

Background and Objectives

Since the era of Shogun Kiyomasa Kato in the 16th century, the Kumamoto region has benefited from an abundant supply of groundwater. Groundwater accounts for 100% of the water supply in Kumamoto, a figure that is much higher than other Japanese cities. This was made possible by the following factors: 1) Kumamoto owns a large groundwater basin, approximately 600 km²; 2) easy infiltration and huge storage of rainwater due to unique soils layers developed by the volcanic activities of Mt. Aso; and higher annual rainfall in Kumamoto (1990 mm) and near Mt. Aso (3250 mm) compared to the national average of 1720 mm.

However, groundwater faces several challenges. Firstly, groundwater management is not easy for municipal governments, because the groundwater is located across different municipalities and the groundwater itself is not traceable. Secondly, groundwater management is not fully stipulated in the law system in Japan. Groundwater is not explicitly specified as a common good by law, either. Thirdly, the recharging rate of groundwater is lengthy; therefore, it takes long time to recover once it is depleted or contaminated. Lastly, it is still difficult to secure financial sources for management because underground layers are located across different municipalities.

The environment of groundwater has been changing in recent years. The amount of groundwater has decreased due partially to higher water consumption amount per person in Kumamoto compared to other cities in Japan, and also due to urbanization which lowers the infiltration of rainwater. In addition, the quality of groundwater has been deteriorating in some locations, where the concentration of nitrate exceeds the environmental standard.

Therefore, in 2008, the group of 15 municipalities in the region developed the Plan for Comprehensive Control of Groundwater in the Kumamoto Area and identified four prioritized areas:

- Improvement of the balance of inflow and outflow of groundwater,
- Protection and improvement the quality of groundwater,
- Raising awareness of citizens for the conservation of groundwater, and
- Establishment of a common goal among stakeholders.

This profile aims to discuss the challenges of groundwater as a source of water supply, from governance and financial perspectives.

Underground Water Management in Kumamoto City

Project Overview

Local ordinance and master plan for groundwater conservation

Even though the national law does not cover the groundwater system, groundwater management has been conducted in the Kumamoto region based on the Groundwater Preservation Ordinances established in 1977 for Kumamoto City and in 2001 for Kumamoto Prefecture, respectively. They also developed and implemented the Plan for Comprehensive Control of Groundwater in the Kumamoto Area in 1996 taking into account input from 17 municipalities in the catchment area. Although the plan had a positive impact such as raising awareness among stakeholders on the importance of groundwater conservation, it was not effective enough to stop the negative trend of groundwater quantity and quality. Therefore, a second version of Plan for Comprehensive Control of Groundwater in the Kumamoto Area was developed in 2008 by involving not only Kumamoto Prefecture and Kumamoto City, but 13 other municipalities¹ in the catchment as plan development entities. A detailed five-year action plan was also developed the following year in order to implement mitigation measures in a timely manner.

Governance of groundwater management

The ordinances and plan stipulate collaboration among relevant local stakeholders, such as municipal administrative offices, private enterprises, and residents in order to establish a common system for conservation management. The groundwater conservation management system in the Kumamoto region is summarized in Figure 1.

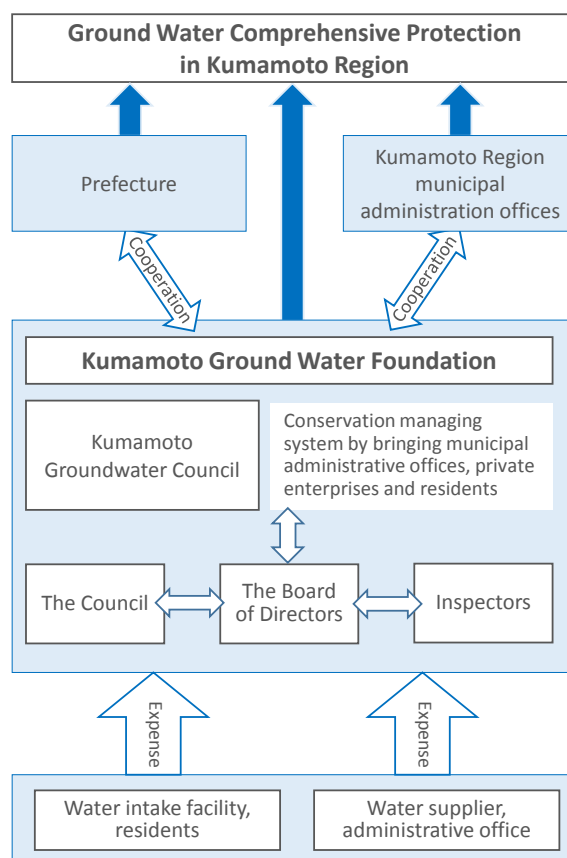


Figure 1: Groundwater conservation management system in the Kumamoto region

Source: Produced by author based on the Case studies of groundwater conservation (in Japanese), Ministry of the Environment, March 2015.
<http://www.env.go.jp/water/jiban/guide/examples.pdf>

Project for recharging groundwater through paddy fields

The Kumamoto prefectural government took the lead in a project to recharge groundwater through paddy fields by forming an agreement among stakeholders in the groundwater basin. The role of each stakeholder (i.e., municipal government, private sector and citizens) in the project was specified by ordinances and master plans. Companies participate in the project as part of their Corporate Social Responsibility (CSR). Companies that withdraw more than 30,000 m³ of groundwater annually are requested to form, implement and monitor a conservation plan in line with the city ordinance and submit a report on the recharge

of groundwater in line with the prefectural ordinance. The project also requests farmers to use fertilizers and treat animal excrement properly in order to decrease the concentration of nitrate.

Financial Schemes

The financial mechanism is an important component to conserve groundwater in Kumamoto. In 1991, the Kumamoto Groundwater Fund was established by Kumamoto City to financially support rainfall infiltration and water catchment forests while the Kumamoto Regional Groundwater Conservation and Utilization Consortium was formed by Kumamoto City together with private companies, etc. in 1995 to financially support water measurements and conduct

advocacy activities for water conservation. Meanwhile, the financial scheme for groundwater management was broken up into three pieces. Mayors of municipalities, the private sector, the prefectural governor and municipal mayors form each organization to individually finance groundwater management. However, in 2009, these organizations were merged into one organization, the Kumamoto Ground Water Foundation. This foundation includes a board, advisory committee, auditor-secretary, and supporting members (Figure 2). The supporting members support the foundation financially. The foundation promotes research for groundwater recharge, groundwater quality, and groundwater conservation. Since 2005, the Kumamoto prefectural government has also introduced a special tax for conservation of water and forests.

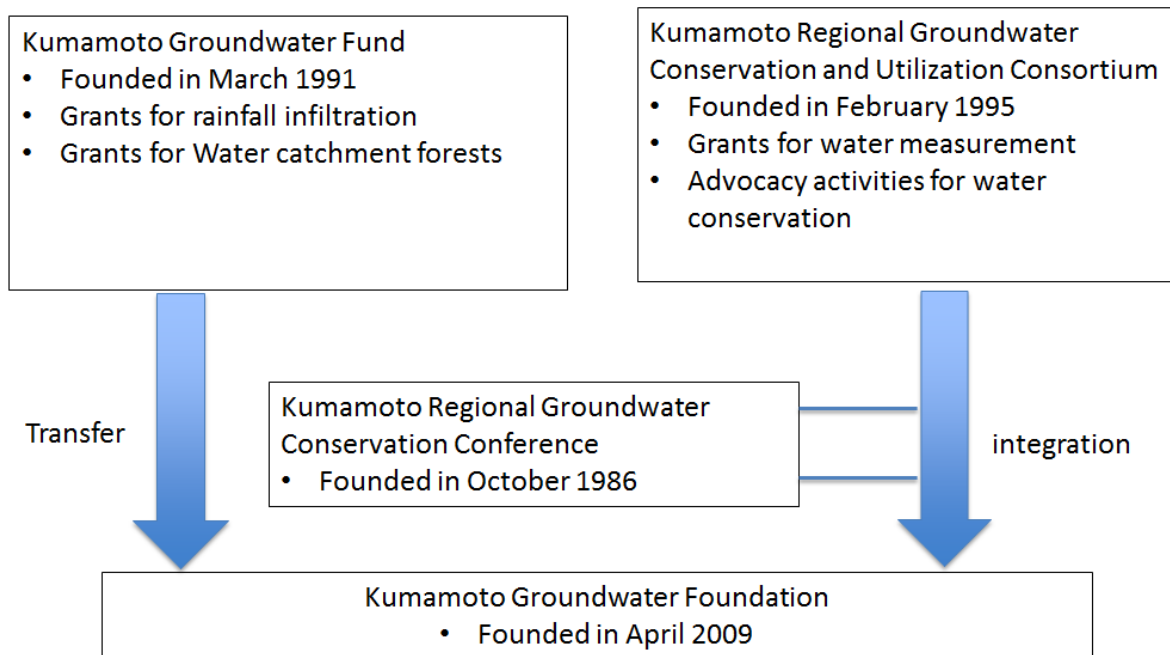


Figure 2: History of organizations for groundwater conservation in the Kumamoto region

Source: Produced by author based on the Case studies of groundwater conservation (in Japanese), Ministry of the Environment. March 2015. <http://www.env.go.jp/water/jiban/guide/examples.pdf>

Project Impacts

Economic Impact:

A special tax for water and forestry conservation generates a revenue of JPY 4,800 billion annually. Also, a project for recharging

groundwater through paddy fields facilitated participation from the private sector. An agricultural association, a foundation, private companies, such as Sony Semiconductor Corporation and Yamauchihonten Umeya, provided the finance for the project.

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Social Impact:

Kumamoto prefecture has long promoted education for water conservation. As a result, awareness for water conservation has been enhanced in the region. For example, Kumamoto Prefecture came top at the national level in terms of the number of students who have made submissions to a water essay contest for the last 8 years. High awareness of groundwater conservation becomes the foundation of citizen's participation in the creation of master plans and daily grass-roots efforts to save water in households.

Environmental Impact:

Daily water consumption per person has decreased gradually every year since year 2005, when these water conservation activities began (Figure 3). Projects aim to reduce the water consumption per person to 218 liters per day. In addition, due to the "paddy field project", the recharge of groundwater has been improved.

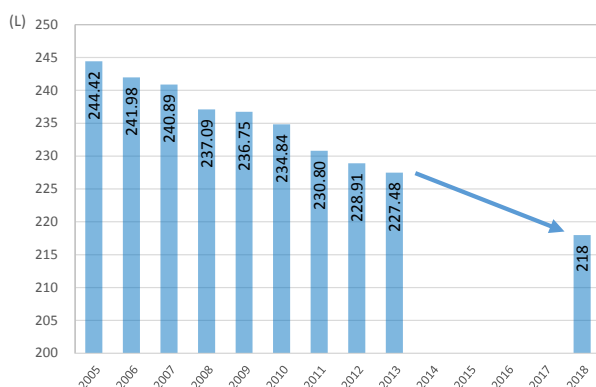


Figure 3: The amount of daily water use per person in Kumamoto region

Source: Produced by author based on Second Kumamoto City Groundwater Conservation Plan (2014-2018), March 2014 (in Japanese).

http://www.city.kumamoto.jp/common/UploadFileDsp.aspx?c_id=5&id=172&sub_id=3&flid=35686

Lessons Learned

Governance at the Groundwater Basin Level:

Given the characteristics of groundwater, the formation of governance at a groundwater basin across different municipalities is critical. It is also essential to note that governance needs long-term commitment. In the case of Kumamoto, the municipalities started acting on it more than 40 years ago.

Proper groundwater management requires comprehensive views, including flood management, water utilization, environmental and ecosystem protection, culture and education, and economics. Therefore, in forming a master plan for groundwater management, it is essential to meet various local needs and mobilize diverse expertise. Possible options need to be examined while referring to not only successful cases but also previous challenges. To promote the participation of residents, water education in schools is essential.

Balancing Water Sources through Multi-stakeholder Collaboration

Balancing water sources is critical. Groundwater tend to be higher water quality but lower water quantity as a water source, compared to surface water source. Since the groundwater volume is limited, Kumamoto's experience shows that collaboration among various experts and stakeholders such as local citizens, academia, the private sector, NGOs, and local municipalities, has been effective particularly for properly managing withdrawal of ground water. In addition, Kumamoto's experience has exemplified that, by including the private sector, the municipalities in Kumamoto region could gain additional financial resources as well as helping companies meet regulations.

Financial Management

In general, there are two ways to secure financing for local governments to conduct groundwater management in Japan. The first is to collect fees from users based on beneficiary-pays principle. The other is to collect as a form of tax for the conservation and recharging of groundwater. As in Kumamoto's case, this kind of funding can be used for groundwater monitoring, recharging activities, groundwater conservation activities, forestry conservation activities, and rainfall infiltration infrastructure development.

¹Compared to the year 1996, there were three fewer municipalities due to municipal mergers.

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