy of Taro Noborio.* ***Right:*** *Figure 14. Kirkham Conference leadership (l to r): K. Noborio, Y. Jin, S. Daroub, and M. Mizoguchi.*

"It was indeed a memorable experience to attend the Kirkham conference in Japan," said Dr. Samira Daroub, SSSA President. "Learning about the aftermath of the nuclear disaster on the lives and livelihoods of the people of Fukushima as an eye-opening experience. It was remarkable to learn how scientists, the government of Japan, and farmers are working together not only to decontaminate soils, but bringing back soils to productivity to safely grow crops and restore normal live to the people of Fukushima."

"Chairing the Kirkham Conference was an incredibly rewarding experience," said Dr. Yan Jin, Kirkham Conference Committee Chair. "Beyond the high-level science, I was particularly moved by the opportunity to connect with the diverse group of students

and early career scientists in attendance. Their gratitude and unbridled enthusiasm breathed new life into the event, leaving me deeply optimistic about the future of our field."

The evening also recognized student competition winners and featured a traditional cultural performance. It was an inspiring finale to an exceptional gathering of the global soil physics community—we all felt like family on the return buses to Tokyo. Planning for the next Kirkham Conference will begin in 2026.

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