April 24, 2020
Tokuron-1/IPADS Development Studies(2020)

Agricultural Engineering

-Production system, Infrastructure, Irrigation-

Masaru Mizoguchi

Lab. of International Agro-Informatics
Graduate school of Agricultural and Life Sciences
The University of Tokyo

What is this?

TOYOTA is leading Japan ?

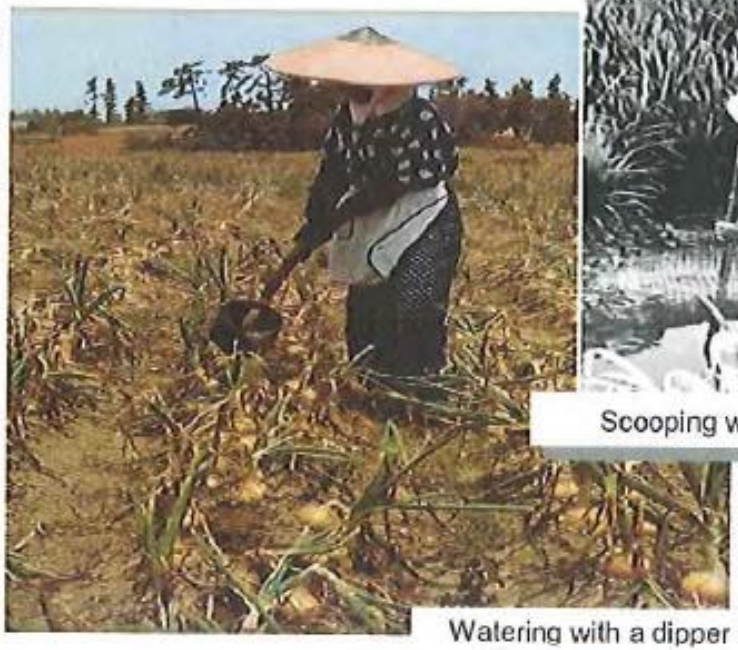
Before the Project

1）Frequent droughts

With no perennial river to draw water from, farmers would depend on unpredictable rainfall and numerous ponds.

13,000 ponds in 33,000 ha of the project area

Watching on the night



Watering with a dipper

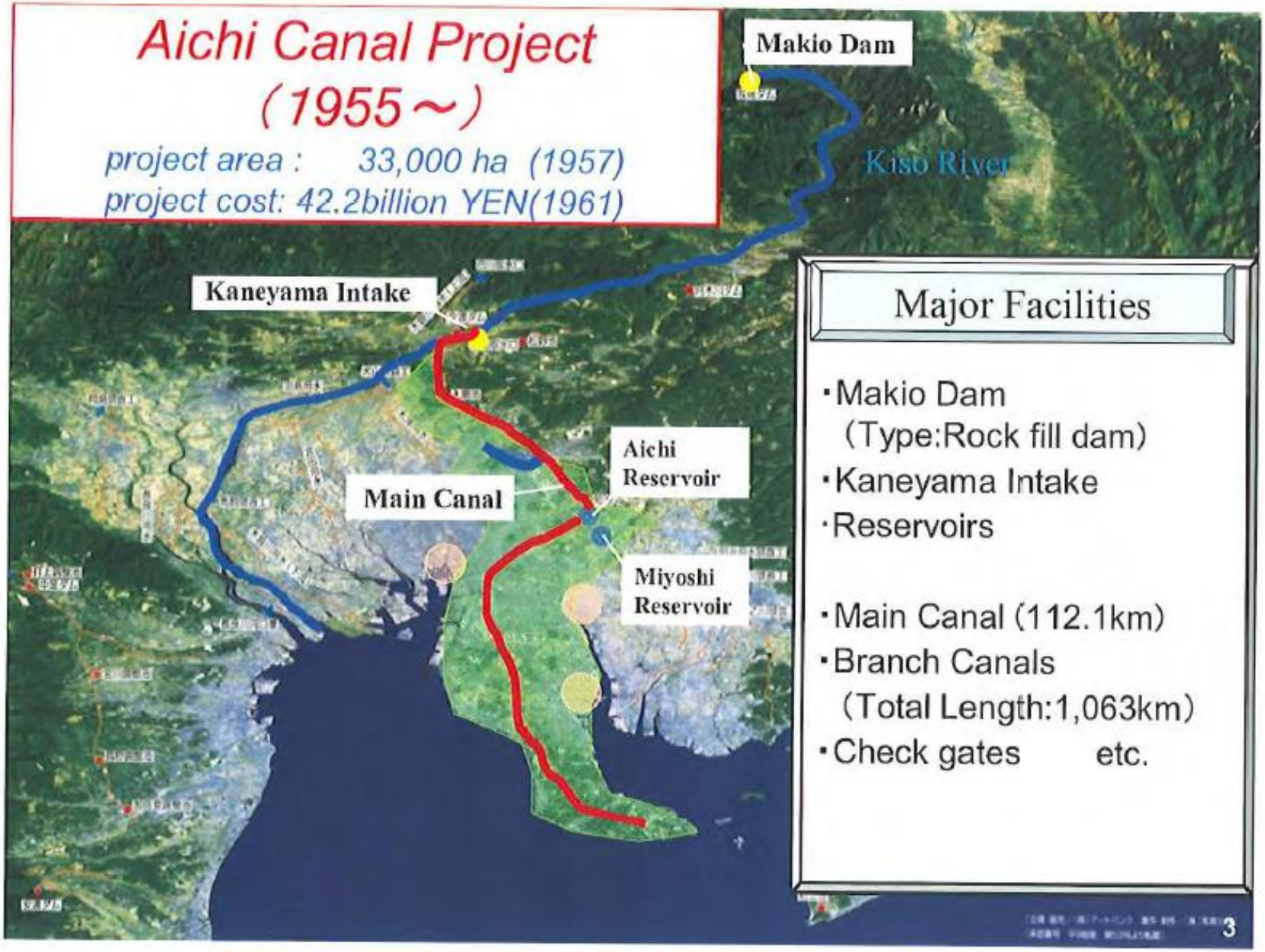
Scooping water from a well

After the web page of 愛知用水総合管理所

Question-1

Why did this area develop?
Who developed this area?

- Group discussion (5 min)-



After the web page of 愛知用水総合管理所

See Movie

Important points of agricultural development project

- Integrated knowledges are required
  - Not only individual knowledge
  - Team work of politics, economy, technology
- Time and space
  - Learn from history
  - Effective use of local resources (soil and water)
- Combination study of public policy and technology
  - What should we do with social capital now?

Land Improvement Projects
（土地改良事業／農業農村整備事業）

JSIDRE (1995)

Definition of land improvement projects in Japan

- MAFF(Ministry of Agriculture Forestry and Fisheries) is responsible for projects to cultivate virgin land, develop agricultural land, consolidate agricultural land plots or construct irrigation and drainage facilities
  - including reservoirs, barrages, pump stations, canals, etc. for improving agricultural productivity
  - constructing infrastructures in rural areas as community roads, domestic water supply systems, sewerage systems

- Such projects are called
  - （土地改良事業）“Tochi Kairyo Project Systems“= “Land Improvement Project Systems”
  - （農業基盤整備事業）“Nogyo Kiban Seibi Project Systems“= “Agricultural Infrastructure Improvement Systems"
  - （農業土木事業）"Nogyo Doboku Project Systems" = "Agricultural Civil Engineering Project Systems"

Land Improvement Project (1)
（土地改良事業）

- Land improvement projects are carried out under a law called the Land Improvement Law. （土地改良法）
- This law was initially enacted and enforced in 1949.

Purposes and Benefits:

(1) increase land and labor productivities （土地･労働生産性）

(2) increase total agricultural production（収量）

(3) improve the agricultural structure by diversification

（多様化による農業構造改善）

Land Improvement Project (2)

Menu of land improvement:

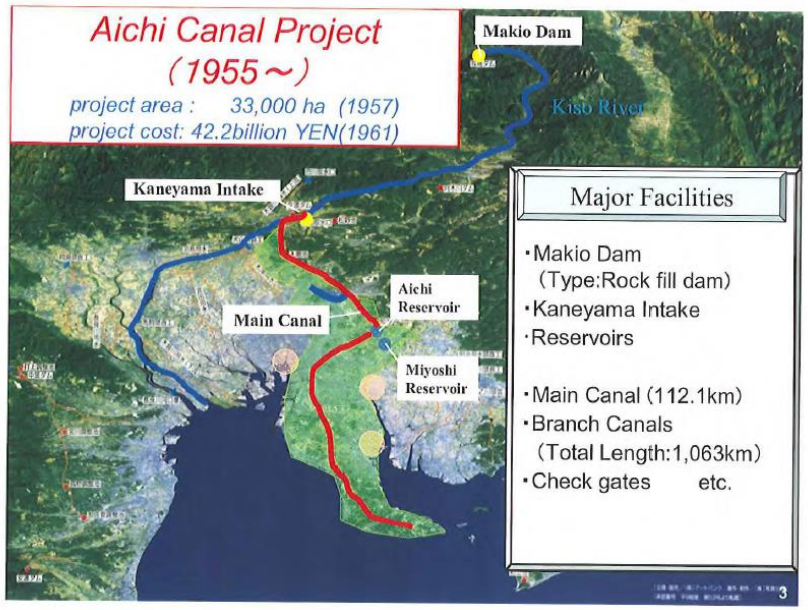
1. Irrigation and drainage（かんがい排水）
2. Agricultural land consolidation（圃場整備）
3. Farm and rural roads（農道）
4. Comprehensive development of non-paddy agricultural land（水田以外の農地総合開発）
5. Comprehensive development of rural areas（農村総合開発）
6. Disaster protection（防災）
7. Reclamation of agricultural land（開拓）
8. Reclamation from sea or lake bottom（干拓）

Characteristics of Land Improvement Project in Japan

- Various menus are provided in term of contents and benefits of facilities
- The main body to implement a land improvement project is either the national government, a prefecture, or a Land Improvement District （土地改良区）
- The costs of land improvement projects are paid by the beneficiaries （受益者）
  - Part of the costs is paid by the farmers who are the direct beneficiaries
- Facilities to be constructed by projects of the same type have to be standardized throughout the country
- "Cost Benefit Ratio" (BC Ratio) is used as the criterion to judge the economical feasibility of land improvement projects

Question-2

Why were not only “canals” but also Makio Dam constructed in Aichi Canal Project?



- Group discussion (5 min)-

Water rights (水利権)

progress of urbanization and diversion of water rights

- The economic growth and progress of urbanization have caused diversion of a large number of paddy fields into housing, office or factory land lots.
  - As a result, it was thought best to divert some of the water for irrigation to water for the newly born cities.
  - In Japan an approval from the Ministry of Construction has to be obtained under the River Law to divert water rights.

- Diversion for irrigation prior to 1896 when the River Law was enforced was considered a traditional water right (慣行水利権), already approved at the time of enforcement.
  - The water rights of irrigation groups with a long history have been legally recognized.
  - In view of the definition under the River Law that river water is a public asset, irrigation groups are prohibited to directly sell their water rights to cities

Orderly Ariake Sea reclamation paddy. This is also work of Agricultural Engineering. Landing Now. (2015.10.23)

Question-3

Why are Japanese paddy rectangle shape with same size?

- Group discussion (5 min)-


Land Consolidation Project
（圃場整備事業）

Standard Plot Size
（標準区画）

- From around 1965, a plot of 0.3 ha（3反区画）has been considered a standard size for paddy land consolidation projects.

- Basic size is 100 meter long and 30 meter wide. With a farm ditch, farm drain and farm road along the shorter side.

- However, land consolidation projects have started to make plots of at least 0.5 ha in order to use farming machinery more effectively and also in order to improve capital and labor productivities.

Standard Paddy Field Layout after Consolidation

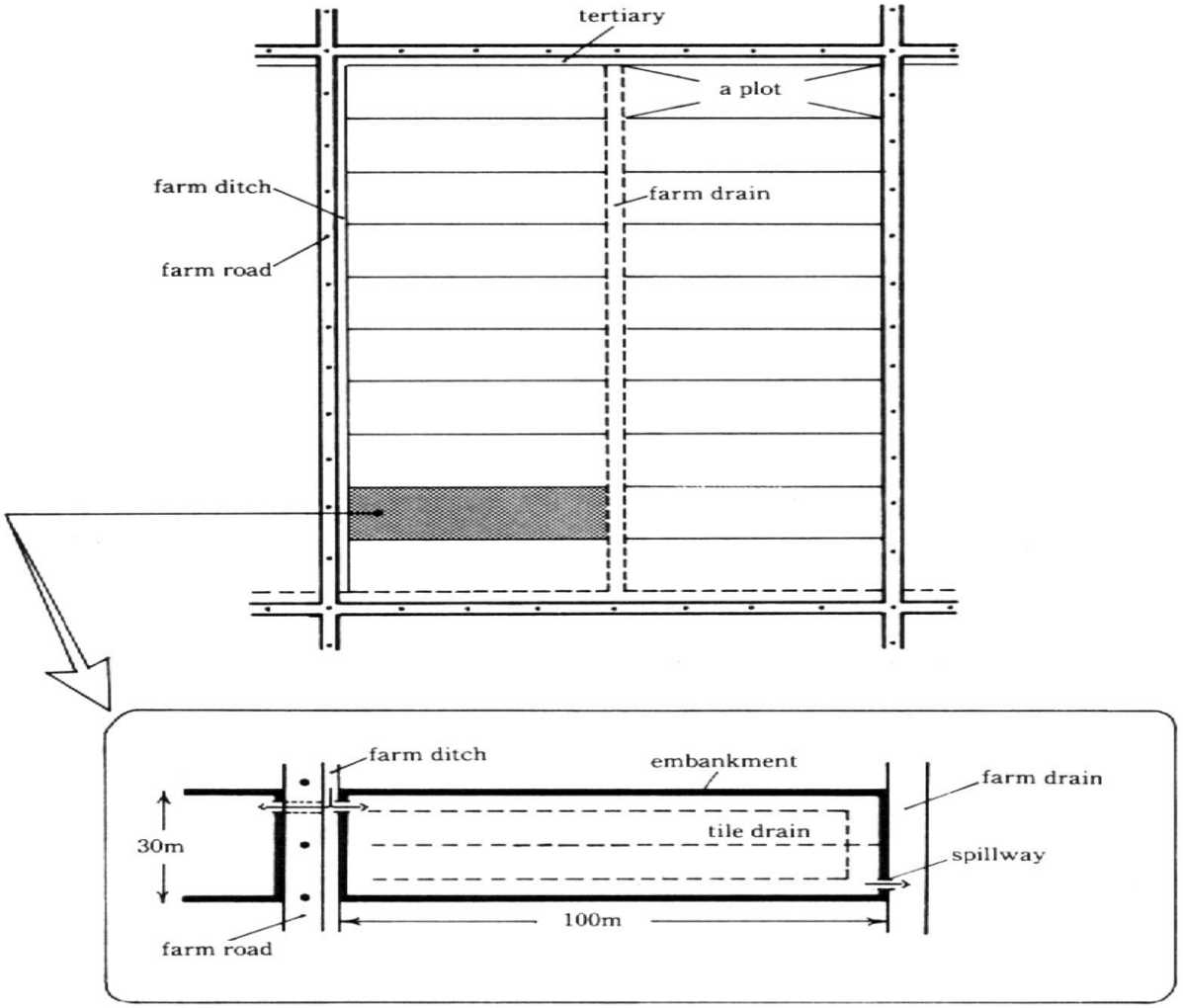


Figure 7 Standard paddy field layout after consolidation.

Conclusions on land improvement

- Agricultural Infrastructure Improvements are public work projects　農業基盤整備は公共事業
  - Application projects　申請事業
  - Need Consensus building　合意形成
  - Take a long time　時間がかかる
- The Spirit of Agricultural Engineering　農業土木の神髄
  - Comprehensive agricultural development technology 総合的な農業開発技術
  - Management of soil and water　水土の管理
  - Improvement of QOL supported by the technology　生活の質の向上
  - Interaction between urban and rural areas　都市と農村の交流

There are a lot of human dramas behind our improved land.

Tee Time ! (5 min)-

- Made in Fukushima
  - https://www.madeinfukushima.com/

- **FUKUSHIMA REBORN**
  - https://www.metergroup.com/environment-case-studies/fukushima-reborn/

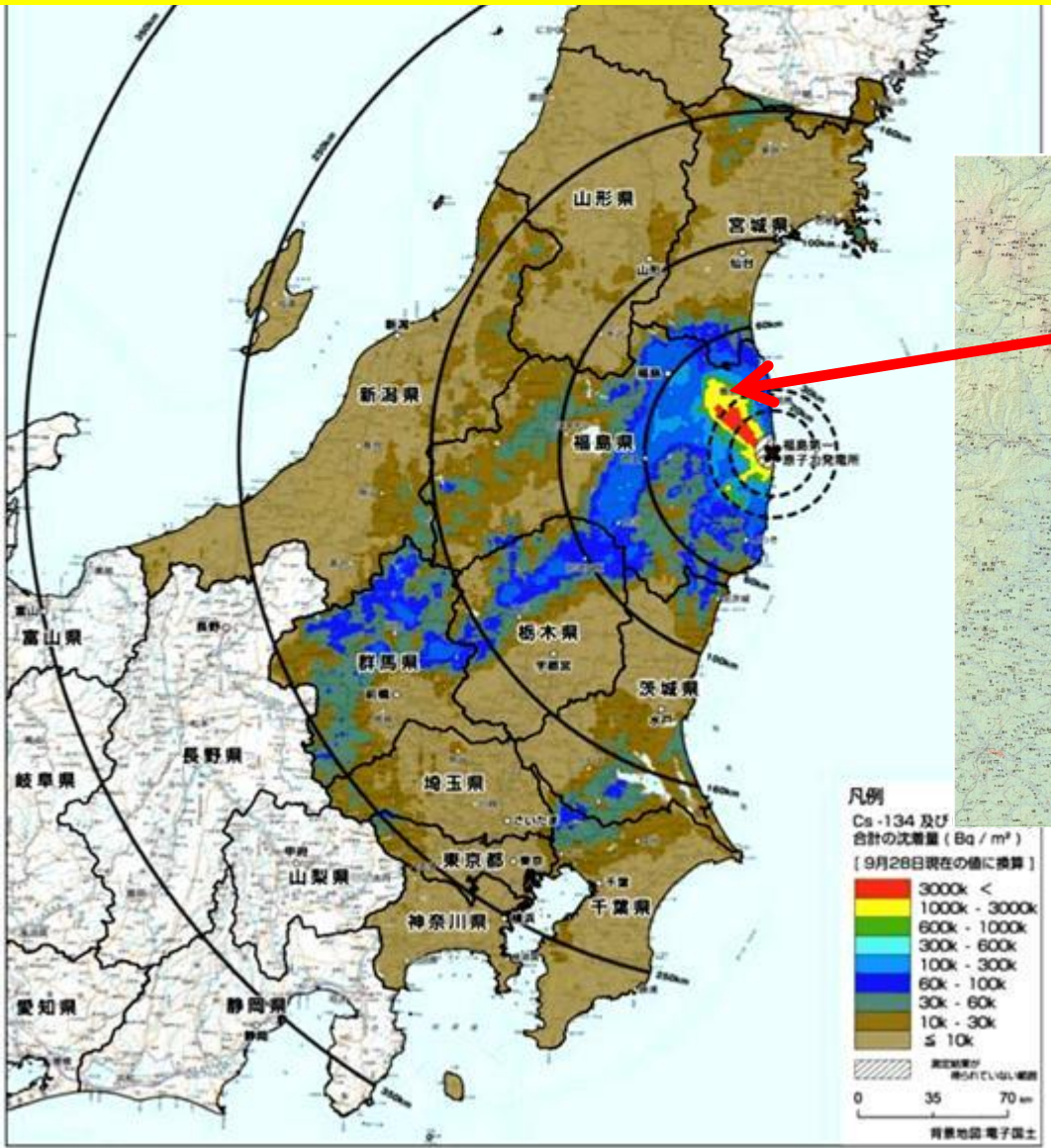
Project-Z for Fukushima

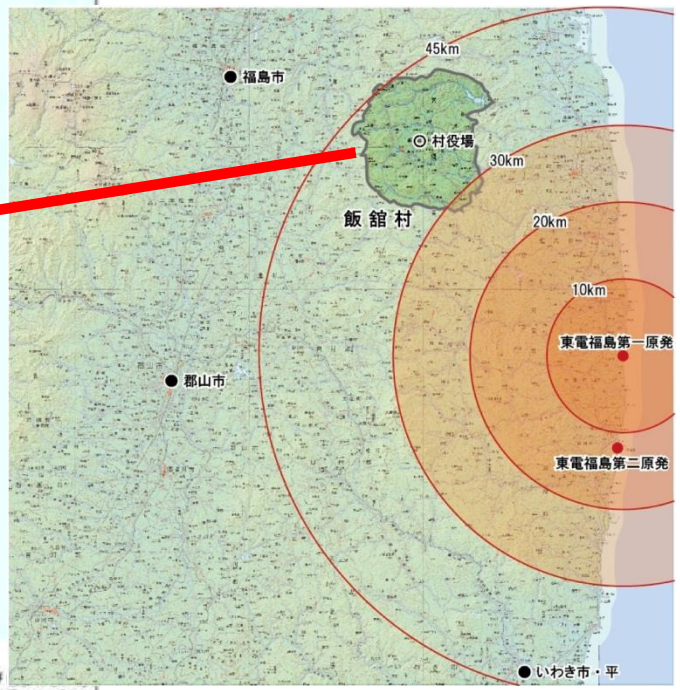
Agricultural land Remediation and Reborn of Agriculture in Iitate Village by a collaboration between scholar and NPO

（2018.12.11）Fukushima Reborn (CM by US sensor maker)

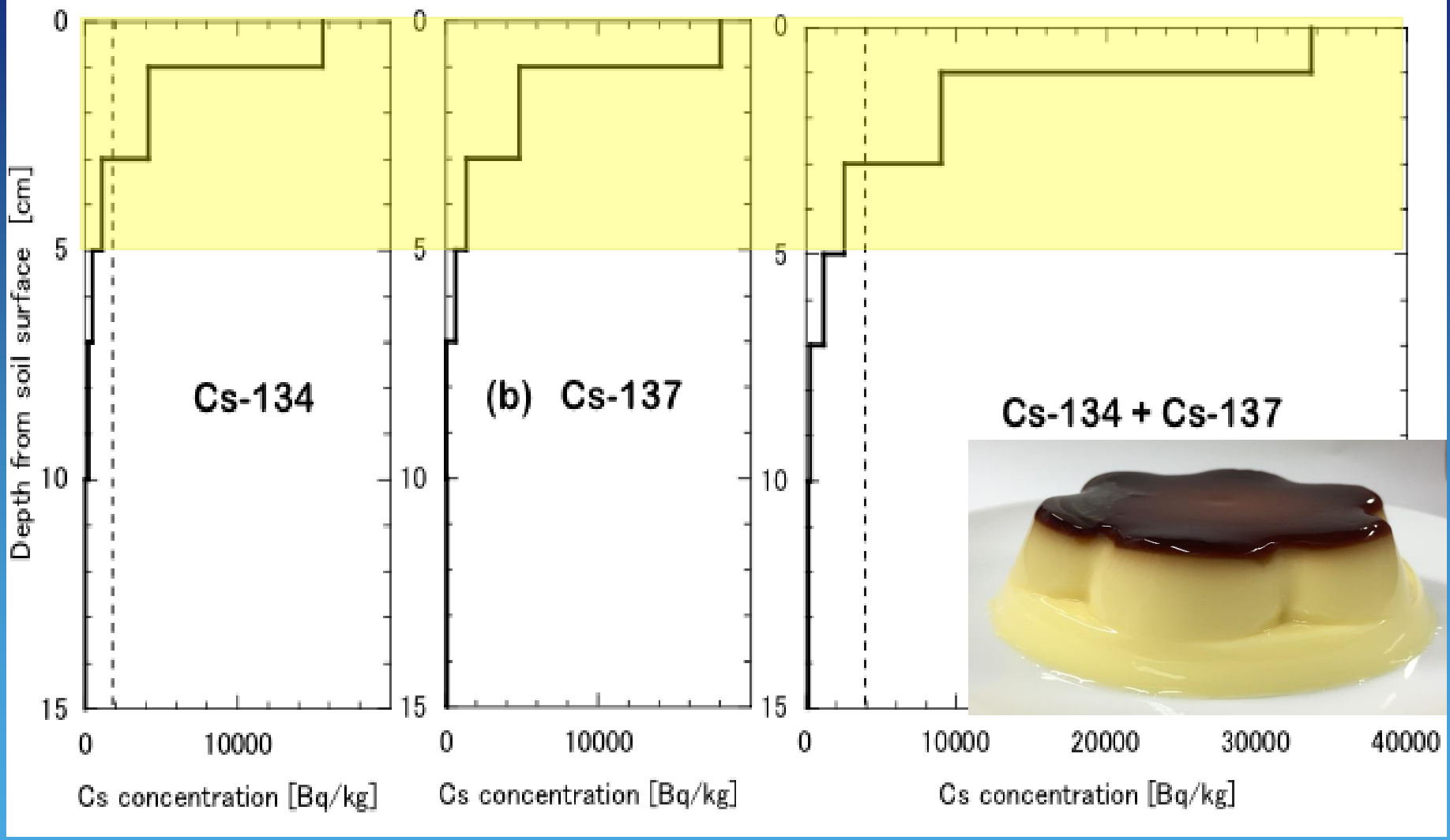
（2015.3.3）The Rebirth of Fukushima (D, H, S)

IoT application to Monitoring Iitate Village in Fukushima Prefecture (2011-)





Vertical distribution of Cs in soil (24/5/2011)



Shiozawa et al. (2011): Vertical concentration profiles of radioactive cesium and convective velocity in soil in a paddy field in Fukushima. Radioisotopes 60 : 323-328

農林水産省

Official decontamination methods by Government

MAFF

Ministry of Agriculture, Forestry and Fisheries

From August, 2012

Stripping topsoil method

Soil puddling method

Deep plowing method

Reality of narrow agricultural field

pdf

Development of decontamination method farmers can do by themselves in paddy contaminated by radiocaesium in Fukushima

Prof. Masaru *Mizo*guchi
Dept. of Global Agricultural Science
Univ. of Tokyo

東京大学
THE UNIVERSITY OF TOKYO

Empathy & Collaboration

The Resurrection of Fukushima: Characteristics & Keywords

Goal: Recovery of the area
Collaboration
Independent Volunteers
Vitality from the varieties of participants
Knowledge, technics, work experience, network
Breadth of vision
Flexible handling
Detailed care

Power for Recovery
Experience, knowledge, Tradition, culture, wisdom

Villagers

Collaboration against Scattering

Empathy & Collaboration

Resurrection of Fukushima

ふくしま再生の会

Non-Profit Organization

Specialists
Science & Technology

Universities/ Research Institute

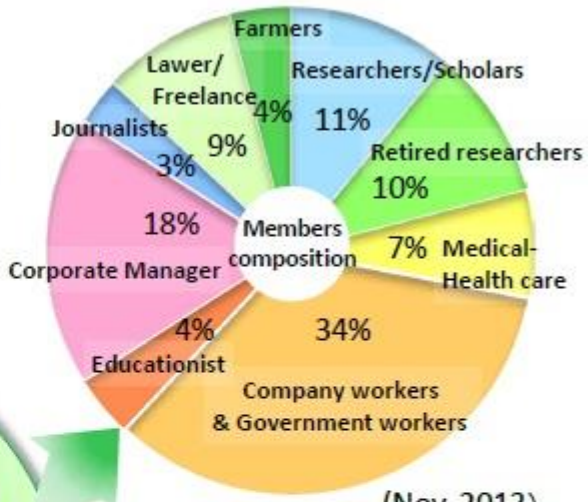
Interdisciplinary Collaboration

Public Service

National Prefectural Local

Overcome Sectionalism & Bureaucratism

Members



(Nov. 2013)

Practices utilizing the properties of cesium and clay (2012)

decontamination method by stripping frozen soil
（2012.1.8）

Rotary weeder method
(2012.4.1)

Made-method-1 (Sasu method)
Stripping topsoil + Deep plowing method

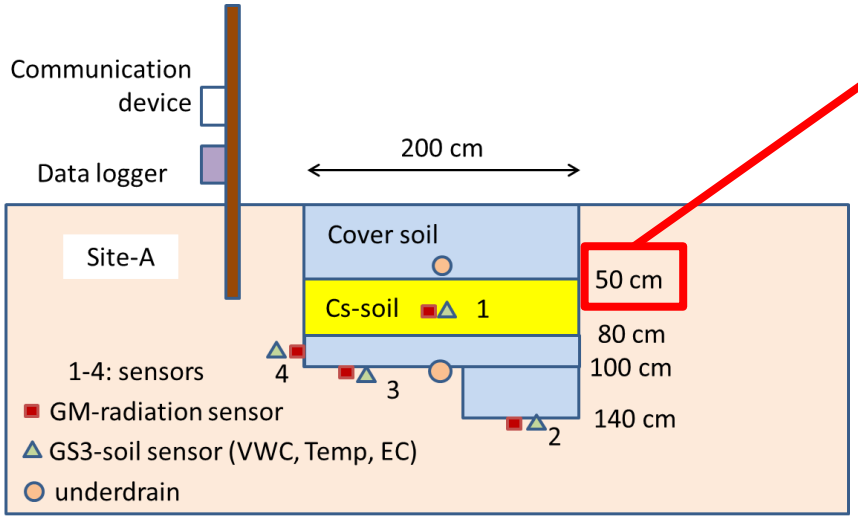
Burial of contaminated soil

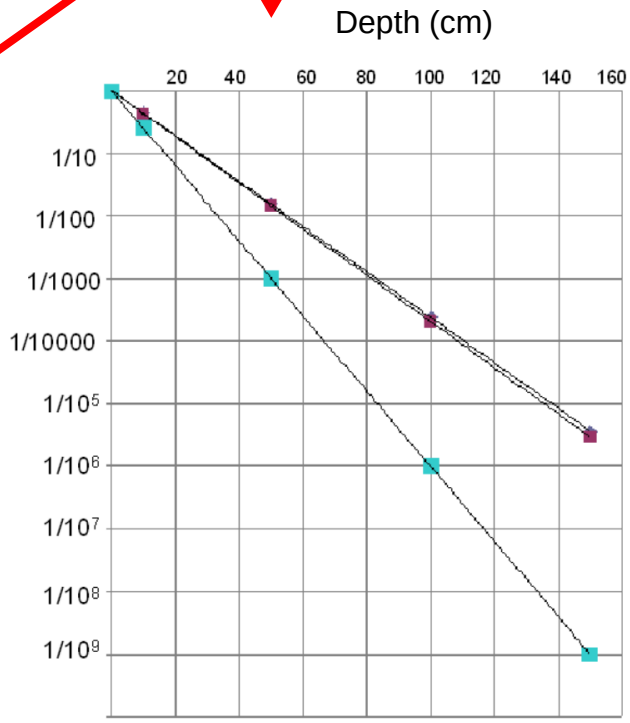
Compaction of soil

2012.12.1

Contaminated soil should be buried in the bare hole!

Radiation dose is 1/100 to 1/1000 just bury 50cm deep!





Measurement of soil radiation

- Instrument “Choshaku-kun”
- Easy to measure soil radiation in a well
- 1 m long, 3 cm in diameter
- with 10 pieces of GM tube arranged at 10cm intervals
- 3-5 min to measure

MISAO Network

有限会社ミサオネットワーク

Buried work

2014/5/18

2015/11/15

Measurement

15/3/21

16/3/20

16/11/6

17/3/12

17/12/9

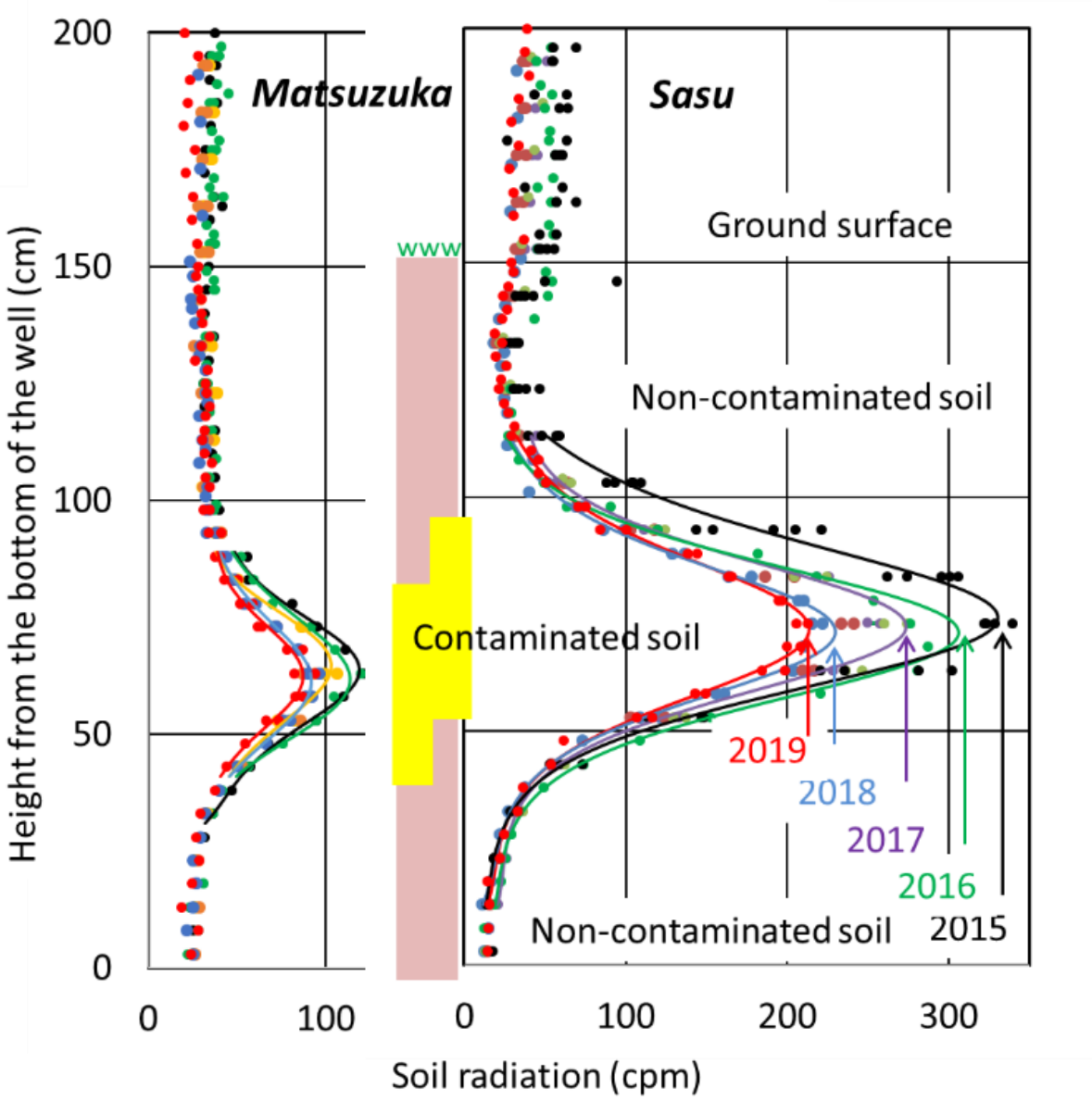
18/3/11

19/3/10

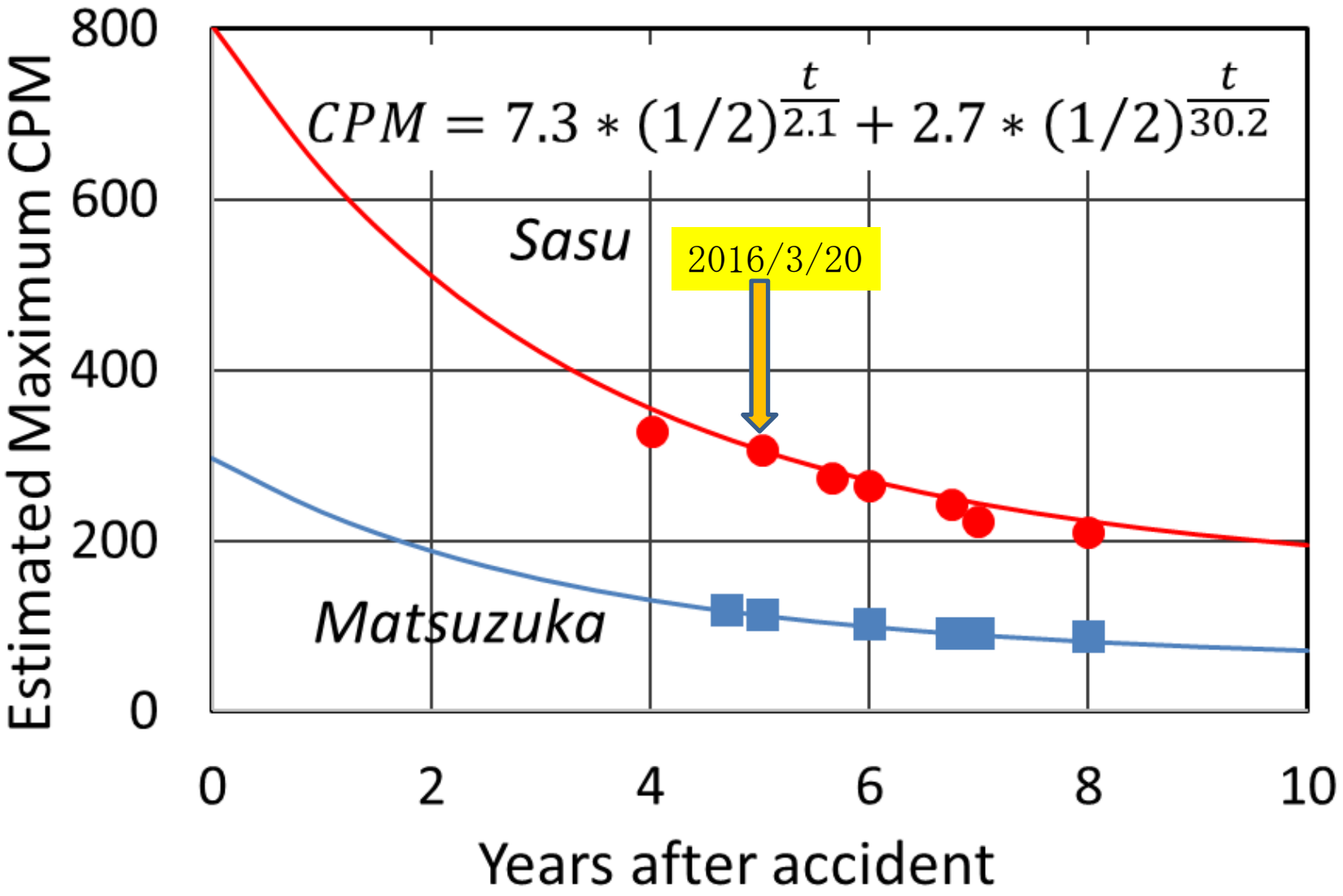
溝口勝 @msrmz · 2017年3月12日

返信先: @msrmzさん

松塚の猛史さんの田んぼで測定。**長尺**くんを固定する新兵器の三脚を作って投入。



Profiles of radiation doses in the soil. Solid lines are fitting curves of data measured in 2015-2019

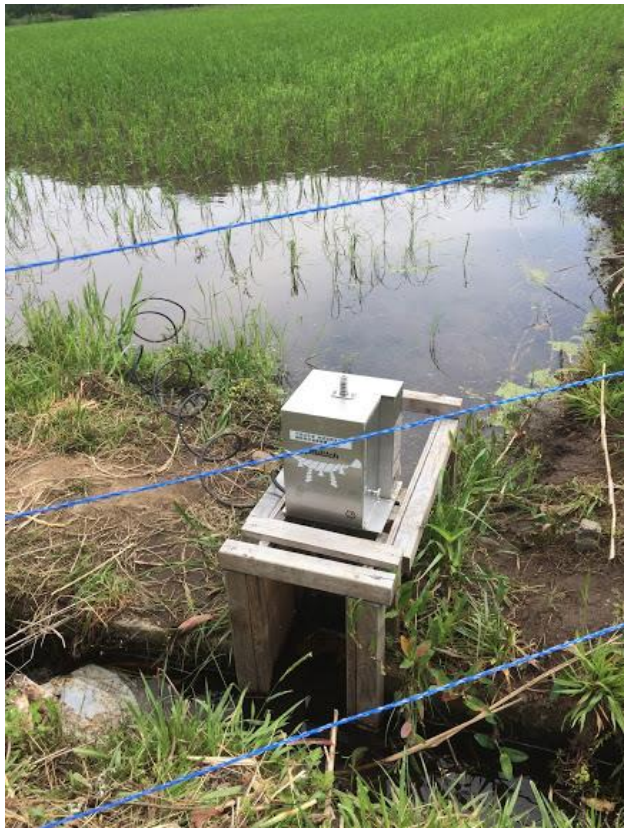


Estimation of radiation dose in soil

Rice cultivation test by NPO from 2012

Irrigation-water control in paddy field in Iitate Village, Fukushima (2018)

- https://paditch.com/product/paditch-gate



1. Set Paditch

2. Add camera

3. Control gate

飯舘の日本酒で世界制覇

Conquer the world with litate sake

虎捕山の麓から　飯舘再生のために
スマート農業のテクノロジーで育てた酒米から純米酒が誕生しました

生酒

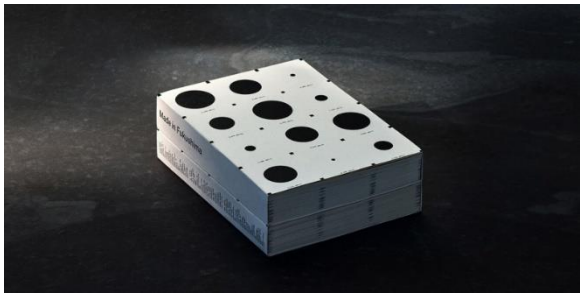
Sake without heat

火入れ

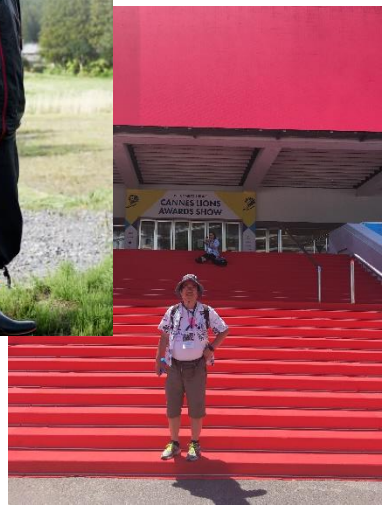
Sake with heat

フィールド WiFi カメラによる酒米水田の監視

Cannes



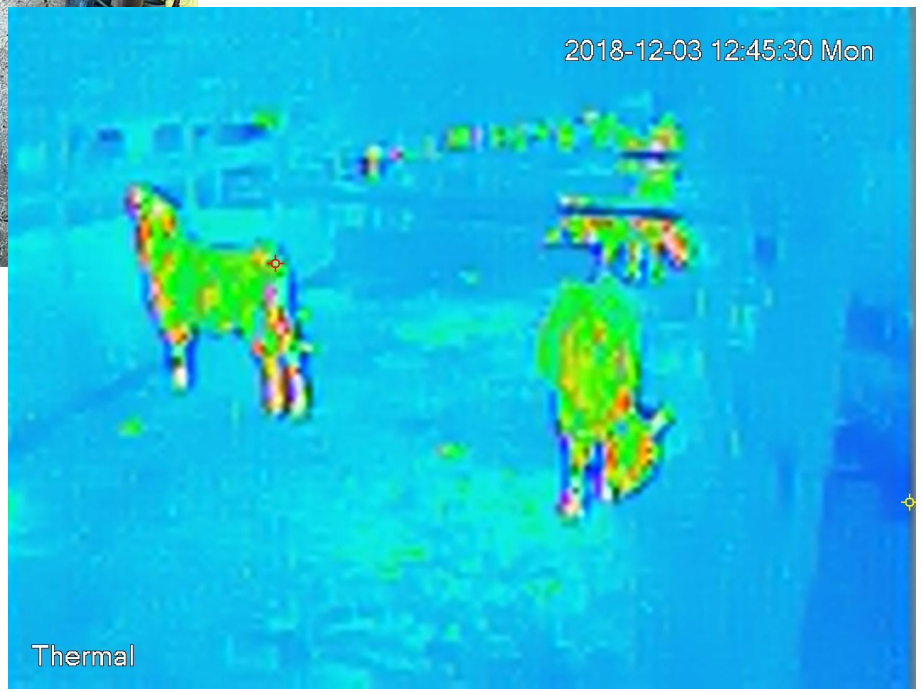
2019/6/19

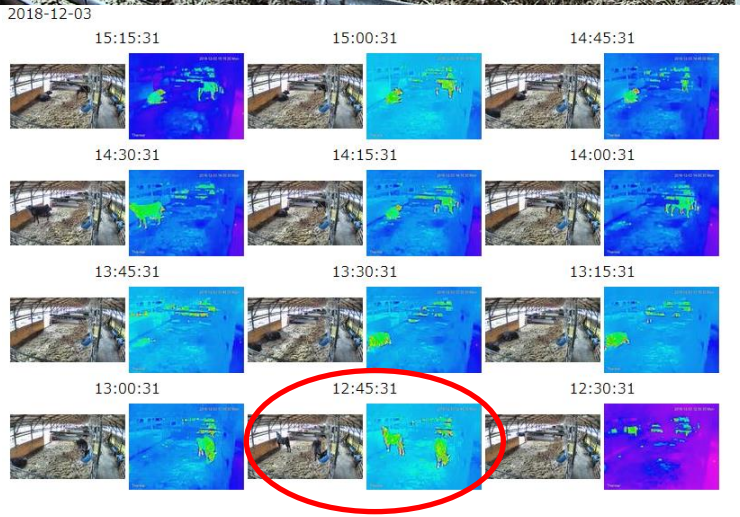


農学部前の高崎屋さんで買えます！

You can buy it at Takasakiya in front of the Faculty of Agriculture, UTokyo!

Cattle (Wagyu) monitoring in Iitate village using image and thermal camera





農村再生と若手教育
Rural regeneration and youth education

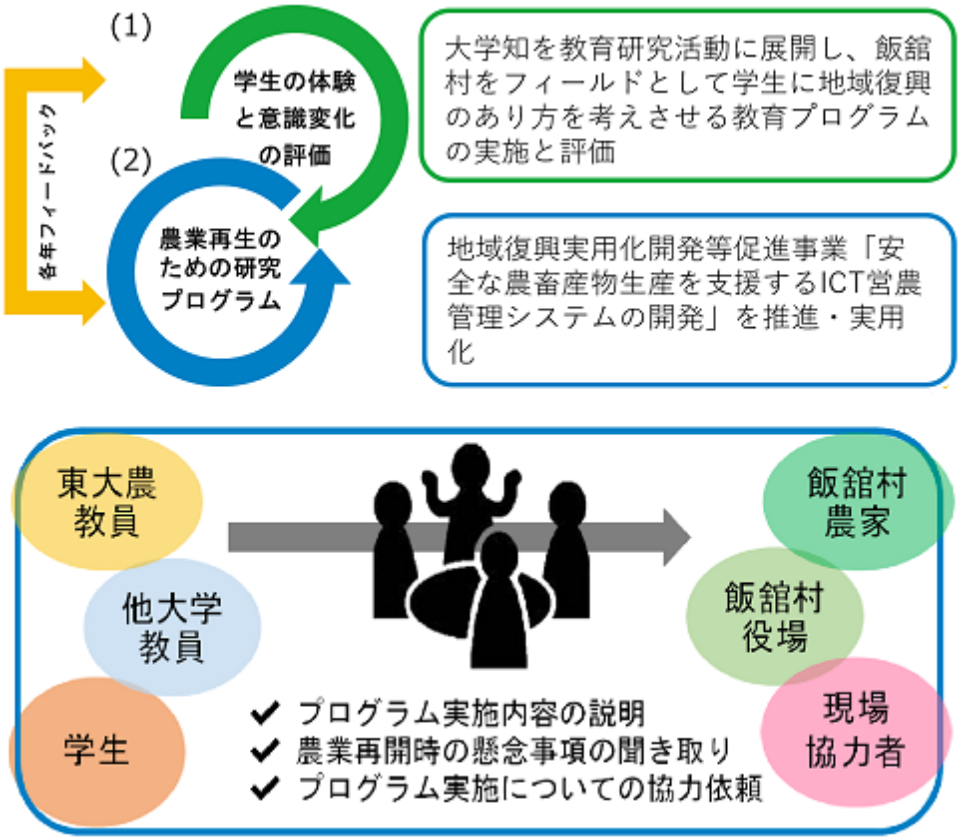
大学等の「復興知」を活用した福島イノベーション・コースト構想促進事業

Fukushima Innovation Coast Project Promotion Project Utilizing “Reconstruction Knowledge” of Universities and Others

（復興庁／文科省：2018-2019; Reconstruction Agency / MEXT)

飯舘村における農業再生と風評被害払拭のための教育研究プログラム

Education and research program for regenerating agriculture and eliminating reputational damage in Iitate Village



までい大学 Madei Univ. (2018)

2018年10月6日 - 7日
宮城大学、茨城大学、
明治大学、四日市大学

2018年10月14日 - 15日
弘前大学、佐賀大学、三重大学、東京農工大学、明治大学

2018年11月25日 - 26日
宇都宮大学、京都大学、
明治大学、東京大学

東大むら塾 （蕎麦栽培@比曽）

Todai Mura Juku (Soba cultivation @ Hiso)

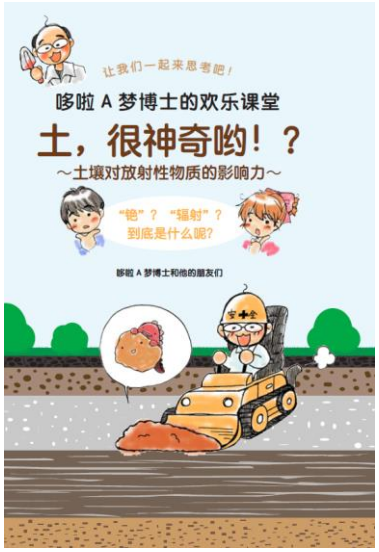
Agricultural soil education for the general public

Soil Museum (2018.4.29)

Publication of
Dr. Doroemon
（Kindle版）

Tour for high school students
（2019.9.14-15）

Japanese



Chinease

English

Conclusion on
Rural regeneration and youth education

- 駒場農学校・横井時敬先生(1860-1927)の名言
- Quotations of Komaba Agricultural School, Tokitaka Yokoi
  - 農学栄えて農業滅ぶ
    - Agricultural science flourished and agriculture destroyed
  - 土に立つ者は倒れず、土に活きる者は飢えず、土を護る者は滅びず
    - Those who stand on the earth will not fall, those who live on the earth will not starve, those who protect the earth will not perish
  - 稲のことは稲に聞け、農業のことは農民に聞け
    - Ask the rice about the rice, ask the farmers about the agriculture
- いま農学部は何をすべきか？
- What should the Faculty of Agriculture do now?
  - 現場から課題を自ら発見し、解決する学習の強化
    - Strengthen learning to discover and solve issues on site
  - FPBL(Field and Project-Based Learning)

Agricultural engineering for Reconstruction

- Prof. Hidesaburo Ueno
  - Owner of Hachiko dog
  - Professor at Univ. of Tokyo
    - Law of Land consolidation(1900)
    - Lecture of Land consolidation (1905)
- Agricultural engineering
  - Infrastructure of food production
  - Barren land to fertile farmland
  - Land reclamation
  - Irrigation and drainage
  - Farmland decontamination
- Land use after decontamination
  - Rural plan after villagers return

(2015.3.8)

Summary of the lecture for your future

Masaru Mizoguchi

Challenge to solve the problems that lie in front of us

- What is the problem?
  - Find and set the right question
- How do we solve the problem?

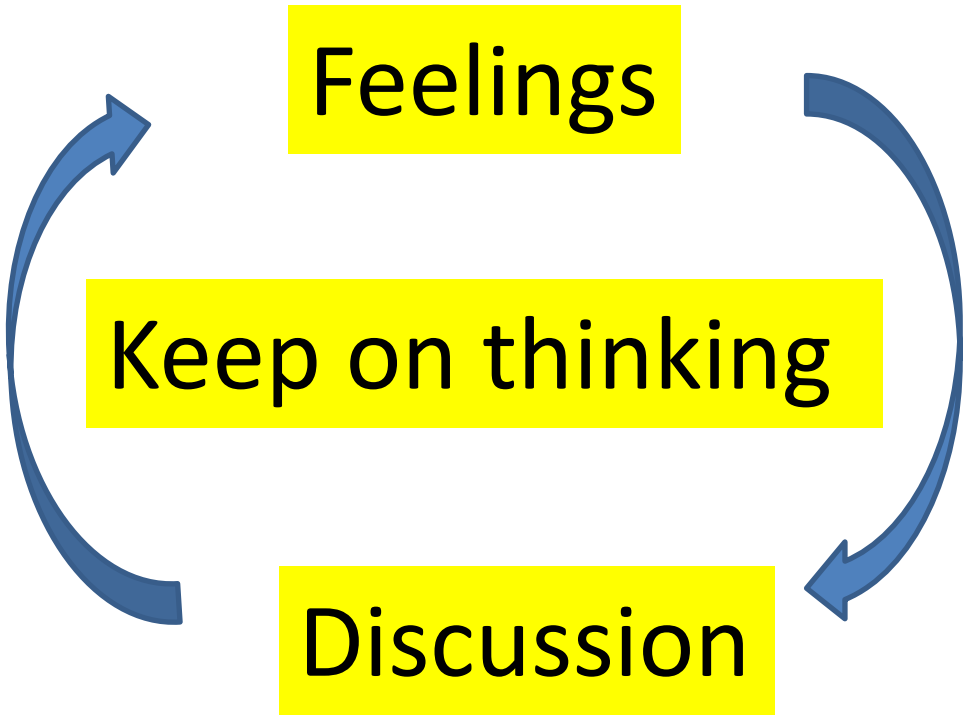
Project-Z by Mizo

Theory and Practice

- Notice the gap between theory and practice
- Understand the theory (Science)
  - Mathematics, physics, chemistry, biology, ecology,,,
  - Sociology, economics, political science,,,
- Know the practice (experience)
  - Field survey, interview, job training, internship,,,,

Where does the idea come from?

- Lecture?
- Book?
- TV?
- Internet?
- Practice?



Homework
レポート課題

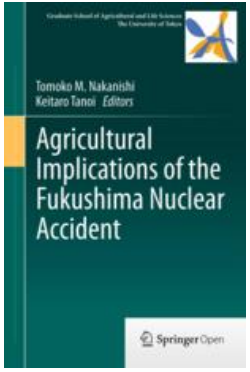
- With reference to Web page, make a report about an agricultural infrastructure project near your hometown. In addition, write your impression of the lecture.
- 参考文献やWebページを参考にして、自分の生まれ故郷近くの農業基盤整備事業の事例について調べて報告しなさい。また、今回の講義に対する印象を述べなさい。

Deadline: May 10, Friday

To: report@iai.ga.a.u-tokyo.ac.jp

References on Land Improvement

- http://www.water.go.jp/chubu/aityosui/a(jyouhou-sub)/06(english)/a_06.html
- IRRIGATION AND DRAINAGE IN JAPAN (3rd Edition), International Affairs Commission of The Japanese Society of Irrigation, Drainage and Reclamation Engineering (1995)
- IRRIGATION AND DRAINAGE IN JAPAN PICTRAL(3rd Edition), International Affairs Commission of The Japanese Society of Irrigation, Drainage and Reclamation Engineering (1995)
- http://suido-ishizue.jp/



References on Project-Z

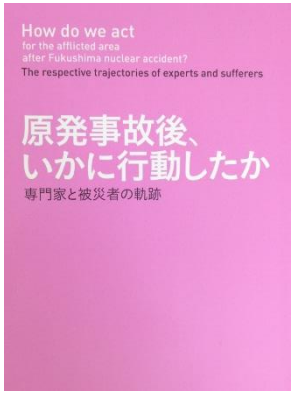
Collection of Mizo's works on Fukushima (in English)

http://www.iai.ga.a.u-tokyo.ac.jp/mizo/edrp/fukushima/Fukushima_articles.html

Movie:

1. (2015.3.3) The Rebirth of Fukushima (D, H, S)
2. (2013.9.19)Frozen soil shuts water flow
3. (2012.11.20)Filtration of muddy water using sand
   Fresh water comes out when muddy water is poured in the sand. When this operation is repeated, fresh water becomes slow to comes out. Clay particles with radioactive cesium are also trapped in the sand by this principle.

TV



1. (2013.12.19) Decontaminating Fukushima: Cleaning up Farms(NHK WORLD)
2. (2013.12.09) Decontamination: Challenge of the Villagers(NHK-WORLD,TOMORROW)
3. (2012.03.09)Japan tsunami: Battling Fukushima radiation one year on(BBC, UK)

Article:

1. (2013.12.12) FUKUSHIMA NEDFRYSNING SOM SKAPAR FRAGETECKEN
2. (2013.10.31)How Engineers Use Ground Freezing to Build Bigger, Safer, and Deeper(NOVA next, USA)

Academic meeting:

Thank you for your attention

Memorial seal for this session participant (special souvenir)