

# *Research Topics 2011*



March 2013



National Agriculture and Food Research Organization  
National Institute for Rural Engineering (NIRE)

## Preface

The National Institute of Rural Engineering (NIRE) is one of several institutes belonging to the National Agriculture and Food Research Organization, an incorporated administrative agency. Scientists at NIRE perform engineering research to support measures to promote rural areas from the technical side, and have developed technology that meets the demands of the times.

Our recent research focuses on the development of technology that contributes to strategic renewal and management of agricultural irrigation facilities, disaster prevention in rural areas, preservation of regional resources for agricultural production, advanced paddy field management, biomass utilization, measures against the effects of climate change on farmland and water resources, and sophisticated environmental control of agricultural structures as well as many other areas. .

This pamphlet outlines the main results of NIRE research in 2011. We greatly hope this pamphlet will be used by engineers of rural engineering.

Junji Takahashi

Director General

National Institute of Rural Engineering

March 2013

## *Research Topics 2011*

No	Title	Page
1	Influence of Circulation Fans on the Distribution of Air Temperature and Air velocity in a Greenhouse .....	1
2	Development of a Quantitative Impact Assessment Method of Climate Change on Agricultural Water Use .....	1
3	Importance of irrigation water sufficiency to restrain decreases in rice grain quality under hot weather condition .....	2
4	Evaluation method for lifecycle basis profitability and energy balance in biomass utilization.....	2
5	Model for planning transportation and application of digested slurry to farmlands .....	3
6	Wireless sensors in reinforced concrete structures .....	3
7	Method for the estimation of accelerated aging time to predict the deterioration of repair Materials in irrigation and drainage canal .....	4
8	Environmental impact evaluation using CO2 emissions that occur with construction to repair a concrete canal .....	4
9	An estimation model for capital stock of the main irrigation and drainage facilities with consideration of stock management measures .....	5
10	Diagnostic procedure for canal systems maintenance and modification .....	5
11	Developing Methods for Fish Habitat Potential Maps using a Census of Organisms in Paddy Fields for Japan .....	6
12	Low Cost and Laborsaving Canal Management Techniques using Transceivers .....	6
13	An optimizing method for priority of small fill dam repair works .....	7
14	Hydraulic functions diagnosis for subsidence canals by vertical section surveying of canal beds.....	7
15	Development of a simple discriminant function to separate two loaches, Dojo and Kara-dojo, in agricultural canals .....	8
16	Social capital exceeding the community that originally existed can promote rural resources conservation activities .....	8
17	Simplified Method for Detection of Open Cracks with a Resistivity Survey .....	9
18	Evaluation of Hazardous Displacement Concentration Portion of a Large Scale Landslide in Farmland Based on Efficient Numerical Method for Stress-displacement and Seepage Flow in the Ground .....	9
19	Disaster Prevention and Maintenance Map for Rice Terraces of Various Soil Types.....	10
20	Characteristics of Tsunami Damages on Gates and Pumping Stations of Drainage Systems by the 311 Earthquake .....	10

21 Coastal farmlands suppress the floods of a Tsunami .....	11
22 Technical Assistance for Reconstruction Planning in Yoshihama, Ofunato, Iwate.....	11
23 Method for reinforcement of soil structures adopted from labor-based-technology that uses a geosynthetic bag system .....	12
24 In situ shear test for an embankment slope (BST-Zonde) .....	12
25 Countermeasure against heavy rainfall by the Surface Cover Method .....	13
26 Salt removal from a tsunami damaged paddy field based on a field survey .....	13
27 Modeling of Basin-wide Water Circulation Incorporating Water Allocation and Management Schemes in Large Irrigated Paddy Areas .....	14
28 Technique to design a multipurpose regulating pond that can utilize existing farm pond enabling an elastic water supply .....	14
29 Scenario for analyses of a reduction in pollutant load discharged from a watershed by recycling of treated water for irrigation .....	15
30 Reuse of abandoned farmland by planting barley in a Mountainous and Hilly Area .....	15
31 Recovery of Idle Farmlands through CSA with Citizen Participation .....	16
32 Compilation of local agricultural history to encourage the promotion of regional understanding on local agriculture .....	16
33 Reclamation of abandoned farmland cooperated with social welfare institutions in rural areas .....	17
34 Local resource information management system for smoothly advancing management of farmland and agricultural water channels .....	17
35 Method for evaluating hydropower potentials and associated project costs for irrigation dams .....	18
36 Existence Factors and Utilization of Irrigation Water Wheels .....	18
37 Index of small scale hydropower cost analysis for irrigation facilities .....	19
38 Method to distinguish parcels planted with rice using ALOS satellite AVNIR-2 data and paddy parcel boundary data .....	19
39 Removal of radioactively contaminated topsoil from agricultural fields using soil hardener .....	20
40 Distribution of radioactive cesium concentration in vertical profile and particle size fractions of a paddy field soil .....	20
41 Decontaminating paddy soil contaminated with radioactive materials by water agitation and soil removal .....	21
42 Low-cost supplementary drainage method for enhancing field drainage .....	21
43 “Disaster Reduction Information System for Earth Dam” provides real-time disaster reduction Information .....	22

## 1. Influence of Circulation Fans on the Distribution of Air Temperature and Air velocity in a Greenhouse

### [Keywords]

Airflow distribution, circulation fan, controlled environment, greenhouse, temperature distribution

### [Abstract]

This paper shows how airflow distribution in a greenhouse is influenced by the number and position of circulation fans. At the top of the tomato canopy, the air velocity increased with an increase in the number of fans. However, the air velocity decreased at the bottom of the tomato canopy. These results indicate the gradual decreased airflow on the leeward side caused a non-uniform air temperature distribution in the greenhouse. Therefore, we conclude that 10-15 fans per 1000 m<sup>2</sup> are necessary to produce an average air velocity of 0.3 m/s, when a fully developed crop is in the greenhouse.

### [Reference]

M. Ishii et al. 2012. Influence of Circulation Fans on the Distribution of Air Temperature and Air velocity in a Greenhouse. J.SHITA 24: 193-200.

	Air velocity (m/s)			
	Height of 0.5 m	Height of 1.5 m	Height of 2.1 m	Average
5 fans/1000m <sup>2</sup>	0.16	0.15	0.42	0.24
10 fans/1000m <sup>2</sup>	0.14	0.28	0.67	0.36
15 fans/1000m <sup>2</sup>	0.32	0.28	0.72	0.44

Table Influence of circulation fans on uniformity of air velocity distribution in the greenhouse.

## 2. Development of a Quantitative Impact Assessment Method of Climate Change on Agricultural Water Use

### [Keywords]

Agricultural water use, distributed water circulation model, extreme events, bias correction, irrigation

### [Abstract]

A quantitative impact assessment method was developed to predict the potential impacts of climate change on agricultural water uses. The methodology of this assessment consisted of downscaling and bias correction techniques for climate projections from Global Climate Models (GCMs), and a distributed water circulation model incorporating various paddy water uses. This water circulation model estimates the cropping area of rice paddies, the water requirements of paddy fields, diversion water at the main irrigation facilities and irrigation water allocation for each paddy field as well as actual evapotranspiration, soil water content and runoff amounts.

### [Reference]

Kudo.R., T. Masumoto, T. Yoshida and N. Horikawa (2012): Development of Quantitative Impact Method of Climate Change on Agricultural Water in Irrigation-dominant Basins, Jour. of Irrigation, Drainage and Rural Engr., 277, pp.21-29

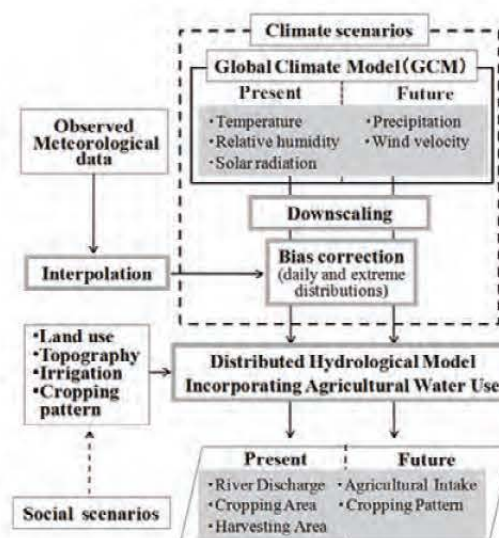


Fig. Schematic of the assessment of the effects of climate change on irrigation using a distributed water circulation model and climate scenarios

### 3. Importance of irrigation water sufficiency to restrain decreases in rice grain quality under hot weather conditions

[Keywords]

Rice cultivation, high-temperature ripening damage, percentage of 1st grade rice, water management, irrigation water sufficiency

[Abstract]

The following is the results of a questionnaire survey for high-temperature ripening damage of rice and water management in 2010, when the highest average summer temperatures on record were recorded. After heading of rice, farmers that select water management expecting to secure sufficient irrigation water tend to restrain the decrease in rice grain quality.

[Reference]

Sakata, S., T. Tomosho, and M. Uchimura (2011): Effects of Cultivation Techniques on the Quality of Rice Grain during Hot Weather Conditions, *Water, Land and Environmental Engineering*, Vol.79 No.8, 27-32 (in Japanese)

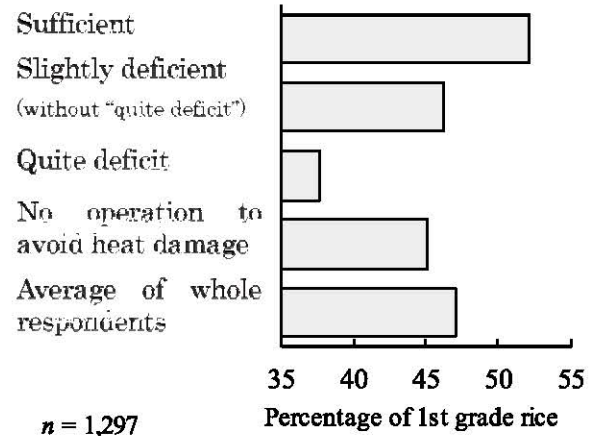


Fig. Relationship between the percentages of 1st grade rice harvested in 2010 and irrigation water sufficiency

### 4. Evaluation method for lifecycle basis profitability and energy balance in biomass utilization

[Keywords]

Biomass utilization promotion plan, Lifecycle, Scenario, Profitability, Energy balance

[Abstract]

Method to evaluate lifecycle basis profitability and energy balance in municipal biomass utilization was developed. Present conditions and the plan were compared for six biomass utilization scenarios as examples. Calculations were executed by dividing into five processes; 1) production or generation of feedstock biomass, 2) collection, transportation and storage, 3) conversion to energy and materials (resources), 4) transportation and storage of produced resources, and 5) utilization of resources. Calculations were also divided into three lifecycle stages; 1) facility construction or arrangement, 2) operation, and 3) disposal. The results can be used to judge validity of a plan.

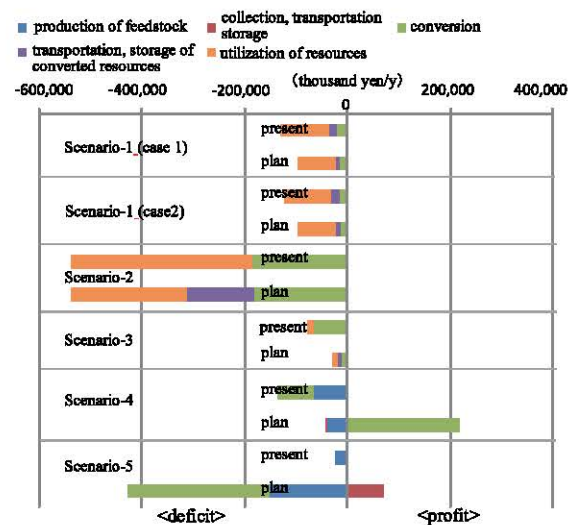


Fig. Comparison of lifecycle basis profitability

## 5. Model for planning transportation and application of digested slurry to farmlands

[Keywords]

Digested slurry, land application, planning support, program, simulation

[Abstract]

The model simulates transportation and application of digested slurry from a methane fermentation plant to farmlands as fertilizer. A planner can make an optimum plan for transportation and application of digested slurry with this model.

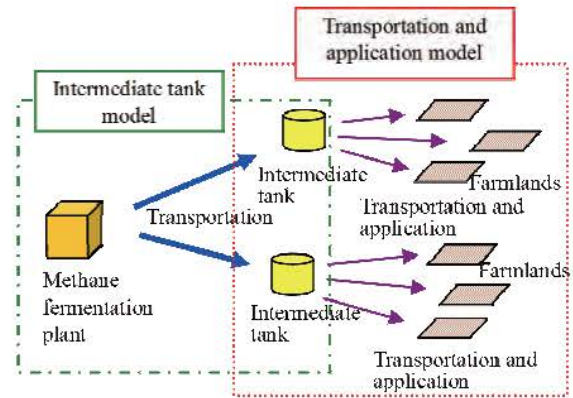


Fig. Structure of the model

## 6. Wireless sensors in reinforced concrete structures

[Keywords]

Wireless sensor, reinforced concrete, monitoring

[Abstract]

We developed wireless sensors embedded in reinforced concrete that can measure the long-term stable temperature, rebar stress and concrete strain. The sensor is easy to install and highly resistant to lightning. The maximum transmission distance is 24 m. Design monitoring period is approximately 10 years with a measurement frequency of once a day.



Fig. Concrete wireless sensor

## 7. Method for the estimation of accelerated aging time to predict the deterioration of repair materials in irrigation and drainage canal

### [Keywords]

Accelerated aging, organic surface coating materials, weathering resistance, binarization, ratio of deterioration area, magnification of accelerated aging time

### [Abstract]

We define the ratio of deterioration area as an index to express the deterioration by ultraviolet rays on the surface of repair materials in irrigation and drainage canals, and clarify the relationship between the weathering years and the accelerated aging time by using this index. We can estimate the accelerated weathering time necessary to reproduce the deterioration of repair materials in the field.

### [Reference]

OKUNO et.al. (2011), Irrigation, Drainage and Rural Engineering Journal, 274:9-16

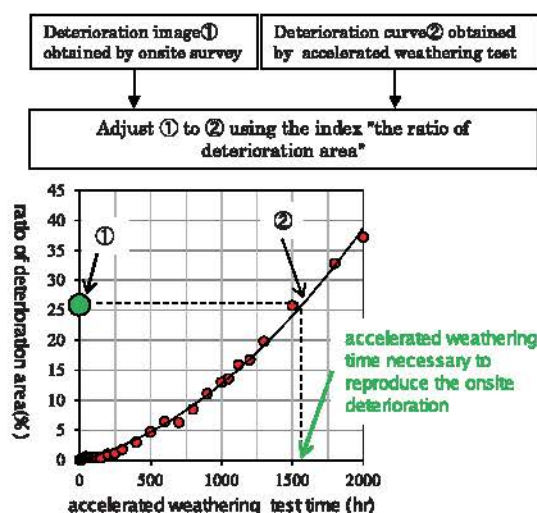


Fig. Method for estimation of the accelerated weathering time to reproduce the deterioration of repair materials in the field.

## 8. Environmental impact evaluation using CO<sub>2</sub> emissions that occur with construction to repair a concrete canal

### [Keywords]

Concrete canal, LCC, single degradation forecasting model, CO<sub>2</sub> emissions

### [Abstract]

A technique for calculating a simply life cycle CO<sub>2</sub> (LCCO<sub>2</sub>) of repair work for facilities was developed. It was shown that this technique can be used for evaluation of environmental impacts. By measuring the total CO<sub>2</sub> emissions for various repair construction methods with this simple calculation technique, the repair construction method that considers the environmental impacts can be selected.

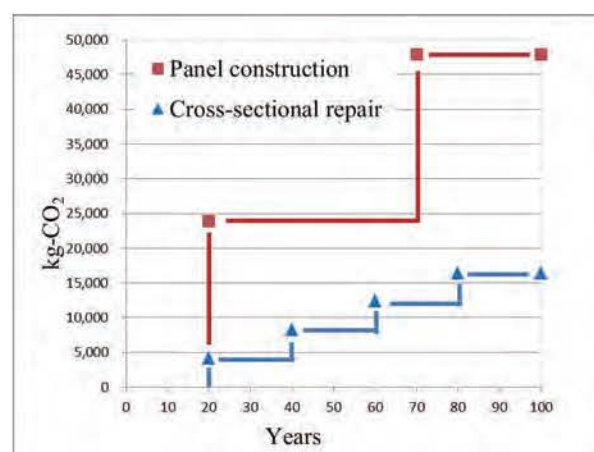


Fig. Comparison of total CO<sub>2</sub> emissions by different repair construction methods



## 9. An estimation model for capital stock of the main irrigation and drainage facilities with consideration of stock management measures

[Keywords]

Stock management measures, irrigation and drainage facilities, capital stock, stock maintenance, benefit evaluation

[Abstract]

In this study, we built an estimation model for capital stock of the main irrigation and drainage facilities that considers the stock management activities. This model used long term investment data and considered prolonged life time of the facilities. This model can be used for management of capital stock and evaluation of a stock management policy.

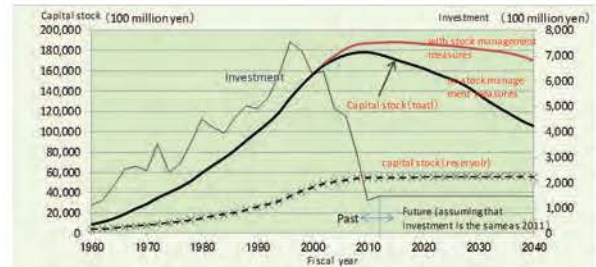


Fig. Chronological change in irrigation and drainage capital stock

## 10. Diagnostic procedure for canal systems maintenance and modification

[Keywords]

Canal system, delivery function, collector function, connector function

[Abstract]

This information will improve diagnostics works for canal systems maintenance and modification. First the user of this procedure plans diagnostic research for predetermined locations. Diagnostic items in each location are previously set on specific templates according to hydraulic structures and their functions such as delivery, collector and connector. The number of survey locations is determined depending on the time and the budget.

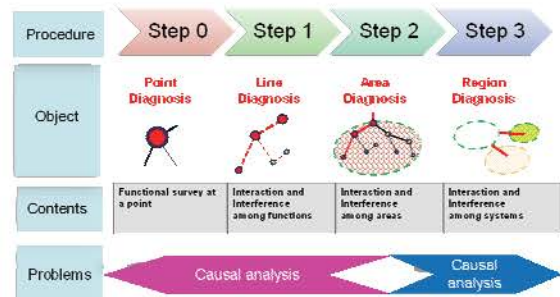


Fig. Diagnostic procedure for canal systems

## 11. Developing Methods for Fish Habitat Potential Maps using a Census of Organisms in Paddy Fields for Japan

[Keywords]

Rice paddy fields, Agricultural canal, Biodiversity, Tone River basin

[Abstract]

Fish habitat potential maps show high habitat quality areas for fish groups consisting of fish species that have similar preferences in habitat, and are useful for conserving fish habitats. The map can be drawn easily by constructing a statistical model from data existing in the Census of Organisms in Paddy Fields and environment factors such as land use and elevation.

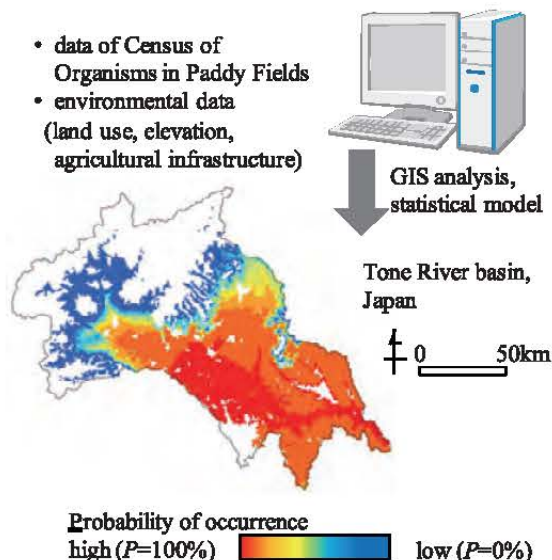


Fig. Calculated habitat quality for the fish species group consisting of carp, goby, killifish, etc.

## 12. Low Cost and Laborsaving Canal Management Techniques using Transceivers

[Keywords]

Information and communication technology, specific low power radio, irrigation and drainage canals, small and geographically-distributed area, laborsaving management

[Abstract]

This is a monitoring system using transceivers to monitor water level, crack movement, and other parameters in agricultural canals. It costs approximately 60% of marketing products using a cell-phone. In addition, the cost of data transfer using this system is free of charge.

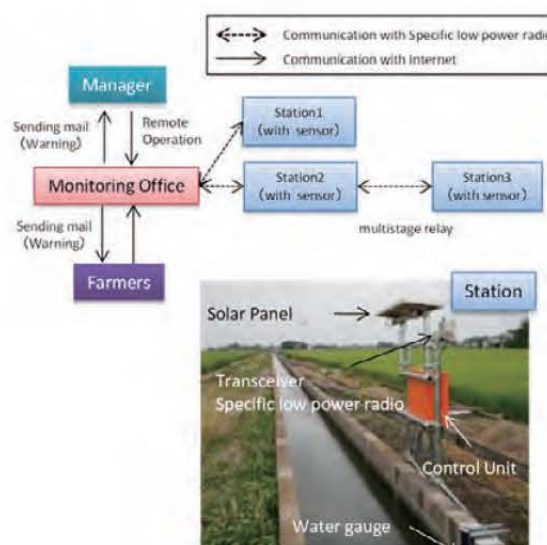


Fig. Overview of monitoring system with transceivers

[Reference]

NAKAYA et.al.(2011), Water, Land and Environmental Engineering, 79(9):21-24

### 13. An optimizing method for priority of small fill dam repair works

[Keywords]

Small fill dams, Repair works, Optimization, Mean variance model

[Abstract]

Priority for small fill dam repair work is easily decided with a small amount of known data. IRR of a small fill dam repair project is highly maintained throughout the entire project investment periods. (IRR: Internal return rate. An index of project management with nominal compound interest throughout a project.)

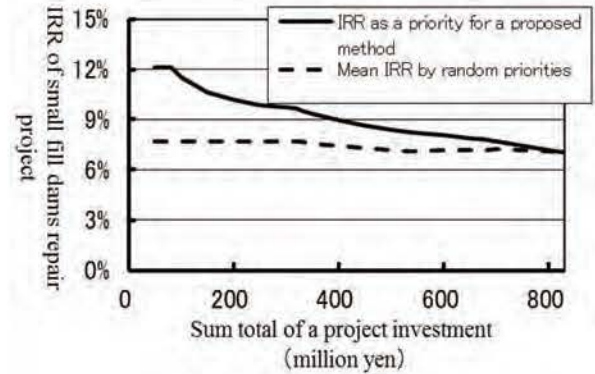


Fig. Example of four small fill dams repair projects.

### 14. Hydraulic functions diagnosis for subsidence canals by vertical section surveying of canal beds

[Keywords]

Hydraulic functions diagnosis, Subsidence canals, Canal systems

[Abstract]

Hydraulic functions diagnosis in subsidence canals is assessed by interviews and vertical section surveying, and shows decreased performance in water delivery such as overflow, shortage of water volume and leakage.

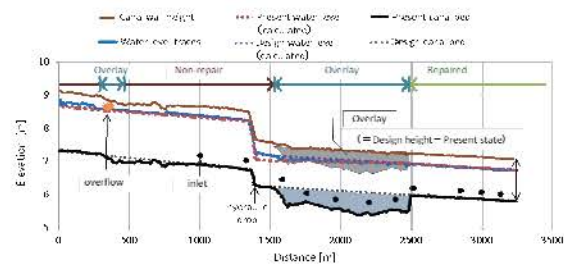


Fig. Hydraulic profiles of a subsidence canal for hydraulic functions diagnosis

## 15. Development of a simple discriminant function to separate two loaches, Dojo and Kara-dojo, in agricultural canals

[Keywords]

Multivariate analysis, Agricultural irrigation facility, Biodiversity

[Abstract]

A simple discriminant function was developed to separate the domestic loach Dojo, *Misgurnus anguillicaudatus* and the invasive loach Kara-dojo, *Paramisgurnus dabryanus* in agricultural canals including ditches. Both loaches coexist and it is difficult to differentiate each species due to similarities in body shapes. The caudal peduncle depth and length of barbell, which were standardized by the standard length (SL), were statistically selected as parameters to develop a simple discriminant function. The discriminant function based on the calculated function scores allows for correct classification of the Dojo and the Kara-dojo 95.3% of the time.

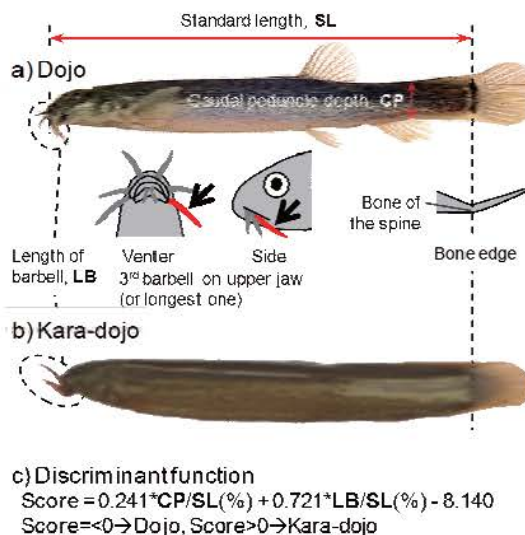


Fig. Body shapes of a) Dojo and b) Kara-dojo and c) discriminant function composed of measurement of 2 body parts

## 16. Social capital exceeding the community that originally existed can promote rural resources conservation activities

[Keywords]

Rural social capital, Entrepreneurial networks, Exceeding the community which existed originally, Rural resource conservation activities

[Abstract]

If an entrepreneurial network is built by experiencing many suitable impacts such as rural promotion measures, social capital will exceed the community that originally existed. As a result, conservation of rural resources, such as measures for conservation and management of farmland, agricultural irrigation water and rural environment, is activated

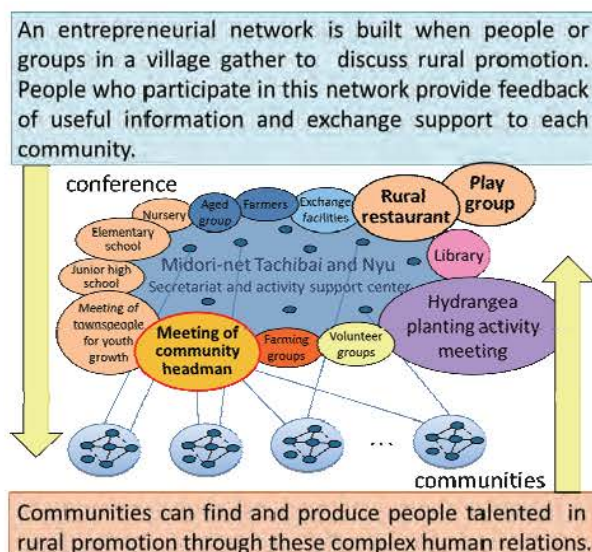


Fig. Case study of an entrepreneurial network

## 17. Simplified Method for Detection of Open Cracks with a Resistivity Survey

[Keywords]

Earth quake, damaged part, resistivity survey, two-dimensional, open crack

[Abstract]

A method is proposed, in which conductive liquid is injected into cracks, resistivity surveys are conducted before and after the injection, and distributions of resistivity changes are calculated for an estimation of the crack. The estimated range of cracks by the parallel survey line is almost the same as the actual crack length. In addition, the estimated range of cracks by the cross survey line can predict the crack depth, if the depth is shorter than the length. Estimation of crack depth by the cross survey line is effective according to estimation of the crack length by the parallel survey line

[Reference]

Inoue and Nakazato (2011) 10th SEGJ International Symposium

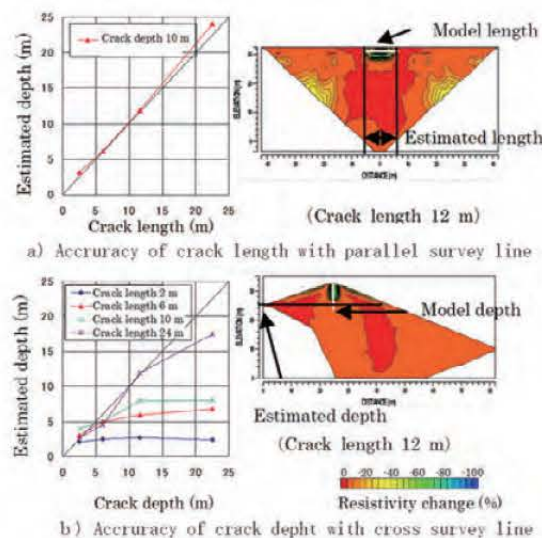


Fig. Estimated accuracy of infiltration during a numerical experiment

## 18. Evaluation of Hazardous Displacement Concentration Portion of a Large Scale Landslide in Farmland Based on Efficient Numerical Method for Stress-displacement and Seepage Flow in the Ground

[Keywords]

Farmland in slopland, Large scale landslides, Stress-displacement analysis, Countermeasures for landslide disaster

[Abstract]

3-D Distribution of stress-displacement and seepage flow in the ground can efficiently evaluated which have the great concerns of a disaster in large scale landslides of farmland. Hazardous displacement concentration portion can be successfully evaluated together with the 3-D ground condition according to recorded groundwater level, and it this is helpful to determine the position of countermeasures for disaster prevention.

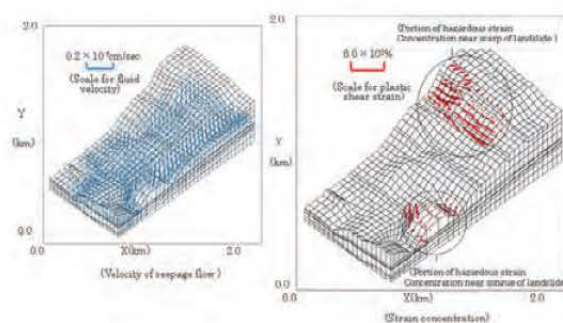


Fig. Schematical presentation of seepage and stress-strain analysis for large scale landslides in farmland

## 19. Disaster Prevention and Maintenance Map for Rice Terraces of Various Soil Types

[Keywords]

Rice terrace, Slope failure in shallow ground of farmland, Analysis of shallow seepage flow, Disaster prevention and maintenance, Hazard map

[Abstract]

Slope failure of rice terraces in hilly areas that usually occur during heavy rainfall due to an uprise in the seepage water level of shallow ground is draws attention. Disaster prevention and a management map can be used to evaluate indices for both-inflow and outflow from the ground surface, which are obtained by performing numerical analysis of seepage flow in shallow ground. Indices can be evaluated for rice terraces of various soil type using potential gradient of seepage water. Necessity of levee weeding and 'shirokaki, azenuri' (- plowing for planting young rice, and levee mending for seepage control-) can be numerically visualized in the above mentioned mapping procedure

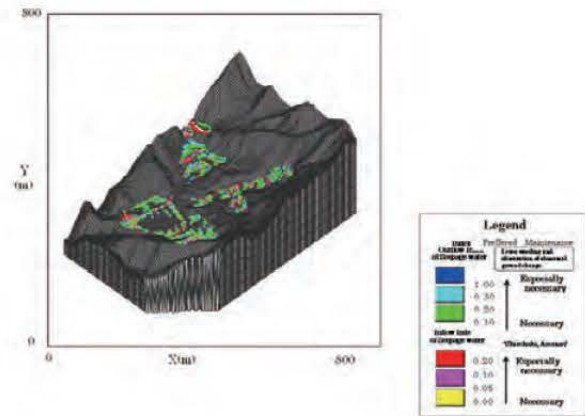


Fig. Disaster prevention and maintenance map of rice terrace

## 20. Characteristics of Tsunami Damages on Gates and Pumping Stations of Drainage Systems by the 311 Earthquake

[Keywords]

311 earthquake, tsunami, gate, drainage pumping station, restoration

[Abstract]

Damages of small gates by the 311 earthquake were concentrated on spindle type gates. Few rack type gates were destroyed. Damages on buildings of pumping stations were concentrated on wood or panel structures. Damage ratio was high in proportion to the inverse distance from coastal lines,

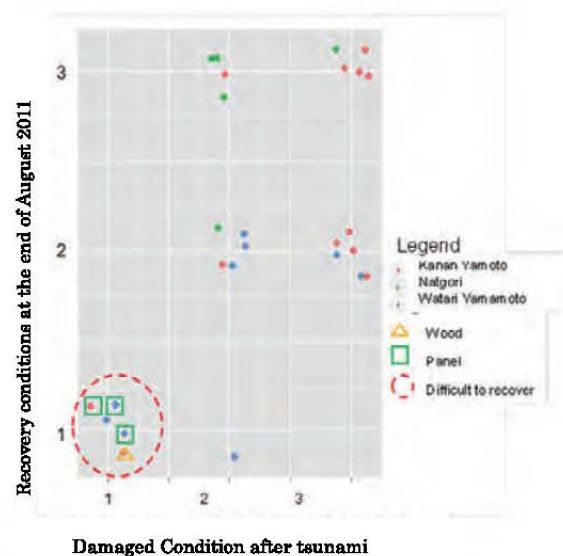


Fig. Building types and recovery at the end of August 2011

## 21. Coastal farmlands suppress the floods of a Tsunami

[Keywords]

Great East Japan Earthquake, Tsunami, Disaster prevention technique, Hydraulic model test

[Abstract]

In order to reduce the damage caused by the huge tsunami that occurred after the 2011 Tohoku Earthquake, the hydraulic model test estimated how much the vigor of a tsunami can be reduced by coastal farmland. Based on the conditions of this experiment, the tsunami was delayed about 2 minutes by the coastal farmland.



Fig. Scene in which a tsunami exceeds a coastal dike

[Reference]

Kiri et al. (2012) Technical Report of the National Institute for Rural Engineering, 213

## 22. Technical Assistance for Reconstruction Planning in Yoshihama, Ofunato, Iwate

[Keywords]

Farmland Reconstruction Plan, Consensus Building, Landscape Simulation, Tsunami Inundation Simulation

[Abstract]

We had the opportunity to technically assist residents to create a farmland reconstruction plan in Yoshihama, Ofunato, Iwate Prefecture. Our landscape simulation facilitated consensus building. Simulation of the tsunami inundation provided a scientific basis for the reconstruction plan created by the residents.

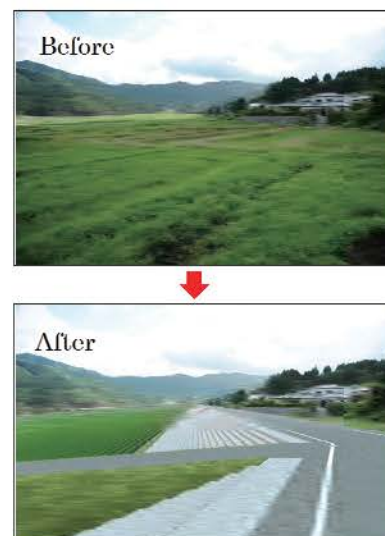


Fig. Examples of Landscape Simulation

### 23. Method for reinforcement of soil structures adopted from labor-based-technology that uses a geosynthetic bag system

[Keywords]

Geosynthetic bag, earthquake resistant, wave erosion, embankment, Labor-Based-Technology (LBT)

[Abstract]

Seismic and wave erosion countermeasures for rural roads, dikes and bank revetments were developed by using a geosynthetic bag system. This geosynthetic bag system has the following advantages; 1) labor-based-technology can be adopted without using advanced construction techniques and heavy machineries, 2) a steep and durable slope can be constructed, and 3) maintenance costs and construction land can be considerably saved

[References]

The pilot test of countermeasure against wave erosion for road embankment in Bangladesh, pp.196-203, The 1st Int. GSI-Asia Geosynthetics Conf. Taiwan, K. Matsushima, Y. Mohri, K. Nakazawa, K. Yamada, T. Horii, M. Ariyoshi, 2009, Nov.



Fig. Rehabilitation work for a rural road embankment in Bangladesh

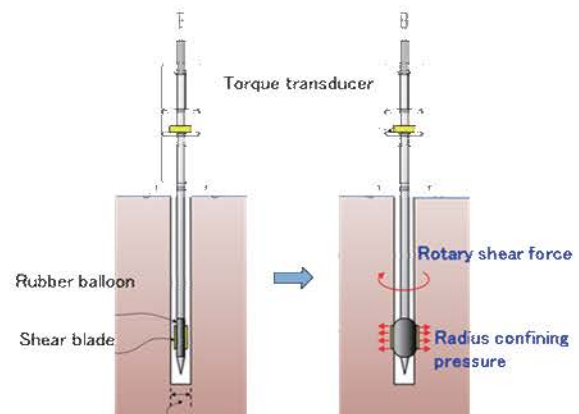
### 24. In situ shear test for an embankment slope (BST-Zonde)

[Keywords]

Embankment slope, In situ test, Shear strength, Slope stability, Seismic stability

[Abstract]

BST-Zonde is an in situ shear test method. This test enables easy and rapid measurement of shear strength ( $c$ ,  $\phi$ ) of an embankment slope such as a small earth dam with an automatic Swedish sounding apparatus installed as a special balloon with shear blades.



Test hall excavated using a Swedish sounding apparatus

Fig. Diagram of the method to test a BST- Zonde

[Reference]

T. Hori etc., In-situ rotating shear test method using an automatic sweden sounding apparatus, Proc. Japan Geotechnical Society conf. 2012



## 25. Countermeasure against heavy rainfall by the Surface Cover Method

[Keywords]

Small earth dam, Heavy rainfall, Countermeasure, Surface cover, Seepage protection

[Abstract]

We developed a countermeasure to protect small earth dams against heavy rainfall with low costs and a short-term construction period, named the “Surface Cover Method”. In this method, erosion protection mats with impermeable sheets are spread from the upstream slope to the downstream slope of an embankment. This method effectively protects against rainfall infiltration, erosion by overtopping and wave erosion of the upstream slope, so is able to protect a dam from sliding, overtopping and piping failure.

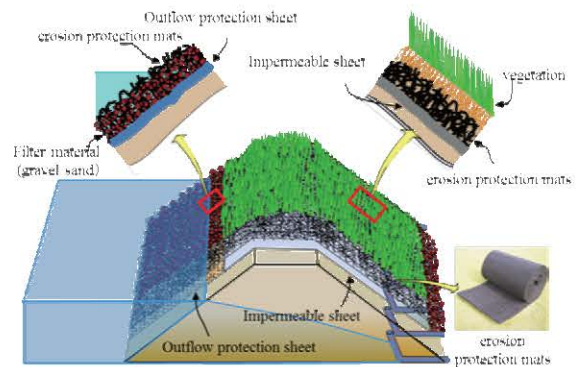


Fig. Model of the surface cover method

[Reference]

Countermeasure of small earth dams against heavy rainfall by the Surface Cover Method, Geosynthetics Technical Information. vo.28, 2012

## 26. Salt removal from a tsunami damaged paddy field based on a field survey

[Keywords]

The 2011 off the Pacific coast of Tohoku Earthquake, tsunami damaged paddy field, salt removal from farmland, irrigation management, sludge treatment, weed control

[Abstract]

To remove salt from a tsunami damaged paddy field, irrigation management should be done over an area wider than a field block. In addition, the salinity concentration of irrigation water should be monitored in an area with a cyclic irrigation system. As a measure for sludge resulting from a tsunami, calcareous materials that do not contain sulfuric acid is recommended. Weed control should be continuously carried out especially against weeds with high salt tolerance at the suitable time.

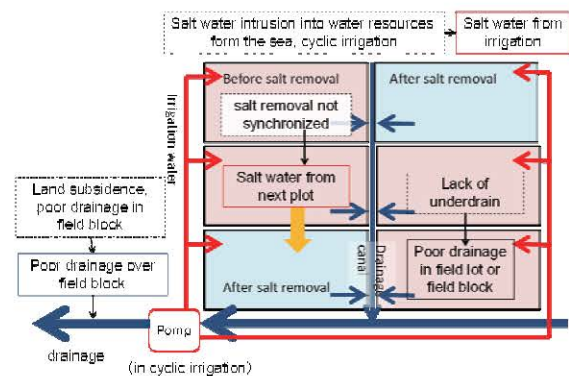


Fig. Causes for insufficient salt removal from tsunami damaged paddy fields.

## 27. Modeling of Basin-wide Water Circulation Incorporating Water Allocation and Management Schemes in Large Irrigated Paddy Areas

[Keywords]

Distributed water circulation model, Paddy irrigation, Water allocation and management, Irrigation facilities, Agricultural water circulation

[Abstract]

We developed a distributed water circulation model incorporated with reservoir operation, and water allocation and management schemes. The water allocation and management schemes contain algorithms configured to account for water intake, allocation, and drainage of irrigated paddies. Integration of these schemes into a distributed water circulation model enabled us to obtain detailed representation of water availability and allocation in large irrigated paddy areas.

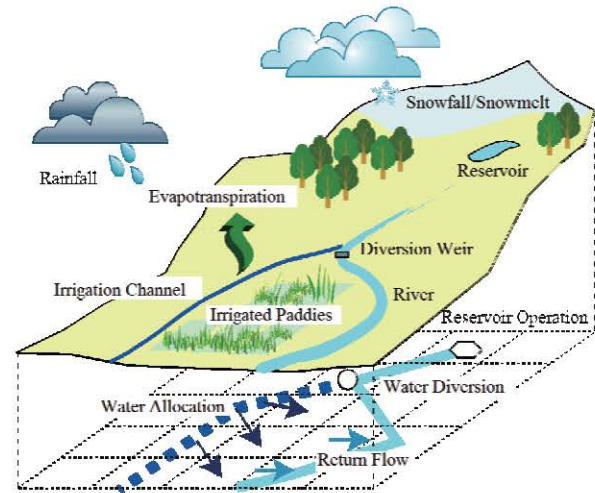


Fig. Schematic representation of the components of water allocation and management schemes in irrigated paddy areas

[Reference]

- 1) Yoshida *et al.* (2012): IDRE Journal, 277, 9-19.
- 2) Yoshida *et al.* (2012): IDRE Journal, 277, 21-29

## 28. Technique to design a multipurpose regulating pond that can utilize existing farm pond enabling an elastic water supply

[Keywords]

Water demand fluctuation, farm pond, rigidity theoretical model, closed circuit analysis, genetic algorithm.

[Abstract]

Water demand fluctuation may be dealt with by optimizing the selection of pump characteristics and operating time in the existing farm pond to minimize invalid discharge quantity and pump electrical charges.

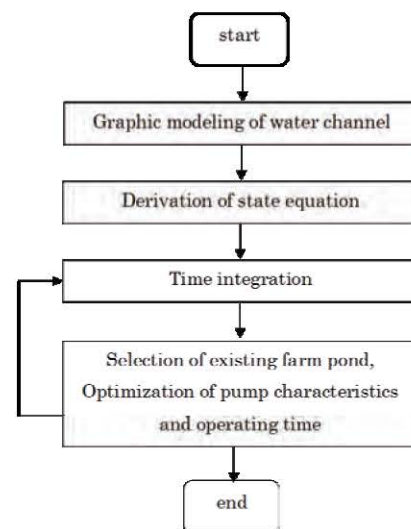


Fig. Flowchart of proposed technique design

## 29. Scenario for analyses of a reduction in pollutant load discharged from a watershed by recycling of treated water for irrigation

[Keywords]

Nitrogen, phosphorus, organic matter, sewage treatment, irrigation, distributed system model

[Abstract]

A model in which a river model was layered on a distributed model (double-layered model) was developed to analyze the transport of water and pollutants in watersheds and rivers. Scenarios for recycling sewage treated-water into agriculture to reduce pollutant load discharge were analyzed. The results showed that irrigating paddy fields with sewage-treated water could contribute to reducing pollutant loads with reductions in BOD, nitrogen and phosphorus ranging from 6%–36%, 16%–46%, and 18%–51%, respectively. Further studies are required on the effects of recycled water on crop cultivation and soil conditions for safe implementation.

[Reference]

Shiratani, E., Y. Munakata, I. Yoshinaga, T. Kubota, K. Hamada and T. Hitomi (2010) Scenario analysis for reduction of pollutant load discharged from a watershed. *Journal of Environmental Sciences*, 22(6), pp.878–884.

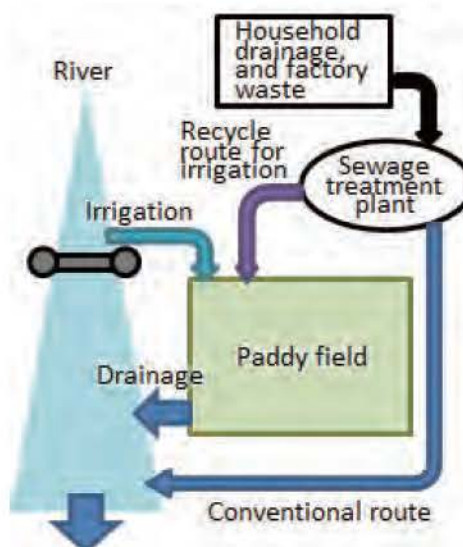


Fig. Water and pollutant flow in a watershed basin

## 30. Reuse of abandoned farmland by planting barley in a Mountainous and Hilly Area

[Keywords]

Mountainous and Hilly Area, barley, abandoned farmland, malting, direct selling, tasting, information about barley products

[Abstract]

Farmers can reuse abandoned farmland by planting barley, malting the barley, and selling the products directly to consumers. Two important conditions are necessary. First, farmers have to stimulate the demand for barley. Second, the farmers' drive to produce barley is improved by agricultural income that is appropriate for the production costs.

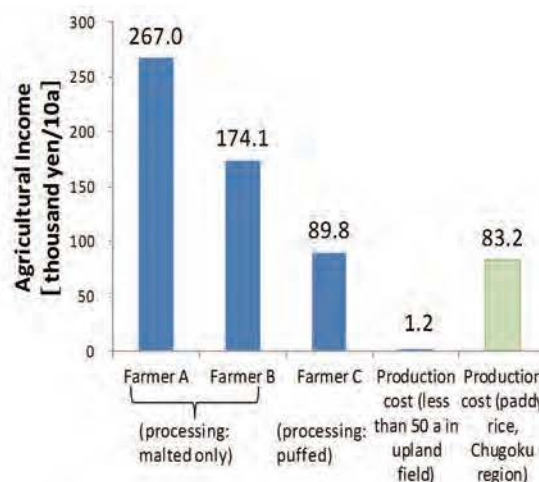


Fig. Agricultural income from barley production and sales

### 31. Recovery of Idle Farmlands through CSA with Citizen Participation

[Keywords]

Community Supported Agriculture (CSA), Citizen Participation, Recovery of Idling Farmlands, Organic Products

[Abstract]

Community Supported Agriculture is a support system for rural agriculture with cooperation between farmers and consumers. CSA promotes communication between farmers and consumers in urban areas. CSA establishes sustainable agriculture by acquiring citizen participation in farm activities such as farm work and collection of products, and shows an effect on the recovery of idle farmlands.

Year	Progress of the activities	Farmland size
1990s	• A resident of the city tried making compost with fallen leaves from a park.	
2001	• Started a local currency circle in Yamato City.	
2002	• Issued local currency to collect fallen leaves.	
2003	• Started a farm to produce sweet potatoes with compost. Farm exchanges of the harvest made with local currency.	5a
2005	• Farm produced various vegetables, and sold them to a users group.	10a
2006	• CSA was established to simplify accounting operations.	130a
2008	• Core member of farm organized users group and facilitated communication among the members.	230a
2010	• Farm was converted to a joint-stock corporation, and direct selling started at the pickup point.	190a

Table Activities of Nanairobatake Farm in Yamato City, Kanagawa Prefecture

### 32. Compilation of local agricultural history to encourage the promotion of regional understanding on local agriculture

[Keywords]

Regional resources, compilation of the agricultural history, promoting agricultural production, residents' participation

[Abstract]

The use and compilation of local agricultural history by resident participation from the perspective of history and geography of regional resources is helpful for facilitating the understanding of people and promotion of local agriculture. Advertising the local agricultural history in and out of the region is helpful for promoting agricultural production and brand power making for effective use of farmland.



Fig. Local agricultural history, "The Story of Cabbage in Iwate"

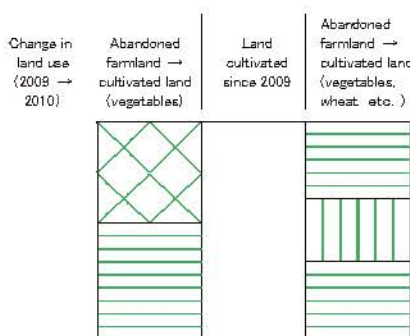
### 33. Reclamation of abandoned farmland cooperated with social welfare institutions in rural areas

[Keywords]

Abandoned farmland, vocational rehabilitation through farm work, social welfare for people with disabilities, regional resources utilization

[Abstract]

Abandoned farmlands were utilized as fields for vocational rehabilitation of people with intellectual disabilities through farm work. The utmost area of reclaimed farmland is 2,400 square meters in this study. Users of social welfare institutions have an opportunity to improve their social adaptability.



Notes: each pattern shows different landowner  
 Field in 2009 (930 m<sup>2</sup>)  
 Five fields (1,475 m<sup>2</sup>) added for a total of 2,405 m<sup>2</sup> in 2010

Fig. Enlargement of reclamation areas of abandoned farmland

### 34. Local resource information management system for smoothly advancing management of farmland and agricultural water channels

[Keywords]

Farmland and agricultural-use channel maintenance engineering subsidy, Geographic information system, Extension of life-span, Check and repair

[Abstract]

Management actions are required to extend the life-span of farmland and agricultural water channels. A system that shares information on institutions for this purpose is also needed. If this system is used, local residents can perform local resource preservation more easily using check / repair history charts from institutions or a scene and living organism habitat distribution chart.

[Reference]

Tokuji Yamamoto(2011), Development of GIS technology for utilizing local resources, vol74, Japan Engineering Association of Survey and Design for Rural Development

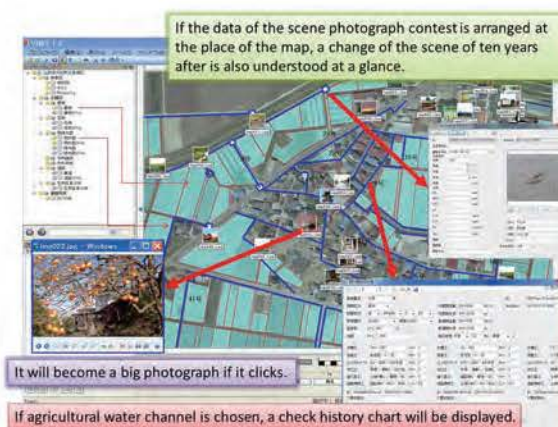


Fig. The chart for farmland and agricultural-use channel maintenance, and the display screen on VIMS (GIS)

### 35. Method for evaluating hydropower potentials and associated project costs for irrigation dams

[Keywords]

Small-scale hydropower generation, irrigation dam, renewable energy, water management, economic evaluation.

[Abstract]

We developed a method for evaluating hydropower potentials and associated project costs when a small hydropower plant is annexed to an irrigation dam, which often has discharges and dam water levels changing with the seasons. The method can assess the tradeoffs between electrical energy maximization and cost minimization, which is a distinctive problem for hydropower projects with irrigation dams. By applying the results of our case studies to other major irrigation dams in the Tohoku region of northern Japan, we are able to evaluate the monthly changes in electrical energy generation potential in the region (Fig.).

[Reference]

Ueda, T., Goto, M., Namihira, A. and Hirose, Y. (2013) Perspectives of Small-scale Hydropower Generation Using Irrigation Water in Japan, JARQ, 47(2), in print.

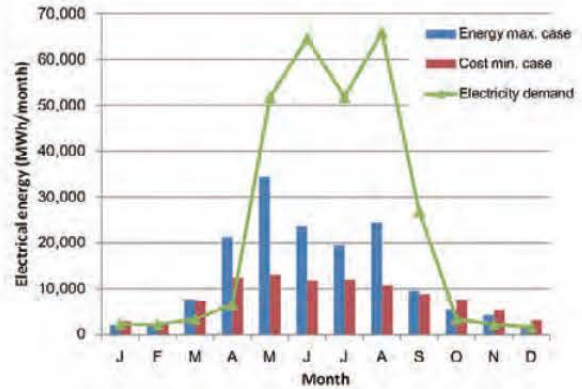


Fig. Estimated monthly hydropower potential and electricity demands for agriculture in the Tohoku region

### 36. Existence Factors and Utilization of Irrigation Water Wheels

[Keywords]

Historical-irrigation-facility, Pump-irrigation

[Abstract]

Merits for using Irrigation-Water-Wheels (IWWs) include low-cost and easy to maintain when compared to pumps. However, if the flow velocity is too small, rotation is not obtained and they cannot be used. Reasons for abolition of IWWs are the rice acreage reduction policy, land improvement projects and other factors.

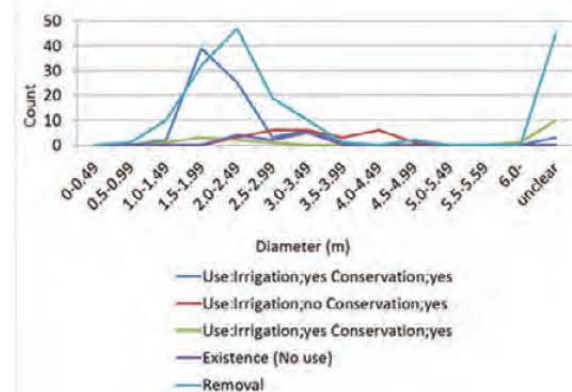


Fig. Frequency of IWWs diameter for different utilizations

### 37. Index of small scale hydropower cost analysis for irrigation facilities

[Keywords]

Small-scale hydropower generation, land improvement project, cost analysis, unit construction cost

[Abstract]

When small scale hydropower is used for land improvement by an institution, maximum output, annual total production of electricity, unit construction cost per kW, unit construction cost per kWh, relationship of redemption years and selling price of electricity are effective indexes to judge the propriety of construction implementation.

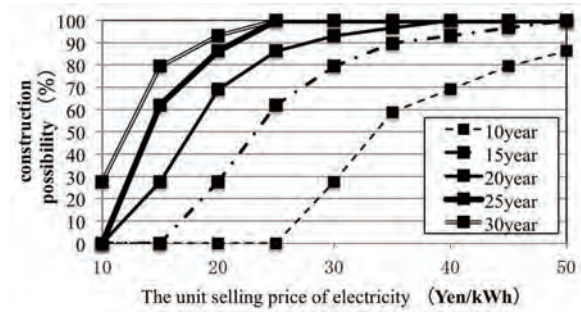


Fig. Relationship between the unit selling price of electricity and possibility of construction

### 38. Method to distinguish parcels planted with rice using ALOS satellite AVNIR-2 data and paddy parcel boundary data

[Keywords]

ALOS satellite, Paddy parcel, Rice planting, Remote sensing

[Abstract]

Image data from an AVNIR-2 sensor of the ALOS satellite is used to distinguish a paddy parcel. First, the pixels of the AVNIR-2 image are classified into 40 classes using an unsupervised classification method (①). Next, the 40 classes are integrated by subjective judgment into 2 classes according to whether rice is planted in the paddy fields (②). Last, the parcels planted with rice are extracted by overlaying the image data of the integrated classification with paddy parcel boundary data, and consolidating the integrated classification results for each parcel (③).

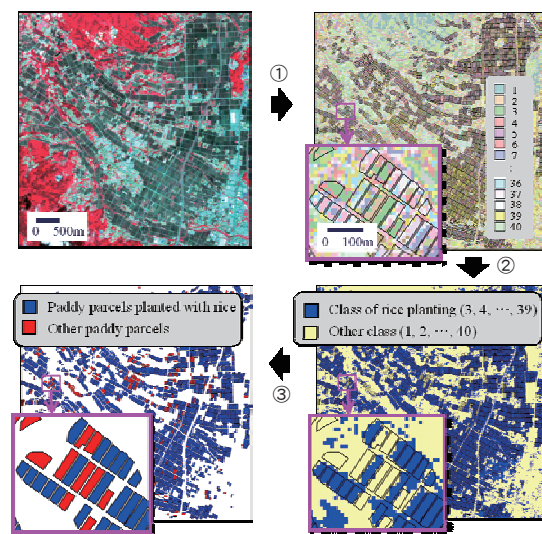


Fig. Flow of method to distinguish parcels planted

### 39. Removal of radioactively contaminated topsoil from agricultural fields using soil hardener

[Keywords]

Radioactive materials, decontamination, removal of radioactively contaminated topsoil, soil hardener, an excavator

[Abstract]

We developed a practical method for decontamination of radioactively contaminated topsoil in agricultural fields. The first step of the method is to harden the thin surface soil with soil hardener mainly consisting of MgO. The second step is to remove the thin surface soil by lateral motion of the bucket of an excavator. The final step is to suck up the removed soil with a vacuum. This method allows for effective decontamination of radioactively contaminated topsoil with a smaller amount of soil removed.



Fig. Removing radioactively contaminated topsoil by a newly developed method

[Reference]

IAEA: Final Report of the International Mission on Remediation of Large Contaminated Areas Off-site the Fukushima Dai-ichi NPP 7-15 October 2011, Japan, pp.36~37

### 40. Distribution of radioactive cesium concentration in vertical profile and particle size fractions of a paddy field soil

[Keywords]

Radioactive cesium, paddy soil, vertical profile, particle size fractions

[Abstract]

Radioactive cesium diffused by the Fukushima Daiichi NPP accident exists mostly within 0 to 2.5 cm of the soil layer in an undisturbed paddy field. Concentration of radioactive cesium in the clay fraction is greatest among the four particle-size fractions of soil.

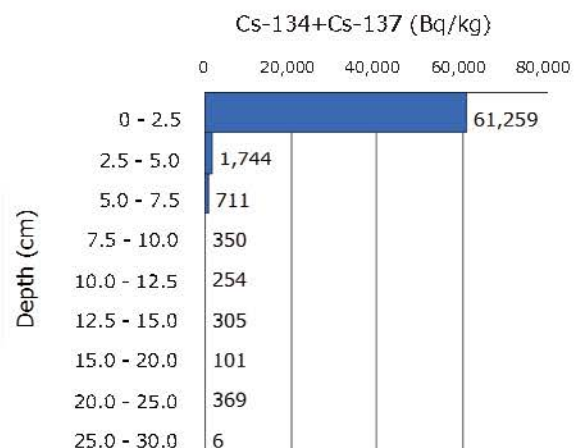


Fig. Distribution of radioactive cesium in a vertical profile of a paddy field soil.



## 41. Decontaminating paddy soil contaminated with radioactive materials by water agitation and soil removal

### [Keywords]

Paddy decontamination, radioactive cesium, agitation,

### [Abstract]

Methods for physical removal of radioactive cesium from paddy field soil were developed. The technologies that were devised and developed were tested on paddy fields in Iitate Village, Fukushima Prefecture.

Removal via soil agitation using water were demonstrated onsite. Paddy field cesium concentration (0-15 cm) was reduced from an average of 16,052 Bq/kg to 9,859 Bq/kg (attenuation ratio: 39%).

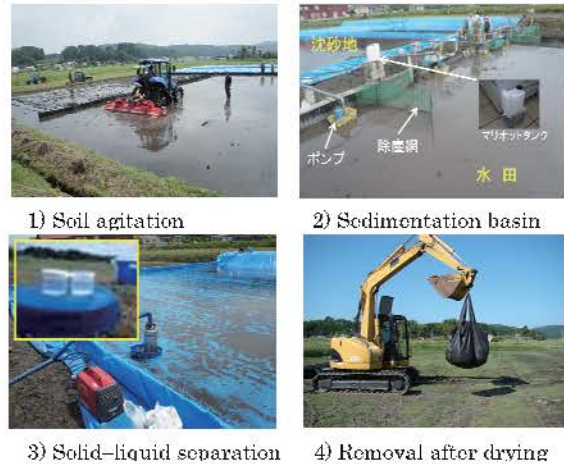


Fig. Steps in soil agitation (Iitate-mura, Aug. 2011)

## 42. Low-cost supplementary drainage method for enhancing field drainage

### [Keywords]

Upland crop, productivity enhancement, subsurface drainage, supplemental drainage with filling, low-cost

### [Abstract]

In a single run with a new machine, straw and other organic materials scattered on the ground after harvesting are deposited under a layer of soil. The new tool “Cutting drain” is inserted and cuts into the subsoil, after which it removes blocks of soil. Organic materials scattered on the ground are inserted under the soil in a single operation. Subsurface drainage through the filling can enhance the yield of upland crops. The construction costs of this new method are lower than conventional methods.



Fig. Overview of “Cutting drain” method

### [Reference]

Kitagawa et al, (2010) Water, Land and Environmental Engineering, 78(11), 899-902.

### 43. “Disaster Reduction Information System for Earth Dam” provides real-time disaster reduction information

[Keywords]

Earth dam, real-time information, disaster reduction

[Abstract]

This system enables the provision of information on disaster reduction, such as the inundation analysis results and degree of real-time danger of earth dams, to local governments and residents through mobile phone mails or homepage messages. Using this system, improvement in the regional ability of disaster prevention and reduction are expected, while supporting the prioritization of disaster prevention measures and appropriate evacuation judgments and behaviors.

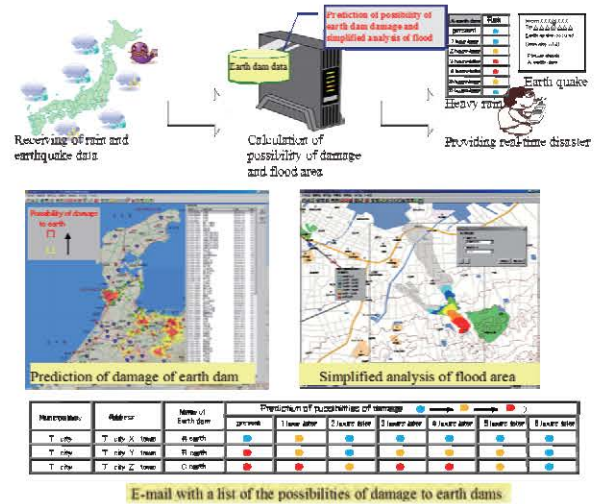


Fig. Disaster Reduction Information System for Earth Dam

**Edited and Published**

**National Institute of Rural Engineering (NIRE)**

**2-1-6, Kannondai, Tsukuba City, Ibaraki Prefecture 305-8609 JAPAN**

**Copyright (C) 2013 NIRE All Rights Reserved.**

**Please contact us directly by e-mail with the contact information below.**

-----

**Information and Public Relations Section**

**National Institute of Rural Engineering (NIRE)**

**e-mail: [nkk-web@ml.affrc.go.jp](mailto:nkk-web@ml.affrc.go.jp)**