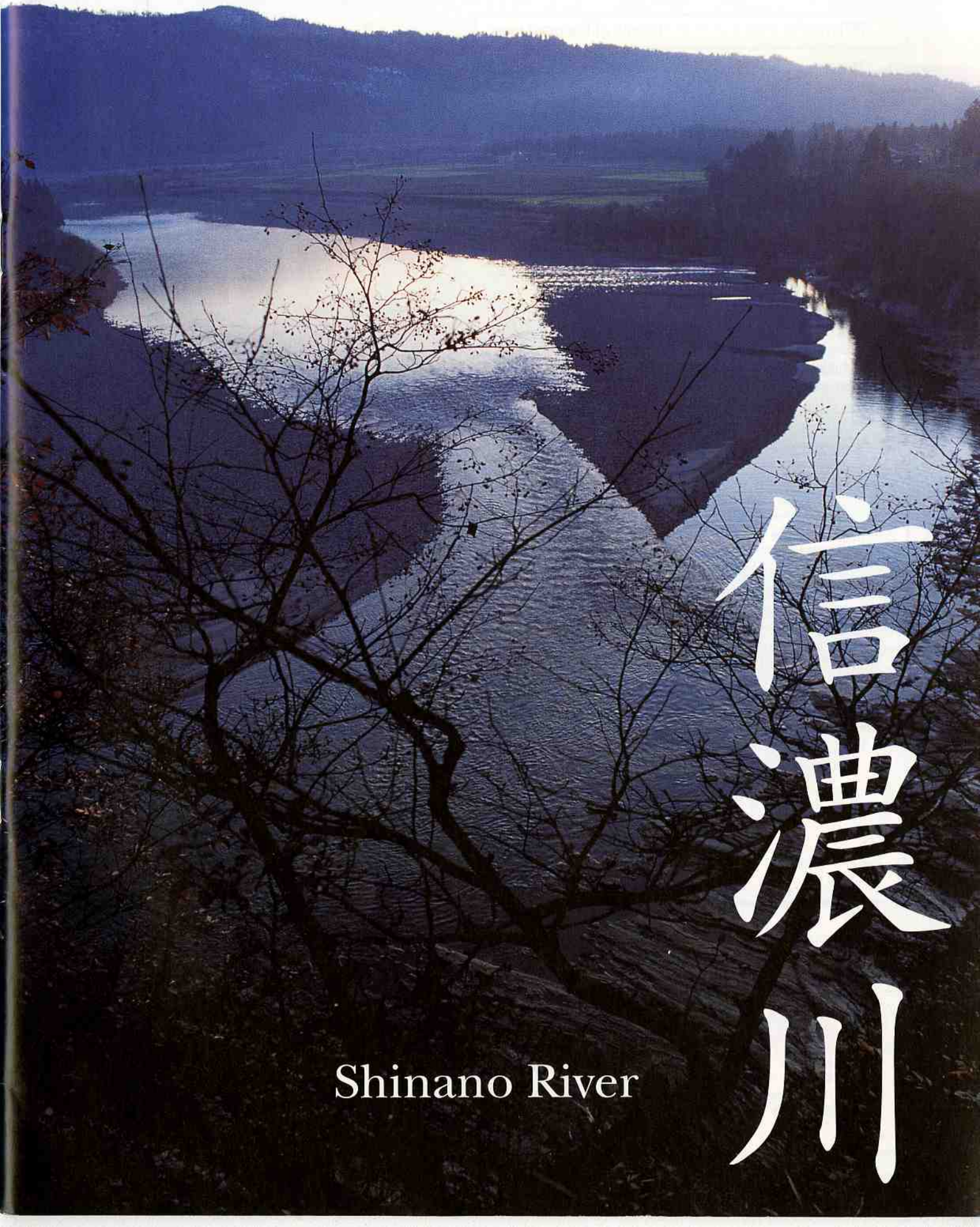


信濃川

Shinano River

Profile of the Shinano River

367km · · · · · · · · · · · · · · · · · Length of the main river

The Shinano River is the longest river in Japan. It is almost the same length as the distance from Tokyo to Nagoya on the Tokaidou Shinkansen ("bullet train") which is 366km long.

No.	River	Length
1	Shinano	367 km
2	Tone	322 km
3	Ishikari	268 km
4	Teshio	256 km
5	Kitakami	249 km

11,900km^2 · · · · · · · · · · · · · · · · · Catchment area

The Shinano River has Japan's third largest catchment area, following the Tone River and the Ishikari River. Its area is almost as great as the land of Niigata Prefecture (about 10,940 km^2).

No.	River	Catchment Area
1	Tone	16,840 km^2
2	Ishikari	14,330 km^2
3	Shinano	11,900 km^2
4	Kitakami	10,150 km^2
5	Kiso	9,100 km^2

16 billion m^3 · · · · · · · · · · · · · · · · Total annual runoff

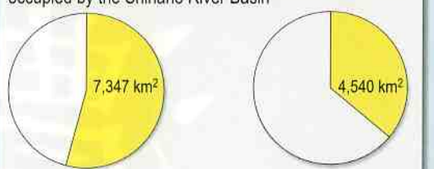
Total annual runoff of the Shinano River is the largest in Japan. This is a result of its large catchment area and also this area is located in one of the heaviest snowfall regions in Japan.

No.	River (Gauging station)	Annual Runoff
1	Shinano (Ojiya)	15.9 billion m^3
2	Ishikari (Ishikari Ohhashi)	15.0 billion m^3
3	Agano (Maorosi)	12.6 billion m^3
4	Mogami (sagoshi)	125. billion m^3
5	Kitakami (Ohizumi)	10.0 billion m^3

2.9 million people · · · · · · · · Population in the River Basin

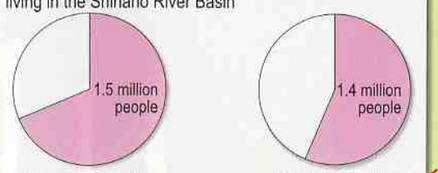
The Shinano River has both the largest catchment area and the largest population of the basin in Nagano Prefecture and Niigata Prefecture. The area of the Shinano River Basin covers more than 50% of Nagano Prefecture and about 40% of Niigata Prefecture. About 70% of the population of Nagano Prefecture and about 60% of the population of Niigata Prefecture live in this basin.

Percentage of the two prefectures occupied by the Shinano River Basin

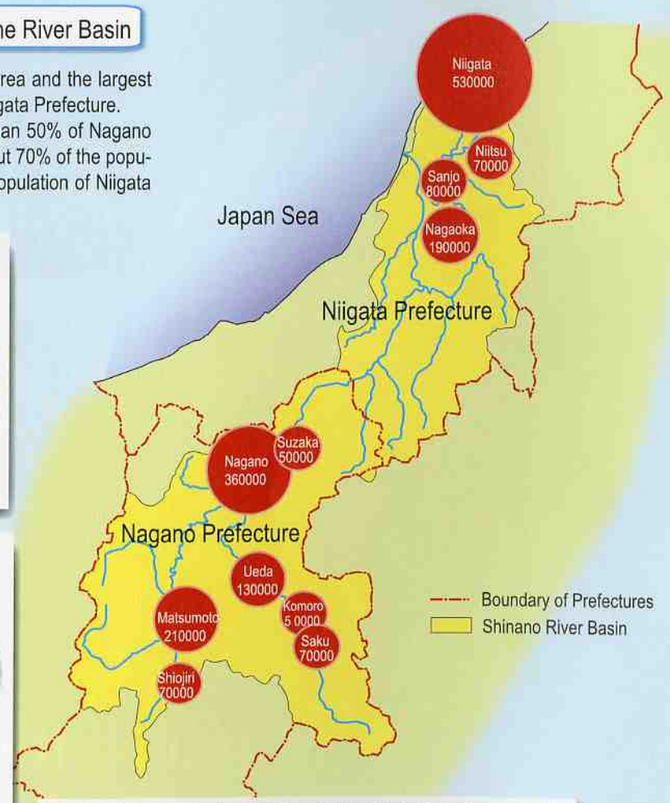


Nagano Prefecture 13,585 km^2 — Niigata Prefecture 12,582 km^2

Percentage of population of the two prefectures living in the Shinano River Basin



Nagano Prefecture 2.22 million people — Niigata Prefecture 2.46 million people



Major Cities and Population in the Shinano River Basin

Contents

Pictures: Spring and Summer / the Shinano River work office, Autumn / Osamu Nobuhara, Winter / Iiyama city

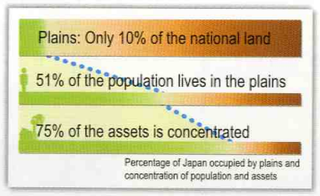
Nature and Society in the River Basin

Topography, climate, and rivers of Japan

Part of the Circumpacific Orogenic Zone

The Japanese Archipelago lies on the Circumpacific Orogenic Zone. Its land extends for 2,000 km in a long narrow belt from south to north and is no more than 300 km wide at the widest part.

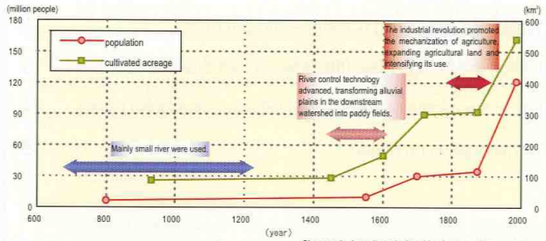
Mountain ranges with the elevation ranging from 2,000 m to 3,000 m run from north to south at the center of the archipelago. Its topography is extremely steep and mountains cover about 3/4 of the national land.



Agricultural culture and the concentration of population and assets on the plains

Hamlets appeared in Japan after agricultural culture arrived from the continent.

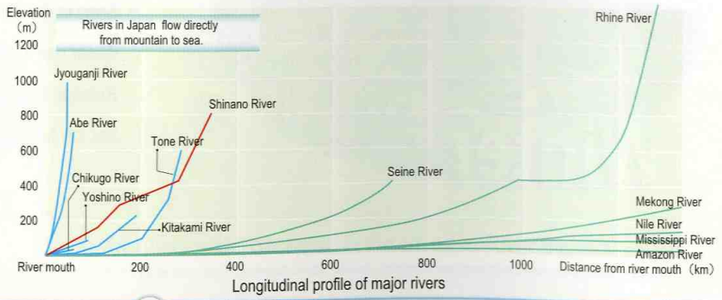
People settled on low land near rivers to obtain required water for agriculture. Then as the production activities advanced, the living population on low land gradually increased.



Changes in Japan's agricultural land area and its population

Steep and short rivers in Japan

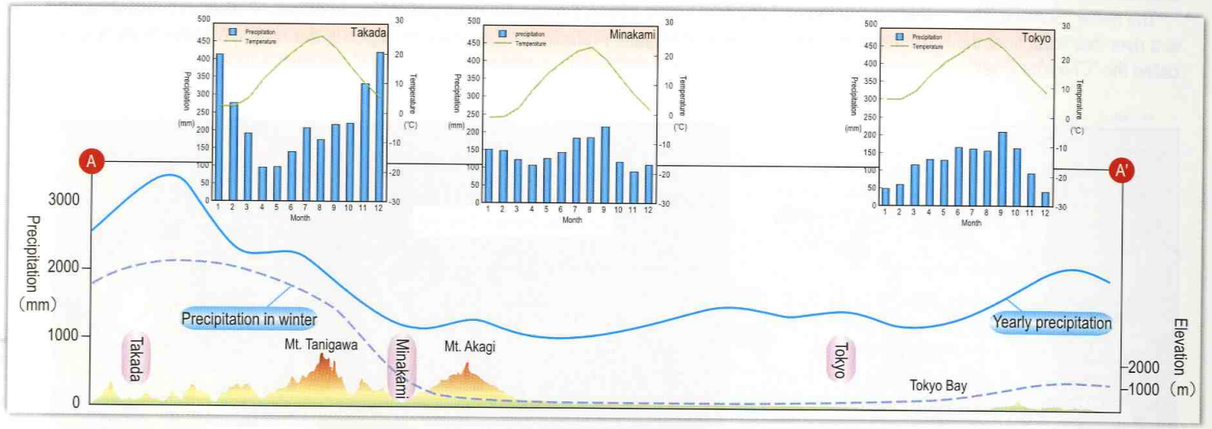
As a result of its steep topography, the rivers of Japan are generally of short length and steep slope. Rainfall on the mountains is rapidly collected in these rivers and rushes into the sea as a flood for a few hours. The wide seasonal fluctuation of the discharge makes both flood control and effective water use extremely difficult.



Longitudinal profile of major rivers

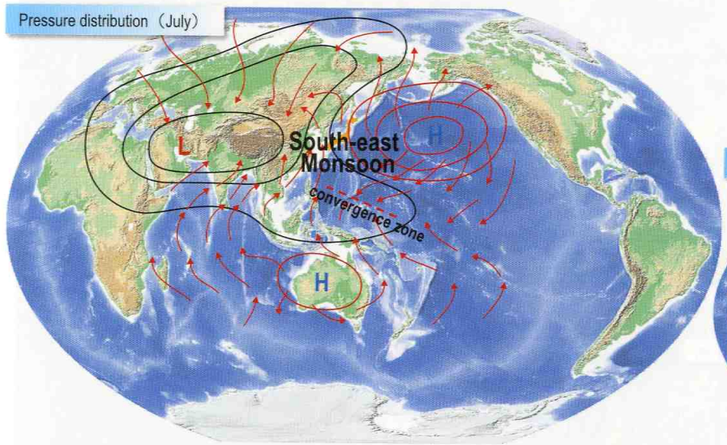
Mountain ranges and climate in Japan

The mountain ranges which lie in the center of the Japanese Archipelago divide the climate of Japan into Pacific and Japan Sea zones. Heavy snow falls on the north side of the mountains in the winter and provides a valuable water resource.



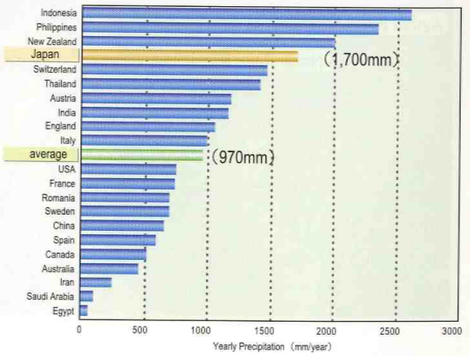
Japan in the monsoon belt

Japan is located on the boundary between the continent of Eurasia and the Pacific ocean where it is influenced by the interaction of continental and marine air flows and lies in the route of low pressure systems. And as a part of the monsoon zone, abundant rainfall is brought to Japan. Accordingly, a seasonal rain front forms above Japan every early June to July, triggering intensive concentrated rainfall. Then during August to September, typhoons strike Japan and bring intensive rainfall to wide areas.



Comparison of countries in annual rainfall

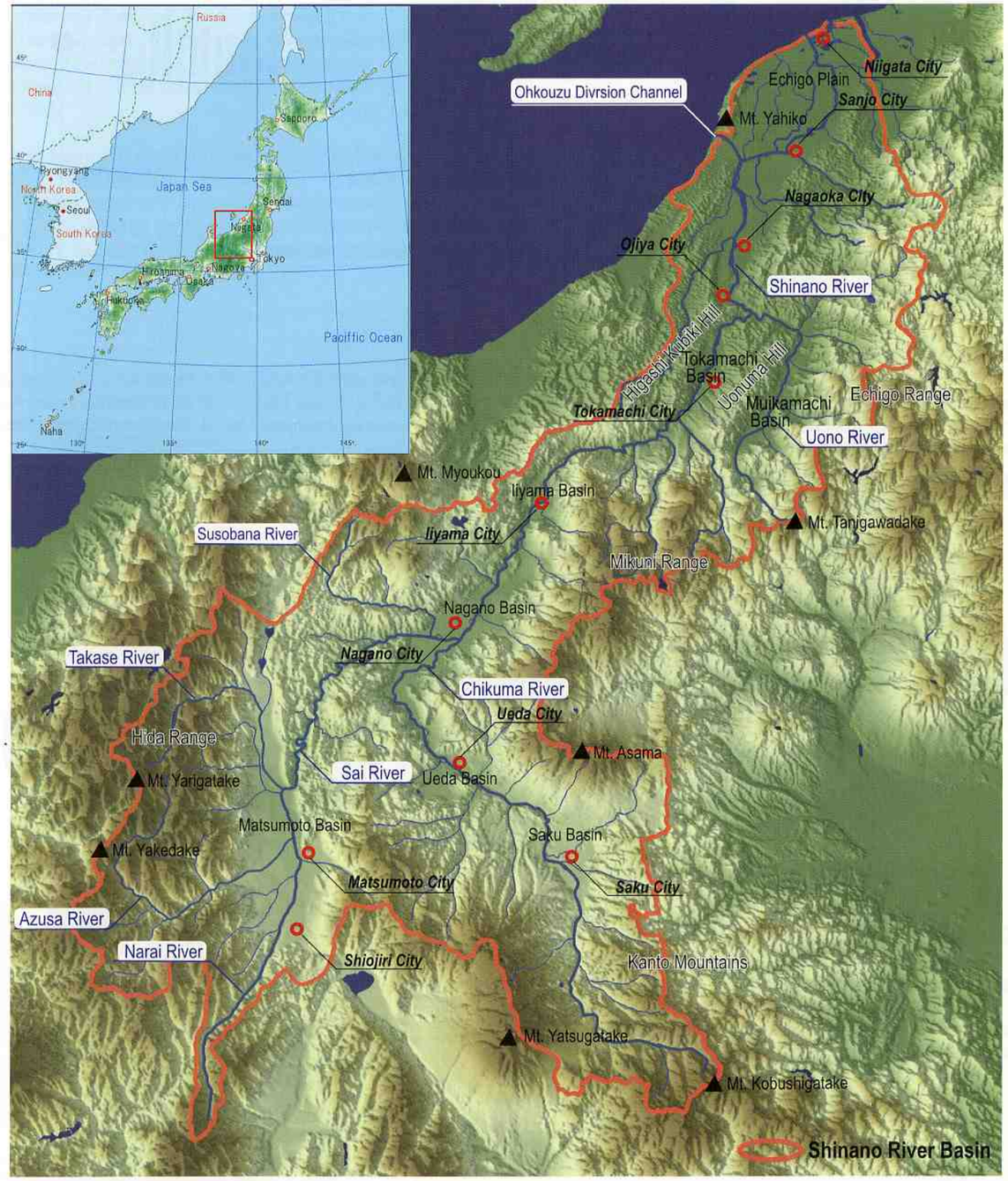
The average annual rainfall in Japan is 1,714 mm which is about twice the global annual average (approx. 970 mm). The total rainfall fluctuates between 1,300 mm to 1,900 mm depending on the year. But the average annual rainfall per capita is about 5,200 m^3/year a person, which is about 1/4 of the worldwide average of 23,000 m^3/year a person.



Outline of the Shinano River Basin

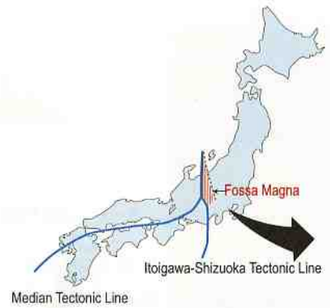
The Shinano River Basin is located in central Japan. The river originates in the Kanto Mountains, Mt. Yatsugatake, and the Hida Range, and links numerous basins as it reaches and crosses the Echigo Plain on its way to the Japan Sea. One of Japan's major rivers, its main channel is 367 km in length (longest in Japan), and its catchment area occupies 11,900 km^2 (third largest in Japan).

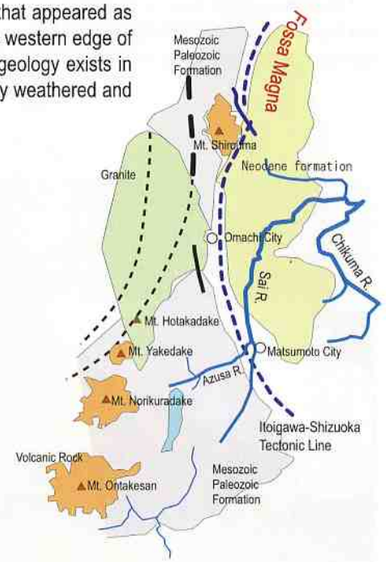
The name "Shinano River", which is the name of this river where it flows through the downstream region (Niigata Prefecture), means that it is a river that flows from the Province of Shinano (old name of Nagano Prefecture). The upstream region of the river in Nagano Prefecture is called the "Chikuma River".



Fossa Magna and the Itoigawa - Shizuoka Tectonic Line

Fossa Magna is a Latin word that means large depression. It is the name of a depression that appeared as the Japanese Archipelago was formed, and now divides it into northern and southern parts. The western edge of Fossa Magna is a group of faults called the Itoigawa - Shizuoka Tectonic Line. This complex geology exists in the upstream part of the Sai River, and sediment that is constantly discharged from this severely weathered and fragmented fragile geology continually threatens the downstream with debris flows.

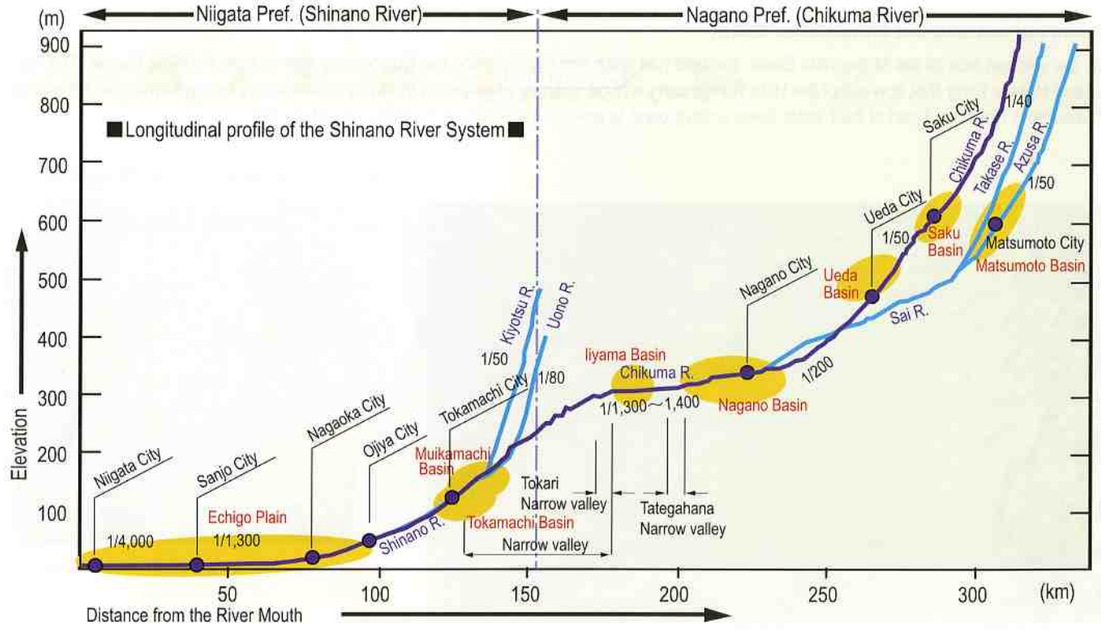




The Shinano River and the Chikuma River

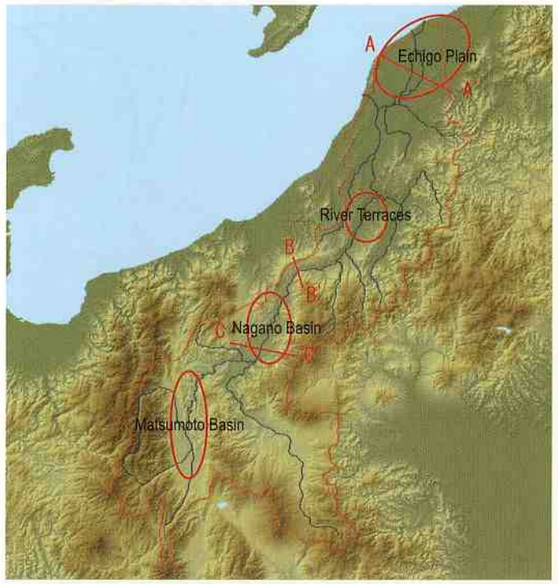
Longitudinal profiles of rivers generally show a curve with a steep gradient in the mountainous upstream region that gradually becomes gentler through the middle and lower reaches of the river. The longitudinal profile of the Shinano River System shows two connected curves.

The Chikuma River and the Sai River (upstream of the Shinano River) rush through a steep mountainous area, then as they pass through the Saku Basin, Ueda Basin, and Matsumoto Basin, their gradients become gentler, changing their aspects as the river of the middle reaches. In the Nagano Basin, the Chikuma River and the Sai River flow into each other with even gentler gradients and the aspect becomes as the river at lower reaches. However as the Chikuma River flows from the Iiyama Basin towards the border of Niigata Prefecture, its gradient rises once again to that of an upstream steep river. The characteristics of the gradients show that the Shinano River System looks like one composed of two independent rivers, the Shinano River and the Chikuma River.

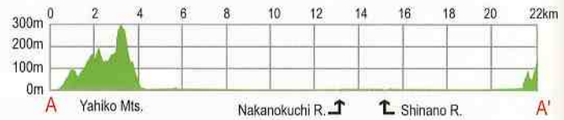


Typical topography of the Shinano River Basin

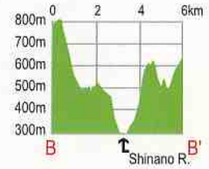
The Shinano River Basin is characterized by extreme fluctuations, the many basins and narrow valleys in its upstream and midstream regions and the particularly broad flat Echigo Plain that combine to provide it with variety unrivaled even by other diverse Japanese rivers . The richly varied topography of this basin is a product of the effects of the crustal change that created the present Japanese Archipelago.



A—A' Cross Section Echigo Plain



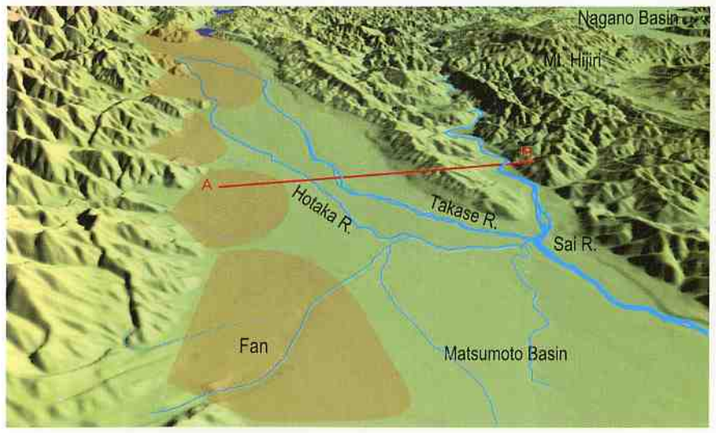
B—B' Cross Section Tokari Narrow Valley



C—C' Cross Section Nagano Basin

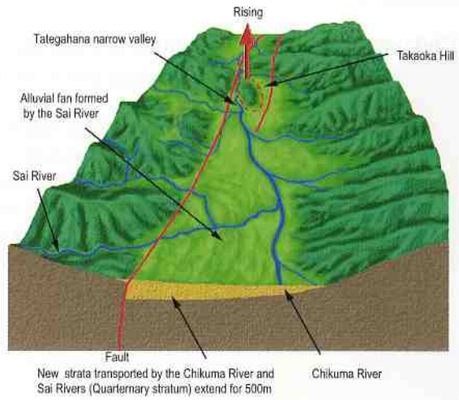
The alluvial fan and the Matsumoto Basin

On the western side of the Matsumoto Basin, the land has risen remarkably since the Quarternary Age to form the Hida Range. The Takase River and Hotaka River that flow out of the Hida Range carry a huge quantity of sediment from this mountainous region forming an alluvial fan in the Matsumoto Basin, and part of their water flows underground to emerge in springs at the lower end of the fan.

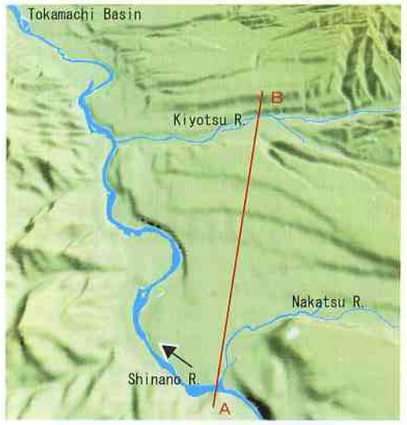


The Nagano Basin and the Tategahana Valley

It is reported that the land is still rising along an approximately 10 km section extending from Tategahana in Nakano City to Iiyama City in the northern part of the Nagano Basin. The Chikuma River has maintained its position by cutting through this uplifted section. But this has resulted in narrow valleys and exposed rock accompanied by a series of large meanders.



River terraces on the middle reaches of the Shinano River



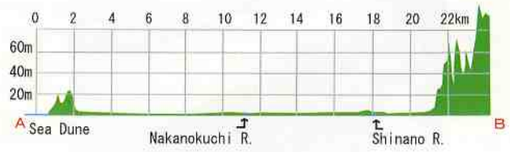
River terraces refer to river course topography consisting of rows of flat hills, each featuring terraces descending towards the river course. Where the river flows onto a plain, sediment carried from upstream settles to form an alluvial plain. The river cuts a terrace through part of the alluvial plain to form a new river course. The flat part on the surface that is the bottom of an ancient valley (valley bottom plain) is called the terrace surface and the steep bluff in front of this surface cut by the action of erosion is called the terrace scarp.

River terrace topography has formed extensively along the middle reaches of the Shinano River, and it is possible to see hills with many terraces near the convergence with the Nakatsu River to the Tokamachi Basin.

The Echigo Plain enclosed by sand dunes

It is reported that the Echigo Plain was once a shallow sea surrounded by sand dunes, but it has been filled in by the settlement of sediment carried downstream by the Shinano River and the Agano River.

The Echigo Plain became a poorly-drained basin isolated from the ocean by sand dunes. The resulting concentration of water flowing into the Echigo Plain at the mouth of the Shinano River, which is a small break in the sand dunes, prevented adequate drainage of this water, forming large stagnant ponds inside the dunes. These were called "kata" which means salt-water lagoons.



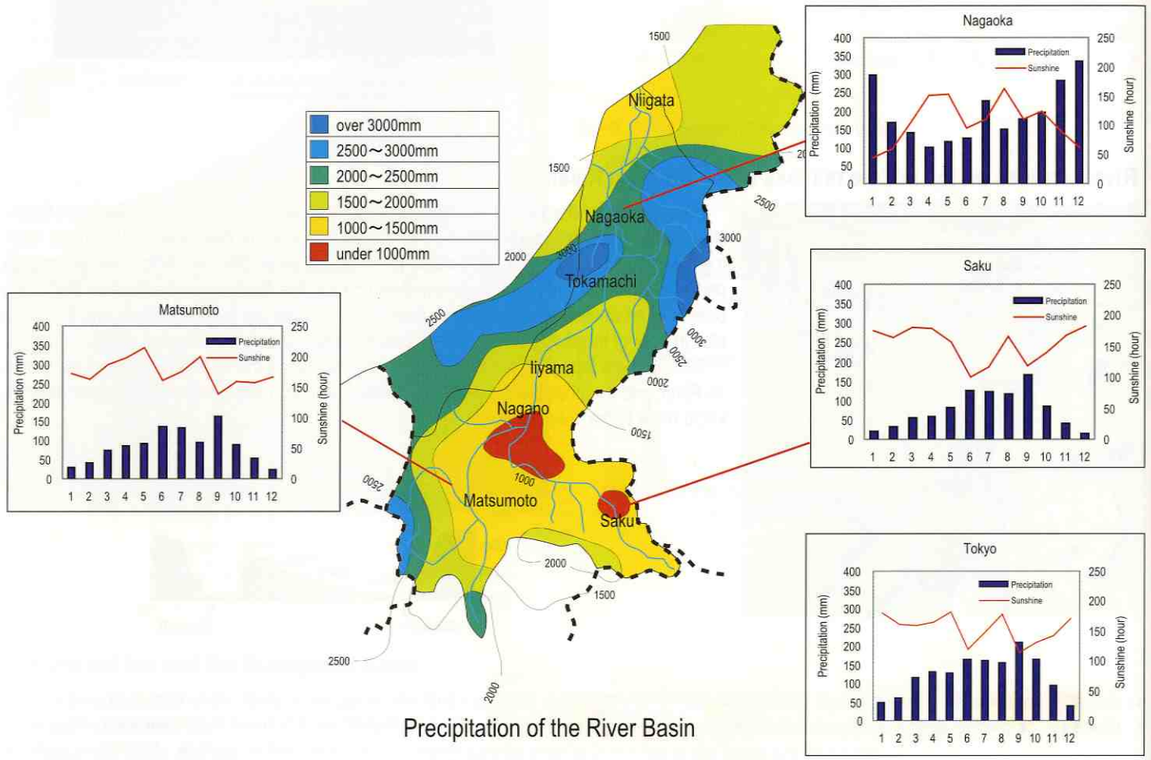
Climate and flow regime of the Shinano

The Chikuma River with little rainfall and the Uono River with heavy snowfall

In Japan, the climatic condition changes widely even in the relatively small regions due to the effects of its long (north-south) and narrow shape and its topography.

The Shinano River Basin is divided into two climatic regions. The contrast between these is particularly apparent in the winter season. In the Matsumoto and Saku regions which are located at the upper reaches of the Shinano River Basin, the climate tends to be clear fine weather with long hours of sunlight in winter. On the other hand, at Nagaoka which belongs to the area with the climate of the Japan Sea side, the winter climate tends to be cloudy with extremely few hours of sunlight and very heavy snowfall.

At Tokyo in the Pacific climate zone, winter brings clear dry weather, but its annual rainfall is higher than in the interior climate zone where Matsumoto and Saku are located. The reason is the position of these cities in this basin surrounded by high mountains far from the ocean.

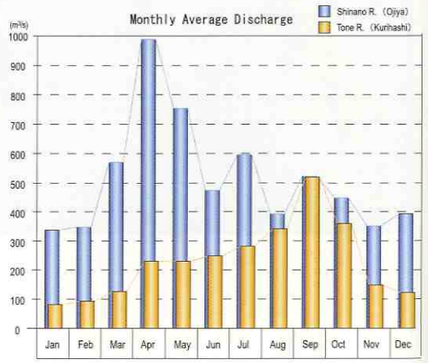


Precipitation of the River Basin

Abundant quantity of water

The Shinano River discharges 16 billion m^3 of annual runoff at Ojiya (catchment area is 9,719 km^2). This is the biggest flow discharge in Japan, because of its vast catchment area and the characteristics of its climate. The seasonal fluctuation of its monthly average discharge is one of the specific characteristics of the Shinano River: 30% to 50% of this annual runoff occurs during March to May when the snow melts.

A comparison with the rivers of the Pacific side of Japan such as the Tone River clearly shows how much water flows through the Shinano River.



Land use in the Shinano

The Echigo Plain

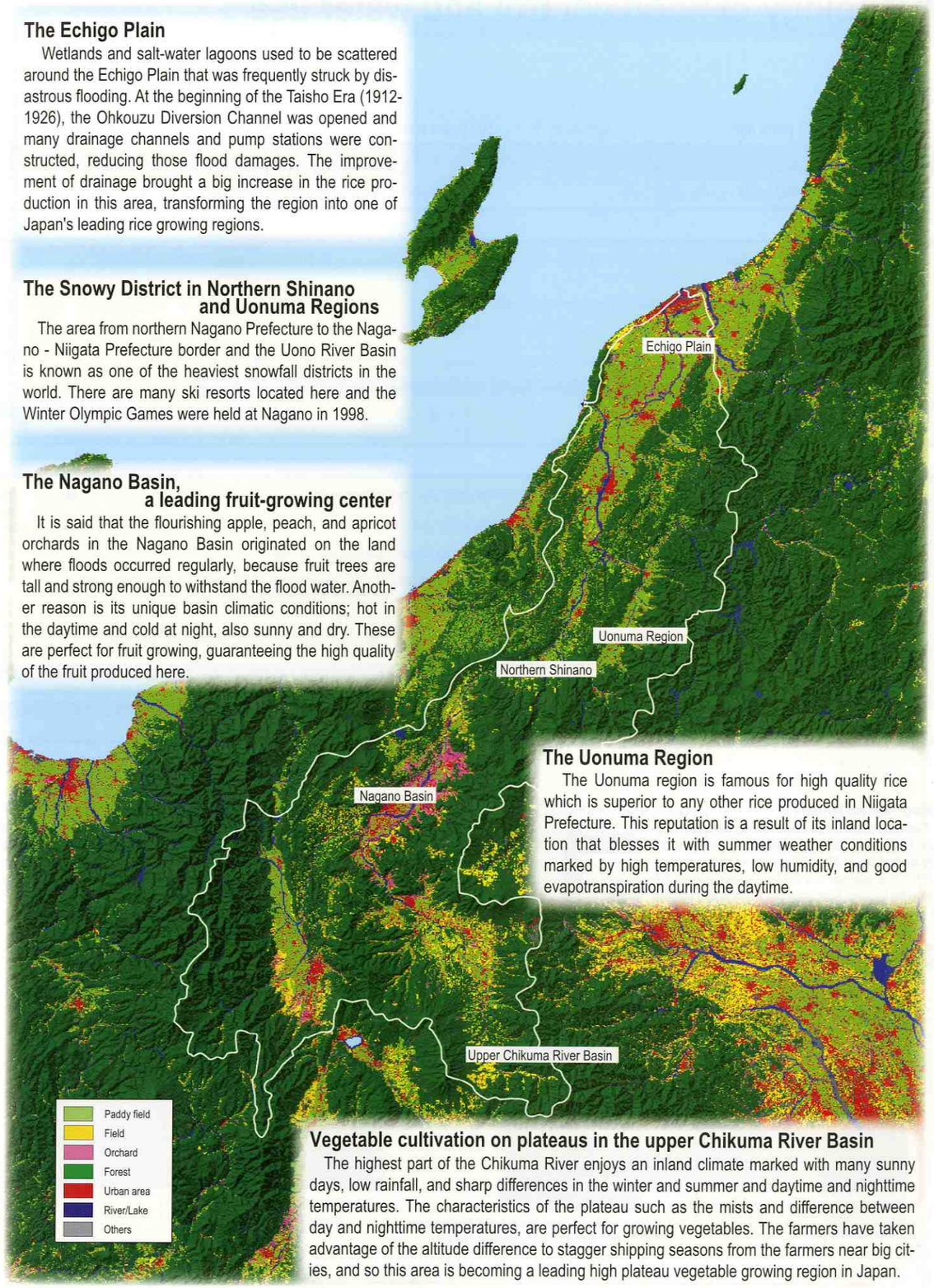
Wetlands and salt-water lagoons used to be scattered around the Echigo Plain that was frequently struck by disastrous flooding. At the beginning of the Taisho Era (1912-1926), the Ohkouzu Diversion Channel was opened and many drainage channels and pump stations were constructed, reducing those flood damages. The improvement of drainage brought a big increase in the rice production in this area, transforming the region into one of Japan's leading rice growing regions.

The Snowy District in Northern Shinano and Uonuma Regions

The area from northern Nagano Prefecture to the Nagano - Niigata Prefecture border and the Uono River Basin is known as one of the heaviest snowfall districts in the world. There are many ski resorts located here and the Winter Olympic Games were held at Nagano in 1998.

The Nagano Basin, a leading fruit-growing center

It is said that the flourishing apple, peach, and apricot orchards in the Nagano Basin originated on the land where floods occurred regularly, because fruit trees are tall and strong enough to withstand the flood water. Another reason is its unique basin climatic conditions; hot in the daytime and cold at night, also sunny and dry. These are perfect for fruit growing, guaranteeing the high quality of the fruit produced here.



The Uonuma Region

The Uonuma region is famous for high quality rice which is superior to any other rice produced in Niigata Prefecture. This reputation is a result of its inland location that blesses it with summer weather conditions marked by high temperatures, low humidity, and good evapotranspiration during the daytime.

Vegetable cultivation on plateaus in the upper Chikuma River Basin

The highest part of the Chikuma River enjoys an inland climate marked with many sunny days, low rainfall, and sharp differences in the winter and summer and daytime and nighttime temperatures. The characteristics of the plateau such as the mists and difference between day and nighttime temperatures, are perfect for growing vegetables. The farmers have taken advantage of the altitude difference to stagger shipping seasons from the farmers near big cities, and so this area is becoming a leading high plateau vegetable growing region in Japan.

History of the Shinano River

Chronology of flood control and water use

400 years ago | 300 years ago | 200 years ago | 100 years ago | 50 years ago

Early Feudal Period (approx. 1100 to 1600)
Late Feudal Period (approx. 1600 to mid 19th century)
Early Modern Period (mid 19th century to mid 20th century)
Modern Period (mid 20th century to present)

History of the Chikuma River (Nagano Pref.)

- 1561: Battle of Kawanaka-jima
- Approx. 1600: Changing the course of the Susobana River (convergence with the Sai River)
- 1742: Flood "Inu no Mansui" (most severe flood disaster in the Chikuma River Basin)
- 1783: Eruption of the Asama Volcano
- 1790: Navigation starts on the Chikuma River
- 1847: Zenkoji Earthquake
- 1879: Beginning of government Sabo work in the upstream Shinano River System
- 1896: Massive flood
- 1915: Mt. Yakedake erupts, forming Taisho Pond
- 1917: Beginning of government improvement work on the Chikuma River
- 1982, 1983: Massive flood
- 1986: Completion of the Omachi Dam

Many irrigation systems are constructed to develop new fields throughout the river basin.
Navigation flourishes on the Chikuma River.
Many large hydro-electric power plants are constructed.

History of the Shinano River (Niigata Pref.)

- 1582: Improvement work on the Shinano River and the Nakanokuchi River undertaken by the ruling regime
- 1615-1624: The Nagaoka navigation route is developed
- 1651: Completion of the Fukushimae Irrigation Canal
- 1671: The Port of Niigata becomes a stopping point on the navigation route linking Osaka with the Sea of Japan Coast through Shimonoseki.
- 1730: Completion of the Matsugasaki Floodway
- 1820: Excavation of the Shin River (work to drain lagoons)
- 1858: Niigata is selected as international trade port
- 1876: Beginning of government improvement work on the Shinano River
- 1896: Massive flood (The Yokota Break)
- 1917: Massive flood (The Sogawa Break)
- 1922: The Ohkouzu Diversion Channel Opens
- 1935: Massive flood in the Uonuma Region
- 1937: Beginning of government Sabo work in the downstream part of the Shinano River System
- 1940: Completion of the Shinano River hydroelectric power plant
- 1964: Niigata Earthquake
- 1972: Opening of the Sekiya Diversion Channel
- 1990: Completion of the Myoken Weir
- 1992: Completion of the Sagurigawa Dam

The salt water lagoons are filled in to develop extensive new fields on the Echigo Plain.
Navigation flourishes on the Shinano River.
Wet paddy field on the Echigo plain is turned into dry paddy field by construction of drainage channels and drainage pumping stations.

Flood "Inu no Mansui"

There are reports of a number of massive floods in the Chikuma River Basin, but the largest and most severe was reportedly the flood "Inu no Mansui" that occurred on August 1 and 2, 1742. It is estimated that this flood claimed about 2,800 lives in the Chikuma River Basin and it took several decades for the region to recover.

On the pole which shows the past disastrous flood water levels, the highest is the water level of flood "Inu no Mansui" which exceeded about 5 m above ground level.

Maximum water levels of historical floods

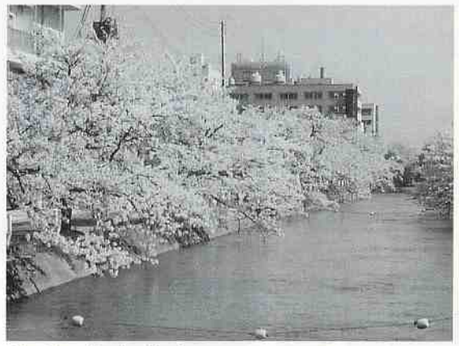
Myousyouji (332.7m)	
Flood in 1742	336.5m
Flood in 1896	334.9m
Flood in 1847	334.8m
Flood in 1910	333.6m
Flood in 1911	333.7m

(Investigated by the Chikuma River Work Office)

The Nagano Basin Flood Water Level Post erected based on records kept by Myousyouji Temple

Fukushimae Irrigation Canal

This was built about 350 years ago. The irrigation channel was constructed to divert water from the Shinano River to supply more than 20 villages suffering from a water shortage. The present system, which was completed in 1952, irrigates about 10,000 hectares of paddy field.



Fukushimae Irrigation Canal

The Yokota Break and the Sogawa Break

In the downstream of the Shinano River, flooding occurred every 3 or 4 years until the Ohkouzu Diversion Channel and other large-scale flood control measures were undertaken. Of these, the Yokota Break of 1896 and the Sogawa Break of 1917 were massive floods still talked about in the Echigo Plain.

Evacuees climb a temple bell tower to escape the inundation of the Sogawa Break

The Uonuma Region Disaster

In September 1935, a typhoon brought heavy rain and strong winds, causing a severe disaster in the Uonuma Region. Mountain slides along the upstream of the Uono River triggered massive inundations downstream. This prompted the government to begin sabo works.

Devastation on the Uono River in September, 1935 (Yuzawa Town)

Water and daily living (Chikuma River and Sai River)

Flood control work on the Chikuma River during the Late Feudal Period (1600 to 1867) was not guided by the modern concept of forcing flood waters to flow between continuous levees constructed on both sides of the river. The levees were basically intended to reduce the hydraulic energy of the flood water. Foe example, partial levees to control flow, ring levees encircling hamlets and fields, and open levees on steep land, there had been many of these were built.

"Segae" (changing a river course)

Since ancient times, the local people have worked hard to change the course of the river in order to protect villages, fields, and the rest of the land from flood damage. Examples in the Chikuma River System include the change of the course of the Susobana river, the Dayu Senryo Levee on the Matsu River, and the change of the course of the Chikuma River in the Matsushiro Domain.

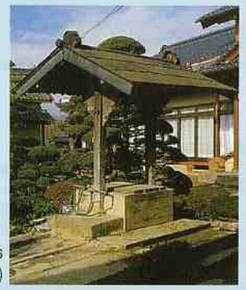
Although changing a river course develops new land on old river areas and prevents flood damage, this work places a heavy burden on the community and it is followed by long years of struggling with increased loss of land to river erosion during flood discharge periods, and boundary disputes.

Ring levees

Once flood water has inundated low-lying land, it cannot be drained. An artificial levee is constructed on top of a natural levee to provide a circle of protection to villages, fields, etc. This kind of village was called a wajyu (inside a circle). They are rare as far inland as the Chikuma River Basin.

Drinking water

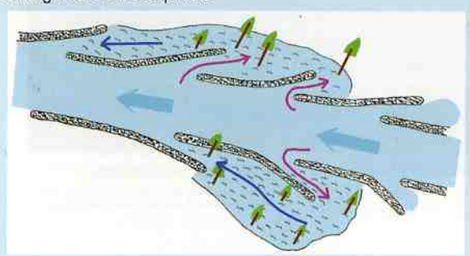
The people predicted the water level during flooding then slightly elevated their wells by building stone walls between half and one meter high to keep contaminated water out of the wells during flooding.

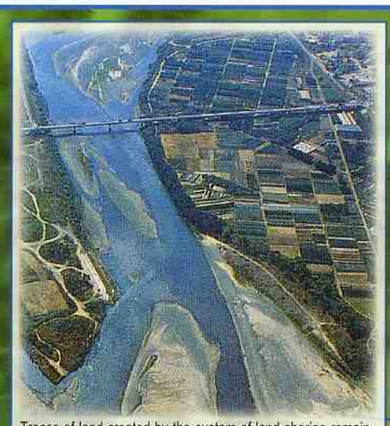


A well raised by stones (Ushijima in Nagano City)

Open levees

These levees are created by leaving openings above and below each one and partially overlapping them. As the levees are not continuous, their role is to cause flood waters to drain quickly through the openings. They are constructed on fast flowing rivers on steep land.





Traces of land created by the custom of land sharing remaining at the convergence of the Chikuma River and Sai River. Generally, the land appears as long narrow strips divided at right angles to the river.

Former river channel. It was made by "Kamiimai's segae" (changing river course)

Aerial photograph of the convergence of the Chikuma River and Sai River. The hamlet enclosed by a circular road is a wajyu town called Ushijima.

Inundation near Matsushiro Town in Nagano City caused by typhoon 18 of September 1982

It is possible to hypothesize the former river course from the state of the inundation by the mud. It shows that it moved 700 m to the west.

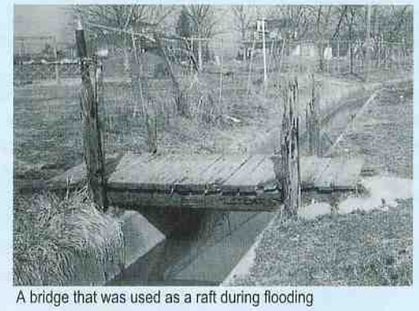
The custom of Jiwari (land sharing)

- wisdom of the farmers of land constantly devastated by flooding -

Along the Chikuma River, the farmers, regularly or after floods, developed new cultivatable land as shared hamlet land by equally dividing river areas and old river beds that are subjected to frequent flooding.

Hashiikada (bridge-rafts)

Hashiikada are usually bridges, but they were used as evacuation rafts when flood waters submerged the land.



A bridge that was used as a raft during flooding

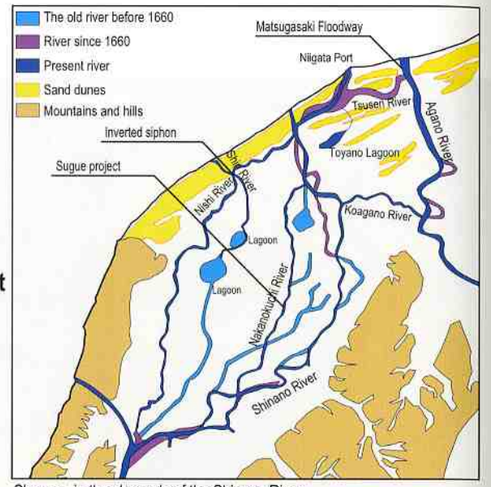
High stone walls

Houses constructed on mounds and enclosed by high stone walls (called mizuya (water house)) to protect them from damage by flood water from the river are scattered throughout the Chikuma River Basin.

A stone wall is constructed to protect the home from flood damage

Life on the Echigo Plain (the downstream Shinano River)

The Echigo Plain is a low wetland covered with reed-filled marshes. As the ancient Shinano River flowed freely across this low plain, its water caused frequent destructive floods. But the people worked constantly to prevent flood waters from covering the land, by building levees, digging artificial channels, and fixing the river position.



Changes in the channels of the Shinano River

Changing the course of the Nakanokuchi River: The Sugue Project

In 1592, Naoe Yamashiro no Kami, a vassal of the Daimyo Uesugi Kenshin, ordered a sixteen-year project to alter the course of the Shinano River. This work, called the Sugue Project, was the first improvement project in the Echigo plain.

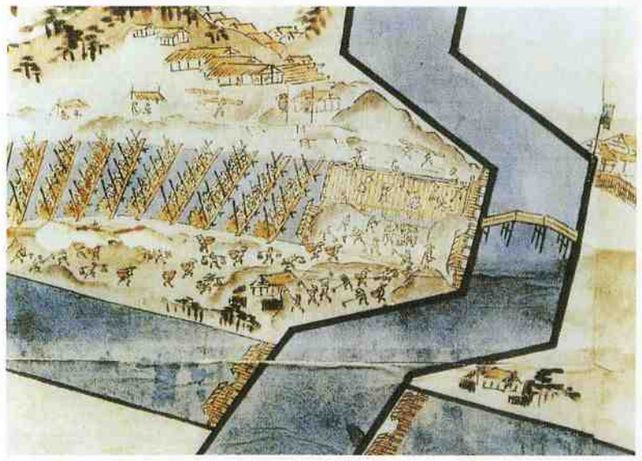
Separation from the Agano River: The Matsugasaki Floodway

About 300 years ago, the mouths of the Shinano River and the Agano River converged and emptied their waters into the Japan Sea together, maintaining the water level of Niigata Port during this period of prosperity when the port was visited by more than 3,000 boats every year.

In 1730, the Matsugasaki Floodway was excavated at the mouth of the Agano River to prevent flooding and drain paddy fields. But the next year's spring flood of melted snow broke the weir, transforming the channel into the main flow of the Agano River. Now the Tsusen River (old river course) and the Koagano River link the Agano River with the Shinano River.

The Matsugasaki floodway was applied to the later construction of the weir for the Ohkouzu Diversion Channel, as a lesson that the work of diversion channel would fail if its water level was not regulated and the diversion weir not structurally strengthened


Excavation to drain water on the Agano River (Spillway)

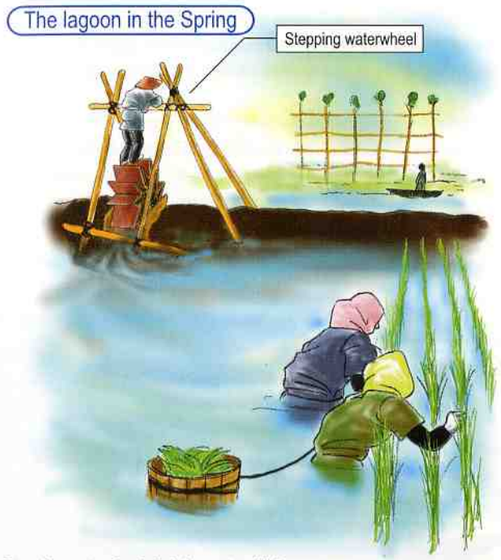

An underground pipe is installed under the Nishi River (inverted siphon)

Excavation of the Shin River and inverted siphon with the Nishi River

The Nishi River Basin was an area with poor drainage and included many lagoons such as the Yoroi Lagoon, Ta Lagoon, and the Oh Lagoon, subjecting the farmers to frequent inundations. Ito Gorozaemon planned to protect the people from flood damage by passing the Shin River under the Nishi river and cutting an opening in the sand dunes to carry its water to the sea. The work was extremely difficult, because at that time, the Nishi river was broad and its water volume much, but it was completed in 1820.

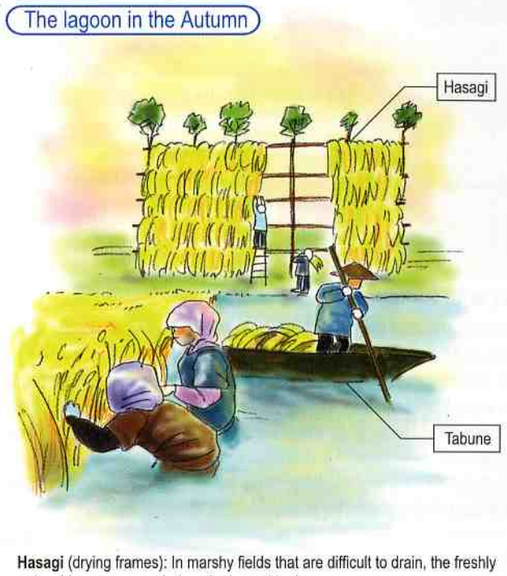
Innovative farming in the wetland zone

Growing paddy on deep muddy fields (submerged paddy fields) made by developing reed swamps was harshly unpleasant work for farmers who walked waist-deep in water. Intensive rainfall submerged the paddy and washed away the fields, destroying all their hopes of a harvest. But this cultivation conducted by constantly battling against the water inspired the invention of a unique farming method called "Boat Farming."



Stepping waterwheel: draining water with human power.

Ukita (floating paddy fields): When the rain increases the depth of the water in a deep paddy field, the rice plants rooted up from the paddy soil and it seems to be floating on the surface.



Hasagi (drying frames): In marshy fields that are difficult to drain, the freshly cut paddy was suspended on the hasagi to dry.

Tabune (paddy field boat): The boats were used to transport seedlings, fertilizer, and cut paddy.

Life in the middle of the Shinano (Shinano and Uono River)

Crossing boats

People crossed rivers to the opposite shore in boats when fixed bridges could not be constructed as today. These were called watashi (crossings). There were many such crossing points on the Shinano River. The Masara Watashi that linked Masara in the City of Ojiya to Hosojima on the opposite bank was used for crossing boats until the post-war years, but it has disappeared with the passing of time.

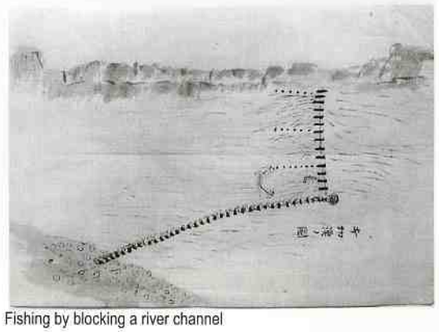

Masara Watashi in bygone days

Traditional fishing methods

The Shinano River System has been used as salmon and sweetfish fishing grounds. Unique traditional methods of catching salmon were used in each river and region.

Flooding during snowfall

The Uono River Basin, which is a heavy snowfall region, suffered from flood damage even during the snowy winter season. The flow was blocked by overnight snow, then overflowed the obstruction. The roads connecting the post station were lowered by packing the snow as people walked, causing damage by forcing the water to flow through these low channels into people's homes.


Fishing by blocking a river channel

Transportation on rivers

Until modern times, all goods transported on land were carried on the backs of animals and people. At the same time, river transport was developed throughout Japan because boats can inexpensively carry large quantities of heavy cargoes such as grains. In the Hokuriku Region as elsewhere, river ports were established and organizations to operate boats were formed on many large and small rivers, creating arteries indispensable for daily life.

On the Shinano River and the Agano River that were linked to the Port of Niigata, numerous boats carried rice and other cargoes back and forth, both on the main river and its tributaries. Each feudal domain controlled and organized its boat transportation, and formed industrial groups. These were called funadou (navigation routes).

Links with highways

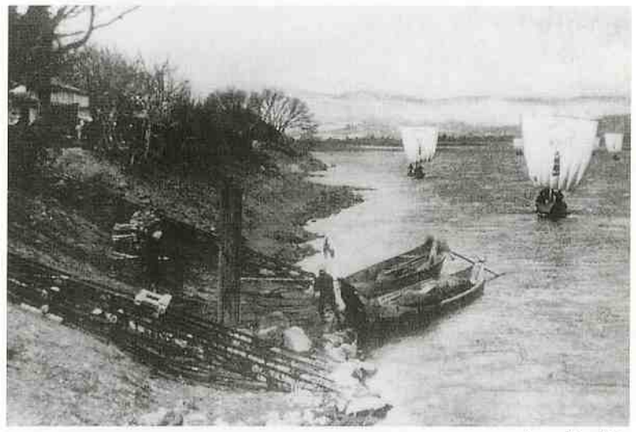
Shipping trade in the Shinano River system had been major routes linked with land transportation.

For example, cargoes carried by shipping trade (Muikamachi route) were transferred to the backs of animals and people at Muikamachi river port. After that, they were carried to Edo through Mikuni Highway.

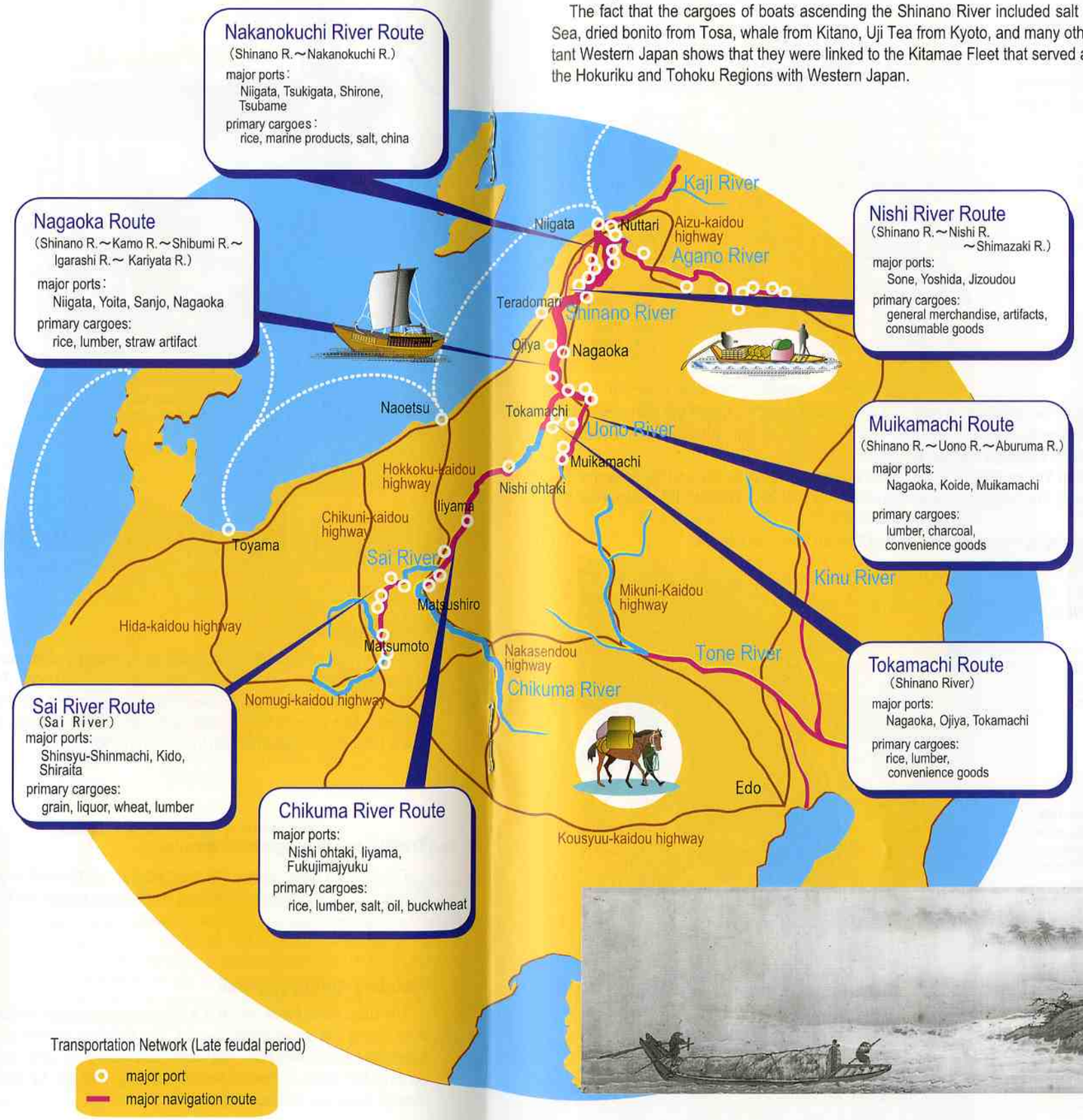
At places where highways go side by rivers such as the Echigo Plain, most people preferred to use boat as far as possible.

Navigation on the Chikuma River

Water transport was a difficult task in the steep section of the Chikuma River. But after the river enters the Nagano Basin, its gradient becomes very gentle, so the area along the river flourished with Iiyama and Matsushiro as bases.



Iiyama River Port

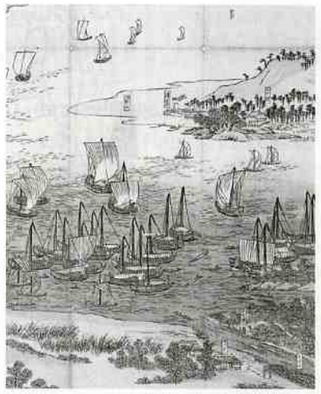


To the open sea on the Kitamae Fleet

Through its role in the shipment of the annual tribute rice, the Port of Niigata where the two large rivers, the Shinano River and the Agano River, reach the ocean grew greatly during the late feudal period (1600 - 1867).

The central government in Edo (now Tokyo) was forced to begin having tribute rice shipped from other regions in the middle of the seventeenth century to feed the city's soaring population. Tribute rice from the various domains was transported on the Shinano River and Agano River to Niigata where it was transported to Edo.

The fact that the cargoes of boats ascending the Shinano River included salt from the Seto Inland Sea, dried bonito from Tosa, whale from Kitano, Uji Tea from Kyoto, and many other products from distant Western Japan shows that they were linked to the Kitamae Fleet that served as a sea route linking the Hokuriku and Tohoku Regions with Western Japan.



Activities in the Port of Niigata

The Nagaoka Funadou (Navigation route)

During the late feudal period, a flourishing shipping industry linked the Shinano River and Uono River with the downstream Nishi River and Nakanokuchi River. The organization that operated the shipping in the Shinano River System was called the Nagaoka Funadou. This organization monopolized the route from Nagaoka to Niigata, earning large profits until it was dissolved following the collapse of the feudal system in the middle of the nineteenth century.

The struggle to travel upstream

River boat transportation that could cheaply transport large quantities of cargo was more efficient than land transportation dependent on animals and the backs of men. However on the other hand, river boat transportation had several problems due to using a flowing river.

This was particularly true when boats traveled upstream. Crew members had to walk on the rough and slippery riverbanks pulling the boats with ropes. After traveling downstream for a half day or full day, they took 3 or 4 days to return upstream to their starting point.

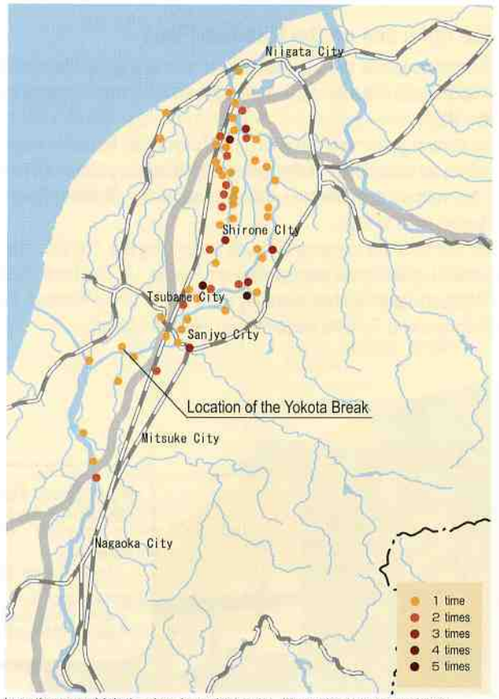
Pulling the boat

The Ohkouzu Diversion Channel

History of the Ohkouzu

Before the Ohkouzu Diversion Channel was Built

Before the Ohkouzu Diversion Channel was built, the Shinano River frequently broke its banks and caused great suffering among the people of the Echigo Plain. This plain was not only poorly drained low wet land, but it was also blocked from the sea coast by sand dunes: topography that hindered the river's flow to the sea. It was, therefore, frequently inundated by heavy rain, and major floods occurred on average every 3 or 4 years.
The plan of the Ohkouzu Diversion was considered from the Edo period. At the beginning, the aim was to reclaim new cultivated land by removing the water from marshland. At the end of the Edo period, the aim changed to prevent the flood disaster of the Echigo Plain.



Locations at which the river burst its banks (From the Edo to the Meiji)

The Yokota-gire (Yokota Break)

It is reported that during the 300 years between 1600 and 1900, the downstream region of the Shinano River inundated the land almost 100 times. The most disastrous of these repeated floods was the massive flood of July 22, 1896. The levees were broken at many locations, but the flood is called the Yokota-gire "Yokota Break" which was the place of breakage that had the greatest impact.

The Shinano River bends sharply to the east near the location of Yokota (Bunsui Town). Here the river course is narrow and the flowing water reaches its highest level. This Yokota Break caused severe damage. The overflowing water transformed a wide area including the Echigo Plain into a sea of mud which flowed all the way to Niigata City.

This massive flood "Yokota Break" played a major part in encouraging the construction of the Ohkouzu Diversion Channel.

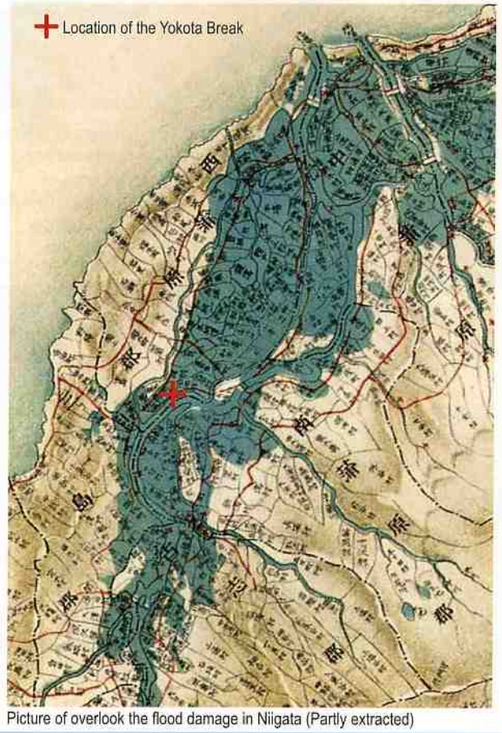
The Yokota Break commemorative stone

The locations at which the river burst its banks by the floods on 22 July 1896, are not only at "Yokota" flood damage also occurred at the middle reaches of the Shinano River such as Nagaoka, the region of Uono River, etc. Also, huge damages occurred at the upper reaches of the Shinano River which is within the Nagano Prefecture.

The damage of this Yokota Break was huge, especially the devastated of cultivated fields. Flood water did not subside from the lowland even several months later. The sanitation condition became poor, and people died due to infectious diseases.

The Yokota Break: Damage of the Niigata region

Human Damage	Fatalities	43
Building Damage	Houses flooded above floor level	43, 684
	Houses flooded over 120cm	6, 642
Land Damage	Flooded cultivated fields (ha)	58, 254
	Damaged cultivated fields (ha)	3, 130



Picture of overlook the flood damage in Niigata (Partly extracted)

Major events in the history of the Ohkouzu Diversion Channel

This diversion channel can be called the key to flood control on the Shinano River. The idea for a diversion channel to protect the Echigo Plain from flooding originated about 270 years ago. The concept overcame several setbacks including the problem of maintaining water depth necessary for river transport, technological problems, opposition movements, and many others to finally become reality 200 years later in 1922. The excavation of this 10 km long diversion channel was completed with the efforts of more than 10 million workers and the loss of 84 precious lives. It forced the removal of 218 homes and the buying of 464 ha of land.

Edo

1716～1735 ●Men from Teradomari, Mr.Kazuemon Honnma-ya, petition the Shogunate to construct a diversion channel at Ohkouzu. However the Shogunate rejected the proposal.

1842 ●The Shogunate begins investigation of diversion channel plans.

1868 ●Great flood.

1869 ●Decision taken to construct diversion channel. The first stage construction starts.

Meiji

1872 ●Riot led by Teisuke Watanabe in opposition to diversion channel project.

1875 ●The first stage construction suspended.

1876 ●Work on Shinano River channel improvement begins.

1881 ●Campaign to construct the Ohkouzu Diversion Channel gains strength.

1896 ●The Yokota-gire (Yokota Break)

1909 ●The flood of "The Yokota-gire" served to restart the work on the Ohkouzu Diversion Channel. The second stage construction starts.

Taisyo

1922 ●Two huge landslides occurred.
●Ohkouzu Diversion Channel opened.

1927 ●Diversion weir collapses, causing extensive damage. Repair work begins immediately.

1931 ●Ohkouzu Diversion Channel attained its present form. (Movable weir, two groundsills and four riverbed retention works completed.)

Showa

1973 ●Completion of second groundsill and sub-weir.

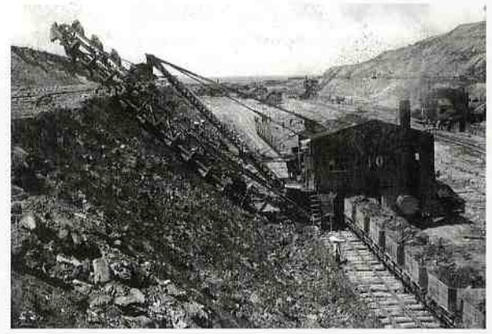
1982 ●Highest ever water level recorded in the Ohkouzu area. Main weir springs leak.

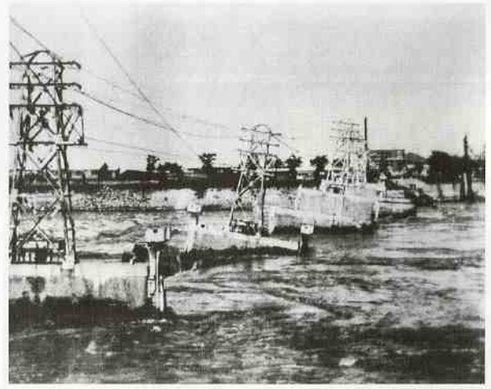
1992 ●Start of construction of new main weir.

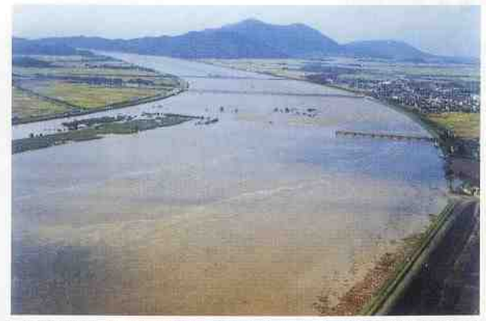
Heisei

2000 ●Completion of new main weir (opened).

2002 ●Completion of Ohkouzu Diversion Weir Project.


Second phase work by using large construction machinery


The elevation difference between the diversion point and the sea was great because it extended only 10 km from a point where the river was still 60 km from the Shinano River Mouth. For this reason, the flow of water during a flood scoured the river bed, causing the collapse of the weir. Concrete was later laid on the bottom to prevent scouring.


A series of floods with higher water level than that of the Yokota Break of 1892 have occurred, but since the opening of the Ohkouzu Diversion Channel in 1922, the Shinano River has not caused even one disastrous flood. (Flood of September 1982)

1869, a ground plan of the first stage construction

Function of the Ohkouzu Diversion Channel

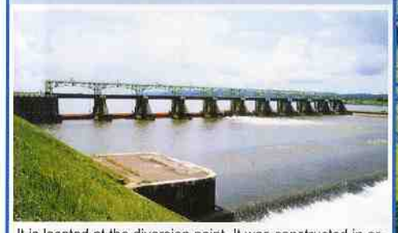
Function of the Ohkouzu Diversion

By the continuous control of the river flow together with the main weir and the movable weir, the Ohkouzu Diversion Channel is preventing the flood water from spreading over the Echigo Plain and protecting the downstream area from flood damage. However, ordinarily it lets most of the water from the main weir downstream towards Niigata City for irrigation, industry, and tap water. Therefore, the Ohkouzu Diversion Channel is working not only for floods but all the time.

Fixed weir

The fixed weir is a concrete overflow type weir to raise the water level above the inlet to the diversion channel.

Movable Weir



It is located at the diversion point. It was constructed in order to replace the broken weir in 1931.

Groundsill and Sub Weir Bed Retention

Their function is to deposit sediment to protect the bottom of the channel from erosion.

Main Weir
(registered national tangible cultural property)

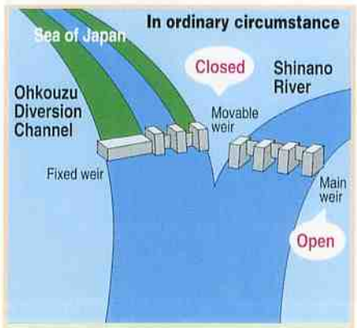
The old weir protected the Echigo Plain for about 80 years and was registered tangible cultural property in 2002.

New Main Weir

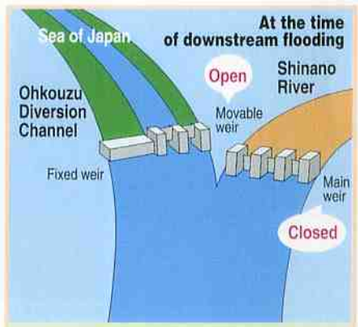
It is located at the entrance of the Shinano River to supply a constant quantity of water downstream. Three types of fishway on either bank, and a lock navigated by shipping were incorporated into the design.

Fish way observatories

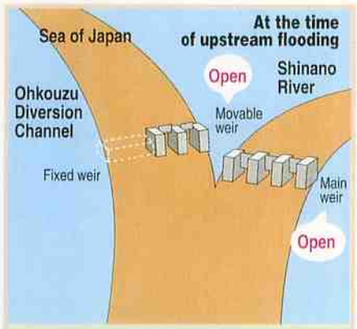
Control of the Weir



The main weir is opened and 270 m^3 of water a second discharged for use downstream.
Water in excess of this amount flows along the diversion channel out to sea.



The main weir is closed and the entire discharge sent directly out to sea.
It is operated to protect the downstream region from floods.



The main weir is opened if there is no flooding downstream and closed if there is flooding.
Floodwater from upstream follows the diversion channel out to sea.

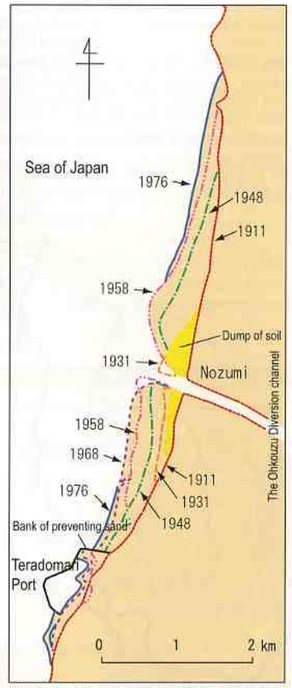
Expanding land / Disappearing land

Expanding land -Teradomari, Nozumi Coastline-

At the mouth of the Ohkouzu Diversion Channel, sediment carried from the upstream has moved the coastline forward about 6 m every year, forming more than 600 ha of sand dunes.

Since the opening of the Ohkouzu Diversion Channel in 1922, much of the sediment carried by the Shinano River has been deposited on the Teradomari, Nozumi Coastline that has formed a new channel mouth instead of in the Port of Niigata.

Teradomari, Nozumi Coastline

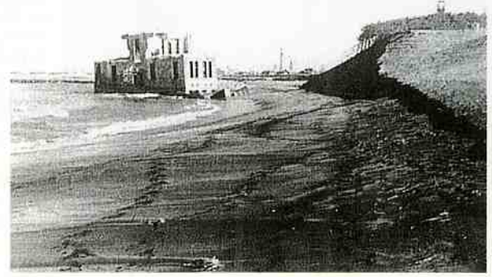


Advance of the coastline at the mouth of the Ohkouzu Diversion Channel

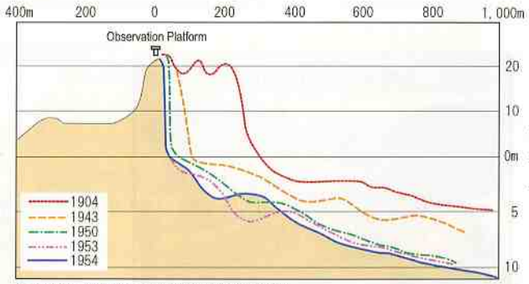
Loss of land -Niigata Coastline-

In contrast to the Teradomari, Nozumi area, the coastline of Niigata City at the mouth of the Shinano River has gradually retreated.

The Niigata-Nishi Coastline is located near the mouths of the Shinano River and the Agano River that carry vast quantities of sediment and the shoreline has moved forward continuously. But after the opening of the Ohkouzu Diversion Channel and the jetty constructed in the Port of Niigata at the river mouth early in the century, t the quantity of sediment carried by the Shinano River has been sharply reduced. Also the extraction of excessive natural gas during the period of high-speed economic growth has caused land subsidence. These have resulted in severe shoreline erosion. The coastline had retreated about 400 m.



Niigata Coastline: Former weather observation station fallen into the ocean (1949)

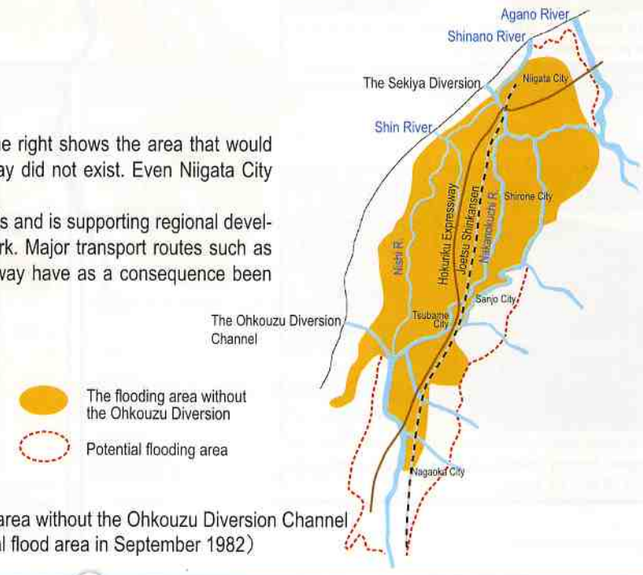


Astonishing erosion of the Niigata Coastline

If we don't have the Ohkouzu Diversion Channel

What would happen if we didn't have it? The picture on the right shows the area that would have been flooded in September 1982 if the divided waterway did not exist. Even Niigata City would have been covered with water.

The Ohkouzu Diversion Channel is protecting us from floods and is supporting regional development and the people. It also improves the transport network. Major transport routes such as the Joetsu Shinkansen ("bullet train") and Hokuriku Expressway have as a consequence been built through the heart of the Echigo Plain.



The flooding area without the Ohkouzu Diversion Channel
(The potential flood area in September 1982)

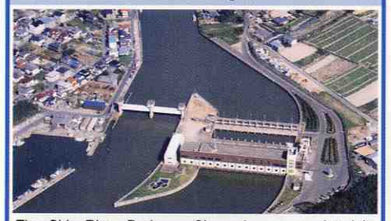
Development of the Echigo Plain

At the Echigo Plain, there used to be many lagoons and swamps, but now this place is known as one of the leading rice producing regions in Japan. This plain was developed by the continual hard work of its residents and reached its present state thanks to the construction of not only the Ohkouzu Diversion Channel, but many other diversion channels and drainage plants.

Excavation of drainage channels

The most important feature of flood control and development of the Echigo Plain is excavation of numerous drainage channels. Eight artificial drainage channels have been constructed on only 60 km of the Shinano River as it crosses the Echigo Plain, because the plain is extremely flat and it is very difficult to drain its water naturally. Therefore excavation of the drainage channels through the sand dunes that block the outlet to the sea, was the best solution to drain the water.

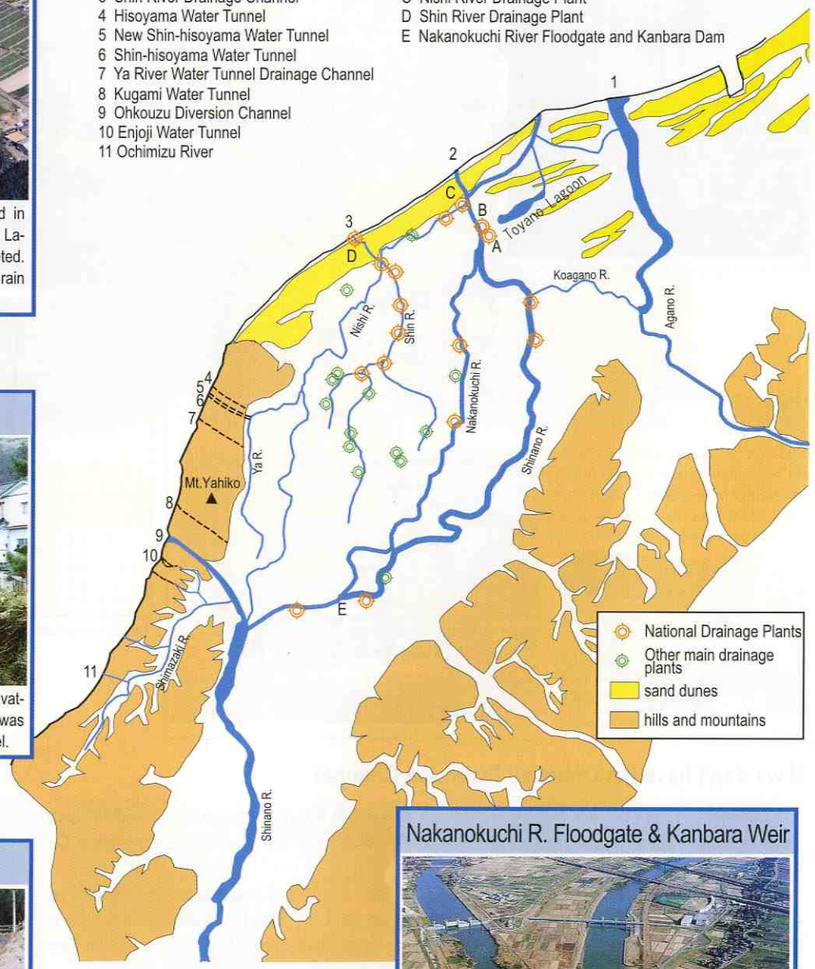
Shin River Drainage Channel



The Shin River Drainage Channel was completed in 1820. In the nineteen-fifties, reclamation of the Yoroi Lagoon, Ta Lagoon, and the Oh Lagoon were completed. The Shin River Drainage Plant has a capacity to drain 240 m^3 per second which is the largest in the orient.

1 Agano River (Matsugasaki Drainage Channel)
2 Sekiya Diversion Channel
3 Shin River Drainage Channel
4 Hisoyama Water Tunnel
5 New Shin-hisoyama Water Tunnel
6 Shin-hisoyama Water Tunnel
7 Ya River Water Tunnel Drainage Channel
8 Kugami Water Tunnel
9 Ohkouzu Diversion Channel
10 Enjoji Water Tunnel
11 Ochimizu River

A Oyamatsu Drainage Plant
B Toyano Lagoon Drainage Plant
C Nishi River Drainage Plant
D Shin River Drainage Plant
E Nakanokuchi River Floodgate and Kanbara Dam



Enjoji Water Tunnel

The Enjoji water tunnel and Ochimizu River were excavated as incidental works, because the Shimazaki River was cut off by the works of the Ohkouzu Diversion Channel.

New-Hisoyama Water Tunnel

Hisoyama water tunnels were excavated as measures against flooding downstream of the Ya River where water runs off from Mt. Yahiko.

Nakanokuchi R. Floodgate & Kanbara Weir

The water volumes of the Shinano River and Nakanokuchi River are controlled during flooding and droughts by the Nakanokuchi River Gate and the Kanbara Weir.

Drainage plants improve the land

Before pumps were installed, flood damage was the worst problem on the low flat land (mostly below sea level), drainage was poor at normal times, agriculture and transportation were difficult.

Deep muddy fields that could not be drained regularly were transformed into fertile land by the pumps (drainage plants), which performed the task of draining the accumulated inner water between the levees.

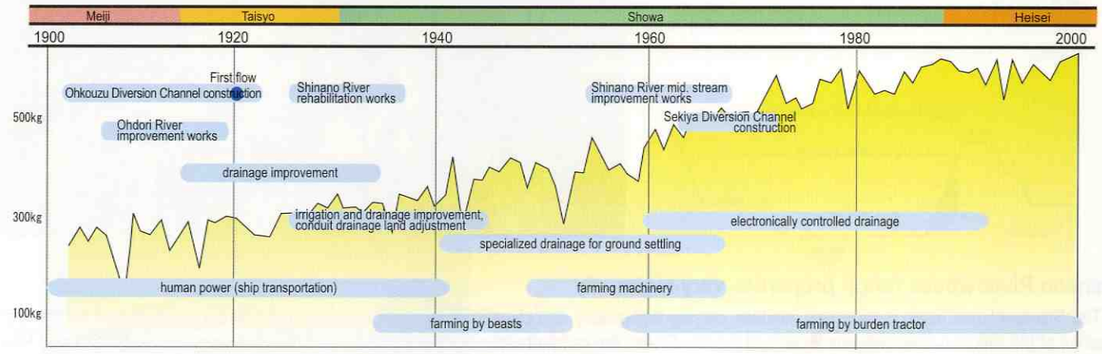
Nishi River Drainage Plant

Development and rice production

After the Ohkouzu Diversion Channel was built, more than 27,000 ha of agricultural land along the Shinano River have been protected from flooding and have become beautiful rice paddies. The paddy fields were once so wet that people could sink up to their waist in them. However, the channel has lowered the water level, improved land with the improvement in agricultural mechanization, and transformed the productivity of the region's rice fields. The quality of rice has improved and now this region produces the most popular rice in Japan, "Koshihikari rice" .

After the Ohkouzu Diversion Channel was built, the width of the lower Shinano River became smaller, making it possible to develop new city land.

Rice yield per 10 a in Niigata Prefecture



The Sekiya Diversion Channel

The Sekiya Diversion Channel that began operating in 1972 was constructed to reduce sedimentation in the Port of Niigata and to prevent the collapse of the Niigata-Nishi Coastline in order to protect Niigata City and its surroundings from flooding.

Functions of the Sekiya Diversion Channel

Protect Niigata City from the flood of the Shinano River!

It protects the city from inundation of the Shinano River by leading the flood water directly through the diversion channel to the sea.

Regulate the water flow of the Shinano River!

It controls the volume of water flow into the Japan Sea during a drought period to secure the required water level for the public water supply and/or agricultural use.

Keep salt water out of the Shinano River!

It prevents salt water flowing back into the Shinano River by the gate and weir which were constructed on the diversion channel and the Shinano River .

Reduce sedimentation in the Niigata-Nishi Harbor!

It prevents sedimentation in the Niigata-Nishi Harbor by carrying flood water which contains a great amount of sediment through the diversion channel.

Prevent erosion of the Niigata Coastline!

It prevents erosion of the Niigata Coastline by discharging sediment through the diversion channel.

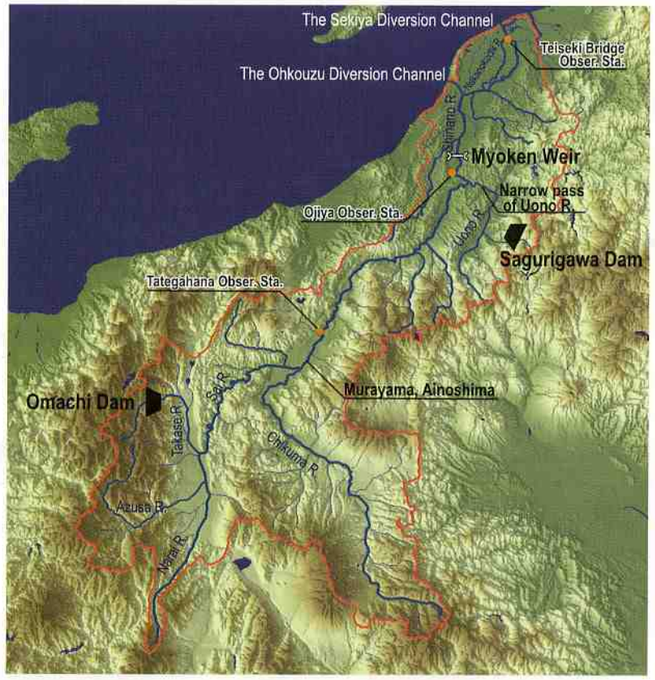
The Shinano and Surrounding Region

Flood control in the Shinano

Down to its middle reaches, the Shinano River flows through a series of alternating narrow valleys and basins, widening in the basins and narrowing in the valleys. Since the flood water does not flow easily at the narrow exits of the basins, this topography is vulnerable to inundation by flood water. Downstream, the Ohkouzu Diversion Channel carries all flood water into the Sea of Japan, while the river usually flows on across the wide Echigo Plain and through Niigata City into the Japan Sea. This page introduces typical flood control projects undertaken in the Shinano River Basin.

How does the flood water flow?

To protect the Shinano River Basin from flood disasters, flood control plans have been prepared to provide protection from flooding by rainfall that is predicted to occur once every 150 years on the Shinano River and once every 100 years on the upstream Chikuma River and its tributaries.



Shinano River whose runoff properties vary regionally

The Shinano River Basin is wide and includes varying topography and climatic conditions, resulting in different forms of runoff on the upper reaches of the Shinano (the Chikuma River and the Sai River), the middle reaches of the Shinano, and the lower reaches of the Shinano River. The runoff on the upper reaches of the Shinano (the Chikuma River and Sai River) and on the middle reaches of the Shinano is strongly influenced by typhoons, while in the lower reaches of the Shinano, the factor affecting runoff is mainly intensive rainfall, because the Ohkouzu Diversion Channel (completed in 1931) completely cut off the flood water from upstream.

Top three runoffs in the history of the river basin (Three regions along the Shinano River)

Upper Reaches of the Shinano River (Chikuma River and Sai River) (Tategahana Observation Station)

	Date of occurrence	Flow volume (m³/s)	Cause	Damage
1	Sep. 27, 1983	7,440	Typhoon 10	Levee break on the Chikuma River; Flooded 3,891 houses above floor level and 2,693 below floor level.
2	Aug. 12, 1959	7,261	Typhoon 7	71 dead and missing people; completely or partially destroyed 5,482 buildings; The largest post-war disaster on the Chikuma River
3	Sep. 10, 1982	6,754	Typhoon 18	Levee break on the tributary (Taru River); Flooded 3,794 houses above floor level and 2,225 below floor level.

Middle Reaches of the Shinano River (Ojiya Observation Station)

	Date of occurrence	Flow volume (m³/s)	Cause	Damage
1	Aug. 23, 1981	9,640	Typhoon 15	Caused severe damage on the Uono River; Submerging 3,000 houses only at Muikamachi town.
2	Sep. 13, 1982	9,290	Typhoon 18	Exceeded the warning water level at Ojiya by 1 m; The highest water level ever recorded at Ohkouzu.
3	Sep. 9, 1983	7,810	Typhoon 10	Submerged 12 buildings below floor level, 140 ha of farm land, and 5 ha of residential district land.

Lower Reaches of the Shinano River (Teiseki Bridge Observation Station)

	Date of occurrence	Flow volume (m³/s)	Cause	Damage
1	Jun. 26, 1978	2,250	Intensive rainfall (during the rainy season)	Large runoff in the middle reaches of the Shinano River Broken levee on the Nishi River Submerged 27,000 ha and 4,000 buildings.
2	Aug. 14, 1976	1,738	Intensive rainfall	Damage in the large scale was not recorded.
3	Aug. 6, 1861	1,666	Intensive rainfall	Overflow and levee break on Kariyata River A break was prevented with rice bales. Submerged 2,000 ha rice paddies at Nakanoshima

Flood control with dams

Dams regulate the flood water from the mountainous area of the Shinano River in order to mitigate the peak flood runoff.

These dams are multi-purpose dams that not only regulate floods, but also maintenance the flow of the river, supply water to the downstream, and generate electric power.


View of the Omachi Dam


View of the Sagurigawa Dam

Chikuma River: Levees in a liquid basin

In the Murayama and Ainoshima district immediately below the convergence of the Chikuma River and Sai River, the deep gravel of the Chikuma deposits on the riverbed and forms an extremely thick permeable layer. In this area, the levees easily leaked.

At locations where the river flows through paddy fields, counterweight fill work on the foundations was constructed.

Turbulence prevention measures in the middle reaches

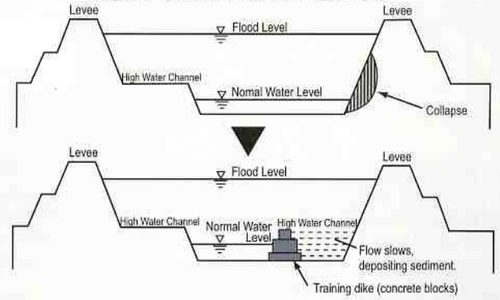
In the middle reaches such as at Nagaoka, Ojiya, and Koshiji, where the river stream is in severe turbulence, so there is a high risk of damage to the bases of levees and devastation of the high water channel. Two measures are taken to prevent such damage.

1. Measures to prevent turbulence at the top of the alluvial fan
Groundsill work is done to prevent the flow oscillating to the left and right at the top of the alluvial fan of the Echigo Plain, which is a cause of turbulence. The Myoken Weir acts as groundsill work, stabilizing the flow.

2. Measure to prevent scouring of levees
A high water channel is constructed to separate the levee from powerful currents so that their action will not scour away the base of the levee. Also, training dikes and groynes are constructed to stabilize the low water channel.


The Myoken weir

Effects of improvement in the Mizunashi district



Measures in narrow passes on the Uono River

On the Uono River, there are narrow passes where the river is relatively narrow and its capacity to carry flood flows is small. There are three places of these narrow passes (Oishi, Koide, and Urasa) and are known as the three great gorges of the Uono Rive. The levees have been set back to expand their flood carrying capacity.


Koide district (taken 1976)


Koide district (taken 1998)

Runoff of snow melt

Snow melt runoff is another characteristic of the flooding on the Shinano River. Melted snow water flows out very slowly, but because it is continuous, the river level remains high, so that a moderate rainfall can increase the danger of flooding.

The Uono River and the downstream of the Chikuma River are in one of the heaviest snowfall regions in Japan, where from 200 to 350 cm of snow accumulates annually. When it melts, the tributaries are filled with a roaring flow of turbid water.

Sabo in the Shinano

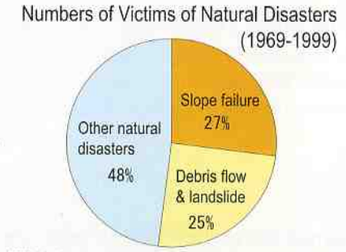
Collapsing land

Mountainous and hilly areas make up 70% of the total land area of Japan. With a large number of rapids, fast-flowing rivers and its geological weakness, the Japanese islands are vulnerable to sediment-related disasters caused by weather conditions like typhoons and localized torrential rain. Sediment-related disasters account for about a half of the dead and missing by natural disasters (excluding those by the Southern Hyogo Earthquake). Therefore the control of sediment runoff, which is called Sabo works, is essential to ensure safety from sediment-related disasters.

The upper stream of the Shinano includes wide areas of volcanic land and devastated land with fragile weak geology. Rainfall on this land triggers hillside landslides, landslides, and debris flows. In the two prefectures of Nagano and Niigata, there are 5,951 locations designated as Sediment-Related Disaster Hazard Area. Also owing to their geological properties, this river basin is particularly prone to landslides. These prefectures also include some of the world's heaviest snowfall regions where from 3 to 5 meters of snow accumulate during the winter, triggering snow avalanches that devastate the surface. And the spring runoff of the melted snow also discharges large quantities of sediment, increasing the danger in many districts.

Mt. Yakedake where volcanic activity continues

Distribution map of medium and severely devastated areas



※Excluding the victims in the Southern Hyogo Earthquake of 1995

Disaster of debris flow on the Na River（1983.9.28）

Sabo - the ongoing struggle with sediment

In order to ensure safety from sediment disasters which devastate the verdant national land, claim precious human lives, and destroy homes, roads, and railways, sabo works such as the construction of Sabo dams and others have been carried out on the Azusa River and Uono River in the upstream part of the Shinano River System.

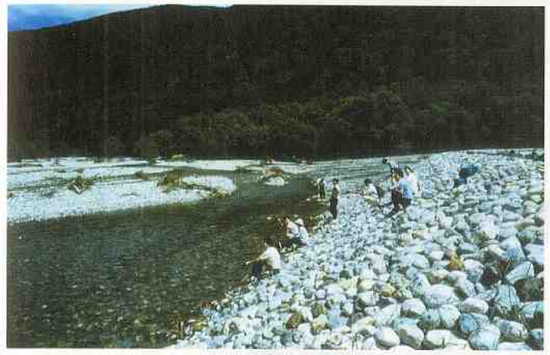
Sediment control projects include the construction of "sabo dams" to prevent erosion and to accumulate large amounts of sediment flow at a time from upstream and "channel works" and "consolidation works" to prevent erosion of the banks and riverbeds of mountain torrents and the inundation of the land by sediment. These are carried out to protect the lives of people living downstream from sediment disasters, transform devastated torrents into safe torrents, and permit people to safely use the surrounding land.

Uranosawa sabo dam (Hirokami Village)

Nobori River channel works (Shiozawa Town)

Sabo harmonized with the natural environment

Large numbers of designated parks including both national and quasi-national parks are located in the mountainous area of the Shinano River, but many of these overlap with Sabo areas. In these designated park areas, it is important to harmonize work with nature by careful consideration of its impact on the natural environment from the planning stage.



Consolidation works on the upstream of Azusa River (Azumi Village)
The surfaces of consolidation works are buried so that they cannot be seen.
(consolidation works: work to stabilize a river bed to reduce movement of its gravel)

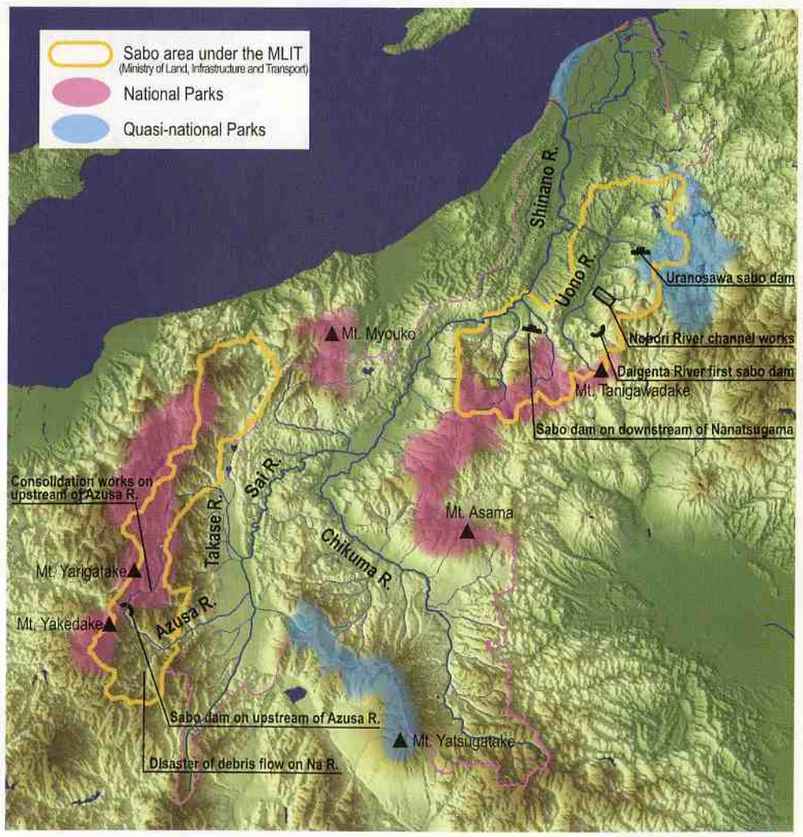
Sabo dam on the downstream Nanatsugama (Nakasato Village)
Blocks that look like natural rock are used to build a sabo dam in harmony with the natural environment.

The civil engineering legacy of Sabo - transcending the times

In the Shinano River, where the risk of disaster is high, sabo works that are ahead of their times have been carried out continually. Many sabo structures that have functioned for 50 years or more are still on duty in the Shinano.

Sabo dam on upstream Kamagafuchi (Azumi Village)
This was constructed in 1944 and has been registered a certified cultural property (2002).

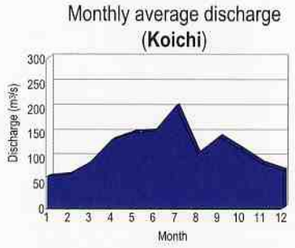
Daigenta River first sabo dam (Yuzawa Town)
This is an arch-type sabo dam constructed in 1939.



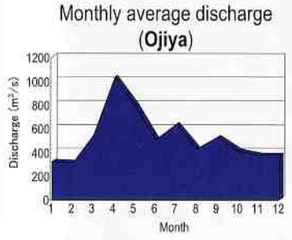
Water use in the Shinano

Flow regime of the Shinano River

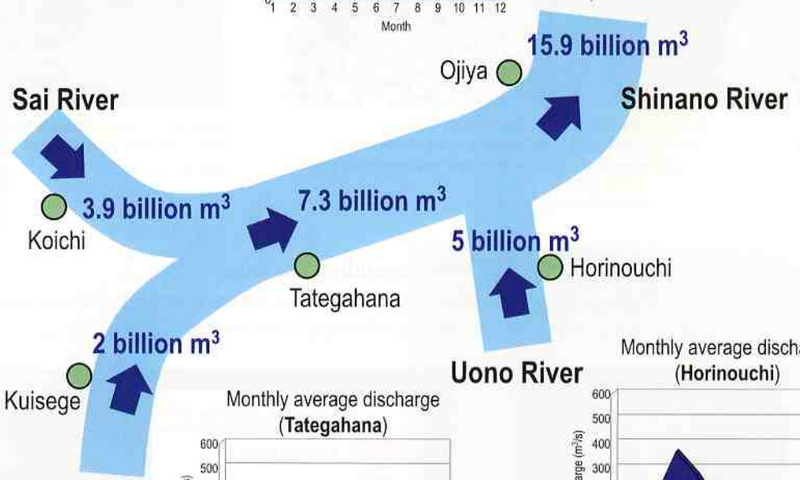
Weather conditions change frequently in the Shinano River Basin, and its flow regime also varies in the different river basins and in different seasons. A comparison between the Chikuma River which includes the Nagano Basin and the Ueda, Saku Basins with its interior climate featuring small rainfall throughout the year, and the Uono River as a region of the world's heaviest snowfall, indicates about 2.5 times larger water runoff from the Uono River even though its basin area is half that of the other river basins.

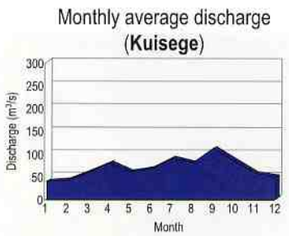


Average annual discharge: 124 m^3/s
Total annual runoff: 3.9 billion m^3

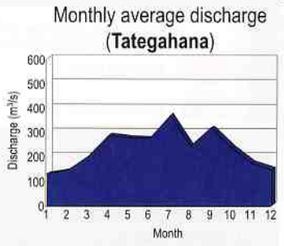


Average annual discharge: 503 m^3/s
Total annual runoff: 15.9 billion m^3

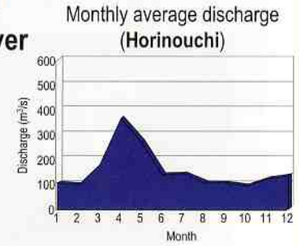




Average annual discharge: 62 m^3/s
Total annual runoff: 2 billion m^3



Average annual discharge: 233 m^3/s
Total annual runoff: 7.3 billion m^3



Average annual discharge: 157 m^3/s
Total annual runoff: 5 billion m^3

River basin		River basin area	Annual runoff	Specific discharge
Chikuma River	(Kuisege)	2,596 km^2	2 billion m^3	750,000 m^3/km^2
Sai River	(Koichi)	2,773 km^2	3.9 billion m^3	1,400,000 m^3/km^2
Uono River	(Horinouchi)	1,408 km^2	5 billion m^3	3,500,000 m^3/km^2

Present state of water use in the Shinano River

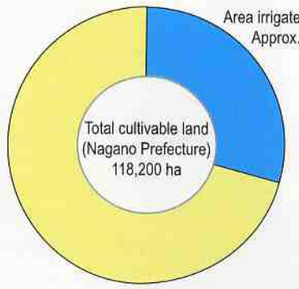
The water resources of the Shinano River are used as follows: the number of hydroelectric power plants is 122 with the total maximum output of approx. 5 million kWh; the intake for irrigation is approx. 570 m^3/s for one of Japanese leading rice producing regions; and about 15 m^3/s of water is supplied to domestic water supply systems serving 2.5 million people. It also supplies about 19 m^3/s of water for the mining and manufacturing industries.

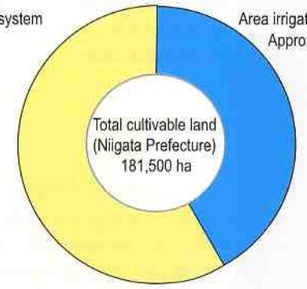
Hydro Power		Domestic Water Supply		Industrial Water	Irrigation	Others
Quantity -Normal- (m^3/s)	Quantity -Max- (m^3/s)	Quantity -Max- (m^3/s)	Population (person)	Quantity -Max- (m^3/s)	Quantity -Max- (m^3/s)	Quantity (m^3/s)
889.44	4950.51	15.43	2,564,100	18.31	566.91	24.65

Agricultural water use

The rivers of the Shinano River System support agriculture in the river basin by irrigating land on the Echigo Plain, which is known as the granary of Niigata Prefecture, and in the Nagano Basin and other basins.

In Nagano Prefecture, the Shinano River System (Chikuma River) irrigates about 34,600 ha of land equivalent to about 30% of all cultivatable land in the prefecture. In Niigata Prefecture, water from the Shinano River irrigates about 75,500 ha, which is equivalent to more than 40% of all land in the prefecture.



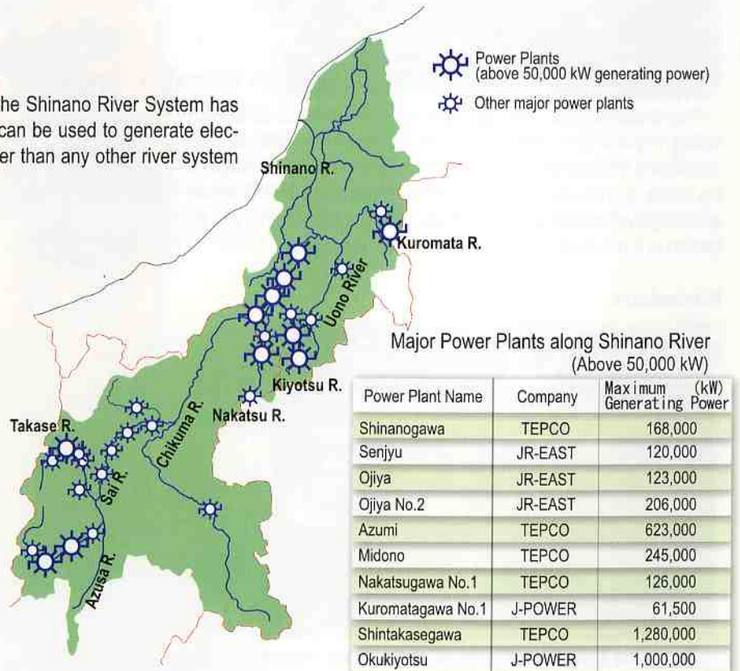


Use of water to wash away snow

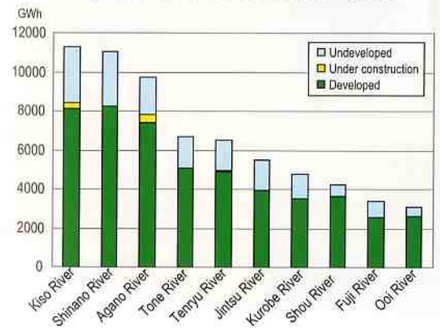
As this is one of the heaviest snowfall regions in Japan, the water of the Shinano River or the Uono River is conveniently used to carry the snow downstream smoothly. These rivers have relatively high discharge flow, so the rivers flowing through the city streets are essential to carry the snow downstream.

Abundant hydroelectric power

Thanks to its topography and high water volume, the Shinano River System has extremely large potential hydropower resources that can be used to generate electricity. Its plants now produce more hydroelectric power than any other river system in Japan.



Hydropower Resources by River System



Major Power Plants along Shinano River
(Above 50,000 kW)

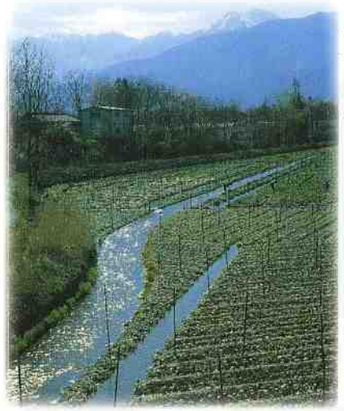
Power Plant Name	Company	Maximum (kW) Generating Power
Shinanogawa	TEPCO	168,000
Senjyu	JR-EAST	120,000
Ojiya	JR-EAST	123,000
Ojiya No.2	JR-EAST	206,000
Azumi	TEPCO	623,000
Midono	TEPCO	245,000
Nakatsugawa No.1	TEPCO	126,000
Kuromatagawa No.1	J-POWER	61,500
Shintakasegawa	TEPCO	1,280,000
Okukiyotsu	J-POWER	1,000,000
Okukiyotsu No.2	J-POWER	600,000

TEPCO : Tokyo Electric Power Plant
JR-EAST : East Japan Railway Company
J-POWER : Electric Power Development Company

Relation between the Shinano and the People

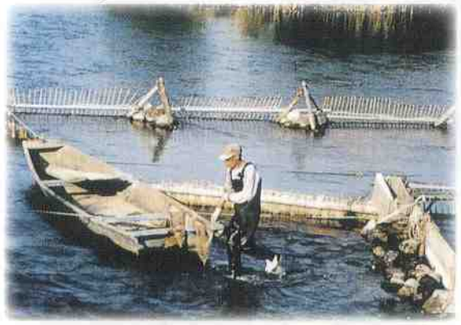
In the Shinano River Basin where people both utilize and struggle with its rivers, the customs of enjoying the benefits of nature and also avoiding disasters have taken firm root of culture of the Shinano.

Wasabi (Japanese horseradish)



Clear cold and abundant water is essential to grow wasabi. Azumino in the Northern Alps where water from melted snow gushes from springs provides the perfect environment for wasabi fields. It is, therefore grown in this area.

Tsukebaryo



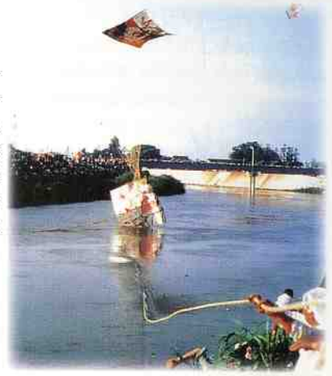
The Chikuma River and Sai River had been famous as salmon fishing regions from ancient times to the early twentieth century. The fishing method called "Tsukeba-ryo", which takes advantage of the habits of chub (during the chub spawning season, the fishermen spread gravel to form spawning beds, then net the fish that are attracted to these beds), is still practiced in several places.

Kananbare

During the Kananbare event held on the Dolls' Festival, children put hand-made dolls on round straw lids and float them down the river. It is a simple custom to thank the river for its water also teaches them to fear its danger.

Giant kite battle

At this event, dozens of teams from Shirone City and Ajikata Village that are on opposite sides between the Nakanokuchi River, gather to fly huge kites or hexagonal kites (up to 7 meters long, 5 meters wide, and weighting 50 kg). The teams entangle their kites in an effort to cut the other team's kite strings.



Ojiya-chijimi (Crepe from Ojiya)

Hemp crepe, which is a light and comfortable material is a famous Japanese product and specialty of the Tokamachi and Ojiya region. This famous product is woven in highly humid conditions as snow falls at night. Yuki-sarashi (snow exposure), which is an important part of the shrinking process, is done by laying it on the snow in early spring and using the snow to bleach it. The snow is indispensable to help bleach the crepe.

Home town of famous sake

The quality of sake depends on the quality of the rice and water used to make it and the skills of the brewer. The upstream region of the Shinano and the Uono River provides these three elements: Japan's leading rice growing area, its snow provides abundant high quality water, and home of the Echigo brewers.

Now, there are more than 100 independent sake producers in Niigata, and their total production ranks third in Japan.

Koshihikari rice

In the past, rice grown in Niigata was harshly criticized with the term "Torimatagi mai" (rice that birds step over = rice so bad a bird won't eat it) because of cold damage and flooding, but the farmers of the region worked unceasingly to create improved varieties, and achieved great progress in the past seventy years.

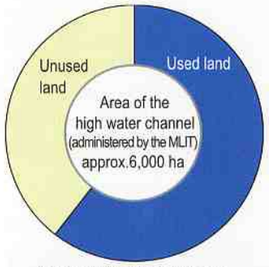
Koshihikari, which is known as a famous rice from Niigata, has established a firm position as one of Japan's best quality and best tasting varieties of rice thank to the abundant water of the Shinano River, the hard work of the people, and the benefits of the climate and natural features of Echigo.

For the future of the Shinano River

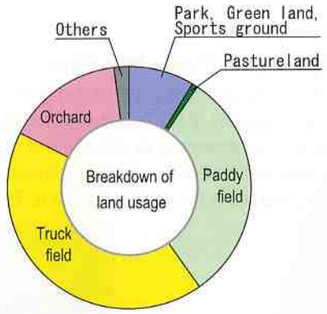
Since ancient times, the Shinano River has been, both physically and spiritually, closely linked to the daily lives of the people through their rice production, river fisheries, and shipping activities, their festivals, and occasionally by floods. The river is still in the limelight as a force that unites the river basin. The residents, business enterprises, and regional administrators conduct their lives and activities aware that the region equals the river basin.

Use of the high water channel

The high water channel is the river area provided to allow the flood water to flow safely towards downstream when its level rises during a flood period, but in Japan, this land is used as sports fields and parks when the water level is normal. The river area in the Shinano River System that is directly administered by the MLIT (the Ministry of Land, Infrastructure and Transportation) covers about 6,000 hectares, and approximately 60% of this land is used. As urbanization has advanced along the river in recent years, the river area, as an open space with water and greenery near the city, has been used for parks, green lands, strolling, sports, fireworks, and other events.



※Unused land includes unusable land.




Use as paddy fields (The lower reaches of the Shinano)

Yasuragitei Embankment


Yasuragitei Embankment (Niigata city)

The lower reaches of the Shinano River are located at the seaward section of the Shinano River basin area, flowing through the center of Niigata City, the largest city on the Sea of Japan.

The Yasuragitei Embankment prevents damage by flood water and also protects against earthquakes. It also serves as a precious urban waterside park right in the center of the city to provide the people with easy access to the Shinano River. Structurally it is the first of its kind nationwide, which utilizes a gentle (1:5) slope; this not only gives protection against rising water levels but also allows many possibilities for recreational use. At the water edge such facilities as steps and stepping stones have been provided to allow people to get closer to the water. It is a familiar place for many people and the scene of numerous events.

Shinanogawa Water Shuttle

The Shinano River used to be a major cargo transport artery used by a flourishing shipping trade. The revival of this shipping activity shows the close links between the people and the river, stimulating the City of Niigata. Transport on the river was revived in 1999 to use the surface of the Shinano River to provide public transportation guaranteed to be free of delays and unhindered by congestion.


Shinanogawa Water Shuttle


A culture activity using the Riverside Fun School (Tokamachi city)

The Riverside Fun School Project was introduced to take the maximum advantage of the various functions of the river to use it as an accessible place for education about nature. At the Waterside Fun School, a plaza, toilets, and other amenities are provided to make it a place where children can experience and study the waterside along the river.

Waterside Plazas

Waterside Plazas are operated cooperatively by the national government and local authorities. They provide centers to bring the people of various regions together and to improve the national rivers by taking the maximum advantage of the charms of the waterside.

In the Shinano River Basin, Waterside Plazas have been established in Ueda City in the Chikuma River Basin and Tsunan Town in the Nakatsu River Basin.


Image of the Nakatsugawa Waterside Plaza


Ueda Waterside Plaza

Together with the local community

-The Chikuma School and the Uonuma Nature School -

In the Chikuma River Basin, gatherings called the Chikuma School are held jointly by the Chikuma River Work Office and the Prefectural History Museum to provide the residents of the region with the chance to study the links between the Chikuma River and its riverside population. And in the Uono River Basin, the Uonuma Nature School established at the request of the Yuzawa Sabo Work Office conducts lively activities.


Chikuma School

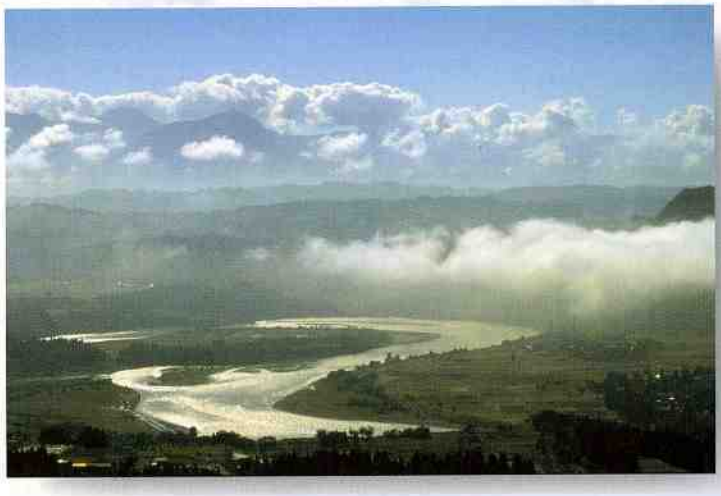
- Regional improvement using dams -

Along the mountain rivers that flow through rich natural settings of the upstream area of the Shinano River Basin, dams constructed to support the life of the river basin and sediment check dams that protect the river basin from danger have, in recent years, been widely used not only for their original functions, but also as recreation areas.


Uonuma Nature School


Takase Valley Festival


Campsite at Shakunage dam lake



Published by

Foundation of River & Basin Integrated Communications, JAPAN

Nissei Hanzomon Building 1-3 Kojimachi, Chiyoda-ku, Tokyo, JAPAN
Phone：03-3239-8171　FAX：03-3239-2434
Homepage Address　http://www.river.or.jp/

●Cooperation　Ministry of Land, Infrastructure and Transport

The Shinano River Work Office
Matsumoto Sabo Work Office
Sagurigawadam Control Office
Shinanogawa Karyu Work Office
Yuzawa Sabo Work Office
Shinano River Ohkouzu Museum
The Chikuma River Work Office
Omachidam Control Office

Pictures:
Cover / Nariaki Onishi,　Back Cover / The Shinano River Work Office Ministry of Land, Infrastructure and Transport