

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.



福島

復興知学講義

秋光信佳・溝口勝 編

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**".

<https://kotobank.jp/image/dictionary/nikkokuseisen/media/ii126.bmp>



日本農学会歴代会長



第1代 古在由直
(1929~1934)



第2代 白沢保美
(1935)



第3代 安藤広太郎
(1936~1947)



第4代 麻生慶次郎
(1948~1949)



第5代 佐藤寛次
(1950~1961)



第6代 平塚英一
(1962~1967)



第7代 住本諭介
(1966~1969)



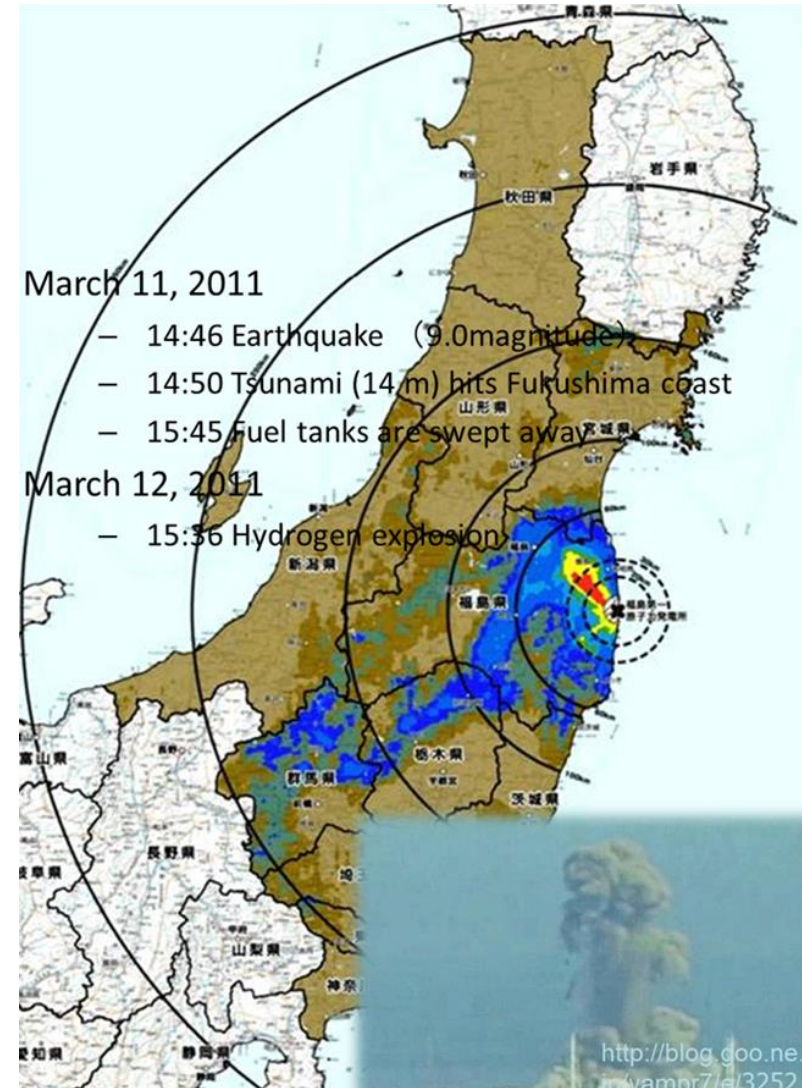
第8代 越智勇一
(1970~1979)

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

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



Remote monitoring of temperature and moisture during the production process of fully ripened compost

○ **Kentaro Uchiyama**¹, Takuro Hara², Masaru Mizoguchi¹

¹Graduate School of Agricultural and Life Sciences,
University of Tokyo

²HIC Co., Ltd.,

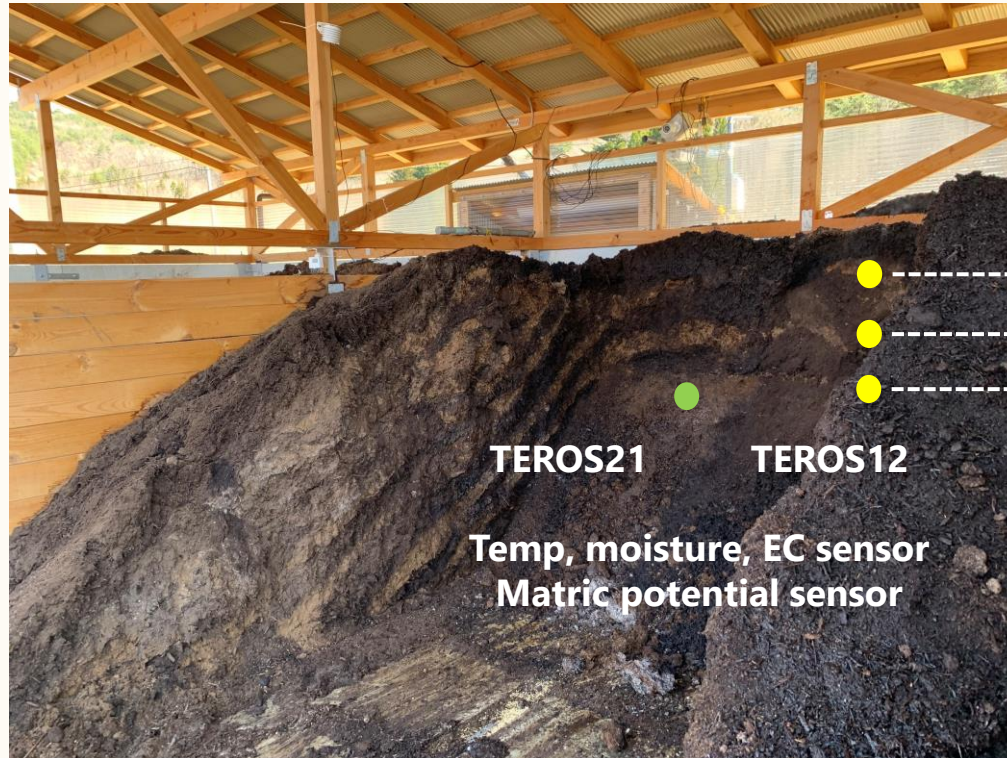
Background

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



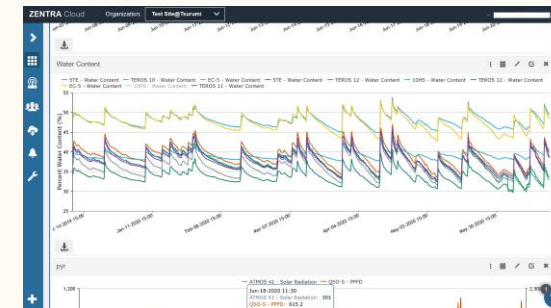
20cm
40cm
60cm

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



Data logger (METER)
ZL6/Em50

Interval=15 min



ZENTRA Cloud



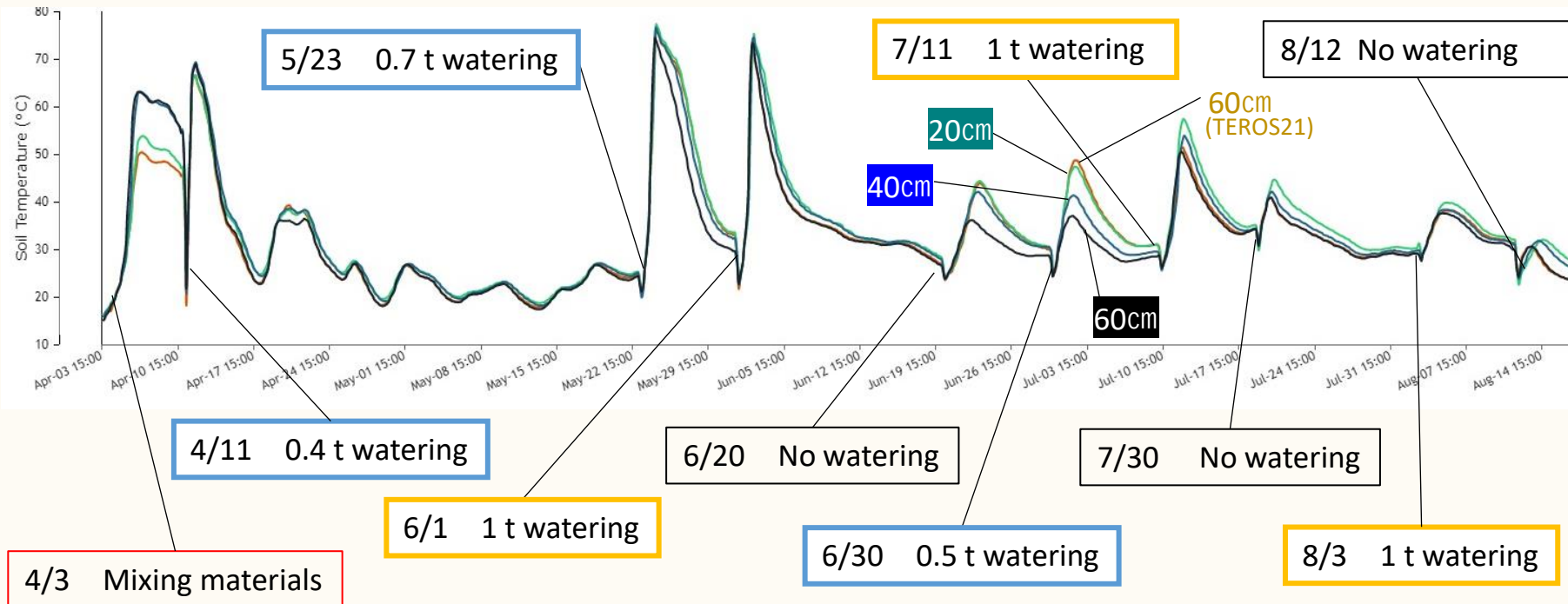
TEROS21
(METER)



TEROS12
(METER)

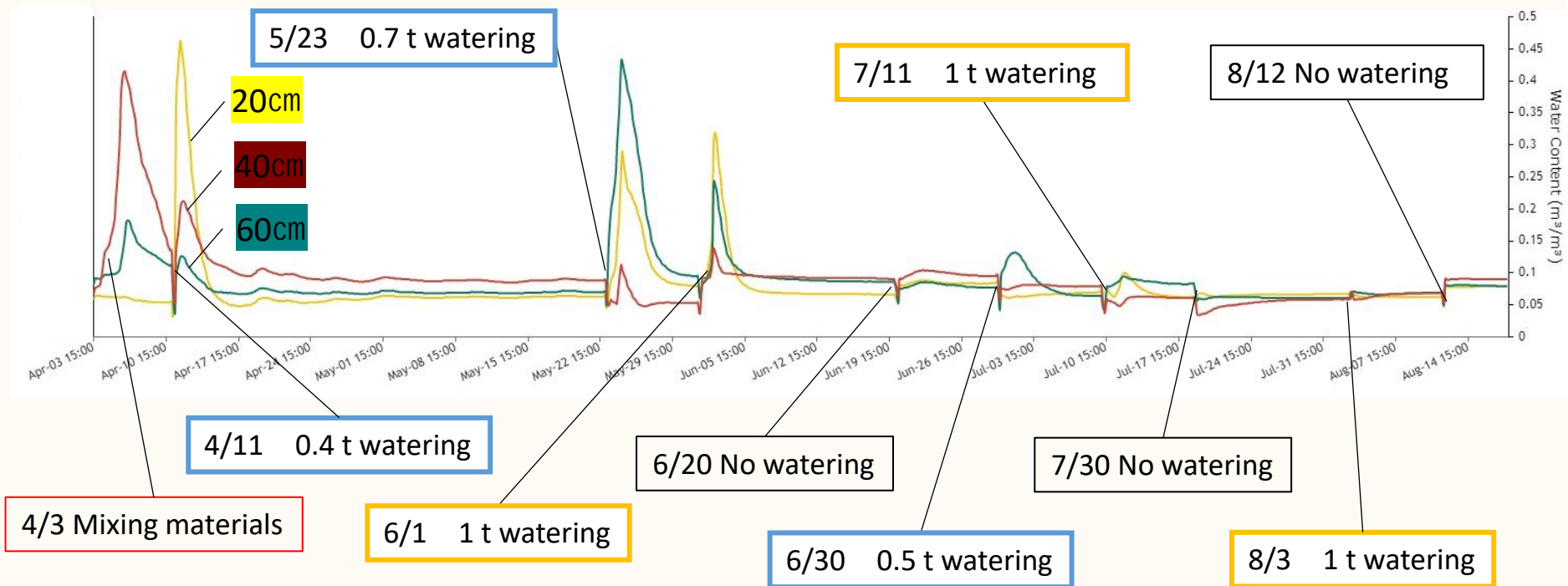
Result-1: Compost temperature

Total compost=30m³

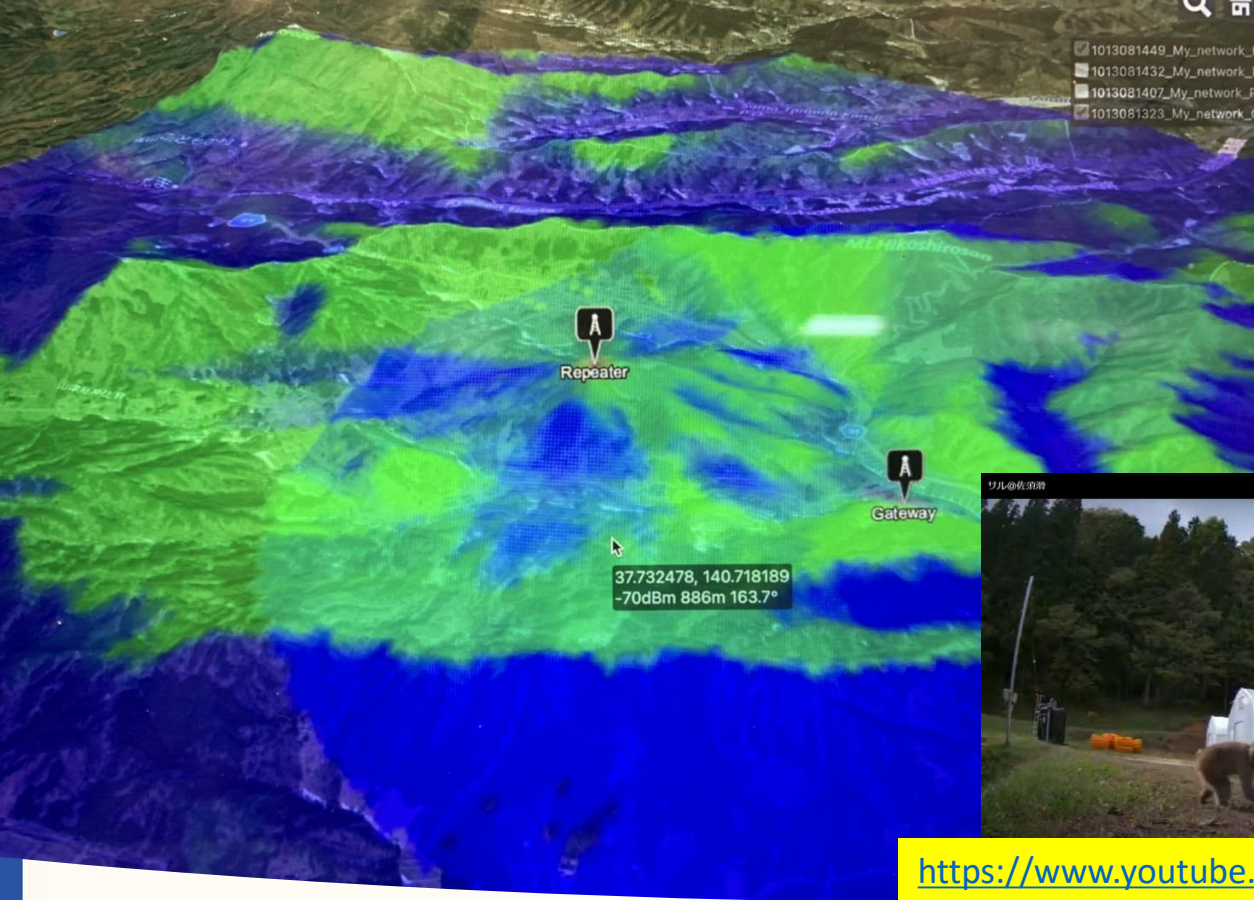


1. Watering at the time of turnover may be effective in the late stage of production
2. Watering at the time of temperature decrease may be effective
3. The temperature increase was highest at a depth of 20 cm
4. Temperature tended to increase at shallower depths after turnover
5. There were small differences 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>

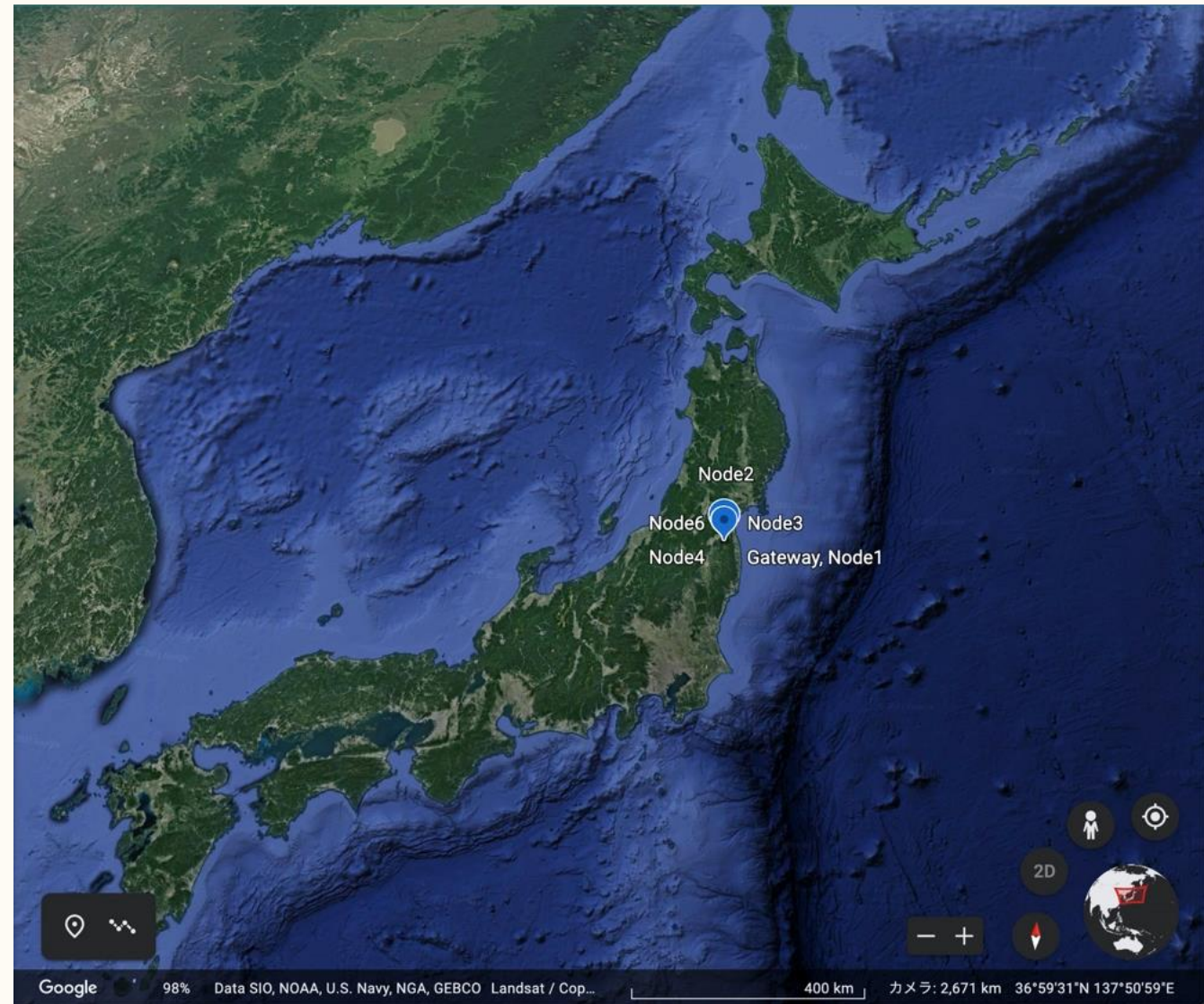
Evaluation of LoRa Radio Propagation and Optimization Method of LoRa Network Construction in Iitate Village, Fukushima



Maulana Riko Ahmad, Hiroaki Sugino, Masaru Mizoguchi
 Graduate School of Agricultural and Life Sciences, The University of Tokyo

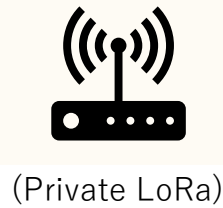
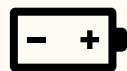
Experiment Site

- 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

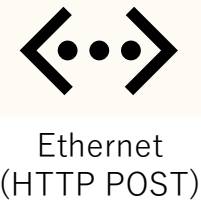
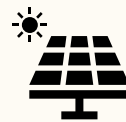


Experimental Setup

Sensor Node
(ES920LRTH2)



Gateway
(ES920GWX2)



Cloud Server
(AWS)



Monitor and download data



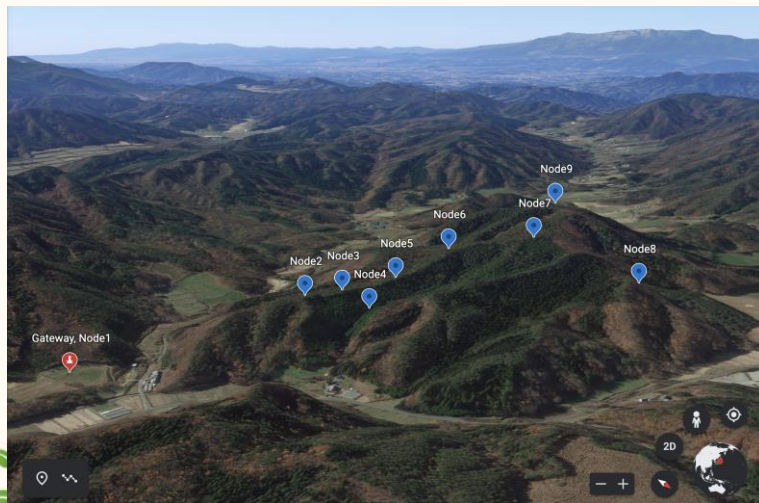
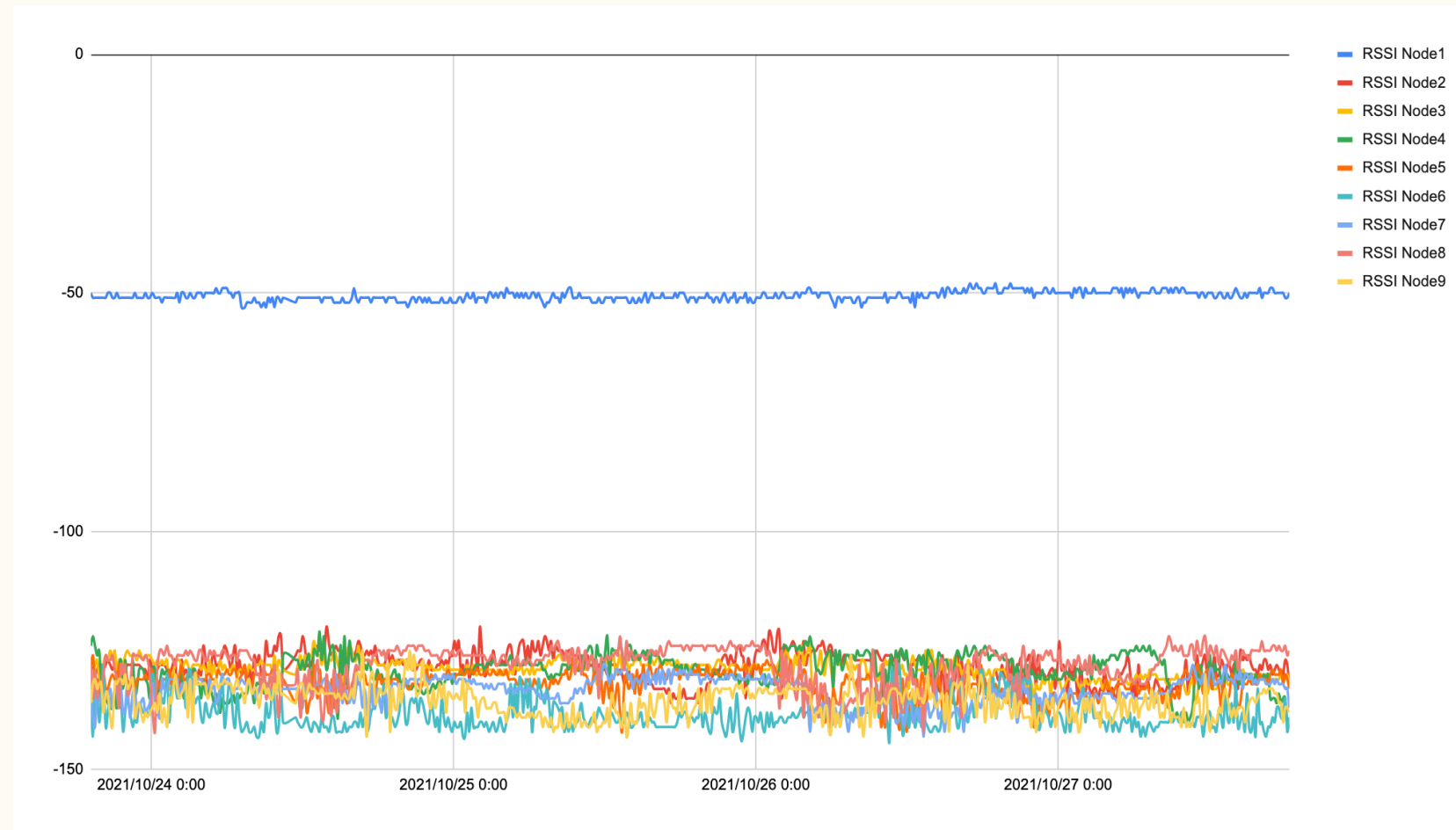
PC · Smartphone · Tablet

System Overview Diagram

together with EASEL, Inc

Result: Signal strength

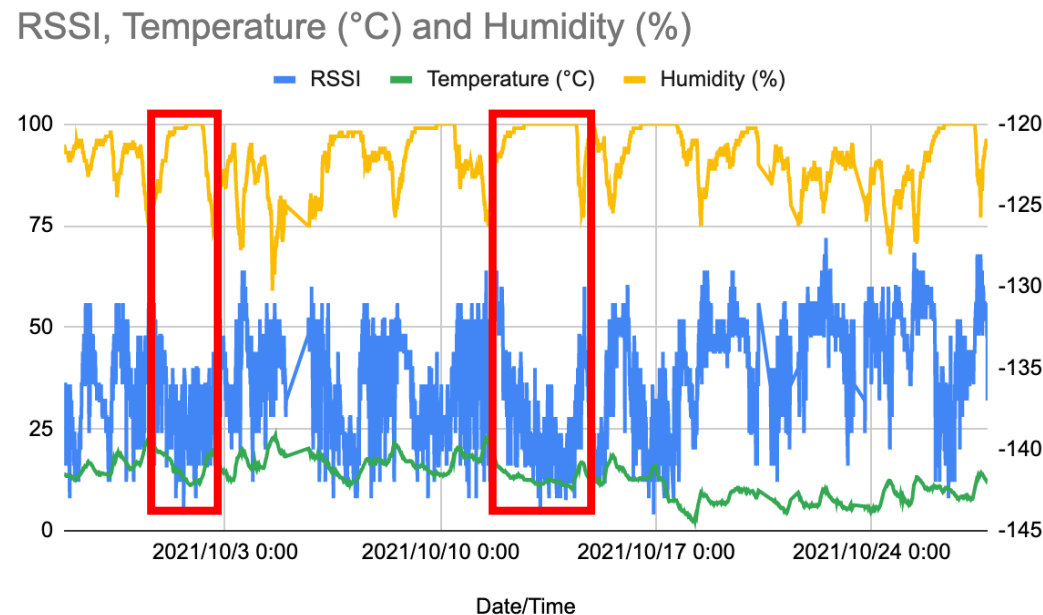
The strength of LoRa signal is not likely to be affected by distance for the mountain with a 2km radius



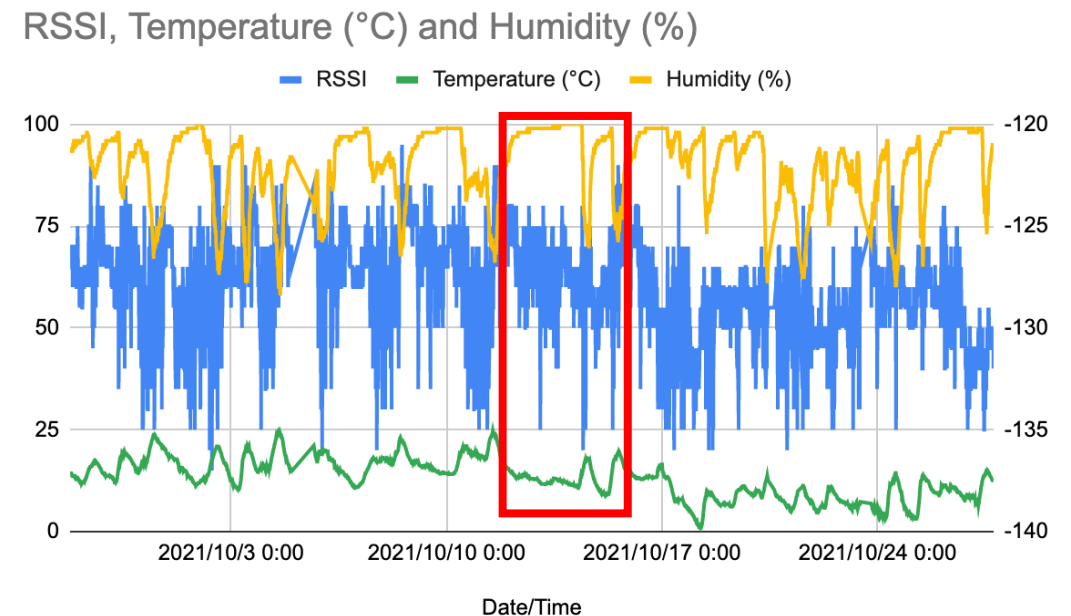
Result: Humidity vs. RSSI signal

- 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

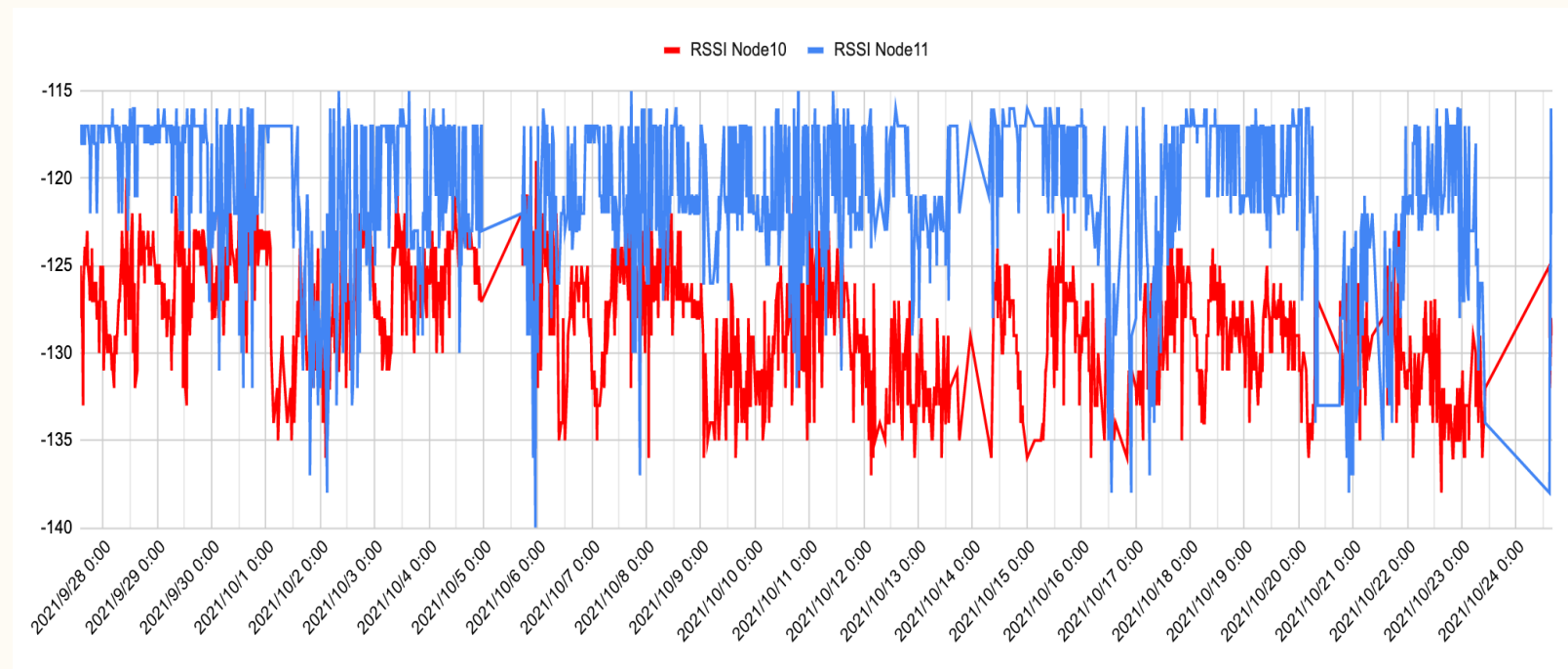
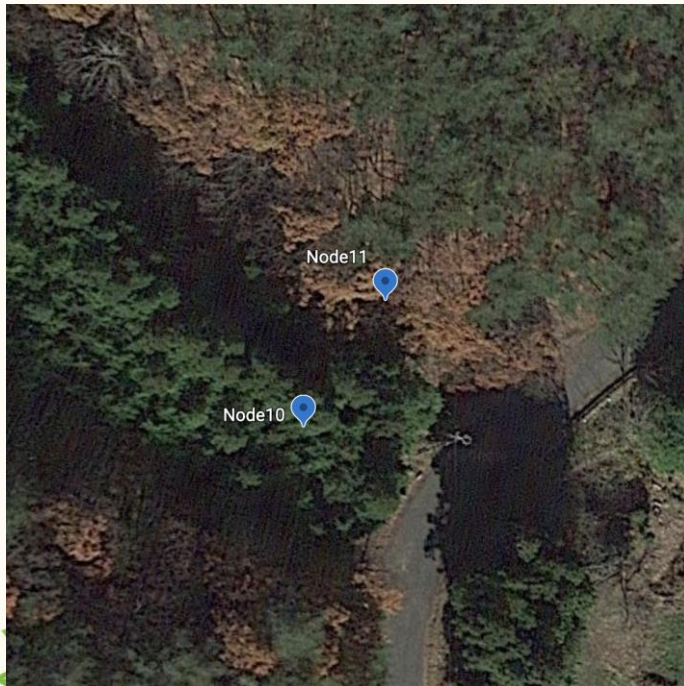


Node6



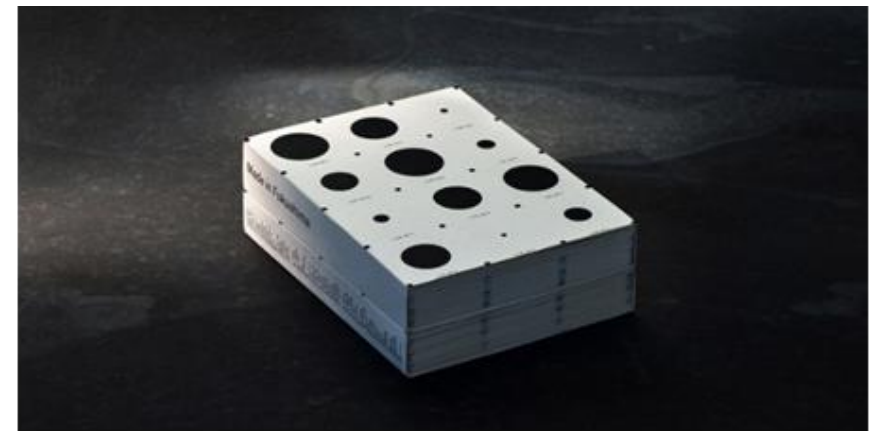
Result: Tree density vs. RSSI signal

- 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.

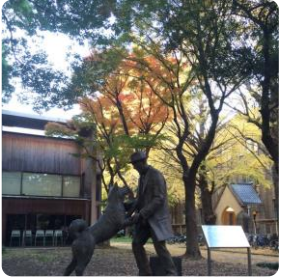


CONCLUSION

- 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 litate Village, Fukushima on Nov. 9.



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