Climate Change Responses for Agricultural Water Management and Institutional Activities in South Korea

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- Climate Change in Korea
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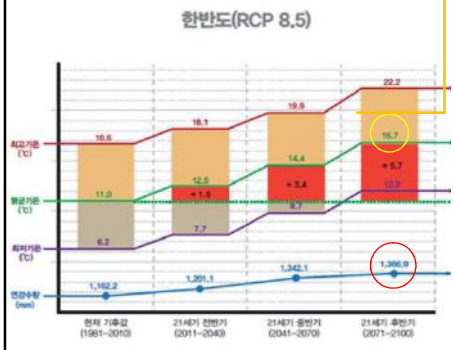
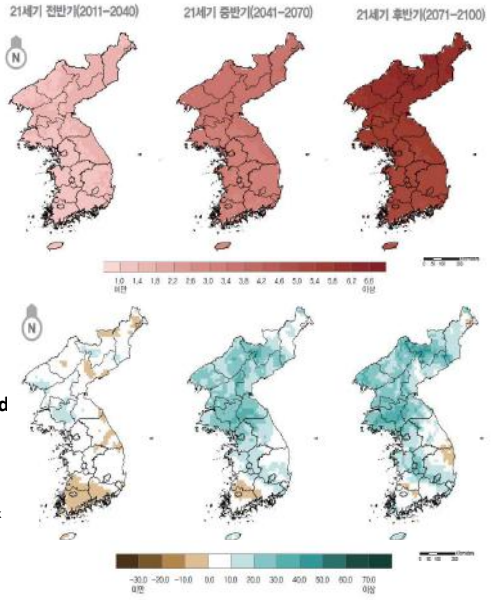
Climate Change Impacts on Korean Peninsula

Yearly Mean Temp increase.
25s: 1.0-1.8
55s: 3.4-4.2
85s: Above 5.4





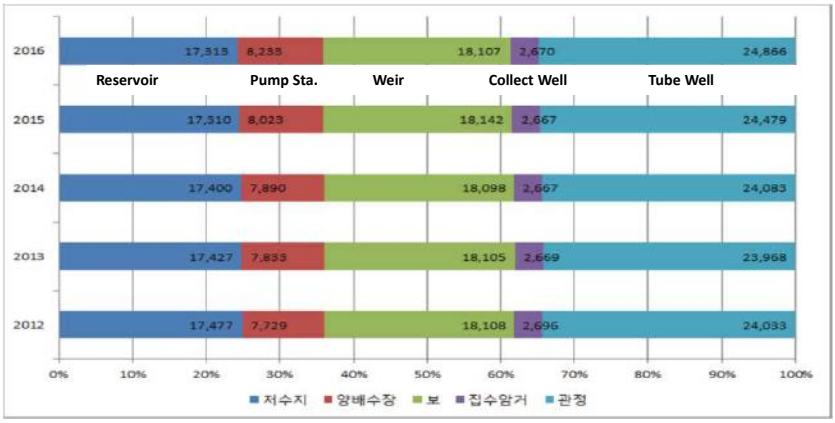
Yearly Rainfall

3.9 times of global average increase, and
3.5 times of East Asia average increase

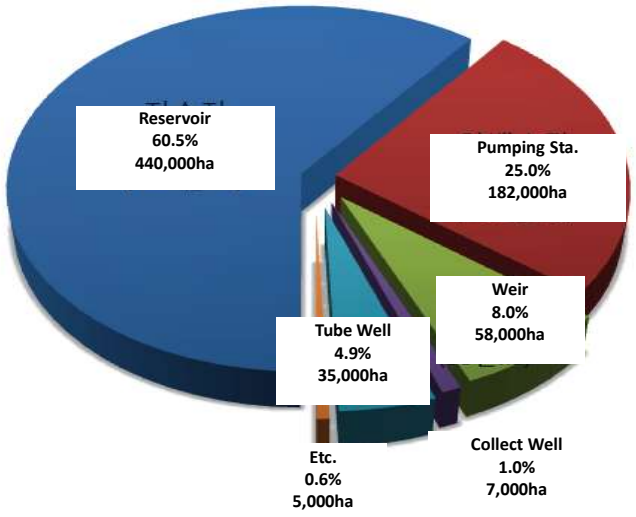
Source: KMA, 2013, Korean Peninsula Climate Change Outlook

Status of Irrigation Structures

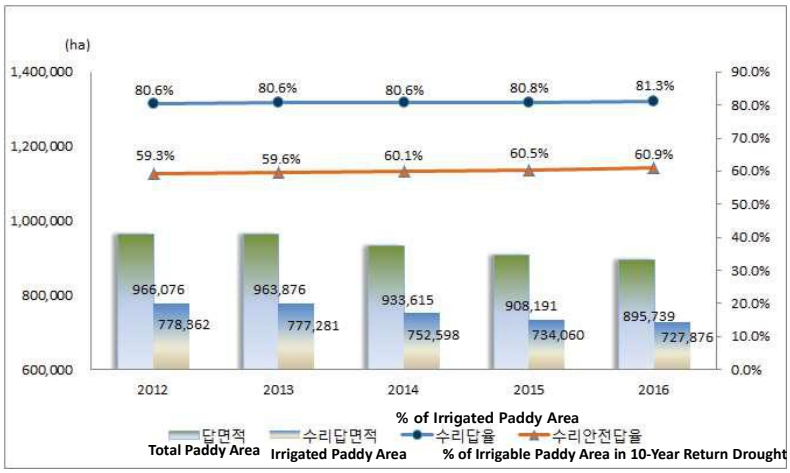
	Number of Irrigation Structures					
	Total	Reservoir	Pumping Station	Weir	Collecting Well	Tube Well
Total	71,746	17,401	7,890	18,098	2,667	24,083
KRC	13,763	3,379	4,357	4,152	308	1,413
Local Govern.	57,983	14,022	3,533	13,946	2,359	22,670



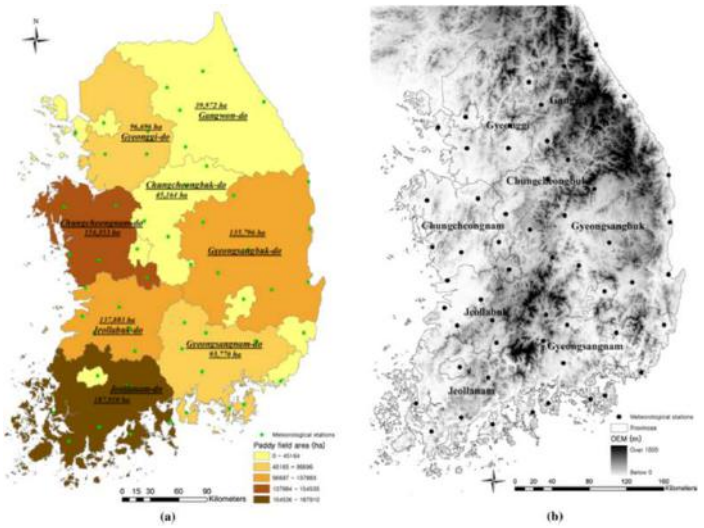
Ratio of Irrigated Paddy Area for Each Irrigation Structures.



Ratio of Irrigated Paddy Area

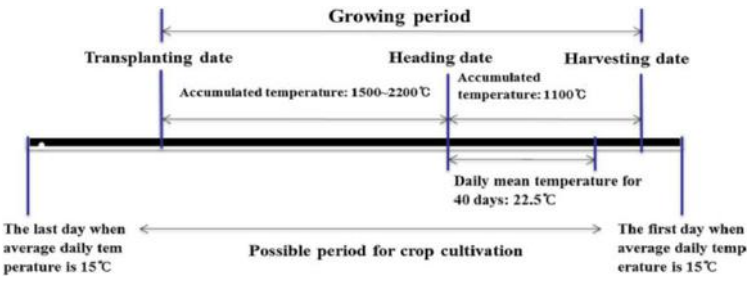


Paddy field areas in eight provinces, elevation and 54 meteorological stations



Sang-Hyun Lee, Seung-Hwan Yoo, Jin-Yong Choi, Bernard A. Engel, 2016, Effects of climate change on paddy water use efficiency with temporal change in the transplanting and growing season in South Korea, Irrigation Science, Vol. 34(443-463)

Process of optimal paddy rice phenology based on accumulated temperature (Park and Lee 2005; Yoo et al. 2013)



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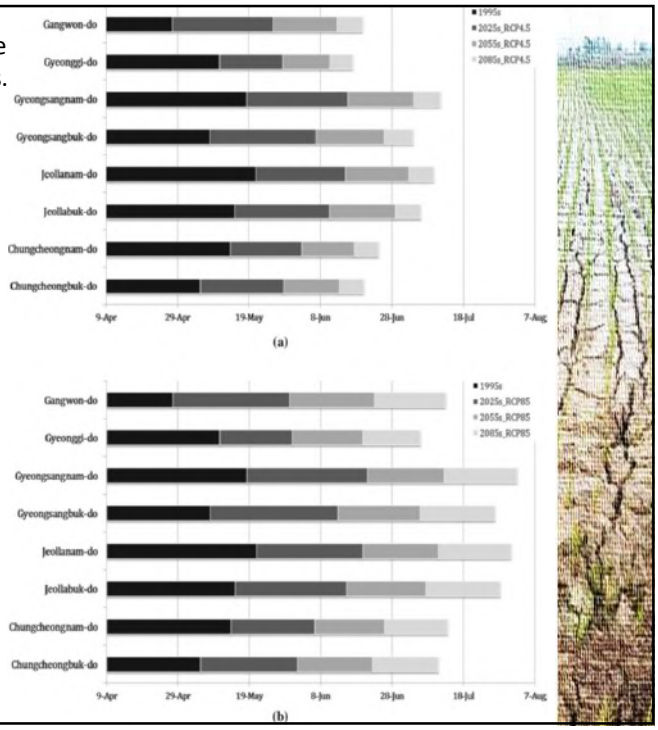
Optimal transplanting date from 1995 to 2085 periods.

(a) RCP 4.5 scenario

(b) RCP 8.5 scenario



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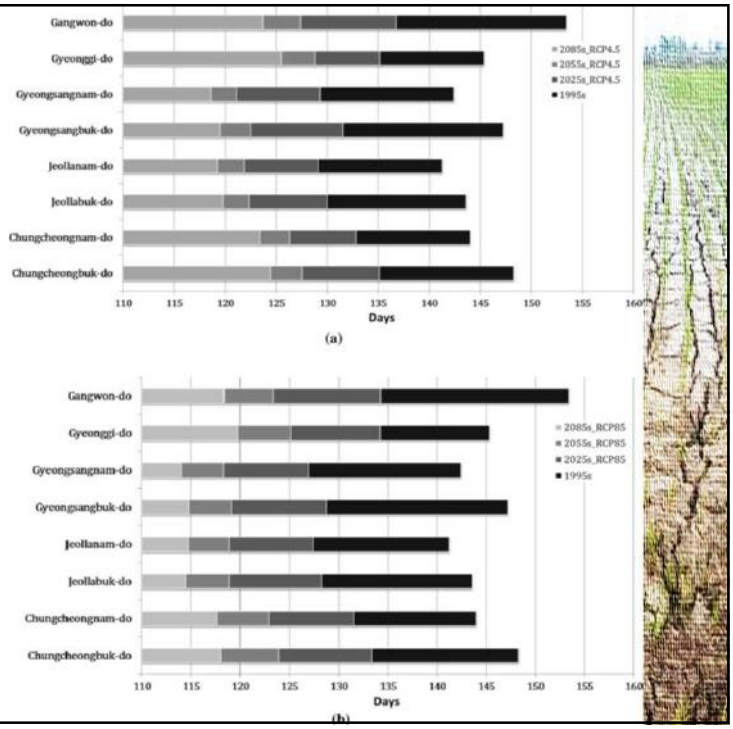
Optimal growing period from 1995 to 2085 periods.

(**a**) RCP 4.5 scenario

(**b**) RCP 8.5 scenario



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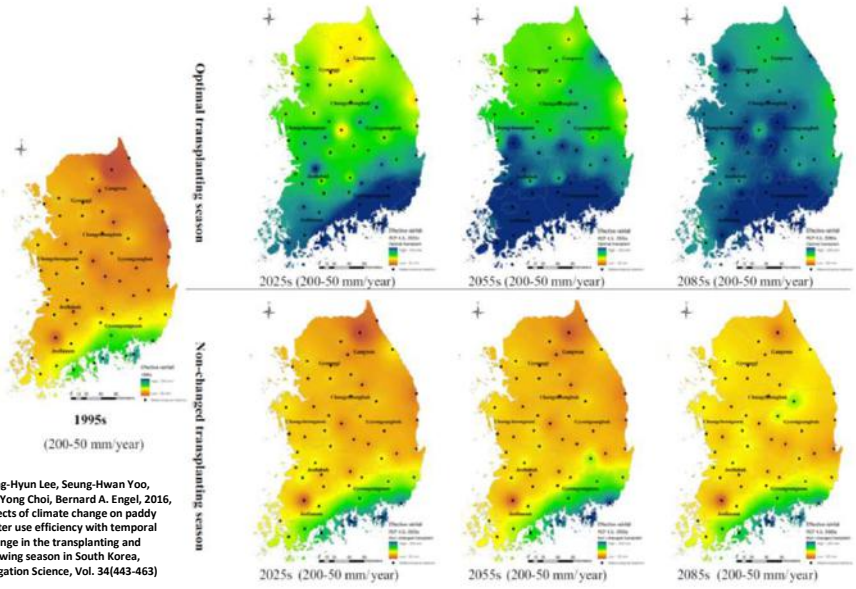
Distributed effective rainfall under the RCP 4.5 scenario during the optimal and non-changed transplanting season



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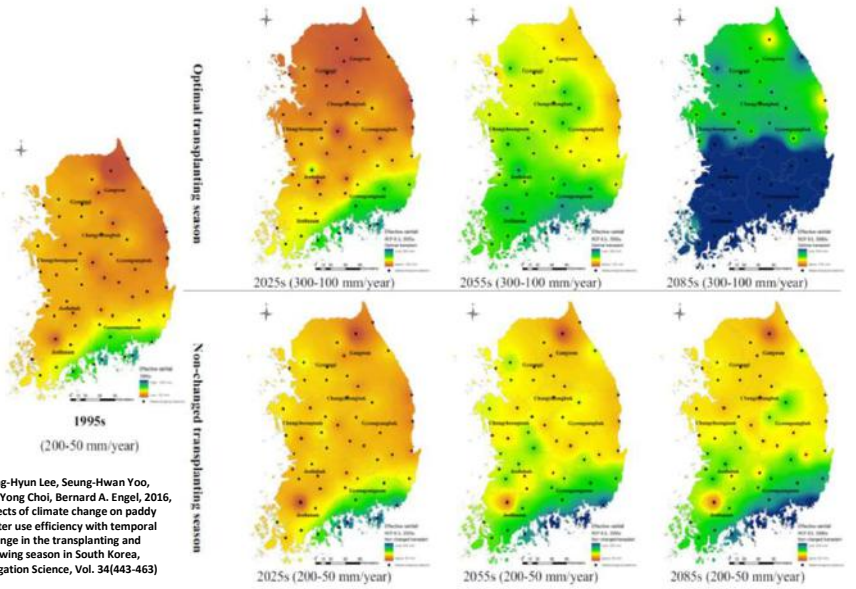
Distributed effective rainfall under the RCP 8.5 scenario during the optimal and non-changed transplanting season



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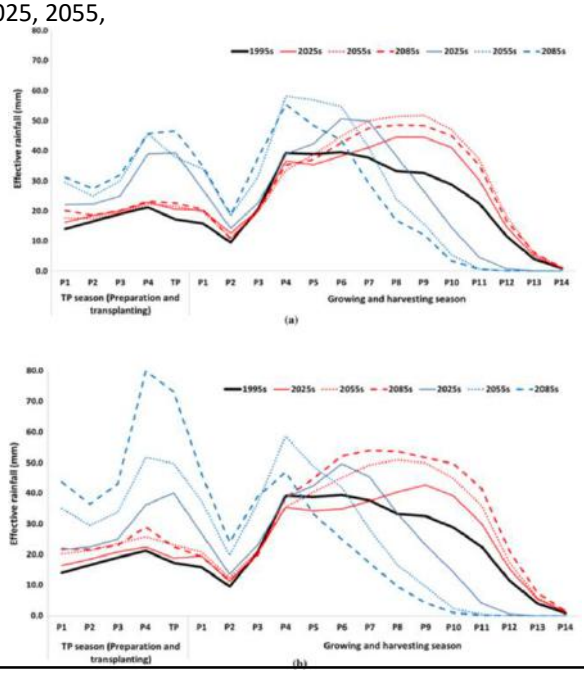
Average effective rainfall for every 10 days in the 1995, 2025, 2055, and 2085 periods.

(a) RCP 4.5 scenario

(b) RCP 8.5 scenario



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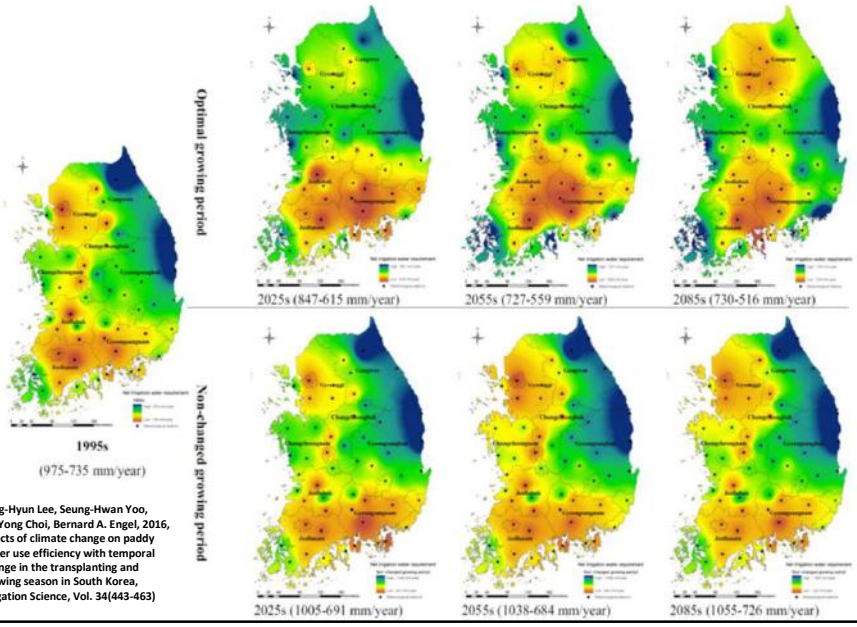
Distributed net irrigation water requirement under the RCP 4.5 scenario during the optimal and non-changed growing periods



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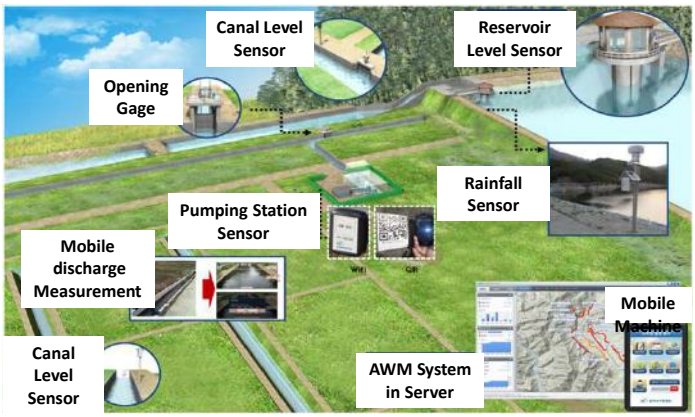
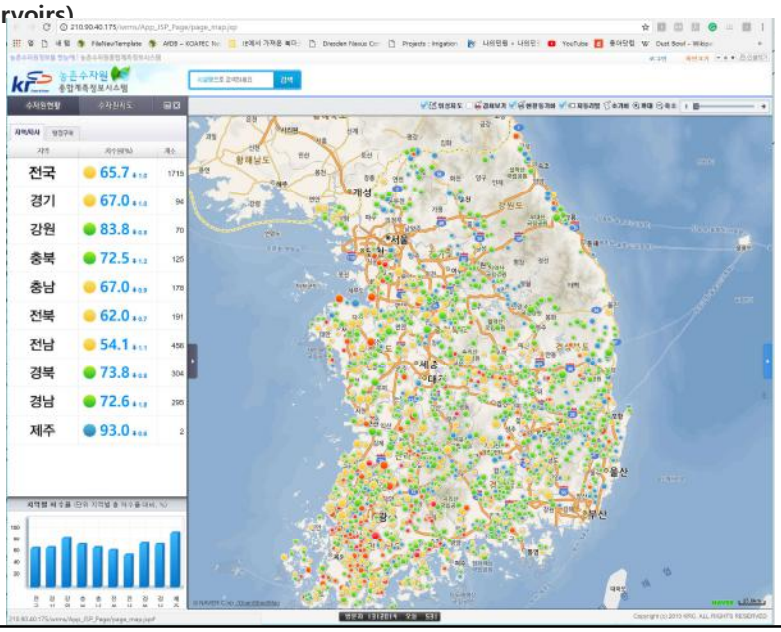
Climate Change Response Efforts for Agricultural Water Management in Korea

- ICT Application for Agricultural Water Management

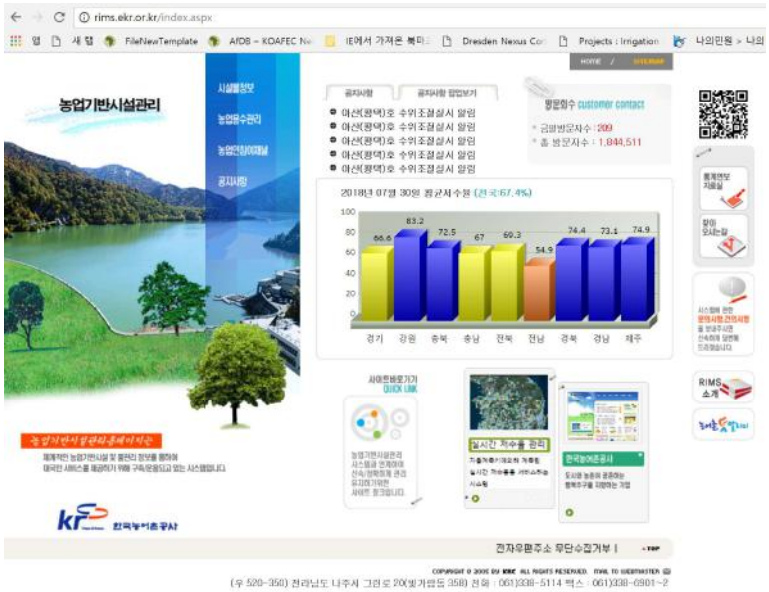


Field instrument for Irrigation Water Monitoring

Nationwide Reservoir Storage Monitoring (1,600 Reservoirs)



Nationwide Irrigation Structures Management (Database and Water Management Monitoring)



Institutional Activities: Legal Activities

- Act
  - Framework Act on Agriculture and Fisheries, Rural Community, and Food Industry (2014)
  - Article 41(Measures against Agricultural and Fishery Disasters, etc.)
    - Defined climate change as a natural disaster and government and local government have a duty for response to it
  - Article 47(Prevention of Global Warming, etc.)
    - Government and local government have a duty for prevention activities of global warming and climate change mitigation. They have to prepare a policy and implement it.
  - Article 47-2 (From 2015 June)
    - Minister of MAFRA (Ministry of Agriculture, Food and Rural Affairs): Every 5 years: Investigation, evaluation and announcement of CC impacts and vulnerability of rural and agriculture to assist policy making as using basic data
    - Investigation implementation for collecting basic information of climate change impact assessment

Reliable Ministry of Government legislation
NATIONAL LAW INFORMATION CENTER

Institutional Activities: Legal Activities

- Enforcement Ordinance of the Framework Act on Agriculture and Fisheries, Rural Community, and Food Industry : Article 19-2 (2015 Dec.)
  - Allocate the climate change response activities into three institutions
  - Agricultural Sector: Rural Development Administration

    Rural Development Administration
  - Forestry Sector: Korea Forest Service

    Korea Forest Service
  - Agricultural water and infra structures: KRC is the key institution for the cc investigation and vulnerability evaluation

    Korea Rural Community Corporation

Reliable Ministry of Government legislation
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Institutional Activities: Implementing Activities by KRC

- Based on the Enforcement Ordinance of the Framework Act on Agriculture and Fisheries, Rural Community, and Food Industry : Article 19-2 (2015 Dec.)
- KRC (Korea Rural Community Corporation) made a "Climate change response division" under the "Project Planning Office"
- KRC had prepared an AIS climate change impact assessment master plan in 2017
- Based on the master plan, a project for AIS impact assessment investigation is implementing in KRC and KSAE (Korea Society of Agricultural Engineers) in 2018.

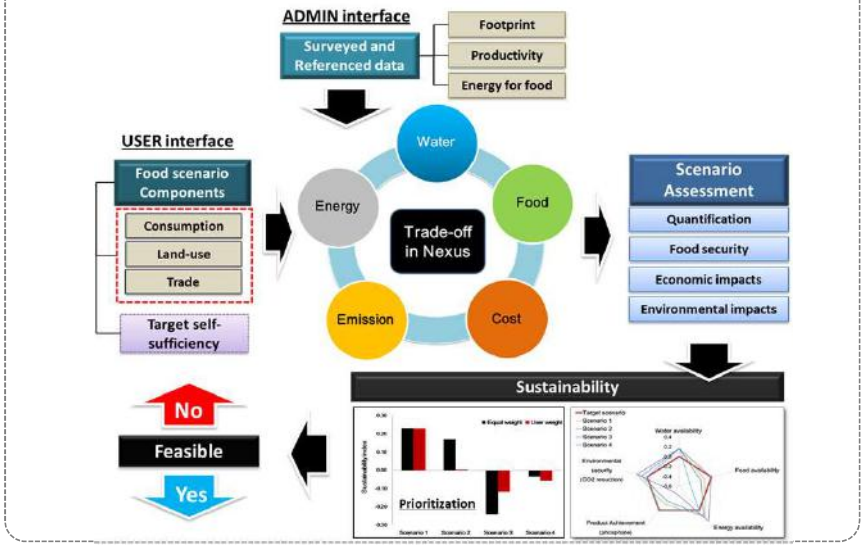
한국농공학회 Korean Society of Agricultural Engineers Korea Rural Community Corporation

SNAK (Smart Nexus for Agriculture in Korea)

- RDA (Rural Development Administration) has launched a project of agricultural water-energy-food Nexus considering of climate change, named as SNAK (Smart Nexus for Agriculture in Korea) in 2018
- Six institutions are involved
  - RDA ((Rural Development Administration)
  - Seoul National University
  - Chonnam National University
  - KREI (Korea Rural Economic Institutes)
  - RRI (Rural Research Institute, KRC)
  - ISTEC (private firm)
- From SNAK project, Nexus tool development for understanding of relationships and trade-offs between the key resources – water-energy-food – and sustainability analysis under climate change regime are expected.

Rural Development Administration 서울대학교 SEOUL NATIONAL UNIVERSITY 전남대학교 CHONNAM NATIONAL UNIVERSITY KREI Korea Rural Economic Institute RRI Rural Research Institute ISTEC

Development of Water-Energy-Food Nexus for assessing impacts of food policy, trade, and land-use on national resource security



SNAK (Smart Nexus for Agriculture in Korea)

Government Institute

RDA
Rural Development Administration

University

SNU
Seoul National University

CNU
Chonnam National University

SNAK (Smart Nexus for Agriculture in Korea)
Climate Change Impact on Water-Energy-Food Nexus in Agriculture

Institutes

RRI
Rural Research Institute, KRC

KREI
Korea Rural Economic Institute

ISTEC
Private Firm

Private Sector

Rural Development Administration | 서울대학교 SEOUL NATIONAL UNIVERSITY | 전남대학교 CHONNAM NATIONAL UNIVERSITY | KREI Korea Rural Economic Institute | RRI Rural Research Institute | ISTEC

- RDA: Project implementation and data inventory development for SNAK
- SNU: integrated biophysical model development and climate change coupling for SNAK
- CNU: Scenario-based nexus platform (SNAK) design, development, and application of climate change impacts
- KREI: Integrating economic and biophysical model to evaluate the effects of climate change and its related policies
- RRI: Data based evaluation bed construction for SNAK application to climate change responses
- ISTEC: Development nexus DSS and digital inventory development

* **SNAK (Smart Nexus for Agriculture in Korea)**

Conclusions

- Korea is one of the climate change vulnerable country in which it has been affecting severely than other region in terms of temperature rising and it is reported that temperature rising will be faster in the next 100 years than before.
- Agriculture including paddy rice cultivation for staple food supply also a quite vulnerable sector to climate change so that seamlessly climate change impacts on agricultural water management has to be investigated. In this presentation, agricultural water management (AWM) responses and institutional activities in terms of impacts and legal actions to climate change are introduced.
- In the AWM aspects, crop water requirement and effective rainfall change based on GCM data considering crop season change due to temperature rising is presented to figure out climate change response measures.
- According to the results, the transplanting and harvesting dates are quite delayed due to temperature rising and the effective rainfall distribution along the growing periods are transformed to the late growing season because of altering of rainfall distribution pattern.
- The nationwide crop water requirement distribution also changed about the RCP 4.5 and 8.5 scenarios demonstrating demands of appropriate climate change responses.

Conclusions

- Institutional activities are activated under consideration of climate change impacts on AWM and AWM facilities. In the legal aspect, climate change impact assessment for agriculture, forestry and agricultural infra structures (AIS) has to be implemented every 5 years as mandated in Agricultural, Rural and Food Industry Framework Act.
- KRC (Korea Rural Community Corporation) had prepared for AIS climate change impact assessment master plan in 2017, and is implementing projects for the AIS impact assessment investigation by KRC and KSAE (Korea Society of Agricultural Engineers).
- RDA (Rural Development Administration) has launched a project of agricultural water-energy-food Nexus considering of climate change, named as SNAK (Smart Nexus for Agriculture in Korea) in 2018 and six institutions are involved with RDA, Seoul National University, Chonnam National University, KREI (Korea Rural Economic Institutes), RRI (Rural Research Institute, KRC) and ISTEC (private firm).
- From SNAK project, Nexus tool development for understanding of relationships and trade-offs between the key resources – water-energy-food – and sustainability analysis under climate change regime are expected.