

April 25, 2019
Tokuron-1/IPADS Development Studies(2019)

Agricultural Engineering

-Production system, Infrastructure, Irrigation-

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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

Question-1

Why did this area develop?

Who developed this area?

- Group discussion (5 min)-

Aichi Canal Project (1955~)

project area : 33,000 ha (1957)
project cost: 42.2billion YEN(1961)

Makio Dam

Kiso River

Kaneyama Intake

Main Canal

Aichi
Reservoir

Miyoshi
Reservoir

Major Facilities

- Makio Dam
(Type:Rock fill dam)
- Kaneyama Intake
- Reservoirs
- Main Canal (112.1km)
- Branch Canals
(Total Length:1,063km)
- Check gates etc.

After the web page of 愛知用水総合管理所

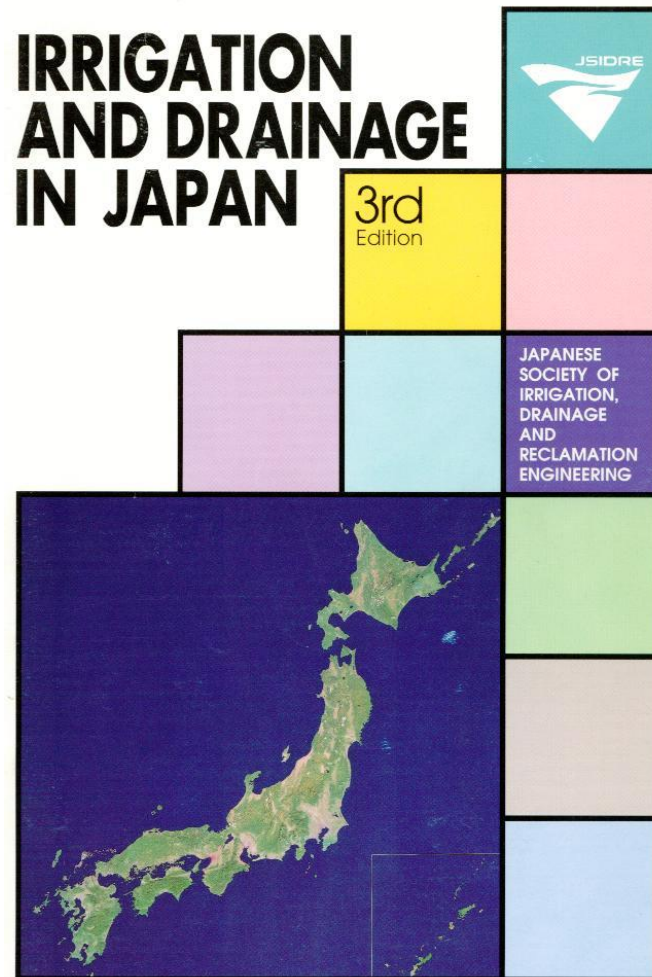
[See Movie](#)

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:

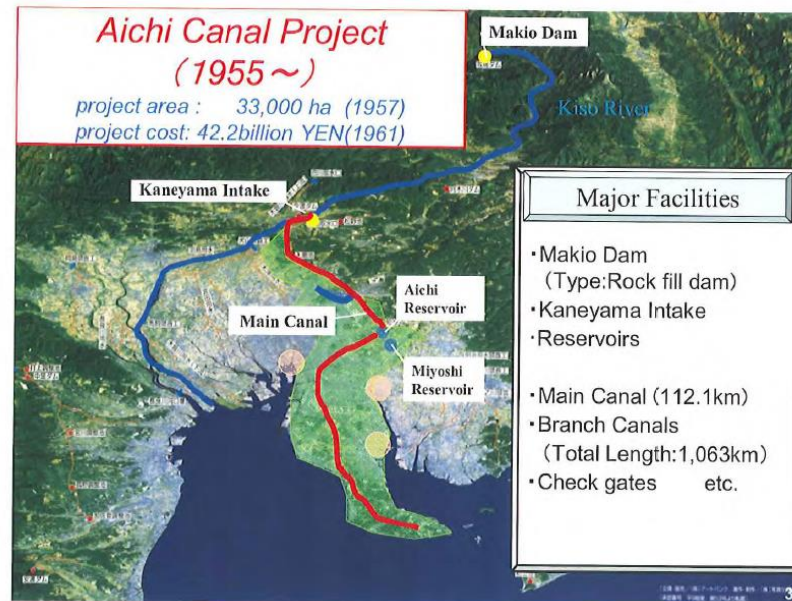
1. Irrigation and drainage (かんがい排水)
2. Agricultural land consolidation (圃場整備)
3. Farm and rural roads (農道)
4. Comprehensive development of non-paddy agricultural land (水田以外の農地総合開発)
5. Comprehensive development of rural areas (農村総合開発)
6. Disaster protection (防災)
7. Reclamation of agricultural land (開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



溝口勝
@msrmz

整然とした有明海の干拓水田。これも農業土木の作品。着陸なう。



1

リツイート



13:25 - 2015年10月23日

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)-

An aerial photograph of a rural landscape. A winding river flows through the center-left of the image. The surrounding area is a patchwork of agricultural fields in various shades of green and yellow, interspersed with clusters of buildings and trees. The overall scene depicts a typical rural environment undergoing or about to undergo land consolidation.

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

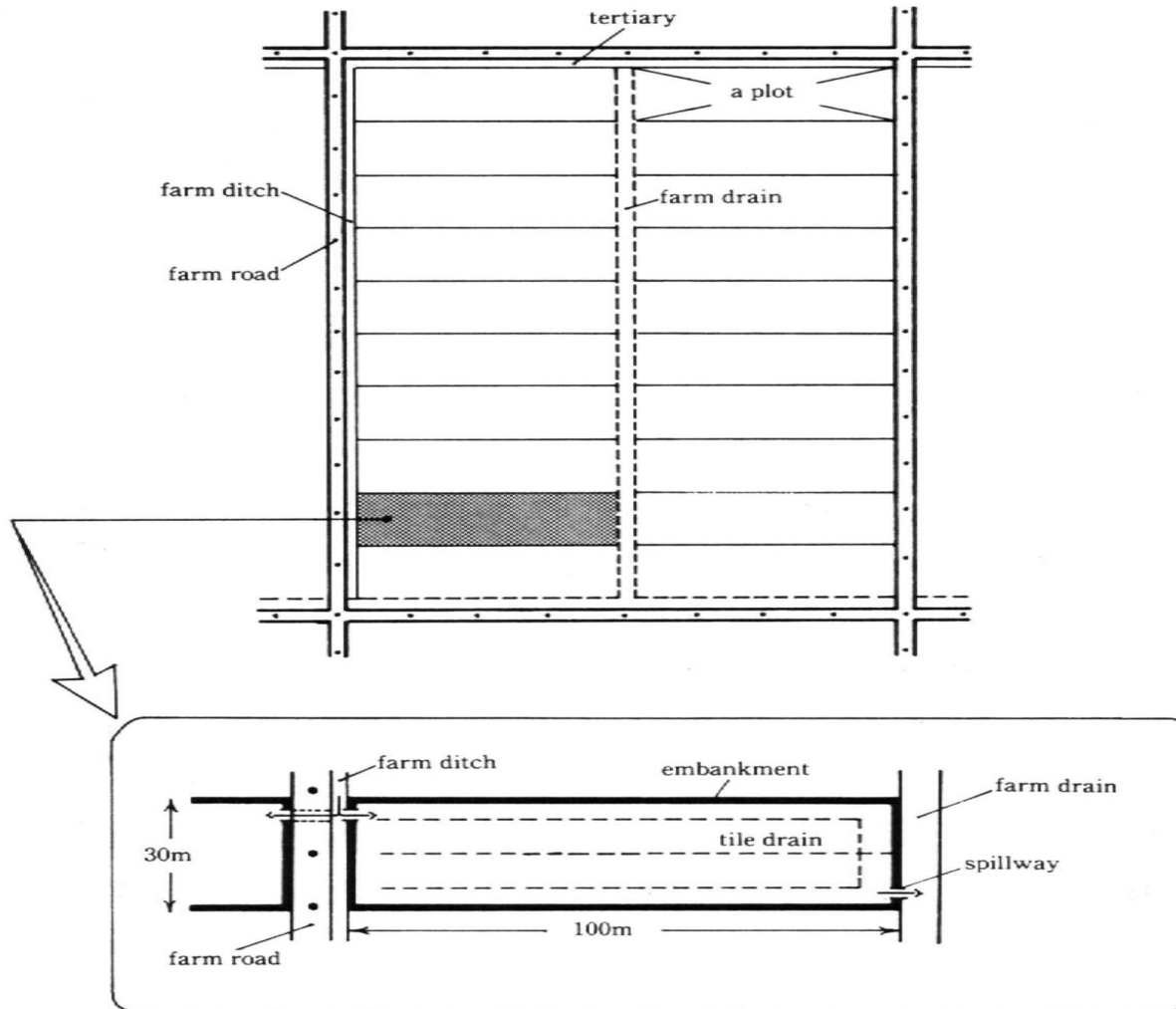


Figure 7 Standard paddy field layout after consolidation.

Conclusions

- 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.

Question-4

What do you do if you are forced to evacuate from your hometown suddenly?

- Group discussion (5 min)-

Project-Z for Fukushima

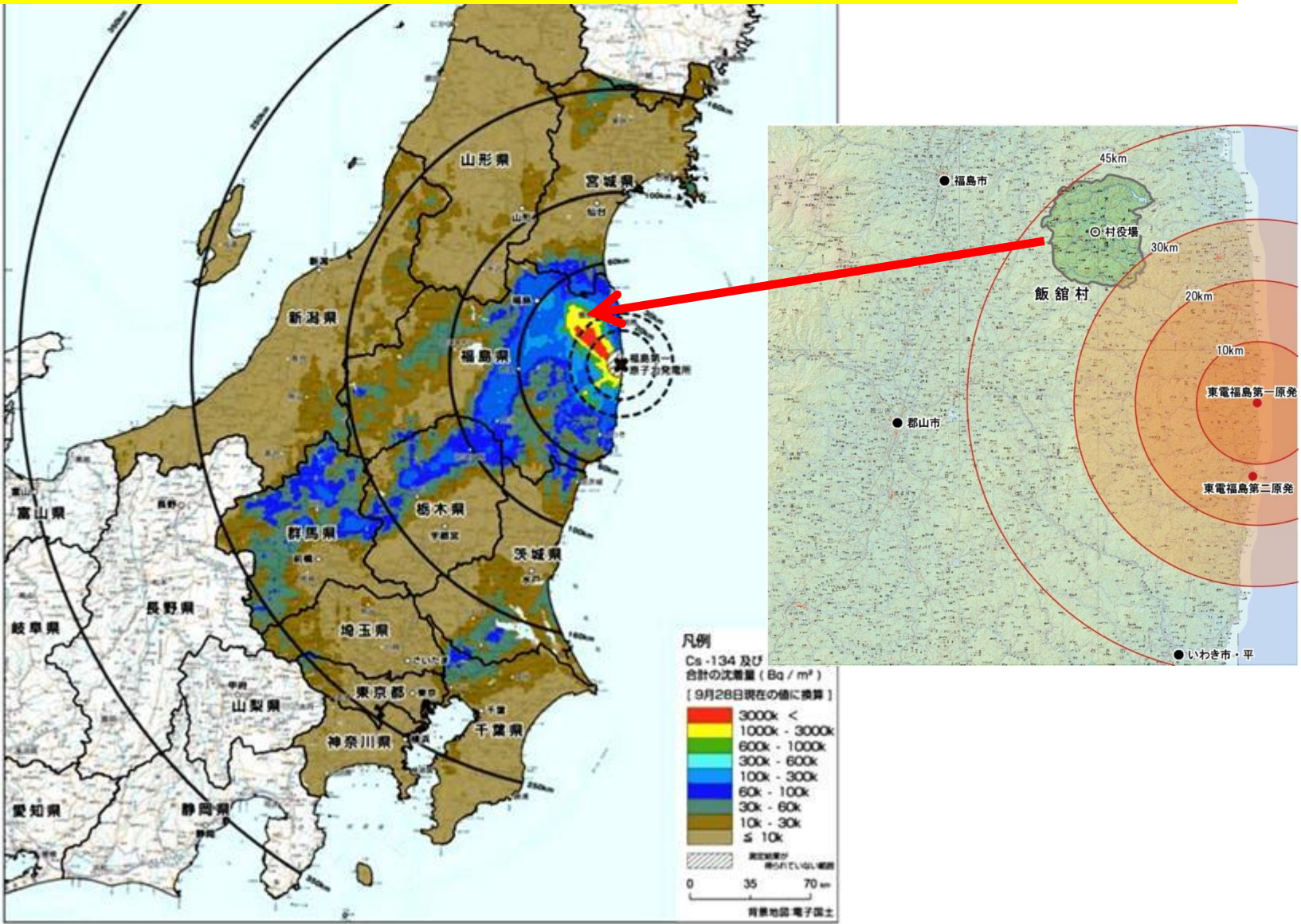
Agricultural land Remediation and Reborn of Agriculture in Iitate Village by a collaboration between scholar and NPO

(2018.12.11) [Fukushima Reborn](#) (CM by US sensor maker)

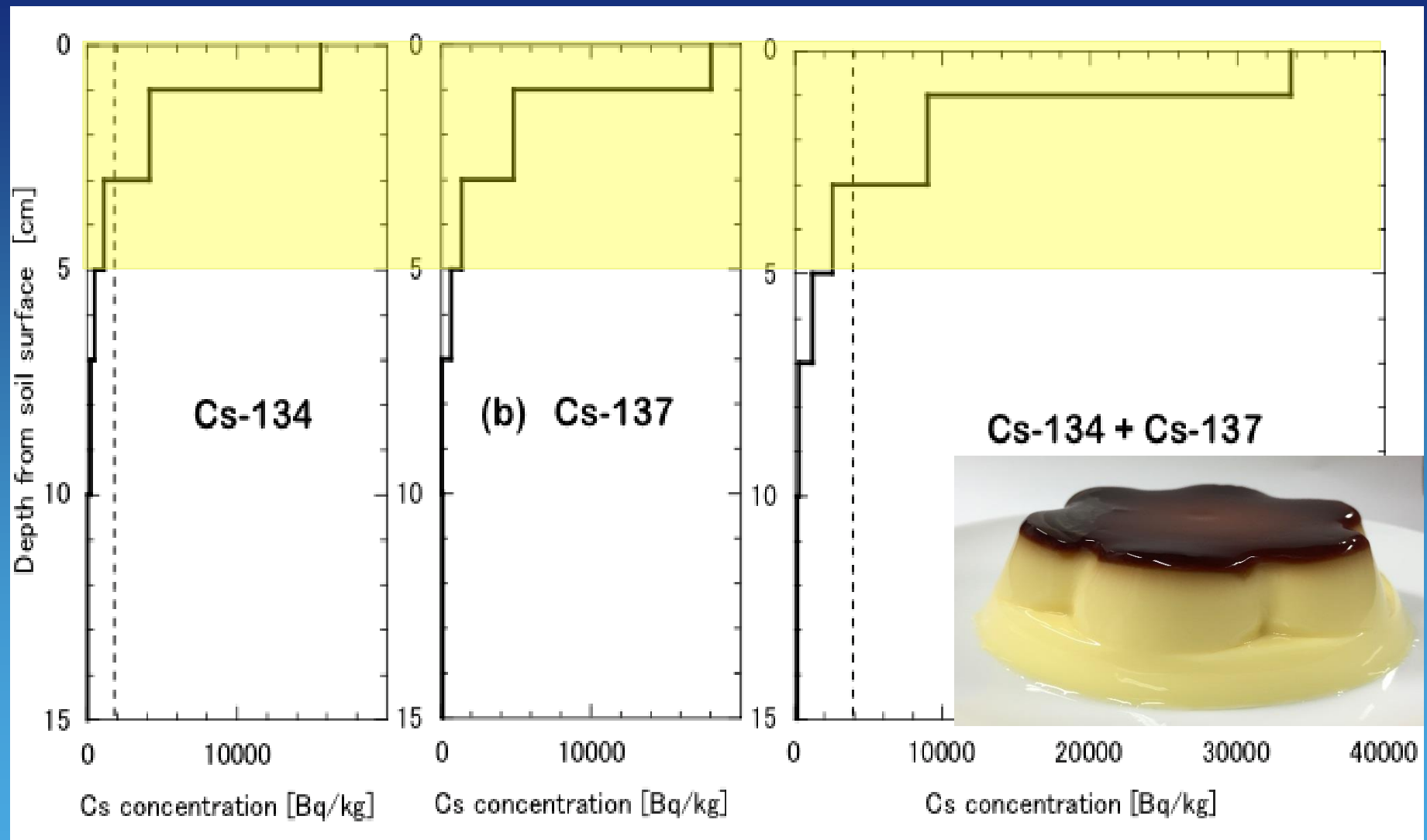
(2015.3.3) The Rebirth of Fukushima ([D](#), [H](#), [S](#))



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



Stripping topsoil method



Soil puddling method



Deep plowing method

農林水産省

Official decontamination methods by Government

MAFF

Ministry of Agriculture, Forestry and Fisheries

From August, 2012

Reality of narrow agricultural field

Wild boars



Heavy Weed



Disturbed agricultural field



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



Prof. Masaru *Mizoguchi*

Dept. of Global Agricultural Science

Univ. 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

Specialists
Science & Technology
**Universities/
Research Institute**
Interdisciplinary
Collaboration

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

Villagers

Collaboration against
Scattering

Empathy & Collaboration

Resurrection of Fukushima



Non-Profit Organization



Members



(Nov. 2013)

Public Service
**National
Prefectural
Local**

Overcome Sectionalism
& Bureaucratism

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

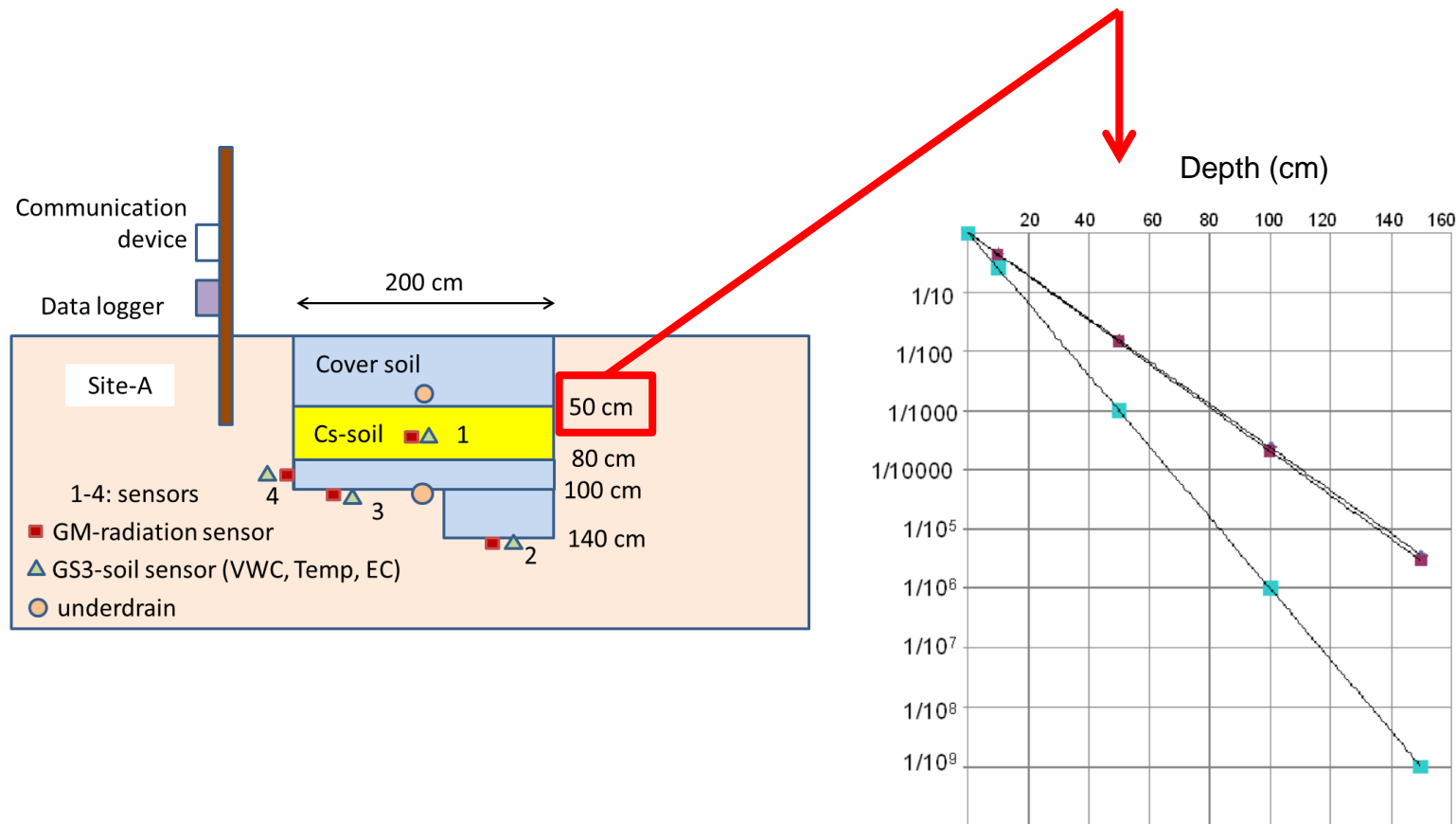


Burial of contaminated soil

Compaction of soil

Contaminated soil should be buried in the bare hole!

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



Made-method-2 (Komiya method)

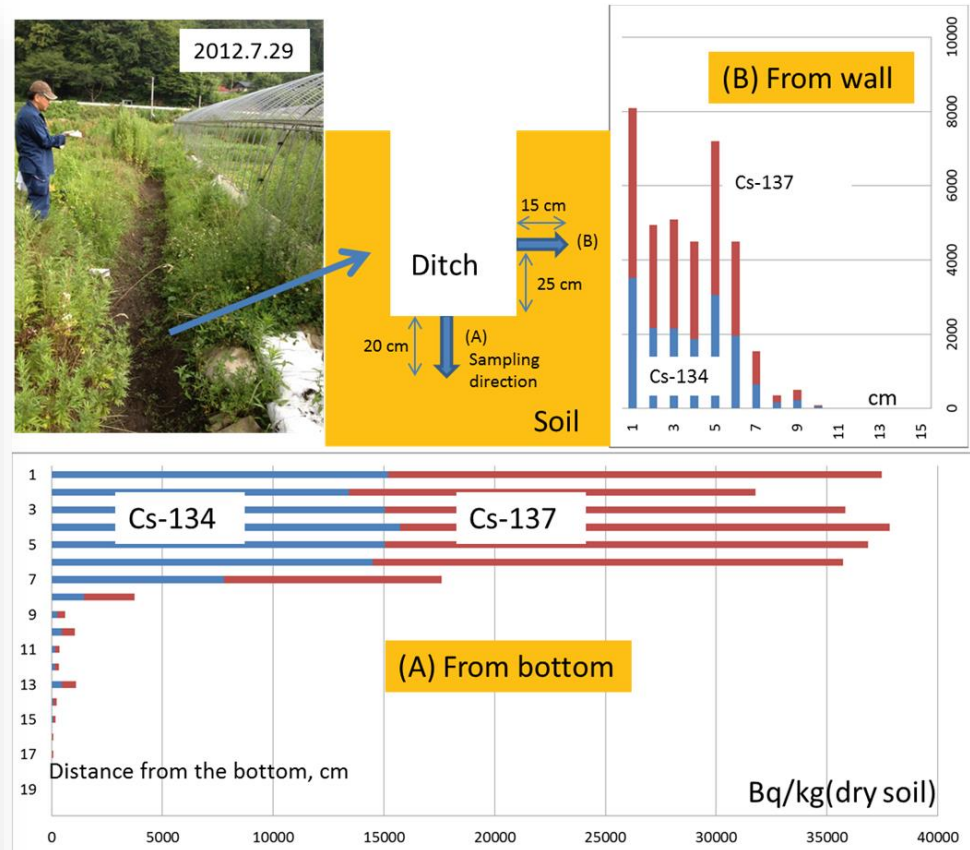
Soil puddling + Deep plowing method (2013)



(2013.5.18)



Pour contaminated muddy water into the drain



A result of the radioactivity measured at each depth by sampling the soil of the bottom and sides of the groove after a dried-up Cesium is not expected to immersion in the soil!

Rice cultivation test by NPO from 2012



Improvement of Drainage defective farmland

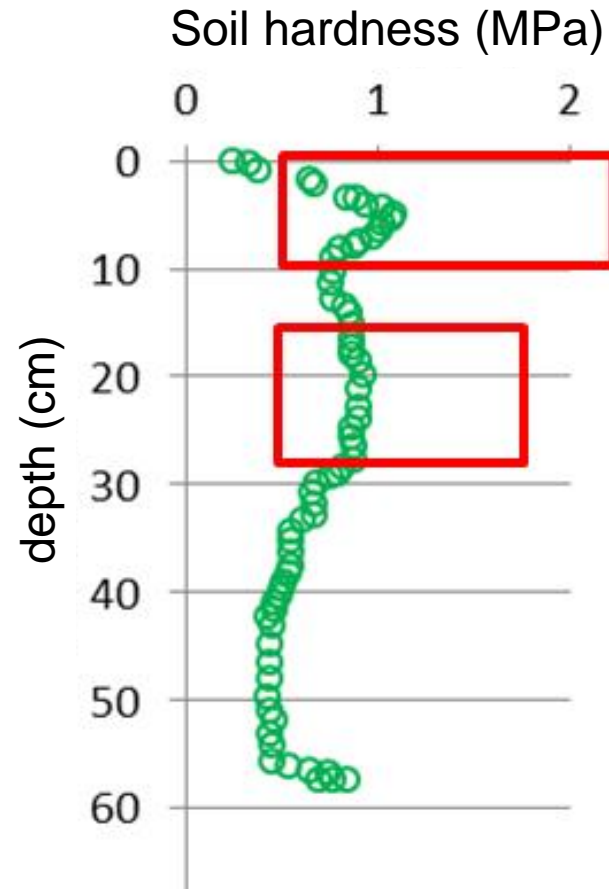


Fig.1 Drainage defective farmland immediately after decontamination.

A hard pan was formed at a depth of 5 cm by stepping on a heavy machine for decontamination in addition to conventional paddy field hard pan at a depth of 20 cm.

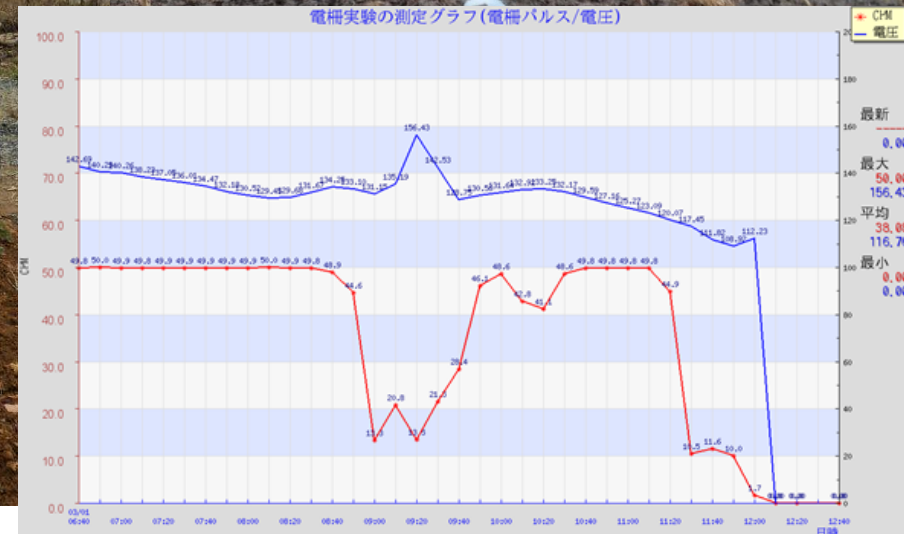
Heavy rain: <https://www.youtube.com/watch?v=AlTwmayfVtw>

Mysterious bubbling: <https://www.youtube.com/watch?v=1YlaKdTu8kg>

Smart fence to protect wild boar's attack

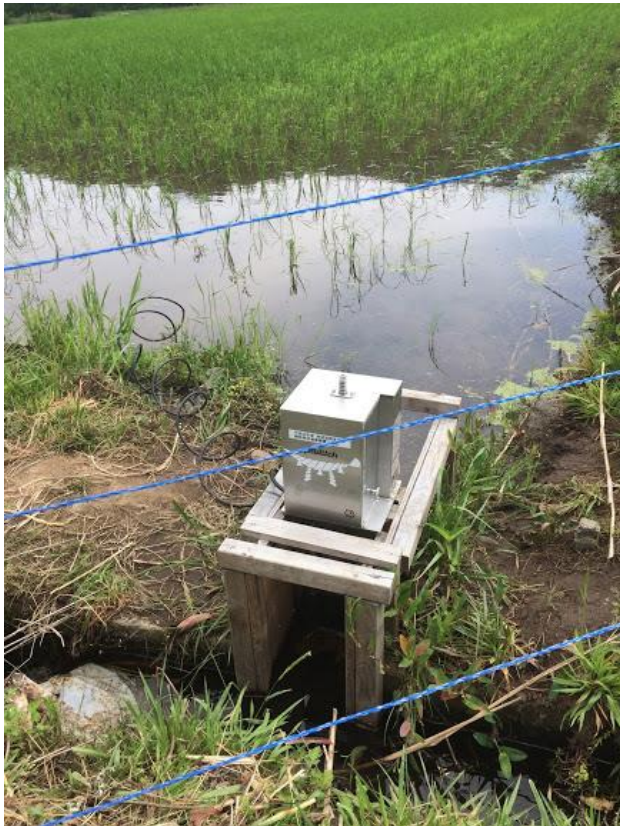


2012/4



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

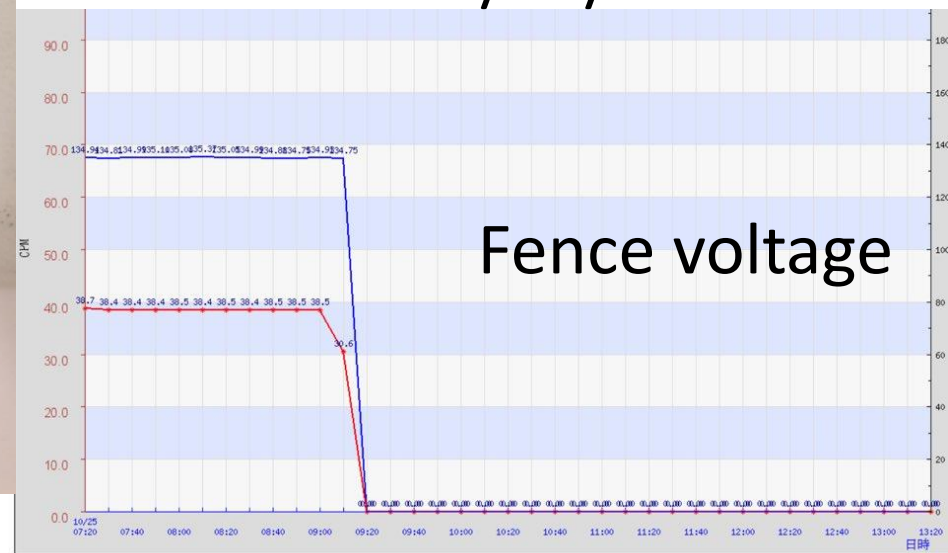


Like Phoenix

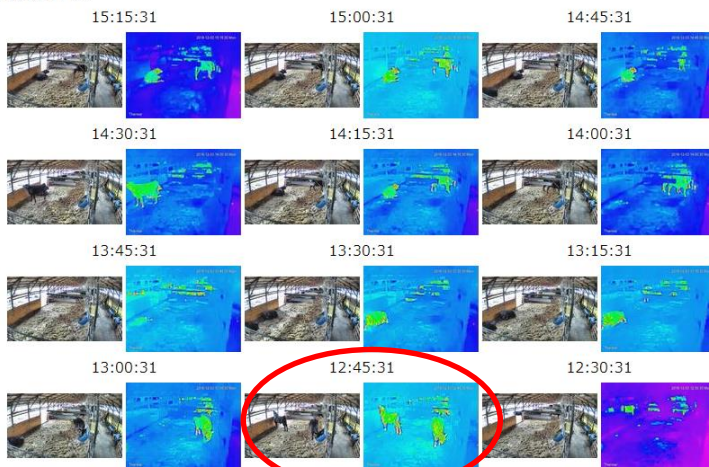
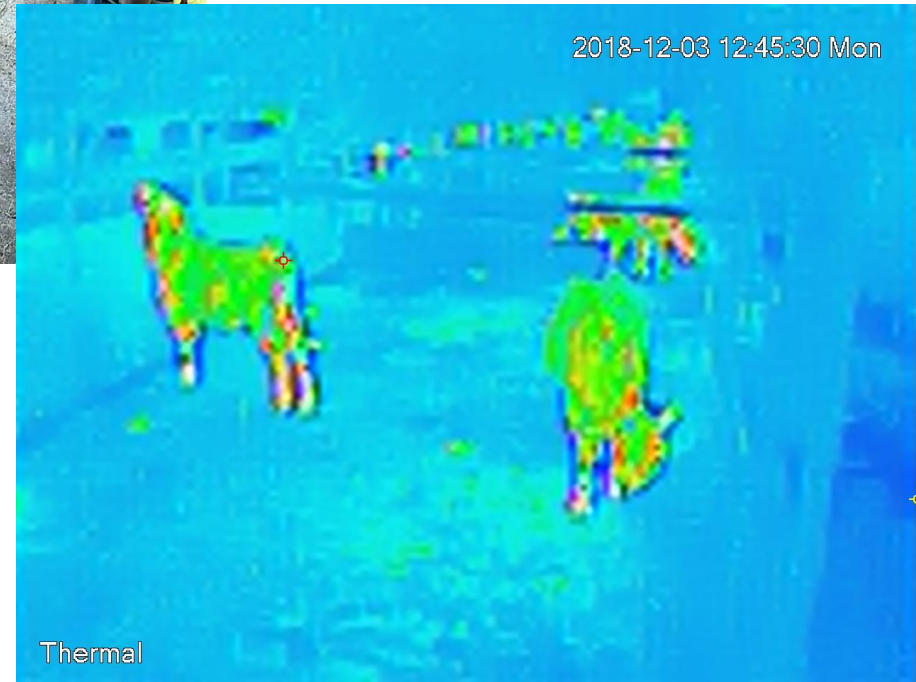
ng by Field camera



2018/10/25

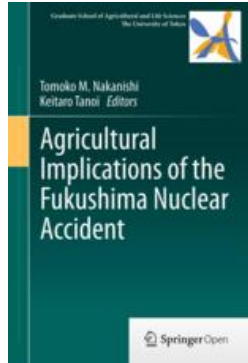


Cattle (Wagyu) monitoring in litate village using image and thermal camera



Conclusions

- Forest management
 - RCs circulation in forest
 - Forest fire risk
- After decontamination
 - Resumption of agricultural production
 - Regeneration of local community
- Eradication of harmful rumors, etc.
- Let's go to Iitate Village together to see a real field!



Activity reports can be downloaded from homepage



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

Movie:

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

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](#)

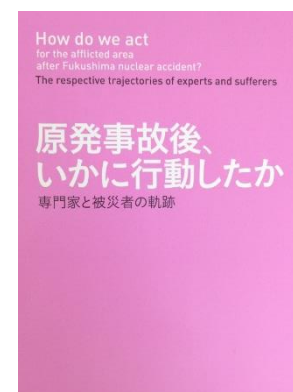
Fresh water comes out when muddy water is poured in the sand. When this operation is repeated, fresh water becomes slow to come out. Clay particles with radioactive cesium are also trapped in the sand by this principle.

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:

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



上野英三郎博士とハチ公

(2015.3.8)

ICT Agriculture in future

Toyota Kanban-system → Agri Kanban-system

- Overseas local production

- Toyota's agricultural version
- Agricultural production
- Apple, strawberry
- Earth Observation Data
- Robotics

- City

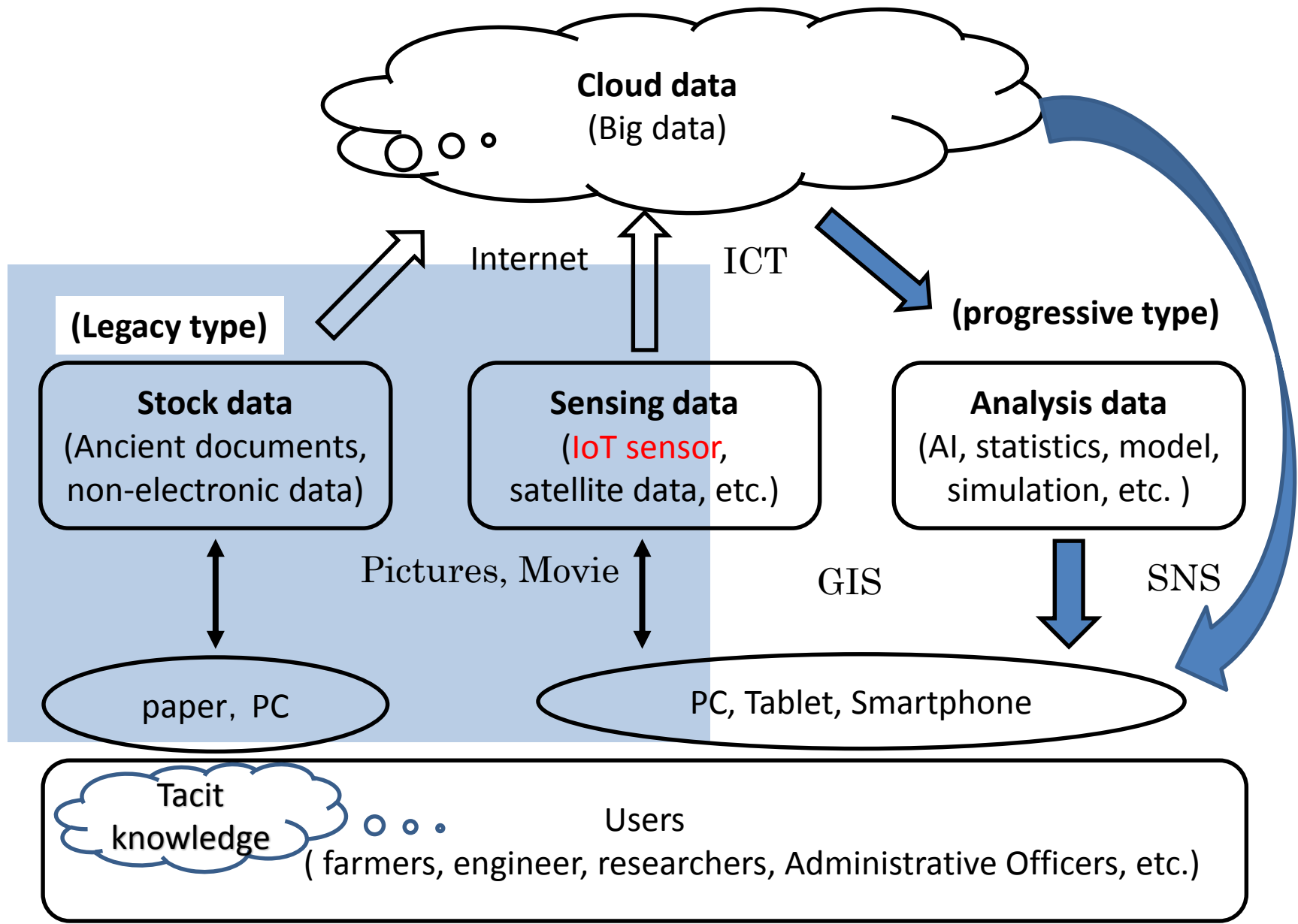
- Place of interaction and encounter

- Rural area

- Child-rearing
- three generations family
- Industrial diversification
- Information infrastructure
- SNS, IoT



Strategy of Agri-data science in Mizo lab.



References 参考文献

- [http://www.water.go.jp/chubu/aityosui/a\(jyouhou-sub\)/06\(english\)/a_06.html](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/>

June 3, 2016

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

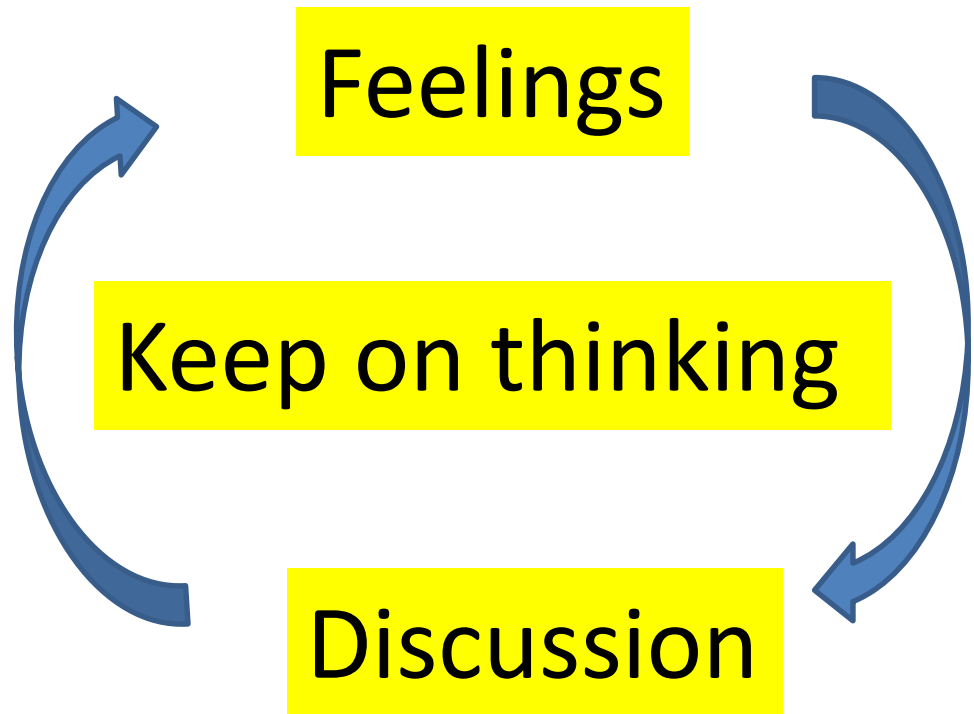


Theory and Practice

- 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

Thank you for your attention



Memorial seal for this session participant (special souvenir)