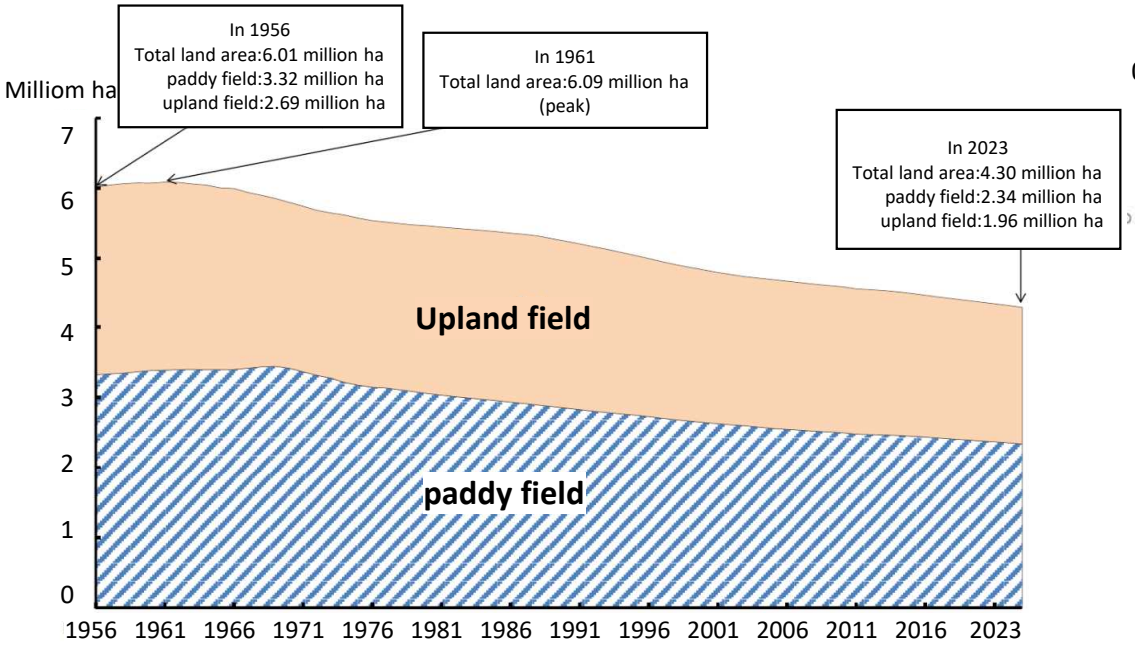
Promotion of Farm Land Consolidation Using Advanced Technology

Contents

1 The State of Japanese Agriculture

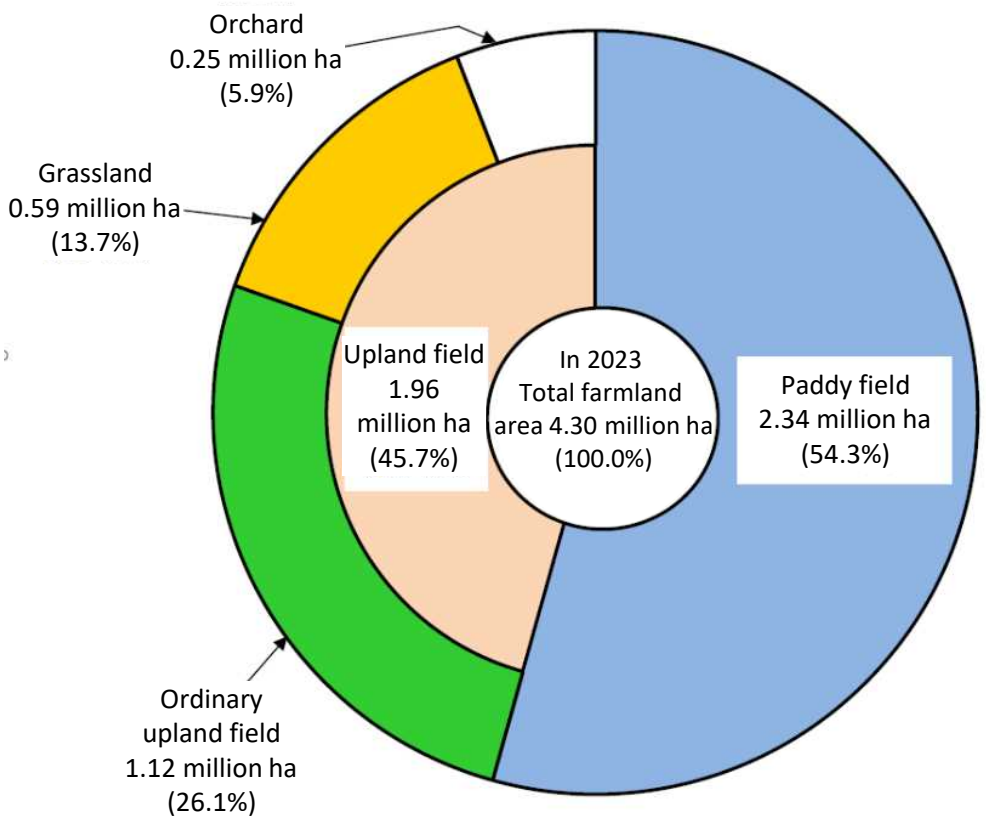
- Japan's farmland area is declining and will be 4.29 million ha in 2023. Its contents, Paddy field is 2.34 million ha and upland field is 1.96 million ha.
- In Japan, the number of core persons mainly engaged in farming has been on a downward trend, 1.23 million in 2022,and the population is aging.
- Total agricultural output in 2021 was 8.8 trillion yen, flat in recent years.

Changes in the area of arable land in paddy field and upland field in Japan



Source : MAFF「Agriculture, Forestry and Fisheries Statistics」

Use of farmland in Japan



Notes: Rounded to the nearest indicated unit.

Source : MAFF「Agriculture, Forestry and Fisheries Statistics」

2 Purpose of Farm Land Consolidation

- By farm land consolidation, which involves large parcels of farmland and the generalization of rice paddies, Improvement of agricultural productivity and agricultural structure, It plays an important role in ensuring food self-sufficiency, contributing to the national economy by reducing agricultural production costs.
- In addition to the effects on agriculture, promote orderly land use, formation of a good water cycle through national land conservation and disaster prevention.

Effects on agricultural production

Improvement of agricultural productivity

- Improved labor productivity
- Improved land productivity

Improvement of arable land utilization

Introduction of high-profit crops

Improvement of agricultural structure

- development of business farmers
- the accumulation and concentration of agricultural land
- Creation of income and employment through AFFrinnovation

Source : Mogami Town, Yamagata Prefecture, November 2007

promote orderly land use

- Creation of non-agricultural land
- Appropriate use of agricultural land through land readjustment

Avoidance of partial abandonment of cultivation

Increase in national land conservation functions

- Prevention of soil erosion
- Flood prevention
- Water source recharge

Multiple function

Strengthen food self-sufficiency

contributing to the national economy by reducing agricultural production costs

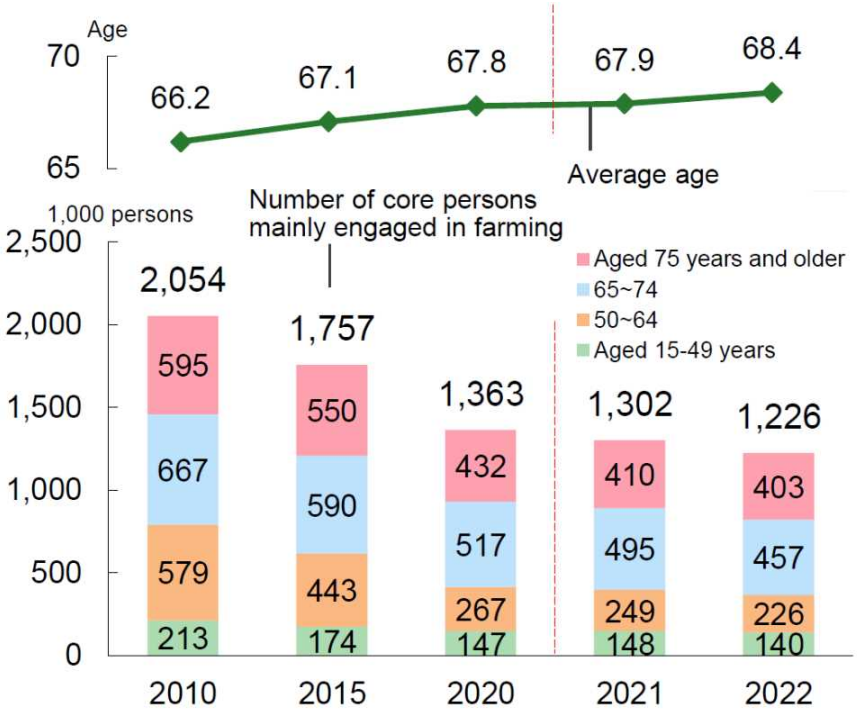
Revitalization of the region, land conservation and disaster prevention

Role in people's lives

1 The State of Japanese Agriculture

- Japan's farmland area is declining and will be 4.29 million ha in 2023. Its contents, Paddy field is 2.34 million ha and upland field is 1.96 million ha.
- In Japan, the number of core persons mainly engaged in farming has been on a downward trend, 1.23 million in 2022,and the population is aging.
- Total agricultural output in 2021 was 8.8 trillion yen, flat in recent years.

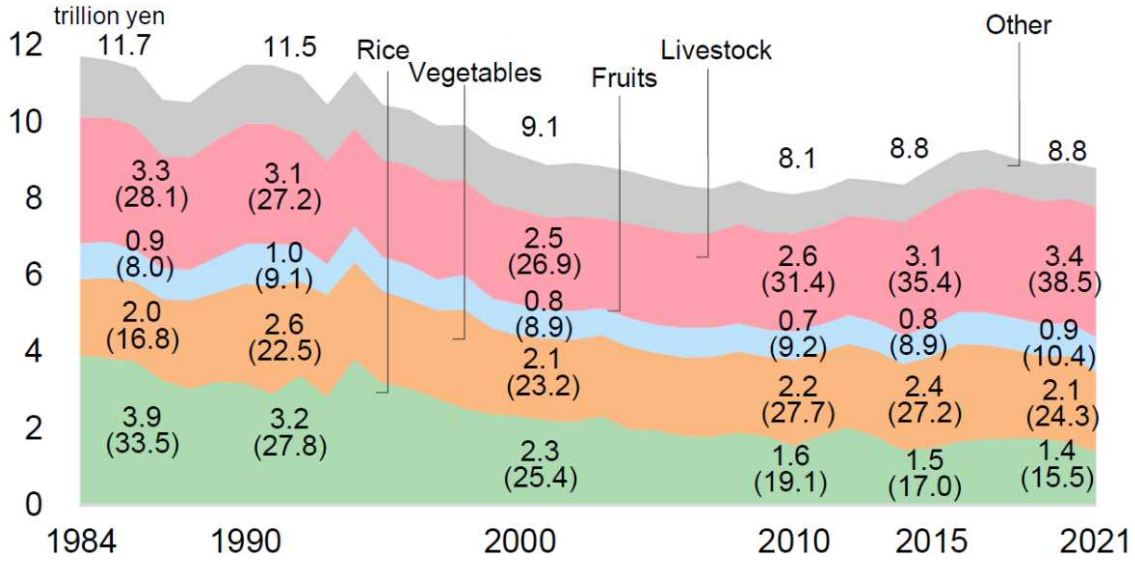
Number of core persons mainly engaged in farming and average age



Source: MAFF, “2010 World Census of Agriculture and Forestry” (recompiled) and “2015 Census of Agriculture and Forestry” (recompiled), “2020 Census of Agriculture and Forestry” and “Survey on Movement of Agricultural Structure”

Notes: 1) Figures as of February 1 of each year.
2) Figures for 2021 and 2022 are the results of the survey on Movement of Agricultural Structure and are estimates captured through sampling survey.

Total agricultural output



Source: MAFF, “Statistics of Agricultural Income Produced”

Notes: 1) Total agricultural output is estimated by subtracting intermediate products such as seeds and feed that are reinput into agriculture from the agricultural products produced in the year (including self-consumption) and multiplying the production quantity in each item by the farm household’s yard sales price for each item. -
2) "Other" is the total of wheat, cereals, pulses, potatoes, flowers, industrial field crops, other crops, and processed agricultural products.
3) Figures in parentheses are the percentage to total output (%).

3 Outline of Government-operated Agricultural Land Reclamation and Readjustment Project

➢ By extensively enlargement of farm lots and drainage improvements over a wide area will promote along with accelerate consolidating and intensifying farmland, elimination and prevention of cultivation abandonment land, improve the profitability of the production area by reducing agricultural production costs and conversion to high-profit crops.

Description of Project　representative example

Government-operated Agricultural Land Reclamation and Readjustment Project
（Next Generation Agriculture Promotion Type）

- Main Project　：land readjustment
- Concurrent Project ：Irrigation and drainage facilities,Farm road,Underdrainage,Soil dressing, Improvement or conservation of agricultural land
- Adoption Requirements:Increase the planted area of high-profit crops above a certain percentage, etc.
- Project Implementing Entity:Government（Government expense ratio:Mainland Two thirds, Hokkaido 75%）

Image of the project

Before project

Small and irregularly shaped agricultural land

After project

Enlargement of farm lots

Enlargement of farm lots, drainage improvement,etc

- Enlargement of farm lots and drainage improvement（Introduction of underground irrigation systems,etc）

Enlargement of farm lots and drainage improvement

Introduction of underground irrigation systems

Improved profitability of production areas

- By consolidation and expansion of farmland parcels suitable for automated agricultural machinery, Promote introduction of labor-saving technologies such as automated agricultural machinery

Status of unmanned operation of automated agricultural machinery

- Facilitate conversion to high-profit crops

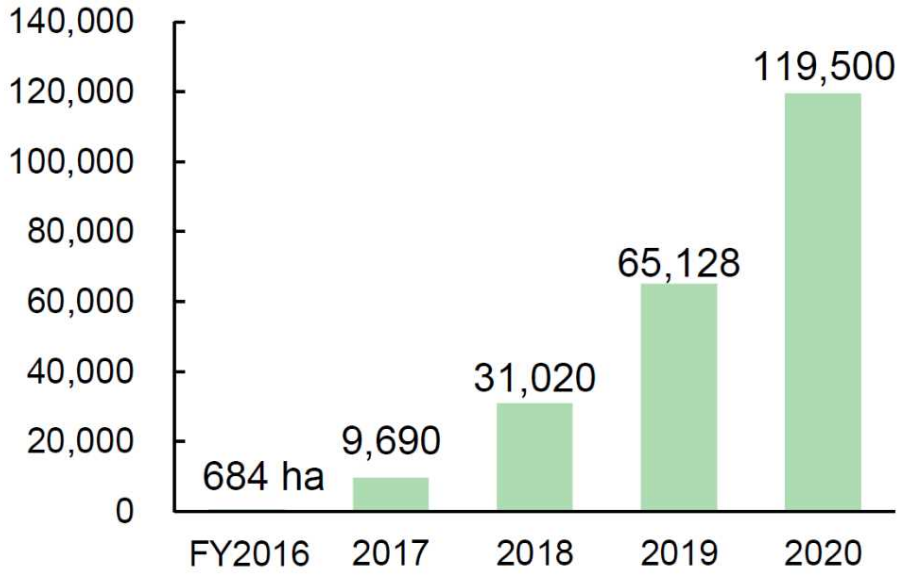
Expanding onion production

4 For the Sustainable Development of Agriculture

- The expected significant decline in the number of persons engaged in farming, it will be necessary to take on the domestic food supply with considerably fewer agriculture management entities than today . Therefore, it is necessary to play a role in providing food to the people through accumulation and concentration of agricultural land, strengthening the foundation of agricultural management, smart agriculture, and introduction of new varieties, etc., while at the same time developing stable agricultural management and improving productivity.
- In addition, while responding to the growing international debate on climate change and sustainability, it is necessary to shift to an agricultural and food industry that contributes more to reducing environmental impact so that food can be supplied stably and sustainably in the future.

- At the agricultural sites, efforts to improve agricultural productivity by using cutting-edge technologies such as robots, AI, and IoT, as well as utilizing data are spreading.

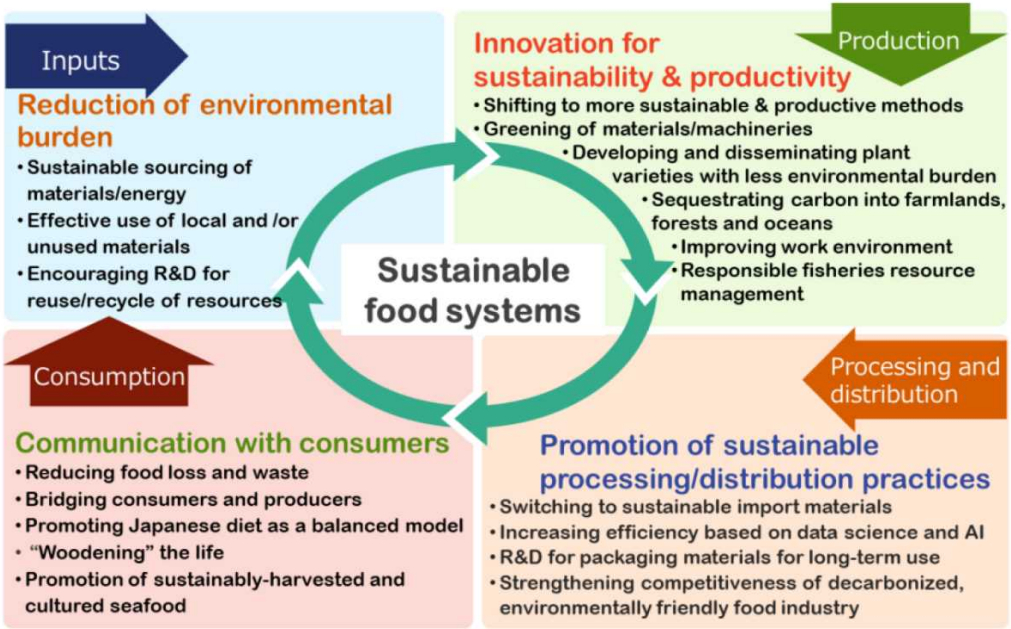
Actual cases of agricultural chemicals applied by drone (estimate)



Source : Prepared by MAFF

- "The Strategy for Sustainable Food Systems, MIDORI" (the MIDORI Strategy) is a policy to be strategically addressed from a medium- to long-term perspective in order to achieve a balance between productivity potential and sustainability in the agriculture, forestry, fisheries, and food industries through innovation. It presents targets to be achieved by 2050 by promoting the development and social implementation of innovative technologies and production systems as well as implementing efforts at each stage of inputs, production, processing and distribution, and consumption.

Specific initiatives at each stage of the MIDORI Strategy



Source : Prepared by MAFF

5 Advanced Technology Introduction Demonstration Project

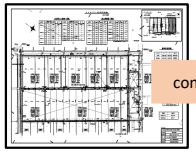
- With the situation surrounding Japan's agriculture, forestry, and fisheries industry changing dramatically due to the shortage of farmers and technicians as a result of the declining population, it is important to promote sustainable growth of the agriculture, forestry, and fisheries industries through the use of ICT and the greening of the agriculture, forestry, and fisheries industries.
- Meanwhile , In farm land consolidation , a)based on the New Long-term Plan of Land Improvement , through the use of ICT , such as ICT-Integrated Construction , labor savings and advancement in project implementation, agriculture, and maintenance b) Toward the realization of zero CO2 emissions in agriculture, forestry, and fisheries as set forth in“The Strategy for Sustainable Food Systems, MIDORI” , there is a need to expand carbon sequestration using biochar and other resources.
- To realize these policy issues, By using the government-operated project implementation area as a model to demonstrate the technology and effectiveness, establishment and systematization of farm land consolidation methods compatible with advanced technology.

1． Description of Project

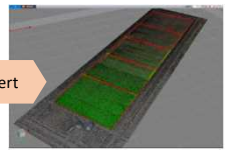
（1）Demonstration Project for Introduction of ICT

Demonstration of integrated farm land consolidation from design to construction, farming, and maintenance management using 3-Dimensional Data.

Investigation and design stage


2-Dimensional Drawing

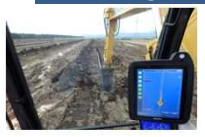
convert


3-Dimensional model


Augmented Reality image


On-site confirmation by Augmented Reality

Construction stage
ICT-Integrated Construction

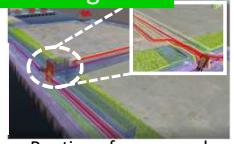


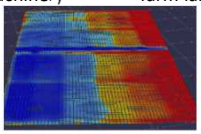
Excavation and slope shaping by ICT back hoe

Land grading by ICT bulldozer

Farming and maintenance management stage

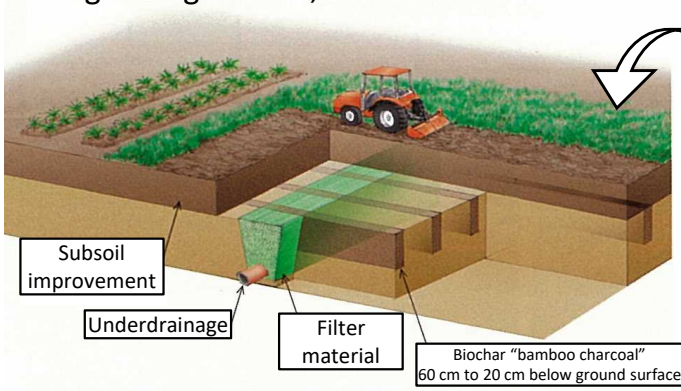
Automatic driving of agricultural machinery


Routing of unmanned farm land transfers


Visualization of farm land characteristics using heat maps

（2）Demonstration Project for Introduction of Carbon Storage Technology

Demonstration of farm land consolidation that contributes to carbon Storage using biochar, etc.



putting


Biochar “bamboo charcoal”

Target work type : Subsoil improvement , Underdrainage , etc.

Investigations and studies

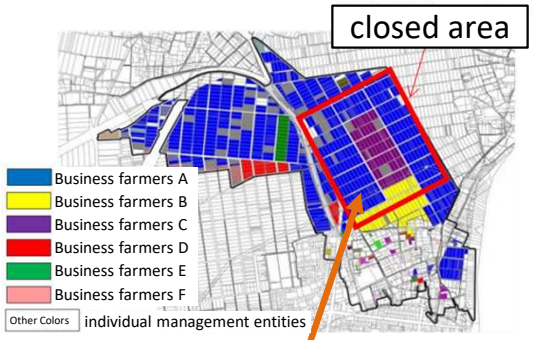
Based on demonstration results , investigation and study of methods, establishment and systematization of farm land consolidation methods compatible , Aiming to generalize the method and spread and expand it throughout nationwide.

6 Demonstration Project for Introduction of ICT

- Demonstration of integrated farm land consolidation from design to construction, farming, and maintenance management using 3-Dimensional Data.
- Generalize the method and expand nationwide

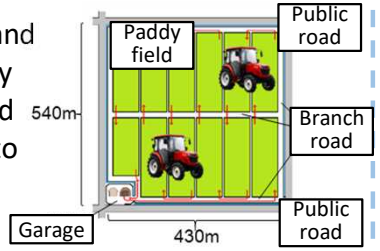
Demonstrate, Investigation, and study a series of processes for farm land consolidation using 3-Dimensional Data

Demonstration of movement between fields



Ensure travel safety by developing entryway, roads, and farm roads with shapes and strengths adapted to travel by automated agricultural machinery.

- Demonstration and establishment of farm land consolidation technology necessary for Automated Agricultural Machinery to move between fields in closed areas.



- A series of processes will be verified, including field design using 3D data and the use of 3D point cloud data obtained from ICT-integrated construction for the travel roues of automated agricultural machinery.

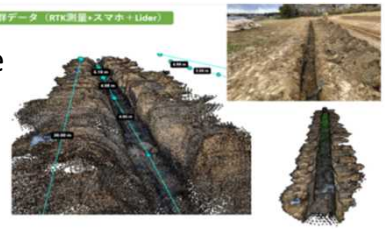
3D point cloud data, Construction deliverables

Mounted on automated agricultural machinery

Entryway Design

Farming and maintenance management

- Verification of technology to determine 3D location information of underdrainage during construction
- Verification of automatic water distribution control technology using ICT and its effectiveness



Point cloud data acquisition of underdrainage

Investigations and studies

Based on demonstration results , investigation and study of methods, establishment and systematization of farm land consolidation methods compatible , Aiming to generalize the method and spread and expand it throughout nationwide.

Generalize the method and spread and expand it throughout nationwide

Based on the results of the demonstration, a series of effects of utilizing 3D data and farm land consolidation methods adapted to Automated Agricultural Machinery, etc. will be verified.

Systematize as technical guidelines, etc., for nationwide deployment.

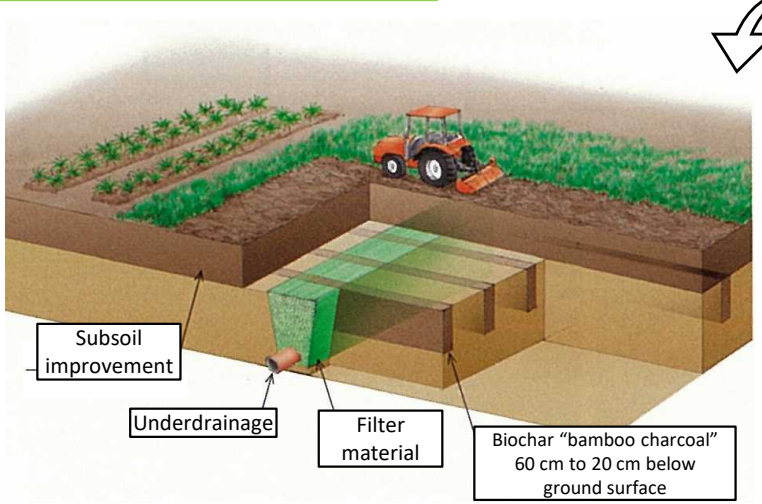
Systematization of farm land consolidation methods" image"
Utilization of 3D data obtained from ICT-Integrated Construction "design, Farming and maintenance"
Size and establishment of closed areas " Optimal farm land plots based on movement between fields"
Establishment of farm land consolidation methods , such as roads to move between fields ,turning at farm road , wide levee , entryway.

7 Demonstration Project for Introduction of Carbon Storage Technology

- The MIDORI Strategy promotes biochar farmland input.
- Aiming to achieve carbon neutrality by 2050 , Systematization of farm land consolidation methods that contributes to carbon Storage in agricultural soils.

Demonstration of farm land consolidation methods using biochar, etc , Investigations and studies.

Demonstration of farm land consolidation for a model field



putting

Biochar "bamboo charcoal"

Example of biochar feedstock "Bamboo in abandonment bamboo groves"

Demonstration of farm land consolidation that contributes to carbon Storage using biochar, etc.

Target work type : a)Subsoil improvement , b)Underdrainage

Investigations and studies

Based on the demonstration results, the effect on the farmland, the optimal method of construction, the method of construction management, and the effect from farm land consolidation to farming, etc. will be studied and systematized.

- Effects on farmland

Investigate the effectiveness of using biochar and other materials as filter material for underdrainage.

→Demonstrate that application of persistent biochar is effective in reducing subsidence of plowsole due to erosion (compaction) of filter material such as chaff.

Corrosion condition of Filter material "chaff"

- The optimal method of construction

Organize construction equipment and work procedures by work type, and systematize points to keep in mind and work methods.

- The method of construction management

Systematize the procedures and points to be noted regarding the transportation, delivery, feeding, etc. of biochar, etc., for each type of work.

Generalize the method and spread and expand it throughout nationwide

Based on the demonstration results, the effectiveness of carbon storage and the methods of adapted farm land consolidation will be verified.

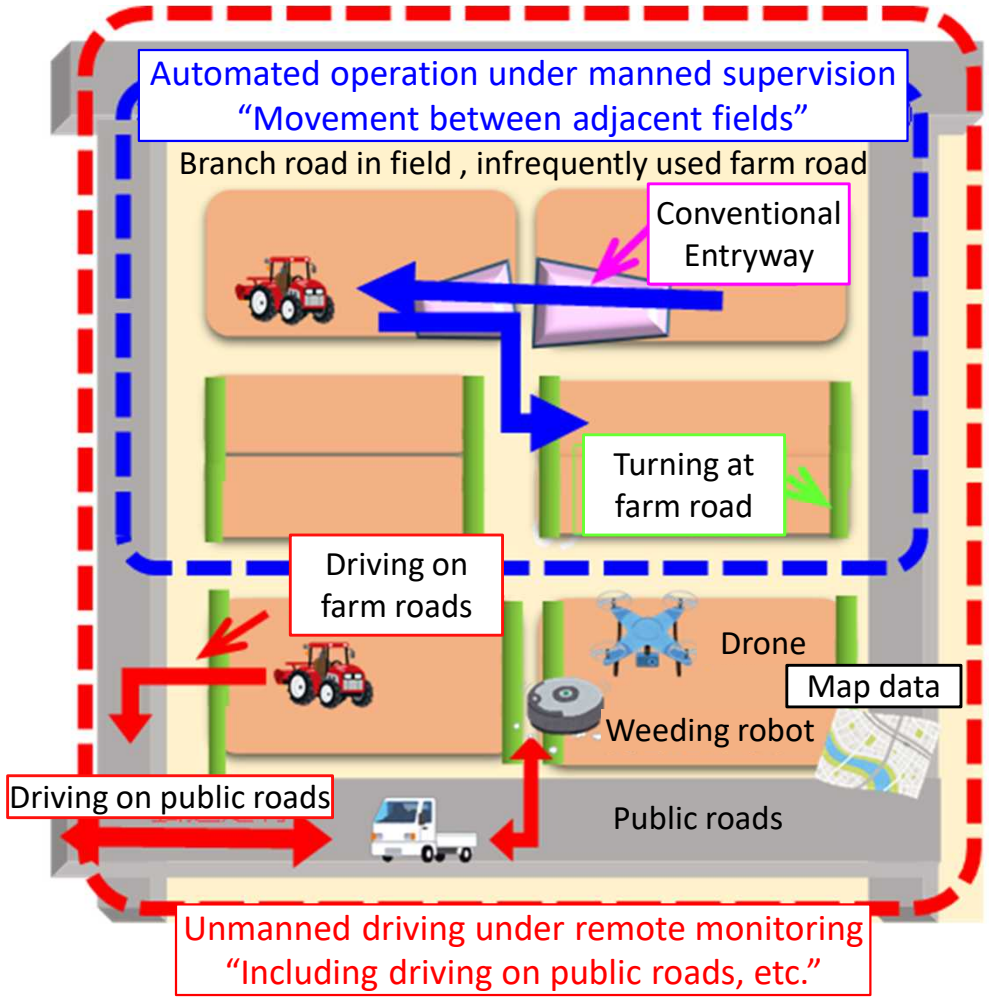
Systematize as technical guidelines, etc., for nationwide deployment.

Creation of new added value

By promoting polisies to realize the SDGs and the MIDORI Strategy , In the future, new added value can be expected to be created, such as "visualization" the reduction of environmental burden and utilization of the Japanese credit scheme system.

8 Guideline for the Farm Land Consolidation Adapted to Automated Agricultural Machinery, etc

- Due to the decrease in the number of business farmers and the aging of the farming population, it is essential to promote the introduction and use of advanced technologies such as automated agricultural machinery, and it is important to promote the farm Land Consolidation compatible with such technologies.
- Therefore, in 2020, the "Guideline for the Farm Land Consolidation Adapted to Automated Agricultural Machinery, etc." was formulated, which outlines the basic concepts and points to consider when preparing the farm land consolidation plans for the introduction and use of automated farm machines, etc., mainly for paddy fields on flat land.
- The 2023 revision includes a) basic concepts and points to note for farm land consolidation in hilly and mountainous areas, including orchard, and b) points to note for farm land consolidation when drones are used and new technologies including those under research and development.



Level of automation of agricultural machinery	Details of efficiency and automation of farming	New Requirements	Plain land	Hilly and mountainous: Gentle slope	Hilly and mountainous: Steep slope
Practical	Automation of steering wheel operation, etc. 	Large parcels of farmland			○
Demonstration	Unmanned automated driving in the field under manned surveillance  Robot tractors	➢ GNSS Correction ➢ Large parcels of farmland ➢ Turning at farm road ➢ Culverting of canals		○	○
Development	Out-of-sight, unmanned, automated between fields travel 	➢ communications environment ➢ Large parcels of farmland ➢ Set of closed areas ➢ Maintenance of farm road shape and width	△		

: Scope of guidelines prior to the 2023 revision

: Scope of future study required ”○ or △ are already reflected”

○ : Points to keep in mind when organizing farmland in hilly and mountainous areas, including orchards, etc.

△ : Additional reference information such as Remote monitoring considerations , Technologies under development.

9 Summary

- Japan's farmland area is declining , the number of core persons mainly engaged in farming has been on a downward trend and the population is aging.
- By farm land consolidation, which involves large parcels of farmland and the generalization of rice paddies, Improvement of agricultural productivity and agricultural structure, It plays an important role in ensuring food self-sufficiency, contributing to the national economy by reducing agricultural production costs.
- Also , important to promote sustainable growth of the agriculture, forestry, and fisheries industries through the use of ICT and the greening of the agriculture, forestry, and fisheries industries.
- Therefore , by creation of advanced technology introduction demonstration project and formulation of guideline for the farm land consolidation adapted to automated agricultural machinery, etc , promoting farm land consolidation using advanced technology.

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