Policies to Manage Agricultural Groundwater Use

KOREA

The Republic of Korea is one of the top ten OECD countries in groundwater use for agricultural irrigation. Even if surface water irrigation is used at a much larger scale, groundwater is used relatively intensively in specific regions. National policies managing groundwater are largely focusing on regulatory instruments, with additional programs and some collective management schemes. The case of Jeju Volcanic Island, where agriculture relies solely on groundwater, shows that additional management approaches are used in complement at a lower spatial level.

1. Main national governmental agency responsible for quantitative management of groundwater

<table>
<thead>
<tr>
<th>Institution</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea Institute of Geoscience and Mineral Resource (KIGAM)</td>
<td>Assessment and prediction of groundwater resource according to climate change. Securing groundwater resource through aquifer artificial recharge on water curtain cultivation areas.</td>
</tr>
<tr>
<td>Korea Rural Community Corporation (KRC)</td>
<td>To carry out preliminary feasibility tests, the designing and the administration of irrigation and drainage facilities and groundwater development in rural region with the intent to share our advanced agricultural techniques and experience concerning water resource development. Performance of various groundwater resources management projects: Rural groundwater management sub-project, etc.</td>
</tr>
<tr>
<td>Integrated Groundwater Information Service (GIMS)</td>
<td>Collection, management, analyse of groundwater information, developments and maintenance of the groundwater database and computer system, standardization of groundwater information, support and distribution of information regarding regulations and policies to the national and local governments.</td>
</tr>
</tbody>
</table>
2. Status and use of groundwater resources

- Annual groundwater recharge: 18.4 km³ in 2012.
- Annual groundwater use: 3.7 km³ in 2012.
- Groundwater withdrawals for irrigation: 1.998 km³ in 2012.

3. Inventory of national policies affecting agricultural groundwater use

Recent groundwater management reforms

<table>
<thead>
<tr>
<th>Reforms</th>
<th>Year</th>
<th>Scope and objective</th>
<th>Degree of implementation</th>
</tr>
</thead>
</table>
| Rationalization plan for agriculture water use by Ministry of Agriculture, Food and Rural Affairs | 2014 | --Preparation of an optimal distributional plan of water resources including groundwater against future water shortage in rural regions.  
--Preparation of a plan to meet the demands for the multi-functional water use with considering climate change. | Complete |

Core groundwater management approaches at national level

- Groundwater ownership: Private and public
- Groundwater entitlement characteristics: Permanent, temporary, linked to land rights and transferable
- Beneficiaries of entitlement: Individuals
- Groundwater entitlement allocation doctrine: Reasonable use
## Main types of instruments used to manage groundwater use in agriculture

### Regulatory approaches

<table>
<thead>
<tr>
<th>Groundwater management plans</th>
<th>Collective management approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandated</td>
<td></td>
</tr>
</tbody>
</table>

### Coordination with surface water management
- Limited

### Regulations on wells
- Approval of new wells
- With environment impact assessment
- Groundwater withdrawal restrictions

### Regulations on irrigated land
- Regulations on irrigated areas
- Regulation on the expansion of irrigated areas
- Irrigated land buyout

### Mandated metering or monitoring system for groundwater
- Mandated metering for agricultural and other users (644 monitoring wells)

### Collective management schemes
- Voluntary (self-regulation)

### Other policies and programs affecting agricultural groundwater use

#### Agriculture water conservation programs
- Subsidies

#### Land policies with implications on groundwater use
- Zoning with restriction on groundwater use

#### Climate change adaptation programs
- Investment in agriculture and groundwater R&D
- Groundwater modelling and data development

#### Watershed conservation programs
- Exclusion zone for conservation area
- Limits of groundwater use close to protected areas
- Acquired groundwater entitlements for water conservation

### Supply side management approaches

#### Programs supporting the development alternative water supplies
- Surface water reservoir expansion
- Rainwater harvesting
- Recycled water
4. Agricultural groundwater use at the regional level

**Jeju volcanic Island**

<table>
<thead>
<tr>
<th>Agro-climatic zone</th>
<th>Climate change prospective (2030-2050)</th>
<th>Is groundwater expected to be significantly affected by climate change in 2030-2050?</th>
<th>Surface Irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperate</td>
<td>Wetter, hotter, more frequent droughts</td>
<td>yes</td>
<td>Surface water is not available and not used for irrigation</td>
</tr>
</tbody>
</table>

**Characteristics of the main aquifers in the regional unit**
The Jeju Island, the largest volcanic island in Korea, is 73 km in length and 32 km in width and the topographic elevations are distributed in a centric shape around the Mt. Halla located in the center of the island. Streams, which are developed in topographically steep N-S direction, run only after the heavy rainfall with 50~80 mm/day. Rainfalls easily and rapidly infiltrate into the subsurface due to the high permeable layers such as clinker, cinder cone, and lava tunnel originated from volcanic rocks. Average values of hydraulic conductivity and transmissivity of the permeable layers are 234 m/day and 6,904 m²/day, respectively.

<table>
<thead>
<tr>
<th>Type of aquifer</th>
<th>Geological type</th>
<th>Area</th>
<th>Groundwater reserve</th>
<th>Groundwater recharge rate</th>
<th>Groundwater quality concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed</td>
<td>Volcanic</td>
<td>1 848.85 km² (2012)</td>
<td>0.52483 km³ (2012)</td>
<td>44.5% (2012)</td>
<td>Growing The main type is nitrate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Volume**

<table>
<thead>
<tr>
<th>Groundwater irrigation</th>
<th>Volume</th>
<th>Area</th>
<th>Number of farms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.319044 km³ (2012)</td>
<td>403.51 km² (2012)</td>
<td>37 893 households (2012)</td>
</tr>
</tbody>
</table>

**Trends**

<table>
<thead>
<tr>
<th>Total number</th>
<th>Increase in the past 10 years</th>
<th>Average</th>
<th>Range</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated number of agricultural wells</td>
<td>3 316 (2012)</td>
<td>Slow</td>
<td>Lowering</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

**Evolution of the depth of the water table**

<table>
<thead>
<tr>
<th>Period of intense groundwater development</th>
<th>Minor</th>
<th>Major</th>
<th>Diminishing</th>
<th>Steady</th>
<th>Increasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>► 1990s</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

**Other uses of groundwater**

<table>
<thead>
<tr>
<th>Domestic</th>
<th>Industry</th>
<th>Energy</th>
<th>Minor</th>
<th>Major</th>
<th>Diminishing</th>
<th>Steady</th>
<th>Increasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pumping related external effects**

<table>
<thead>
<tr>
<th>Minor</th>
<th>Major</th>
<th>Growing</th>
<th>Steady</th>
<th>Reducing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓</td>
<td></td>
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Main types of instruments used to manage groundwater use in agriculture

<table>
<thead>
<tr>
<th>Regulatory approaches</th>
<th>Economic instruments</th>
<th>Collective management approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Groundwater management plans</strong></td>
<td><strong>Economic instruments to regulate quantity: pricing</strong></td>
<td><strong>Collective management schemes</strong></td>
</tr>
<tr>
<td>► Mandated</td>
<td>Charges are on pumped water in agriculture</td>
<td>► Voluntary (self-regulation)</td>
</tr>
<tr>
<td><strong>Coordination with surface water management</strong></td>
<td></td>
<td>► Water user associations</td>
</tr>
<tr>
<td>► Limited</td>
<td></td>
<td>► District or community based initiative</td>
</tr>
</tbody>
</table>

**Regulations on wells**

► Approval of new well
  ✓ Accounting for well space restriction
  ✓ With environmental impact assessment

► Groundwater withdrawal restrictions

**Regulation on irrigated land**

► Regulations on irrigated areas
► Regulation on the expansion of irrigated areas
► Irrigated land buyout

**Mandated metering or monitoring system for groundwater**

► Mandated metering for agricultural and other users, 141 monitoring wells

Other policies and programs affecting agricultural groundwater use

**Watershed conservation programs affecting groundwater use**

► Limits of groundwater use close to protected areas

**Energy program**

► Electricity subsidies

Supply side management approaches

**Aquifer recharge programs**

► Aquifer storage and recovery programs

**Programs supporting the development alternative water supplies**

► Surface water reservoir expansion
► Rainwater harvesting
► Recycled water
5. Bibliography

Institutional websites

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- www.groundwater.or.kr
- english.kwater.or.kr
- www.gims.go.kr
- jejuwater.go.kr

Official reports

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- Annual reports for groundwater development, utilization, and monitoring published by Ministry of Land, Infrastructure and Transport
- Annual reports for groundwater development, utilization, and monitoring published by Ministry of Construction and Transportation
- Annual reports for groundwater development, utilization, and monitoring published by Ministry of Land, Transport, and Maritime Affairs
- Annual report for groundwater development in Jeju Special Self-Governing Province (2012)
- Master plan for water resources management in Jeju Special Self-Governing Province (2012)

Additional sources

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