Expanded summary

Climate change impacts and adaptation for the conservation districts around the Seto Inland Sea, Japan

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This presentation will report on the impacts and adaptation of climate change on Japan's conservation districts, focusing on the Seto Inland Sea coast, which is said to be similar to the Mediterranean Sea.

The Seto Inland Sea is known for its warm climate and low rainfall. However, in July 2018, the area was hit by heavy rains that are said to be related to climate change, causing great damage. The heavy rains continued for three days, and are called the "Western Japan Heavy Rains." Simulations using supercomputers have since shown that the frequency of such three-day accumulated precipitation has increased from approximately once every 68 years (1.5% probability of occurrence) to approximately once every 21 years (4.8% probability of occurrence) as a result of climate change.

First, we will look at Kurashiki City, which was particularly hard hit. Kurashiki City was one of the first cities in Japan to implement a conservation system for its historical center. The area that suffered the greatest damage from the Western Japan Heavy Rains was the Mabi district, which sprawled after the WWII. The levees broke in 18 places, the water reached a maximum depth of 5m, 4,600 buildings were flooded, and 51 people died.

On the other hand, the damage to the conservation district was minor. The conservation district is formed around the Kurashiki River, which was used as a river port, but the river did not flood. However, inland flooding occurred behind the main street. The conservation district had a sewer system that could also handle rainwater drainage, but it was unable to cope with the unprecedented heavy rain. As a countermeasure, new pumps, new water conveyances, and new discharge channels are planned.

In the Mabi district, the old highway (Sanyo Road) runs along the foot of the mountain, and the old settlements were located on the slight elevation. However, the new urban area spread into the lowlands (paddy fields), causing great damage. The historic district is attractive in that it has inherited nature without changing its essence within the urban space, and it shows that it has a certain resilience to natural disasters. However, it is unclear whether the area will be able to withstand the expected worsening of disasters in the future.

During the same Western Japan heavy rains, the conservation district of Takehara City, Hiroshima Prefecture, suffered flooding above floor level. Takehara also suffered flooding above floor level three years later in the heavy rains of July 2021.

Takehara is also a port town that uses the river (Honkawa River) as a river port. The town is formed on a slight elevation along the mountain, but the irrigation channel that flows from the mountain through the town and into the Honkawa River overflowed, flooding the conservation district. Currently, construction is planned to expand the river channel of the Honkawa River, build new rainwater storage facilities, and pumps as a hard countermeasure.

In Japan, local governments are required to publish flood hazard maps as one of the adaptation measures to intensifying natural disasters. According to one study, 30% of conservation districts nationwide are included in the flood area when the maximum expected rainfall (about once in 1,000 years) falls. However, 26.6% (4,700 km2) of the general urban area is within the expected flood zone, where 31.1% of the population (24.26 million people) live. No additional measures have been taken specifically for the conservation district.

As climate change progresses, there are concerns about damage from high tides as well as heavy rains. Here I report on the case of Tomo, which is in the same Hiroshima prefecture as Takehara.

Tomo is a beautiful port town facing an inlet that retains port facilities from the Edo period. However, the roads in the town are narrow, so a bypass was planned to be built by connecting both sides of the bay with landfill and bridges. Due to persistent opposition from citizens, the plan was changed to a tunnel, which is expected to open next year.

However, a long debate has arisen over high tide countermeasures between a group that prioritizes safety, including the government, and a group that prioritizes the historic landscape.

The measures proposed by Hiroshima Prefecture to deal with high tides include the installation of a retractable flood gate on the east side of the port, and the construction of a seawall and a 3m-wide management road on the west side of the port. Opposition arose to the plan for the western area, which was seen as a scaled-down version of the abandoned filled-in bridge. The government has reviewed the design and has proposed building a new levee and management road away from the original stonework. However, they have not yet been able to convince the opposed group why such extensive construction is necessary.

Currently, in Japan, disaster adaptation measures for preservation areas are compiled as disaster prevention plans (Tomo's disaster prevention plan was introduced in the presentation). However, the focus is inevitably on earthquakes and fires, and measures to deal with climate change are insufficient.