Resilience Agronomy Starting from Fukushima

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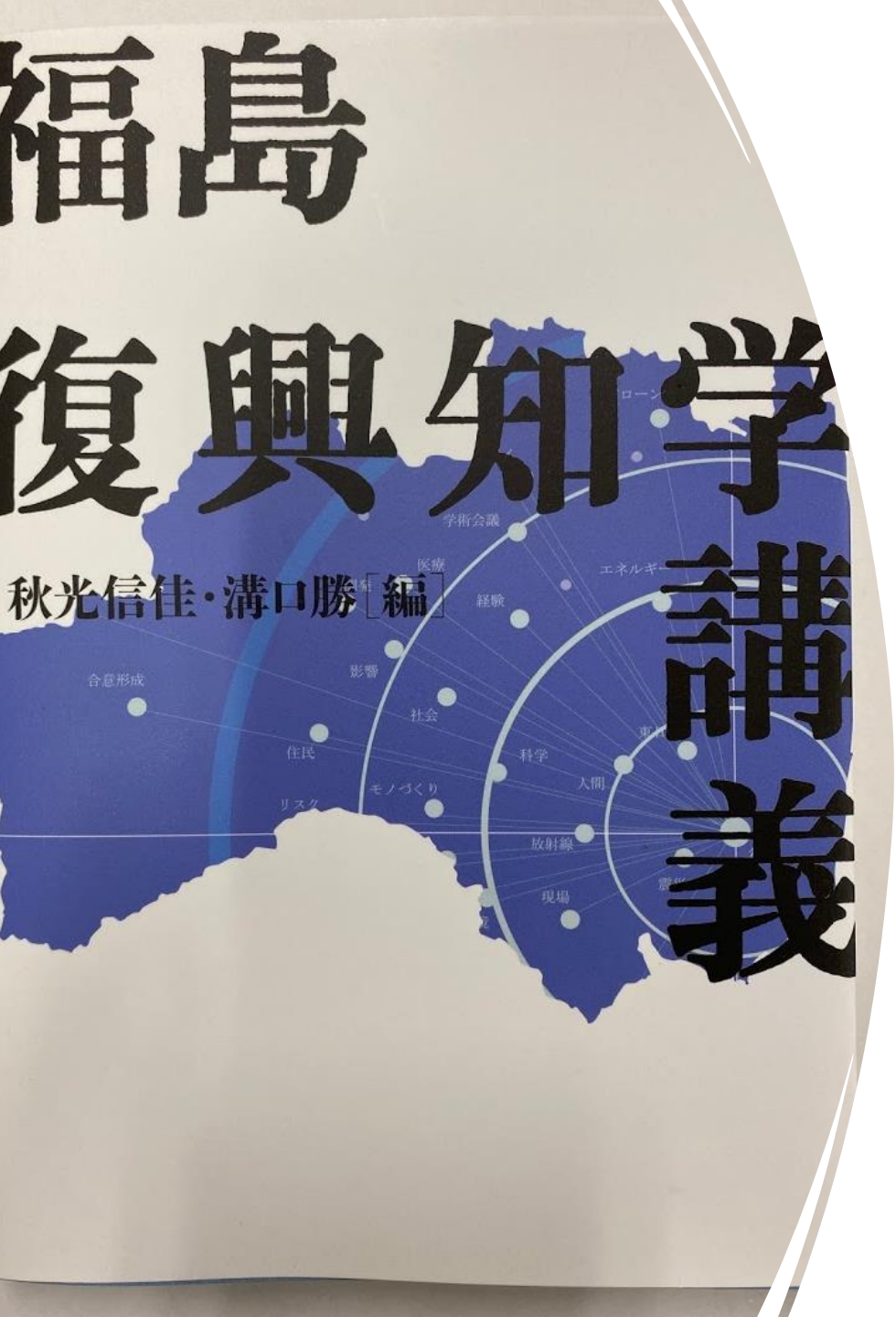
INTRODUCTION

- Ten years have passed since the nuclear power plant accident.
- Researchers from various fields have been involved in agricultural issues in Fukushima since the accident.

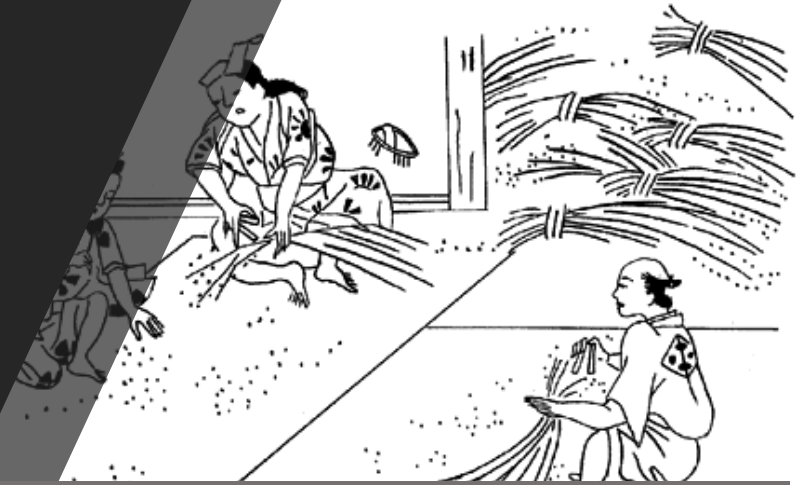


INTRODUCTION-2
-Reconstruction knowledge -

- Researchers' efforts have been accumulated as reconstruction knowledge which is about to be revived as an old but new agricultural science to solve problems in the field.

HISTORY OF JAPANESE AGRICULTURAL TECHNOLOGY

- Dedicated farmers developed during the Edo and Meiji eras (1600-1900).
- Dr. Tokiyoshi Yokoi (1860-1927: a graduate of Komaba Agricultural School) in the Meiji era
  - saw that the agricultural scientists of the time, who had learned Western science, were trying to do things without seeing the actual field
  - ridiculed them at a lecture, saying, "Agricultural science flourishes, but agriculture dies".



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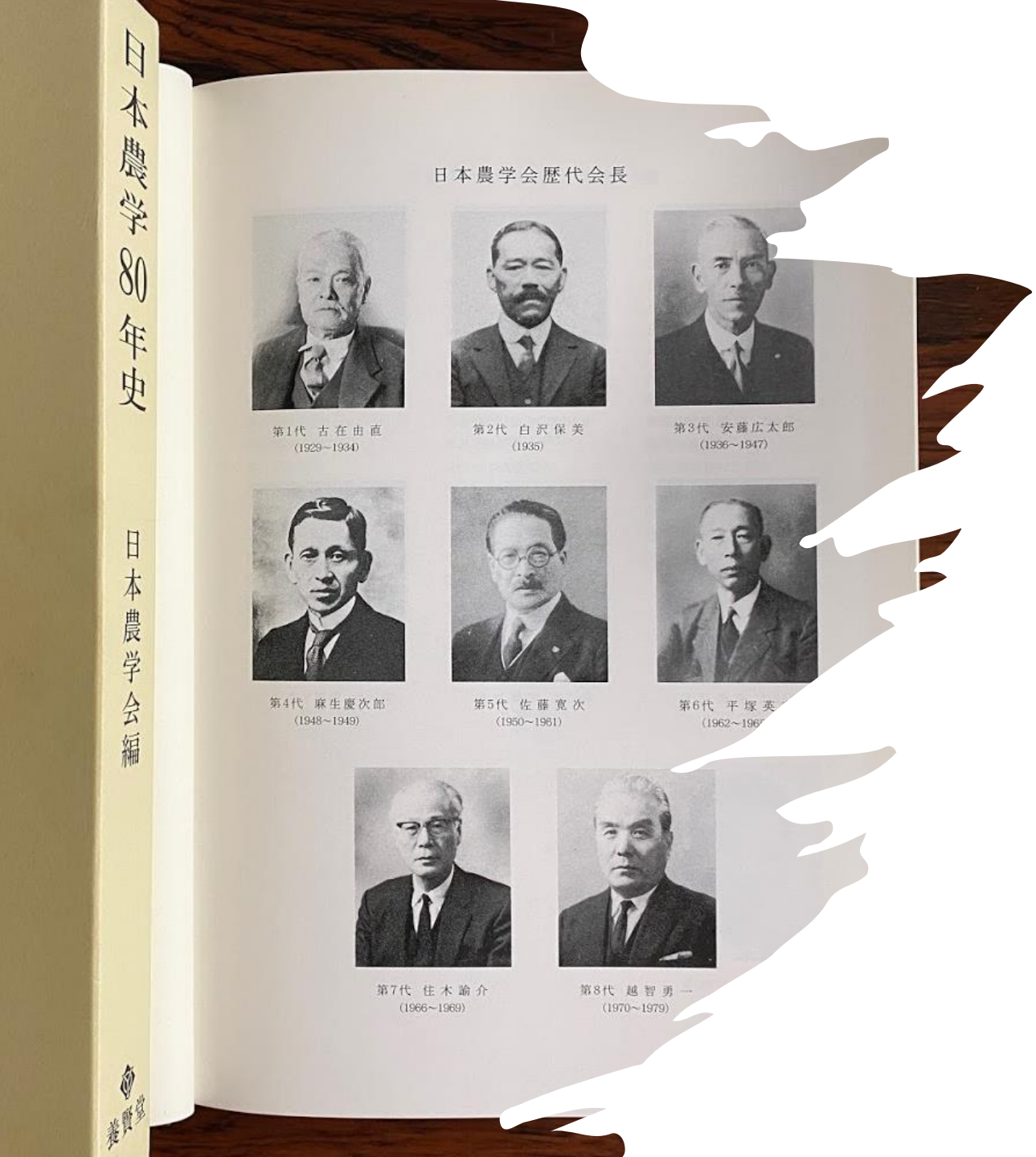
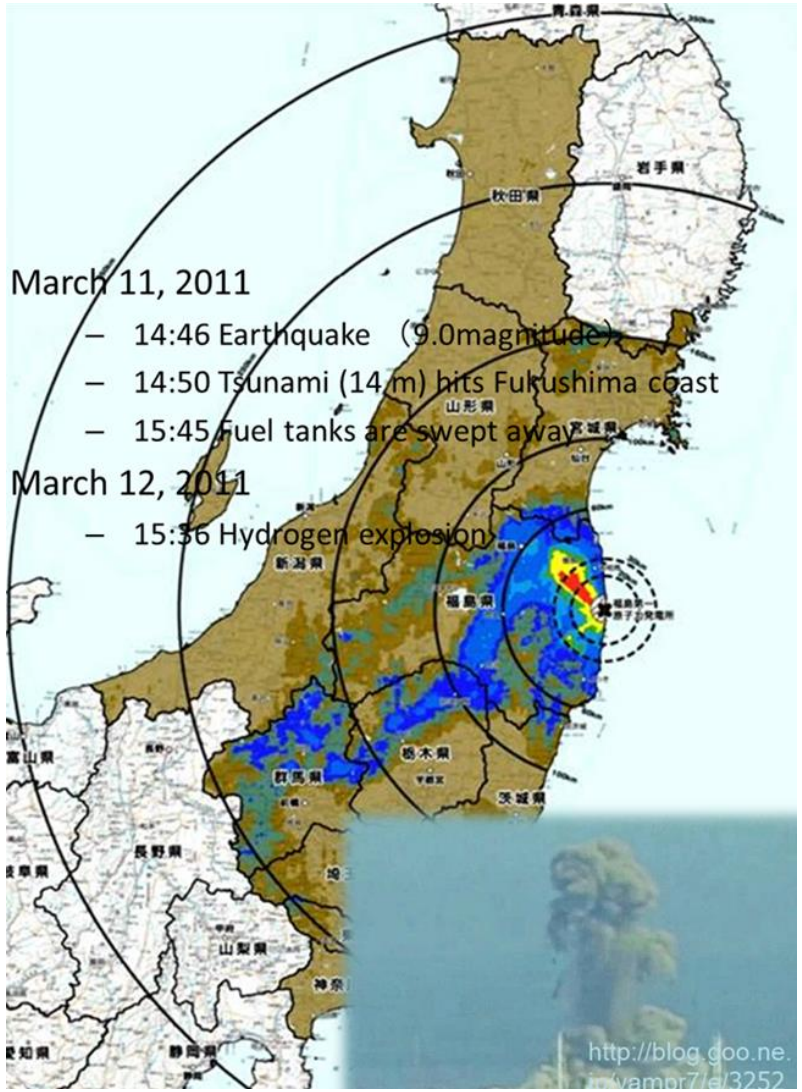


THE JAPAN SOCIETY OF AGRICULTURAL SCIENCES

- Modern agricultural science in Japan started
  - with the Veterinary Society in 1884,
  - and by 1929, 16 societies had been established,
  - and now consists of more than 50 societies reflecting the subdivision of research fields.
- The Society for Reconstruction and Agricultural Sciences became the 53rd society to join the Japan Society of Agricultural Sciences in 2020.

NUCLEAR POWER PLANT DISASTER IN FUKUSHIMA

- In March 2011, the Tohoku region was devastated by the tsunami caused by the Great East Japan Earthquake, and the coastal area of Fukushima Prefecture was contaminated by radioactive materials due to the nuclear power plant accident.
- While the 1986 Chernobyl accident was brought to an end with the sarcophagus treatment, the first human challenge to revive the region continues in Fukushima and accumulate its experiences as reconstruction knowledge for ten years.
- The Reconstruction Agency in the Japanese government, is trying to create an international education and research center that will be the core of creative reconstruction, including an attempt to disseminate such reconstruction knowledge to the world.



WHAT IS AGRICULTURAL SCIENCE?

- RURAL AREAS
  - are places of food production and living environments
- AGRICULTURAL SCIENCE
  - is a discipline that works with the people who live there.
  - In normal science, we search for literature and set a research theme
  - But in Fukushima, there are many issues arising from the nuclear power plant accident.
- We have a CHANCE
  - to ask dedicated farmers who have returned in the areas where evacuation orders have been lifted without defeated by adversity.
  - "Ask the rice about rice, and ask the farmers about agriculture." （Professor Yokoi）
- Only faculty members and students go to the fields in Fukushima and talk with the farmers, we will be able to see the real issues and come up with research themes. →FPBL(Field and Project-Based Learning)

RESILIENCE AGRONOMY -NEW AGRICULTURAL SCIENCE

- Resilience: the ability to be happy, successful, etc. again after something difficult or bad has happened （Cambridge Dictionary）

Reconstruction → Resilience

Soil decontamination is finished!

We need to make a new community with hope

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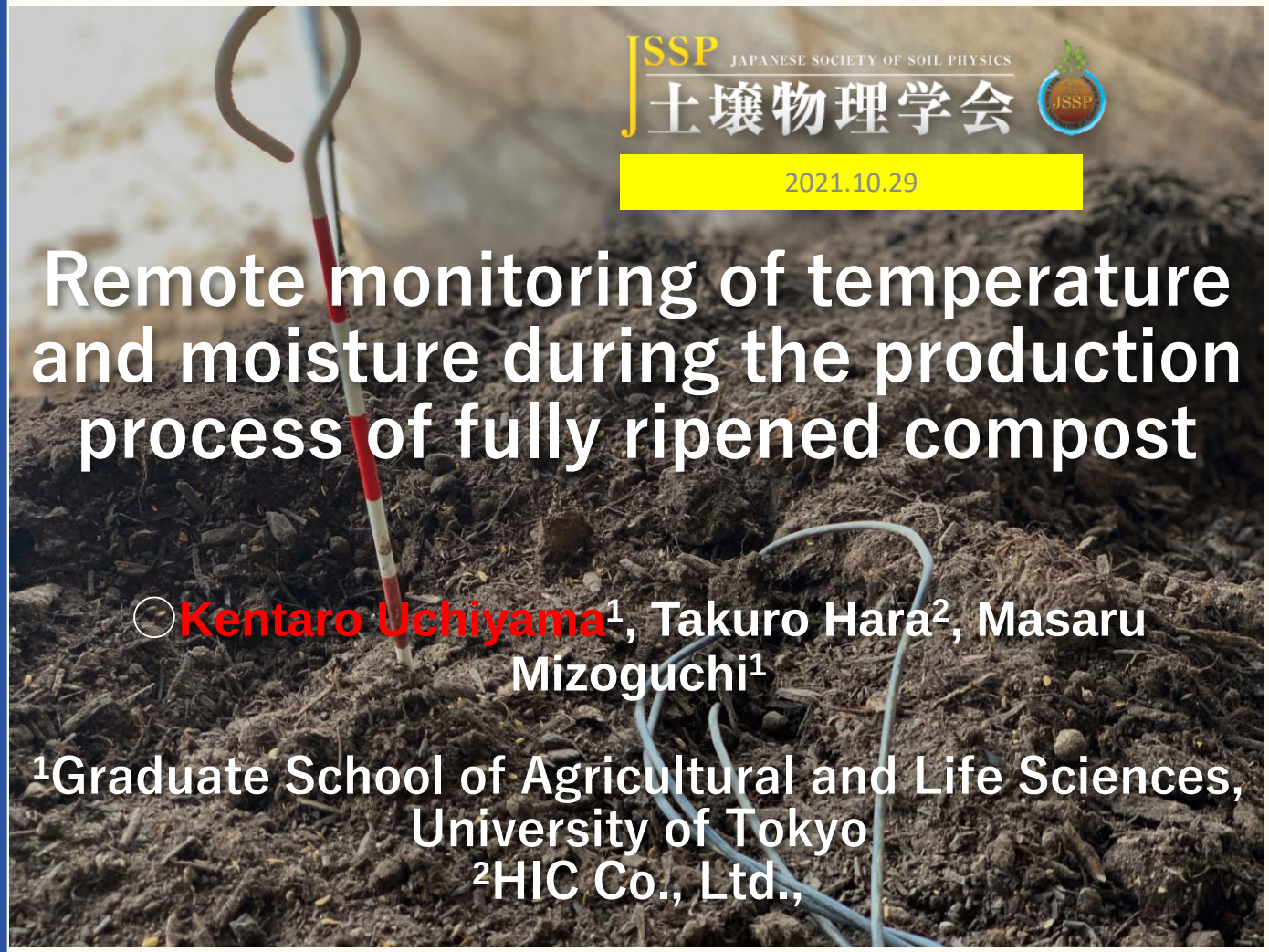
MY CHALLENGES OF RESILIENCE AGRICULTURAL SCIENCES IN FUKUSHIMA (TWO EXAMPLES)

1. Composting using IoT sensors
    - to recover the soil fertility that was lost due to soil decontamination work in Fukushima

2. Animal monitoring using LoRa communication technology
    - to protect crops and fields from monkeys and wild boars



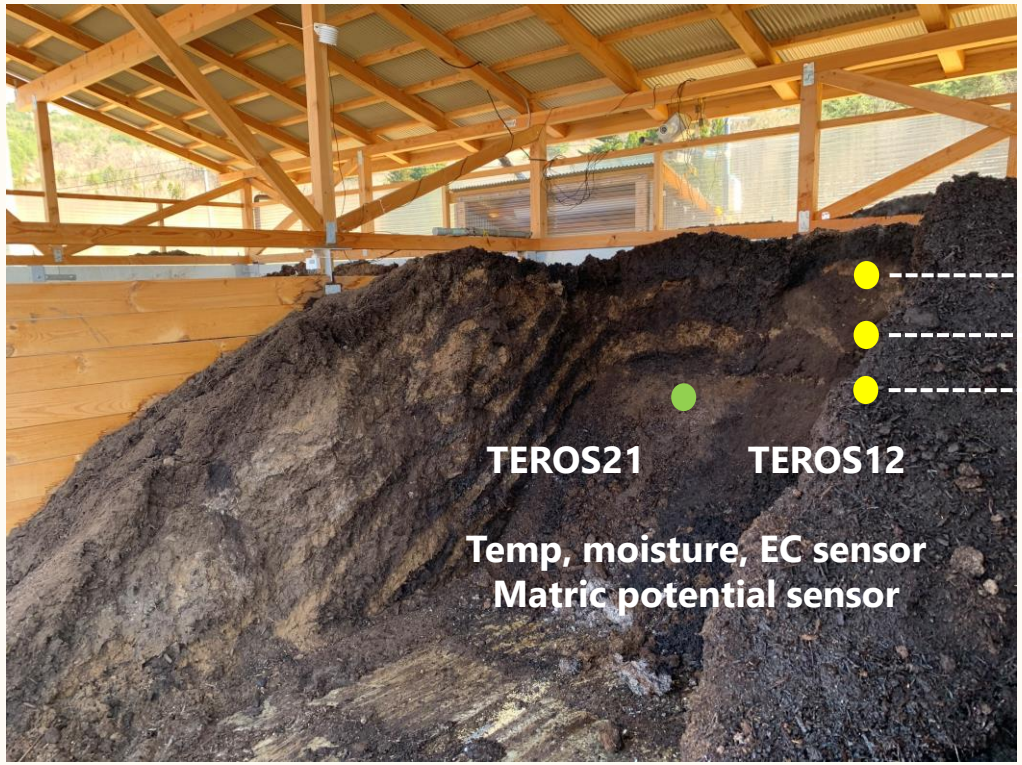
Background

The high-quality compost is needed for the recovery of soil fertility lost due to soil decontamination work in Fukushima.

There is no standard for measuring the degree of maturity of "fully ripe compost“.

A method to measure and judge the degree of maturity at each production site is needed/

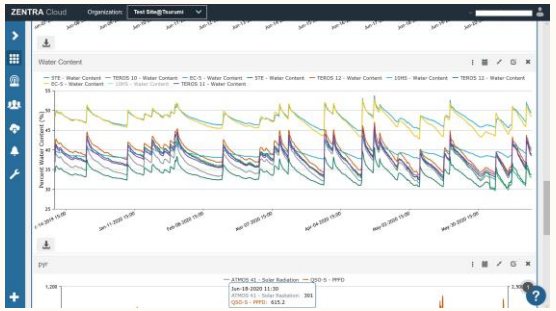
ICT/IoT monitoring Unit



Depth of sensors (20, 40, 60 cm from the top)

Data logger (METER)
ZL6/Em50

Interval=15 min



ZENTRA Cloud

TEROS21
(METER)

TEROS12
(METER)

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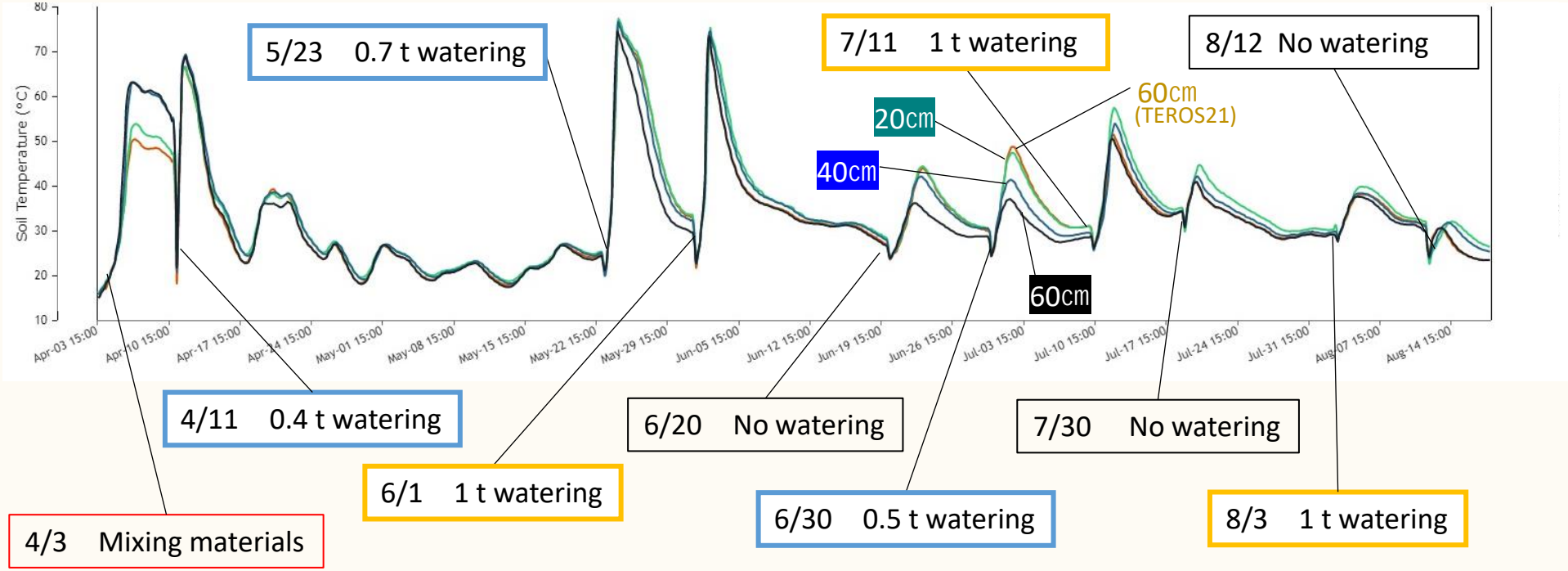
Result-1: Compost temperature

Total compost=30㎥



1. Watering at the time of turnover may be effective in the late stage of production

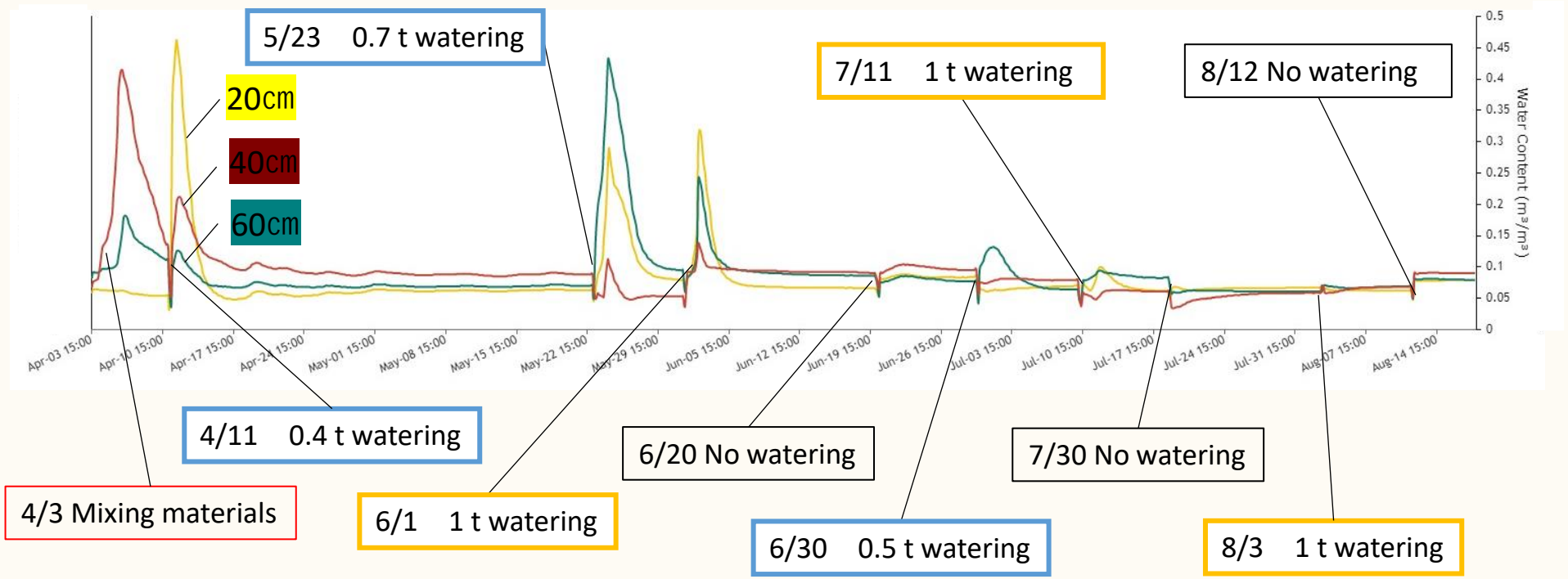
2. Watering at the time of temperature decrease may be effective

3. The temperature increase was highest at a depth of 20 cm

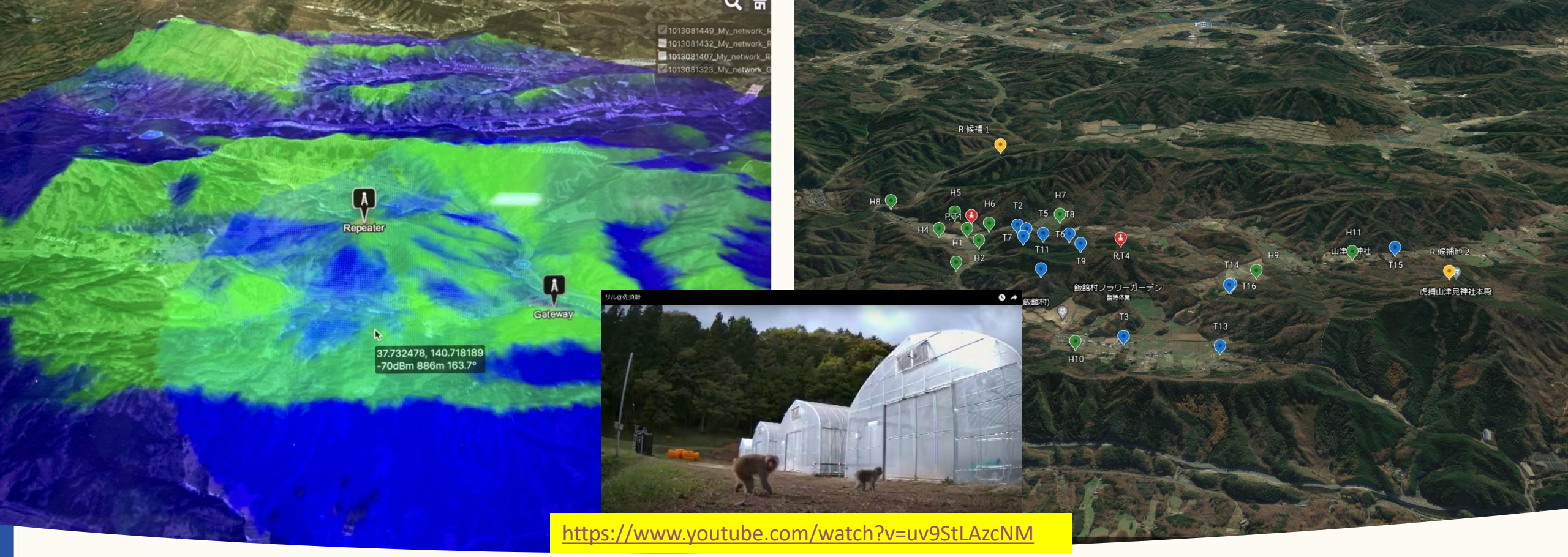
4. Temperature tended to increase at shallower depths after turnover

5. There were small differences among the depths (60cm, 40cm, and 20cm)

Result-2: Compost moisture content



1. **After the turnover, the moisture content in the compost changed with/without watering**
2. **The moisture content in the compost varied greatly depending on the depth**
3. **There was no reproducibility in the change in moisture content with depth.**



https://www.youtube.com/watch?v=uv9StLAzcNM

Evaluation of LoRa Radio Propagation and Optimization Method of LoRa Network Construction in Iitate Village, Fukushima

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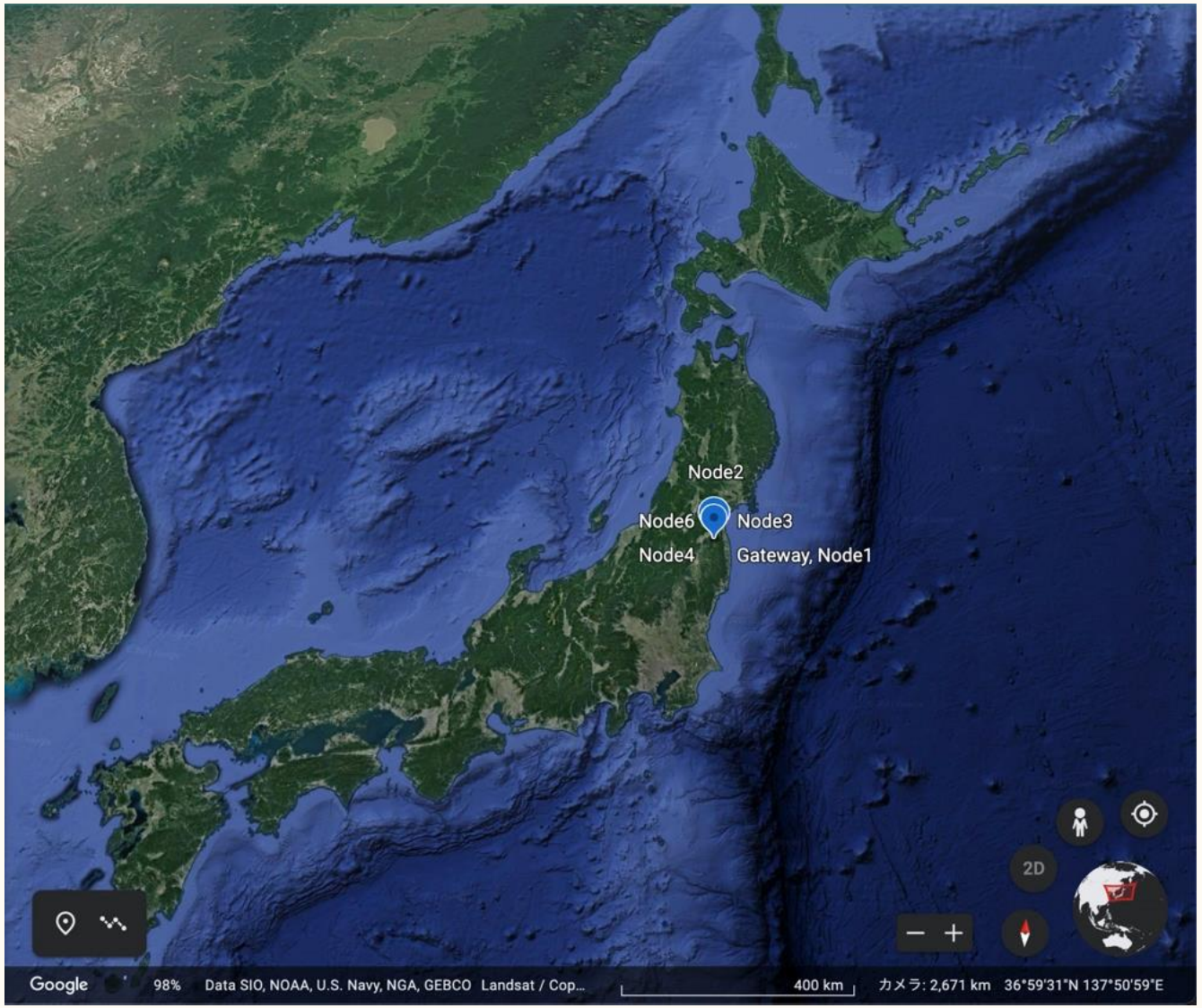
Experiment Site

- Site : Sasu District,
  Iitate Village,
  Fukushima Prefecture
- Device : 12 nodes, included
  1 Gateway node
  11 Sensor nodes
- Altitude : 419m ~ 593m
- Height : 1.5m above ground
- Distance : 0~2km

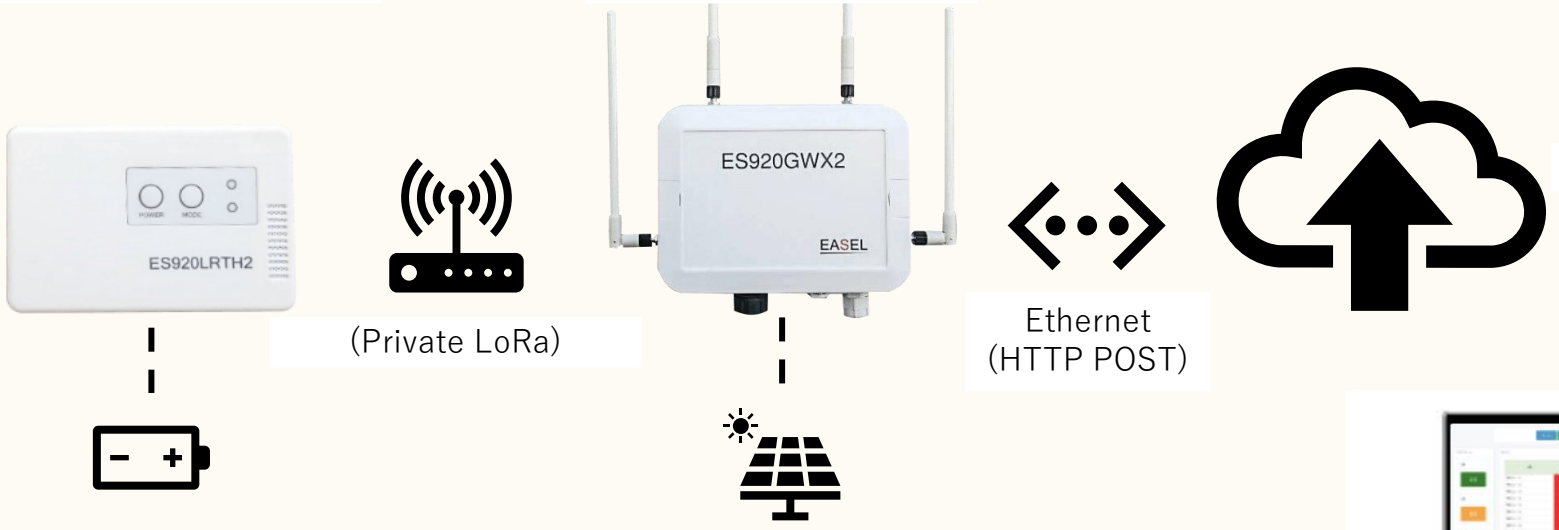


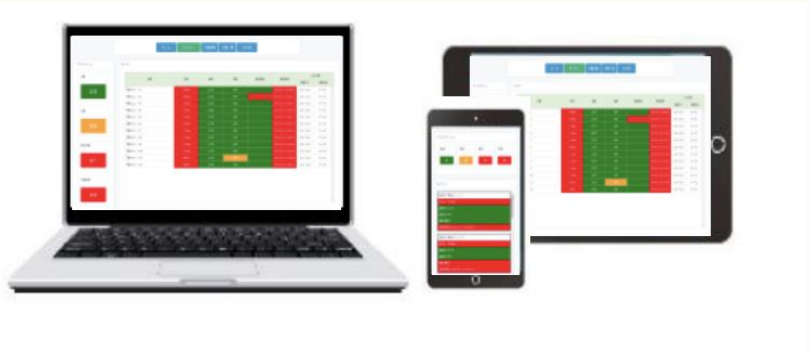
Experimental Setup

Sensor Node (ES920LRTH2)

Gateway (ES920GWX2)

Cloud Server (AWS)





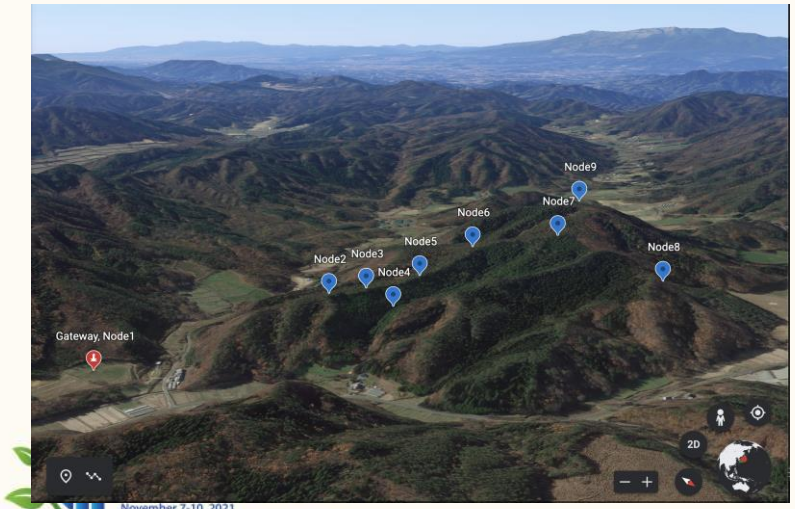
PC・Smartphone ・Tablet

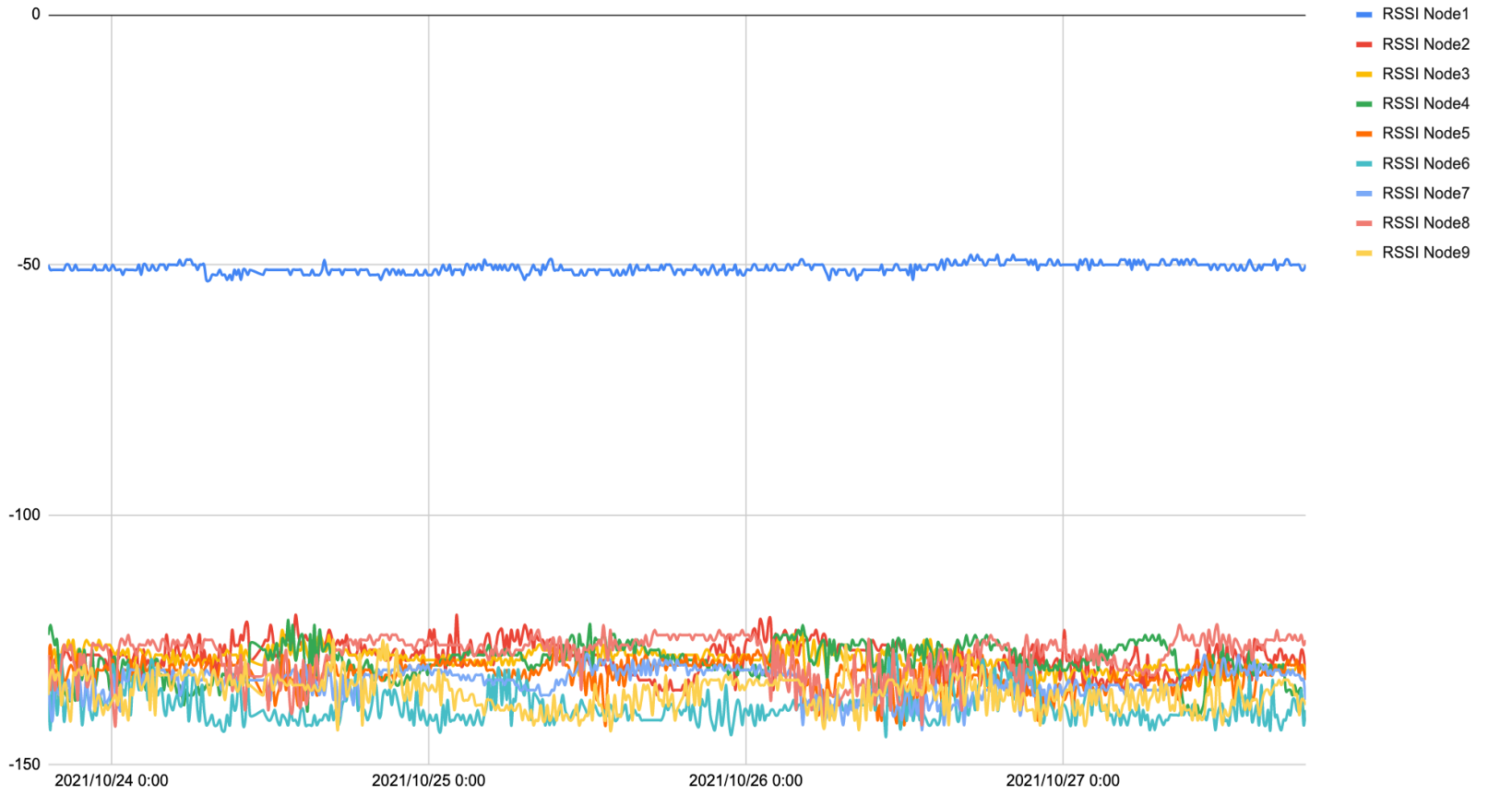
System Overview Diagram

together with EASEL, Inc

Result: Signal strength

The strength of LoRa signal is not likely to be affected by distance for the mountain with a 2km radius

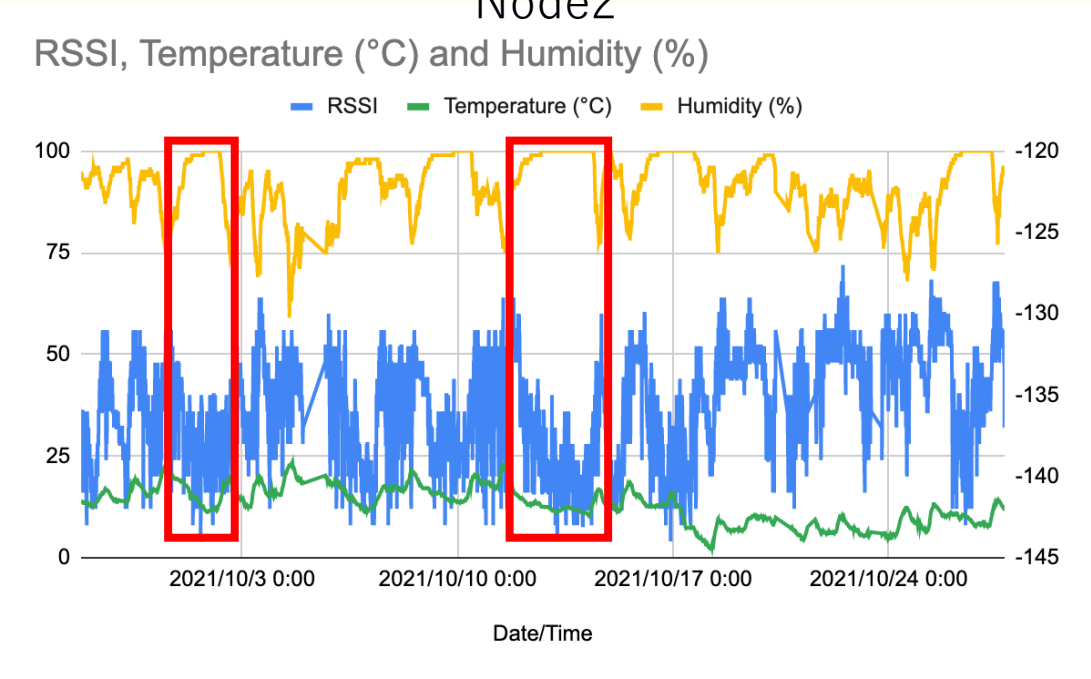




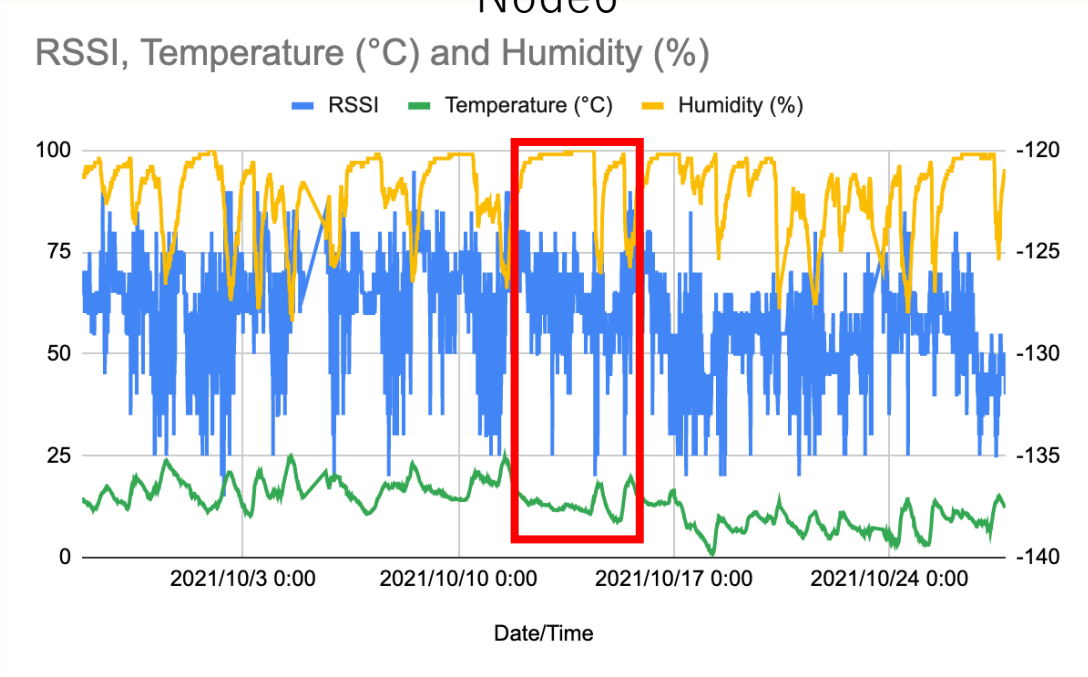
Result: Humidity vs. RSSI signal

- It was reported that humidity has no correlation with the RSSI signal in Urban area, but on this research shows that there is an effect of humidity for RSSI signal in the case of mountains.

Node2

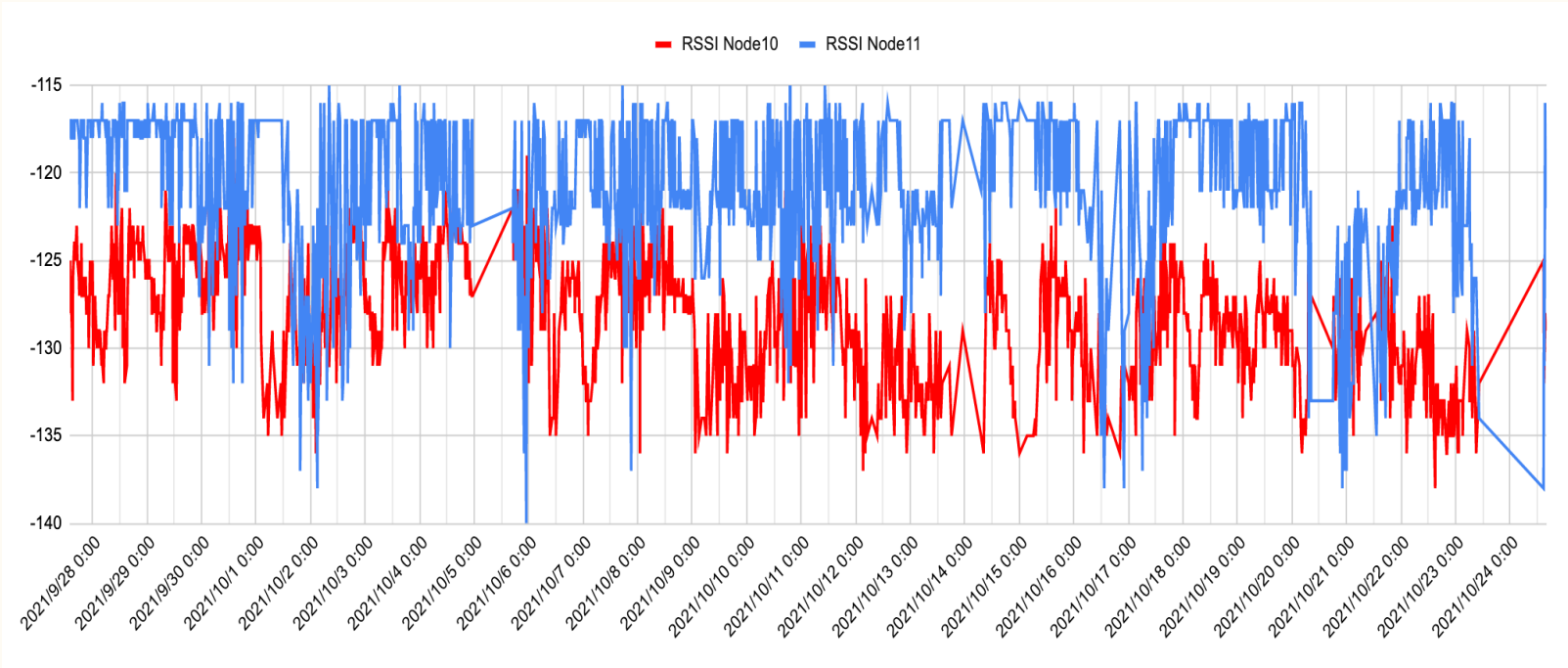


Node6



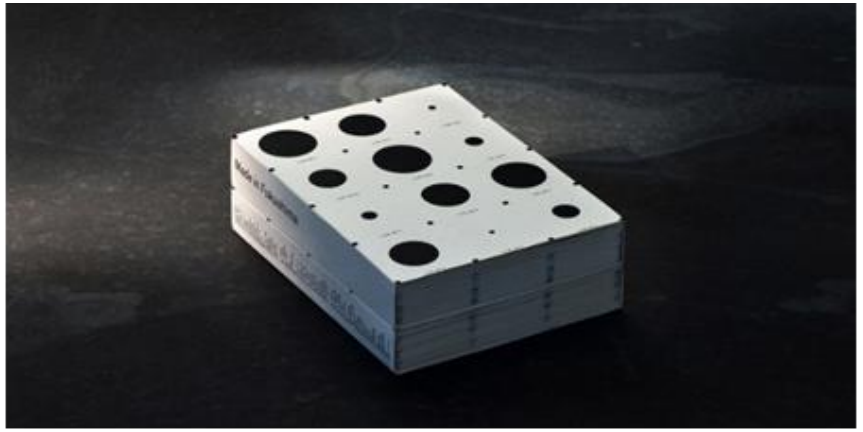
Result: Tree density vs. RSSI signal

- Assumed that Node10 and Node11 have same environment conditions beside tree density
- The lower the density of the trees, the more stable the signal strength.



CONCLUSION

- Agricultural science is the comprehensive science and technology.
  - However, it is now too diverse and fragmented!
- The new agricultural science is now trying to revive as a ***Resilience Agronomy*** like a phoenix from Fukushima, Japan.
- Let’s go to the real field, and talk with the farmers!



https://www.madeinfukushima.com/

THANK YOU!

- See you in ZOOM meeting after video session from a real field of Iitate Village, Fukushima on Nov. 9.

https://www.youtube.com/watch?v=3R3jyauYGd4