SEDIMENT CONTROL OFFICE, DEPARTMENT OF PUBLIC WORKS,
SHIZUOKA PREFECTURAL GOVERNMENT

EROSION CONTROL IN SHIZUOKA

1 History of Erosion Control Works in

History of Erosion Control

The history of erosion control in Shizuoka Prefecture is long. Since the enforcement of the Erosion Control Law in Meiji 30th (1897), Senmata in Tamagawa village, Abegun(now included in Shizuoka city) was designated as an area of erosion control in Meiji 34th. The works of erosion control subsidized by the government were started in the next year. But Shizuoka suffered large scale disasters everywhere in the prefecture in Meiji 43th (1910) and 44th (1911). As the result, the designation was applied to many other areas, and erosion control works were started with the basins of Abe River and Seto River. Check dams were constructed in Taisho period by use of a dry masonry technique and they are still in use.

In Showa 7th(1932), the erosion control was evaluated and its effectiveness was acknowledged. Because of the acknowledgement, the subsidy was increased and the Department of Erosion Control was placed in the prefectural government in Showa 13th (1938). In Showa 19th (1944), the department was ended due to administrative reform during war period and integrated into the Department of River and Port.

As mountains and lands were devastated due to excess deforestation during war time, the 1st five-year plan was made to control floods in Showa 24th (1949). Since then, the promotion of food control projects has been plotted, and the preparedness against debris/sand flow disaster has been proceeded.

In Showa 33th (1958), the prefecture is ailed from an unprecedented disaster caused by Kanogawa Typhoon, and the importance of erosion control was recognized. In order to deal with the year-by-year increasing works, the Erosion Control Section in the Department of Public Works was reestablished in Showa 41th (1966) and reorganized to the Sediment Control Office of Managing Office of River and Sediment Control in Heisei 11th(1999), and is still in operation now.

In Showa 12th (1937). the upstream of Abe River which underwent a landslide called Ohya Collapse, one of the three worst in Japan, in Showa 34th (1959), the upstream of Kano River devastated by Kanogawa Typhoon, and in Showa 44th (1969), the collapsing area at Japan's symbolic mountain Fuji, Osawa Collapse, were included in designated areas of the erosion control which are directly administrated by the central government. And the erosion control was put into practice by the Ministry of land, Infrastructure and Transport.

Chronology of Erosion Controls in Shizuoka Prefecture

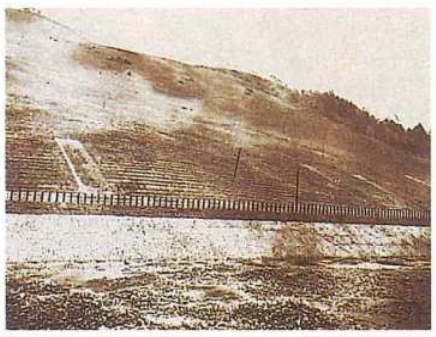
Era (year)	Controls by Local Government (Shizuoka)	Controls by Central Government	Others
Meiji 30 (1897)		The Erosion Control Law and the Prescription of Execution of Erosion Control Law were established.	
31 (1898)		The Erosion Control Works subsidized by the Nation started.	
34 (1901)	The Okusenmata Tamagawa village in the Abe county was designated as an area of erosion control.		
35 (1902)	Erosion control works were executed in Senmata River in the Abe River water system.		
41 (1908)	The regulation to control various works at areas which need erosion control, was enacted.		
43 (1910)	The regulation to control designation of erosion control area was enacted.		
Showa 10 (1935)	A general meeting of Shizuoka Prefectural Erosion Control Association was convened.	The National Flood Control and Erosion Control Association was established.	
12 (1937)		Erosion control works by the Minister of Construction itself started in upper part of Abe river.	
15 (1940)	The Department of Erosion Control was placed.(Shizuoka branch of National Flood Control and Erosion Control Association was launched.)	The National Flood Control and Erosion Control Association was organized.	
19 (1944)	The Department of Erosion Control was abolished. (Integrated to the Department of River and Port.)		
24 (1949)		The First 5-years Plan of Flood Control Works was established.	
27 (1952)	Land slide activity started. (At Akamatsu, Shimada city.)	The landslide prevention at sub-land areas was started.	
33 (1958)		The Prevention of Landslide etc. Law was established .	The Kanogawa Typhoon
34 (1959)		Erosion control works by the Minister of Construction itself started in upper part of Kano river.	
39 (1964)	Subsidized erosion control works of Ohsawa Collapse of Mt. Fuji was started.		
41 (1966)	The Department of Erosion Control was placed again.		
42 (1967)	The regulation to control designated areas in Shizuoka prefecture for erosion control was enacted.	The Step Slope Failure Prevention Works started.	
44 (1969)		The Law of Prevention of disasters by the steep slope failure was established. The Erosion Control works by the Minister of Construction itself started in the Collapse of Osawa of Mt. Fuji	
46 (1971)	The guideline of staffing minotors at erosion control designated areas in Shizuoka prefecture was enacted.		
48 (1973)		The first Slope Failure Prevention Week executed.	
49 (1974)			The Tanabata Heavy Rain. The Earthquake occurred off shore of Izu Peninsula.
51 (1976)	The guideline of patrol at steep slope areas in Shizuoka prefecture was enacted.		
52 (1977)	The municipality-subsidizing institution was enacted for the projects to prevent landslides at steep slope areas.		
53 (1978)			The Earthquake occurred in the sea near Izu Oshima Island
56 (1981)		100th anniversary ceremonies of Erosion Control Works were held.	
58 (1983)		The first Debris Disasters Prevention Month executed.	
60 (1985)	A conference presided by National Land and Cliff Slide Prevention Association to present researches was held.	20th anniversary ceremonies of Steep Slope Failure Prevention Works are held	
Heisei 6 (1994)	A panel discussion was held at a local area of landslide by National Land and Cliff Slide Prevention Association.		
7 (1995)			The Earthquake occurred in southern Hyogo Prefecture
8 (1996)	The Shizuoka Prefectural Erosion Control Volunteers Association was launched.	100 years passed since the Erosion Control Law was established.	
9 (1997)		The Erosion Control Volunteers Associations were established in the nation wide.	
11 (1999)	The Department of Erosion Control was changed to the Erosion Control Office.		
12 (2000)		The Debris Disaster Prevention Law was enforced.	
13 (2001)		The Debris Disaster Prevention Law was enforced.	
14 (2002)	100 th anniversary ceremonies of Shizuoka Prefecture's Erosion Control Works were held		
15 (2003)	The National Meeting of promotion of preventing debris disasters were held in Shizuoka Prefecture.		

Shizuoka Prefecture

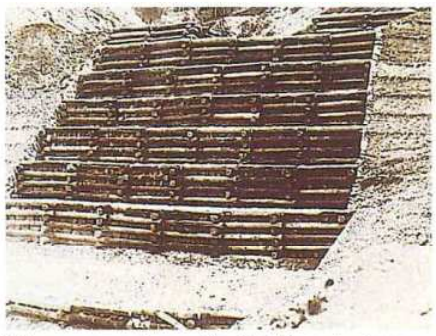
Erosion control works in the period from Meiji era to the prewar days

Konnosawa torrent in Ohi River drainage (Okusa, Shimada City). Check dam covered with stones constructed in Taisho 2th (1913)

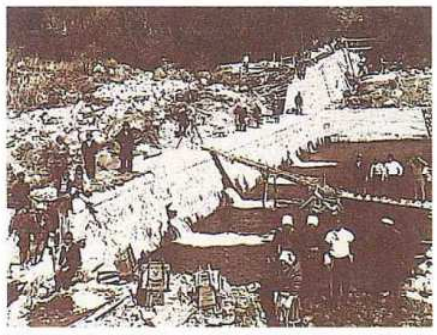
Ogasazawa torrent in Ohta River drainage (Toyosawa, Fukuroi City). Erosion control works for village promotion in Showa 8th (1933)



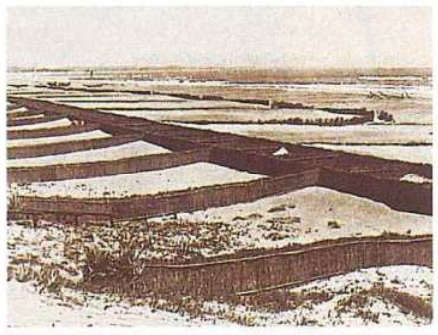
Ohi River (Ohka,Ohnaga village,Shida County-Shimada City now). Erosion control works for village promotion in Showa 8th (1933)



Kiriyamasawa torrent in Ohi River drainage (Ieyama,Kawane Town). Kiriyama No. 2 check dam made with wood in Showa 9th (1934)



Shirata River (Shirata, Higashiizu Town, Kamo County). View of the construction of Shirata River erosion control in Showa 13th (1938)



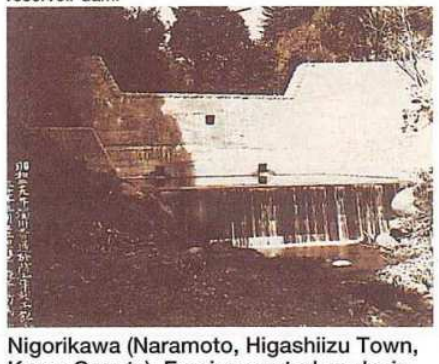
The right bank at the mouth of Ohta River (Fukude, Fukude Town, Iwata County). Flying sand prevention works at the seaside of the river mouth in Showa 14th (1939)

Erosion control works from postwar period to 1965 (before the establishment of Erosion Control Department)

Isajigawa (Koto Town, Hamamatsu City). Erosion control works in Showa 25th (1950).

Sugegaya River in Hagima River drainage (Sugegaya, Sagara Town, Haibara County). Erosion control works in Showa 27th (1952). It was the biggest dam at that time in Shizuoka Prefecture and is still used as a reservoir dam.

Okina River inTenryu River drainage (Nishiure, Misakubo Town, Iwata County). Erosion control works in Showa 28th (1953)



Nigorikawa (Naramoto, Higashiizu Town, Kamo County). Erosion control works in Showa 29th (1954).

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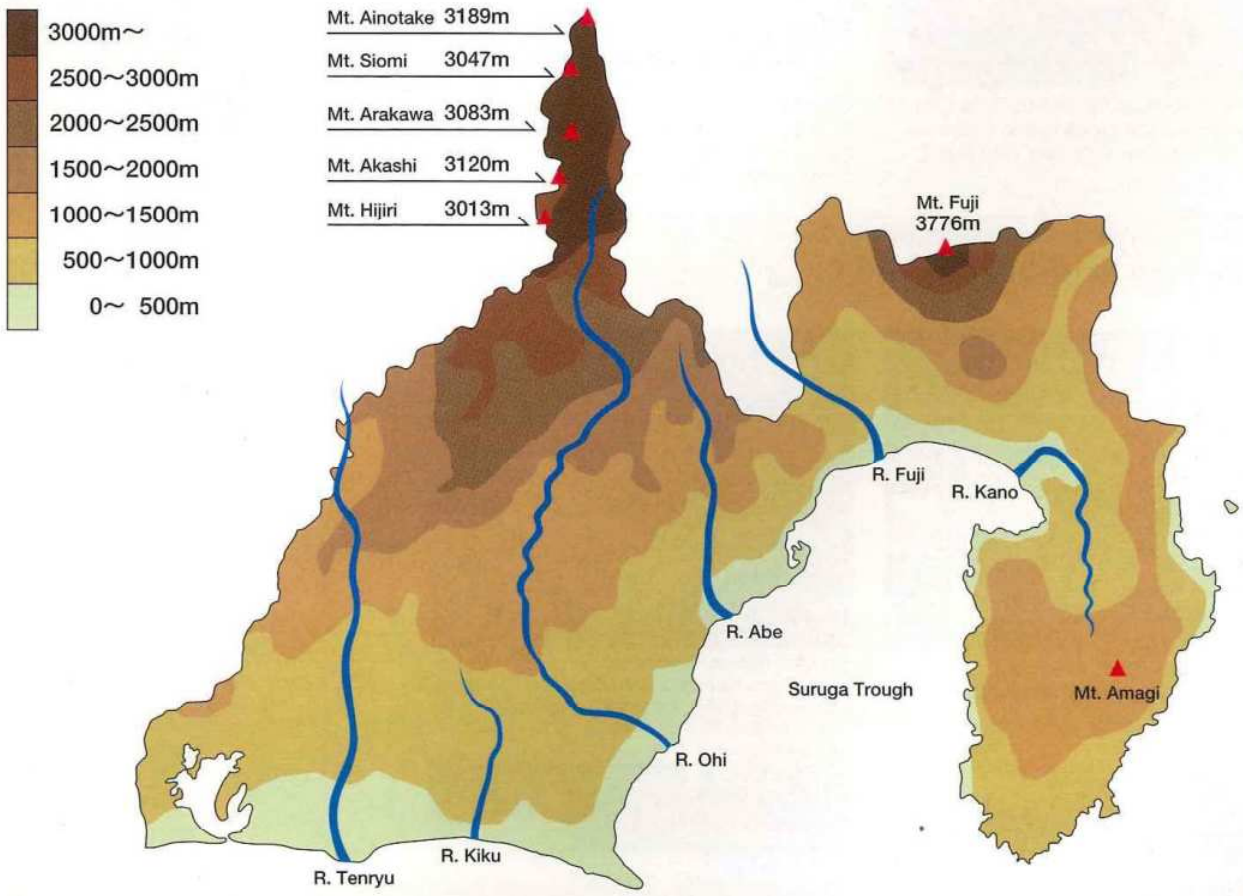
2 The Form of Shizuoka Prefecture

Location

Our prefecture is located in the middle of Honshu on the Pacific side. Shizuoka is blessed with a warm climate and abundant nature. It is adjacent to Kanagawa Prefecture in the east divided by Hakone Mountain, Aichi Prefecture in the west across Hamanako Lake, Yamanashi Prefecture and Nagano Prefecture in the north divided by Mt. Fuji and the Southern Japan Alps. Shizuoka Prefecture measures 155 km from East to West and 118 km from South to North. It covers about 7,779 km of land and consists of 20 cities, 49 towns and 4 villages. The population in Shizuoka is 3,790,000 people.

Direction	Place	Longitude or Latitude	
East end	East end of Hatsushima Island Atami city	East longitude	139°10′
West end	West end of Kosai city	West longitude	137°28′
South end	South end of Mikomoto Island Shimoda city	North longitude	34°34′
North end	North end of Shizuoka city	North longitude	35°38′

Nomber of municiparities 69	22 cities	43 towns	4 villages
cf. The number is decreacing due to municipality mergers.			
Prefecture area 7,779.46km²		Population 3,795 thousand as of 2004. Jan.	



Main rivers in Shizuoka Prefecture

River name	Water source	Length
Tenryu river	Lake Suwa in Nagano Prefecuture	213km
Ohi river	Ikawa in Shizuoka city	168km
Fuji river	Yamanashi Prefecture	128km
Abe river	Umegashima in Shizuoka city	51km
Kano river	Izu city	46km
Kiku river	Kanaya town	28km

Main mountain in Shizuoka Prefecture

Mountain name	Location	Hight
Mt. Fuji	Boundary between Shizuoka Prefecture and Ymanashi Prefecture	3776m
Mt. Ainotake	Boundary between Shizuoka Prefecture and Ymanashi Prefecture	3189m
Mt. Arakawadake	Shizuoka city	3083m
Mt. Akaishidake	Boundary between Shizuoka Prefecture and Nagano Prefecture	3120m
Mt. Shiomidake	Boundary between Shizuoka Prefecture and Nagano Prefecture	3047m
Mt. Hiziridake	Boundary between Shizuoka Prefecture and Nagano Prefecture	3013m

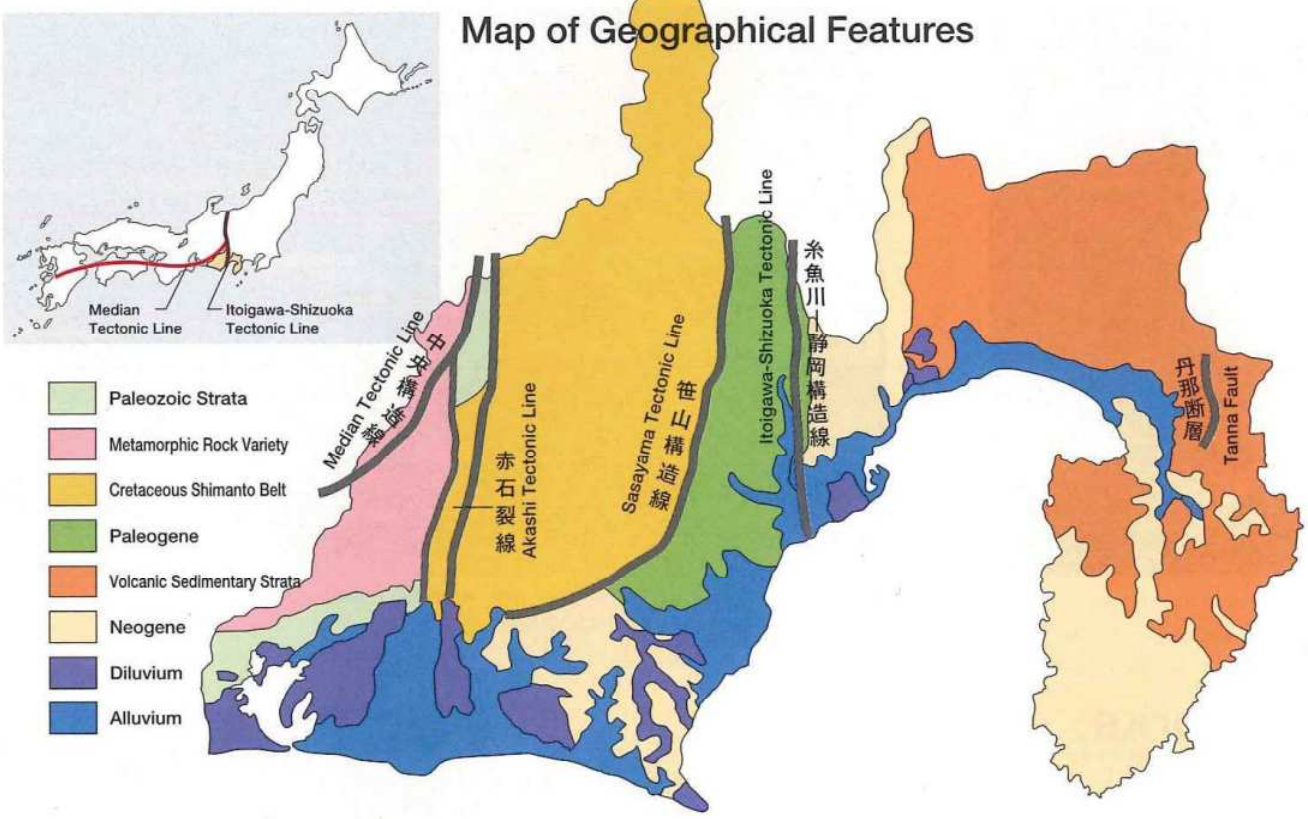
Topographic Features

In our prefecture, the mountains of the Southern Japan Alps including majestic Mt. Fuji are running in the north. And the rivers with swift flow such as Kano River, Fuji River, Abe River, Ohi River and Tenryu River are originated from these mountains. The fan deltas of these rivers form coastal plains. About 73 % of the whole area in our prefecture is mountainous. Many dams are built at the rivers and are used to generate power. The Izu Peninsula extending out to the Pacific Ocean, holds Suruga Trough on the western side whose depth is more than 3,000 meters stretching from south to north.

Geographical Features

The geographical feature of our country is complicated. Especially our prefecture, which is so complicated that it is said to be a miniature model of our country because of consisting of various kinds of geographical features. From the north to the south, Ryoke Metamorphic Zone, Sanbakawa Terrain, Chichibu Terrain, Shimanto Belt, Setogawa Group and Ohigawa Group are all next to each other. And along with these strata, there are the groups of Fossa Magna fault represented by the ltoigawa-Shizuoka Tectonic Line. Shizuoka also has regions with geothermal active area, such as Mt. Fuji and the new volcanoes in the Izu Peninsula. The western part of our prefecture belongs to the so-called South Western part of Japan. It is divided between the Inner Belt (mountain side) and Outer Belt (sea side) with. The eastern part belongs to the Fuji Volcanic Zone of East Japan and many active faults are confirmed in the Izu Peninsula. Because our prefecture geographical features vary so much, there are many fragile areas that can easily collapse.

Map of Geographical Features



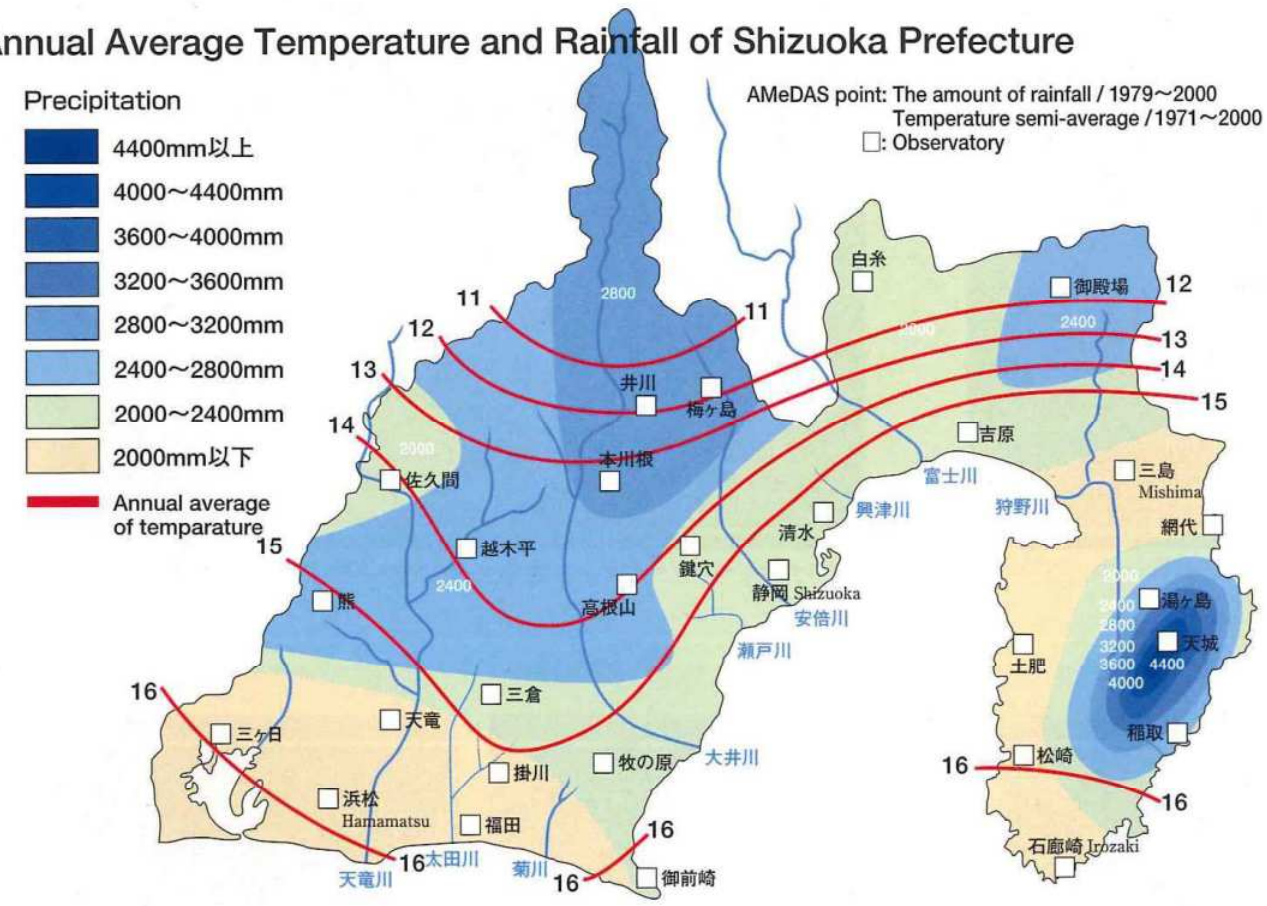
Ryugashi cave (Inasa Town)
[Carboniferous period, lime rock of Jurassic Chichibu Zone]
The lime rock area in the western part of Shizuoka Prefecture, consists of many lime stone caves.

Udoyama, Nihondaira (Shizuoka City)
[Quaternary Conglomerate strata]
This is the newest mountain in Japan excluding volcanoes where the delta in Abe River was upheaved 300m for about 100,000 years. Much gravel and sand flow out because of its conglomerate strata.

Omuroyama (Ito City)
[Izu Monogenetic Volcano group] 580 m above sea level.
This mountain was formed by the fine volcanic rocks called scoria layered onto each other.

Mt. Fuji with a shade cloud
It would be bad weather after about 6 hours, if a cap cloud has come out on the top of Mt. Fuji.

Annual Average Temperature and Rainfall of Shizuoka Prefecture



The average temperature of our prefecture in a year is 15-16 degrees. In August, the height of summer season, the average temperature is 25-26 degrees. In winter, it is warm in the southern part of Izu Peninsula and even in the coldest day in Irozaki they rarely have the day the temperature fall below the freezing point. Annual precipitation is more than 2,000 mm throughout the prefecture. June is usually the month with the most rainfall. During this month, We have 312 mm of rainfall in Shizuoka, 262 mm in Hamamatsu and 246 mm in Mishima (average). As for the duration of sunshine, it is less than 2,000 hours in the eastern part but 2,000-2,300 hours in other places, As you can see, we are blessed with fine weather, and there are many fine days even during the winter.

Weather

3 Making Areas Resistant to Disasters

1 Erosion Control Works

The works are carried out by the prefecture or national government to prepare erosion control facilities in the designated erosion control areas to protect the people and houses at the downstream of the river from abnormal wash-away of rocks and sand, such as debris flow.
The works for erosion control carried out by the prefectural government consist of those subsidized by the national government and those self-supported by local governments.

Usual Erosion Control Works (Cost shared 1/2 by National Gov't subsidy and 1/2 by Prefectural Gov't.)

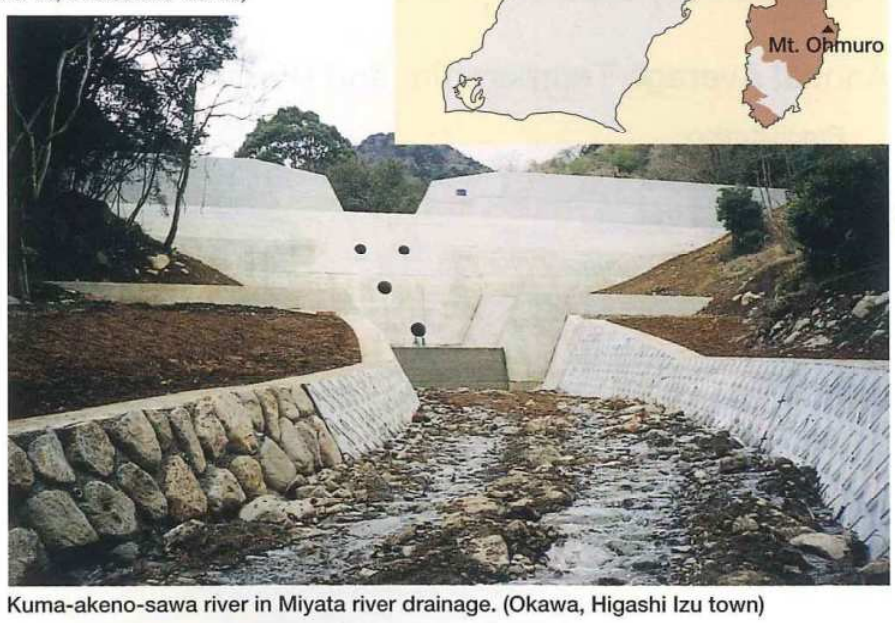
Wadeno-sawa river in Abe river drainage
(Ashikubokuchigumi Funasawa, Shizuoka city)

Sena-miya-sawa river in Tomoe river drainage (Sena,Shizuoka city)
Erosion control dam to protect houses.

Volcanic Erosion Control Works

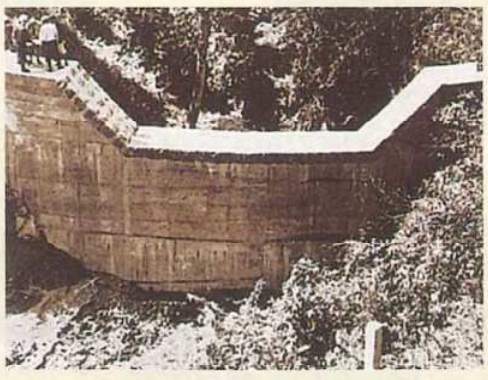
The works are carried out to prepare erosion control facilities to protect the people and houses at the downstream of the volcanic areas from disasters. We try to prevent abnormal wash-away of rocks and sand, such as debris flow, volcanic mud flow, pyroclastic flow and lava flow accompanied with volcanic eruption. (The ratio of the Government Subsidy is 5.5/10, Prefecture 4.5/10)

Fumoto river in Fuji river drainage (Fumoto, Fujinomiya city)



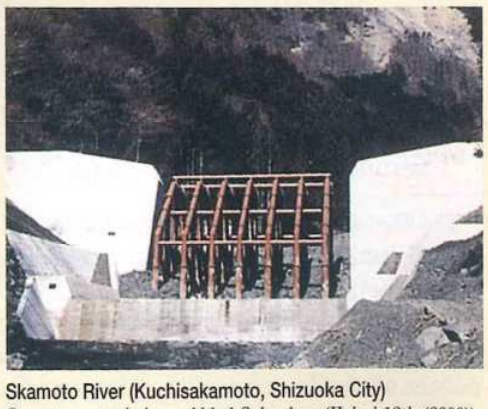
Kuma-akeno-sawa river in Miyata river drainage. (Okawa, Higashi Izu town)

Various Check Dams



Megurisawa in Fuji River drainage (Utsubusa,Shibakawa Town) Arch type check dam, first constructed in Shizuoka Prefecture (Showa 28th (1953))

Izunma River in Tenryu River drainage (Urakawa, Sakuma Town) Steel slit dam, first constructed in Shizuoka Prefecture (Showa57th (1982))



Skamoto River (Kuchisakamoto, Shizuoka City)
Open-type steel-pipe gridded Sabo dam (Heisei 12th (2000))

Emergency Works of Erosion Control

To execute construction in an emergency, such as the construction of dams at the rivers which threaten to cause the considerable debris disaster to the downstream of the river, if the unstable debris produced from the damage by a violent storm, flood or earthquake is left there, we will quickly work on it. (Cost shared 2/3 by National Government's subsidy and 1/3 by Prefectural Government.)

Koyanosawa in Kano River drainage (Hata, Kannami Town)
Disaster caused by torrential rain August 31, Heisei 10th (1998)

Yatsu River in Kawazu River drainage (Yatsu, Kawazu Town)
Disaster caused by torrential rain September 10-11, Heisei 3th (1991)

Erosion Control for the Prevention of Impediment in Higashi Fuji Military Practice

It is the project to carry out erosion control works with the financial aid of the National Defence Facilities Agency, as the basin was devastated from the use of heavy firearms in the practice of the Self-Defence Foree, so that there are anxieties of the washing away of rocks and sand to the downstream of the river.

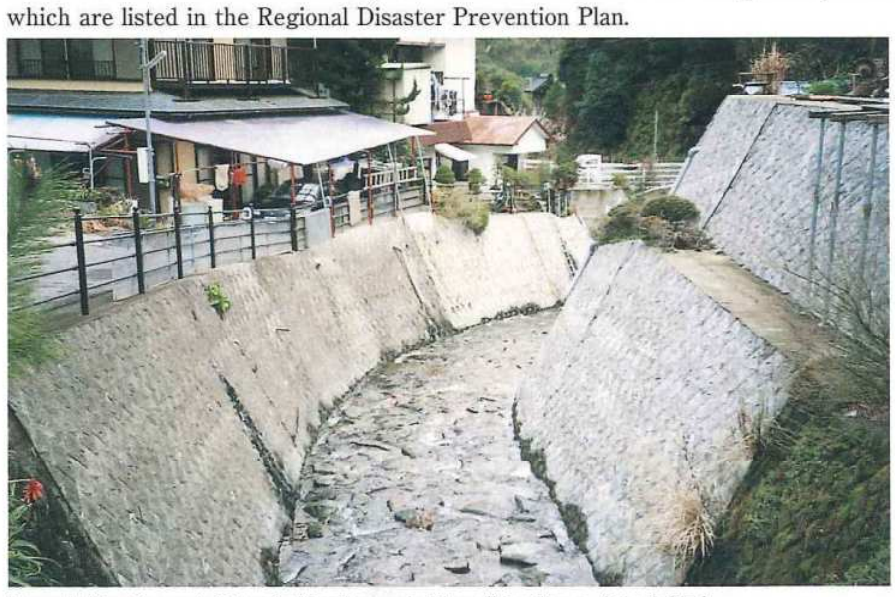
Zunazawa channel work in Kano River drainage (Jinba Gotenba City)

Erosion Control Carried Out by Shizuoka Prefecture

It is the project to carry out erosion control works without the National government financial aid. The other part of this project includes repair and maintenance of the facilities, research and analysis.

Natural Disaster Prevention Works

It is the project to carry out erosion control works using the bond issued by National Disaster Prevention Projects to build facilities at the dangerous places which are listed in the Regional Disaster Prevention Plan.



Branch Kamitagaoh River in Kamitagaoh River (Kamitaga, Atami City)

Various Check Dams

Kamekubosawa in Abe River drainage (Kuchisakamoto,Shizuoka City). The highest check dam in Shizuoka Prefecture, H: 26m, L: 81m (Heisei 1th (1989))

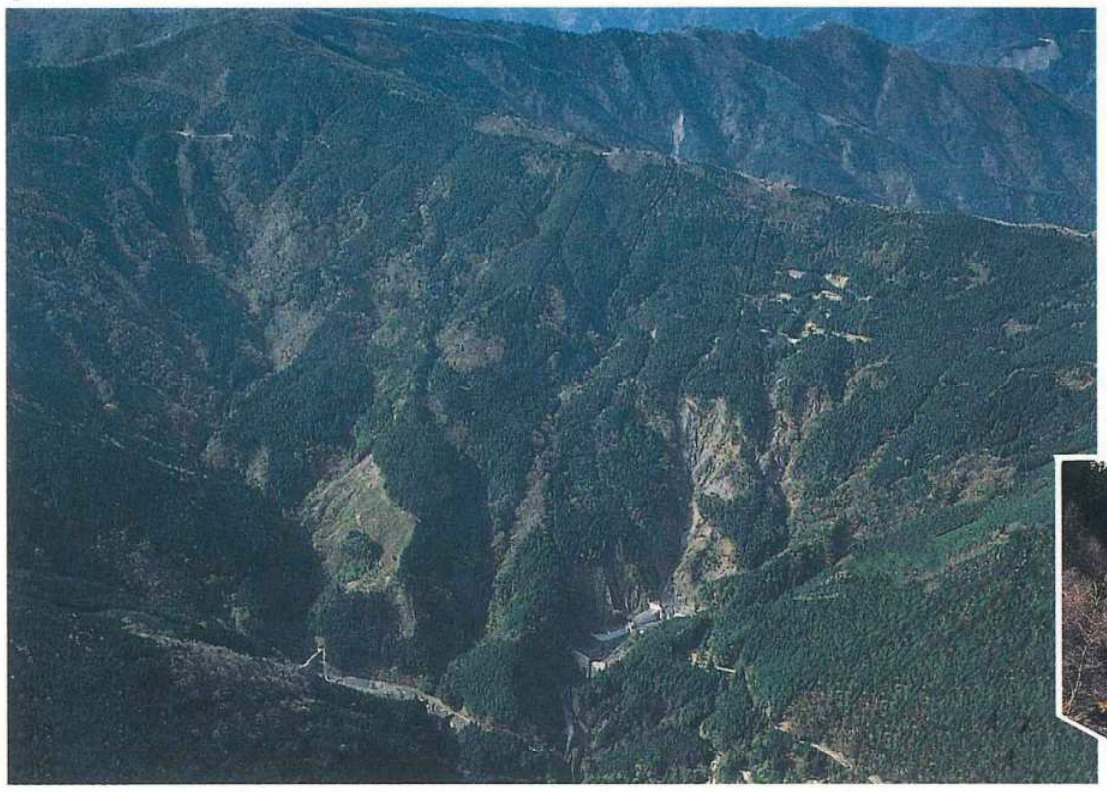
Fumotogawa in Fuji River (Fumoto, Fujinomiya City).
The longest check dam in Shizuoka Prefecture, H: 6m, L: 262m (Heisei 2th (1990))

Nakayamasawa in Kawazu River drainage (Yugano, Kawazu Town). The steel made cell dam first constructed in Shizuoka Prefecture, H: 12m, L: 49.5m (Heisei 3th (1991))

2 Prevention and Control Works of Landslide

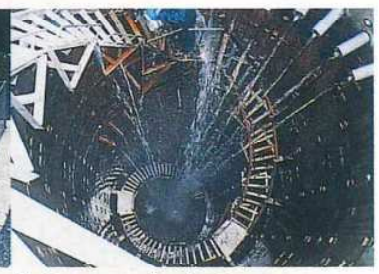
Landslide prevention measures, such as drainage wells, horizontal drainage boring, and piling work at considerably dangerous areas designated by the Minister of Construction. It is carried out based on the 9th National Seven Years Plan of Flood Control.

Prevention and Control Works of Landslide (Cost share 21 by National Gov't subsidy and 1/2 by Prefectural Gov't.)



Large-Scale Landslide Prevention Works for protecting Shizuoka City
Kuchisakamoto Landslide (Kuchisakamoto, Shizuoka City)

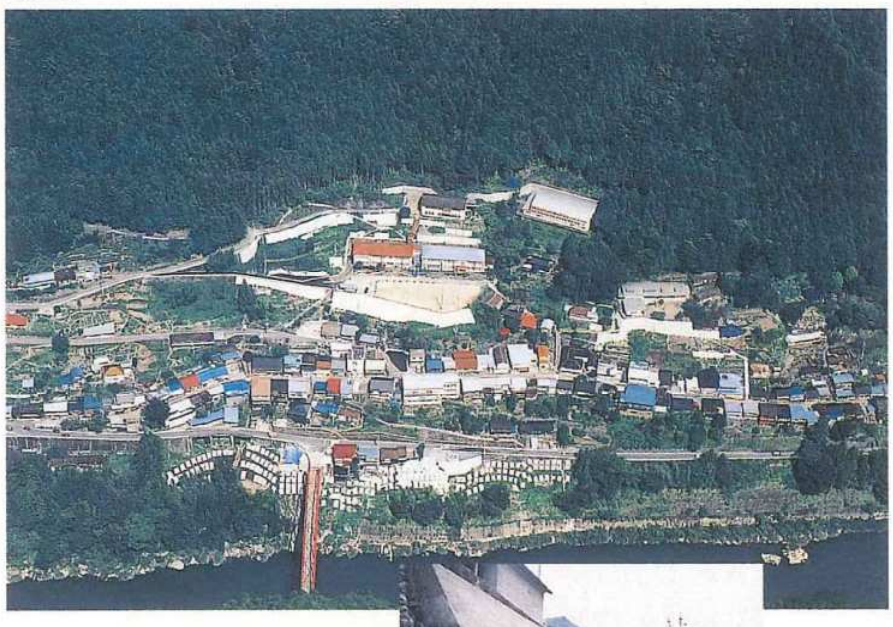
Drainage Well works (RC segment)

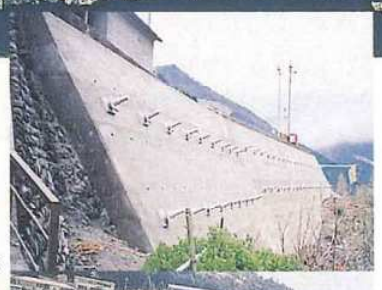


Draing groundwater from a catchment well.

The scene at the end of collapse

Landslide Prevention Works to protect industrial roads and houses.
Nishido Landslide (Nishido,Sakuma Town)





Concrete wall and anchor work

Pressure plates and anchor work

Piling work

Landslide Prevention Works to protect houses and important traffic network.
Nishikurasawa Landslide (Nishikurasawa, Yui town)

Piling work (Finish view)

Emergency Works of Landslide Prevention

It is necessary to execute urgent landslide prevention works to deal with the problem of landslides due to storms, floods, earthquakes, etc. and if the situation becomes serious and cannot be left as it is from the viewpoint of economy as well as public welfare. (National Gov't subsidized projects --- Cost shared 2/3 by the subsidy and 1/3 by Prefectural Gov't. Cost for others shared 1/2 by the subsidy and 1/2 by Prefectrual Gov't.)

Hansei Landslide (Hansei, Kikugawa Town)
Disaster occurred caused by torrential rain September 23-24, Heisei 10th (1998)

Just after the disaster hit

Landslide prevention works accomplished

Morokosawa Landslide (Morokosawa, Shizuoka City)
Disaster occurred caused by torrential rain September 11-12, Heisei 12th (2000)

Crack appeared on the bank protection at the toe portions of the landslide.

Landslide prevention works accomplished Slope frame and anchor works

Prevention and Control Works of Landslide in Shizuoka Prefecture (Improvement of Living Environment Works)

These projects are carried out without National Government subsidies, including landslide control works and maintenance of their facilities.

A water channel for leading groundwater to drainage.

Otaki Landslide
(Ohi, Sakuma Town)

Natural Disaster Prevention Works

It is the project to carry out landslide control works financed by the bond of Natural Disaster Prevention Projects at the dangerous places which are listed in the Regional Disaster Prevention Plan.

Minemura landslide (Kanaya, Kanaya Town)

3 Steep Slope Failure Prevention Works

It is the project to carry out steep slope failure prevention works, such as retaining wall or frame work, in the designated dangerous steep slope areas, and the landslide may collapse many houses.
The project consists of works with and without national government financial aids.

Steep Slope Failure Prevention Works

Steep slope works designated taking into consideration the environment
Tennoyama Steep Slope (Ieyama, Kawane Town)

Before Development

Akebushi No.2 Steep Slope
(Akebushi, Matsuzaki Town)

After Development

●Path Preparation and Neighbors

We promote the exchange among the local residents by preparing pathes with steps and slopes where houses are divided above and below a cliff.

Steep Slope at Kamijimahakkaji
(Kamijima, Hamamatsu City)

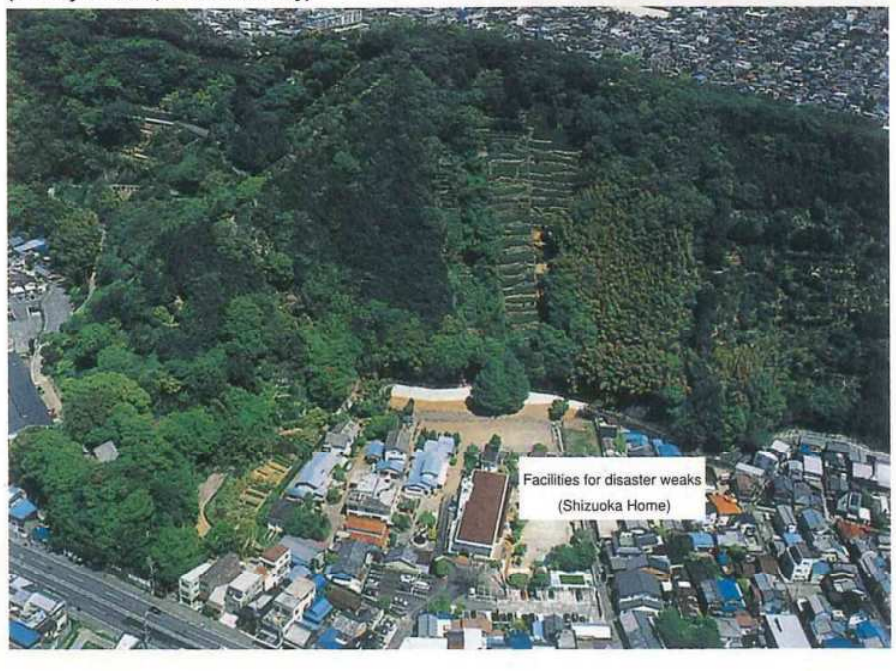
Preparation of neighborhood steps

●Institutions for the Disaster Weak

We build communities where we can live safely and in ease by preparing the places which insure a safe living for the disaster weaks in old people homes, hospitals, clinics, day nurseries and kindergartens.

Children playing in the places
where safety measures are taken
for disaster weaks.

Inomiya Town No.2 Steep Slope
(Inomiya Town, Shizuoka City)



Emergency Works of Steep Slope Failure Prevention

To execute emergency collapse prevention works at the places which are recently eroded by a storm, flood and earthquake etc. and if they are left as they are, they may collapse in the next rain. (Cost shared 4/10-4.875/10 by National Gov't subsidy, 4.6/10-5/10 by Prefectural Gov't and 1/10-0.25/10 by localities.)

Yamagaya Steep Slope (Kamiasahina, Hamaoka Town)
Disaster caused by torreential rain June 27-28,Heisei 12th (2000)
The scene of the damage, one house half destroyed and the other partly destroyed, and the warehouse completely destroyed

Just after the disaster hit

Finish walls and frames in Prevention works

Steep Slope Failure Prevention Works carried out by Shizuoka Prefecture

(Improvement of Living Environment Works)

It is the project to carry out steep slope failure prevention works that are not supported by the national government financial aid works.

Tenjinyama Steep Slope (Shitaru of Minamiizu Town)

Natural Disaster Prevention Works

It is the project to carry out the steep slope failure prevention works financed by the bond of Natural Disaster Prevention Projects at the dangerous places listed in the Regional Disaster Prevention Plan.

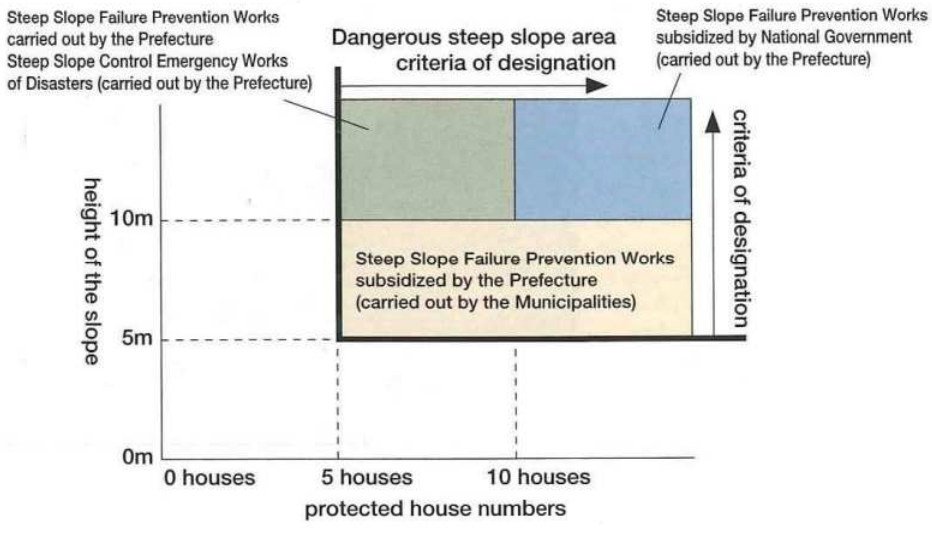
Mariko Iziri designated as a steep slope area (Mariko, Shizuoka city)

Subsidy for the Steep Slope Works

(Improvement of Living Environment Works)

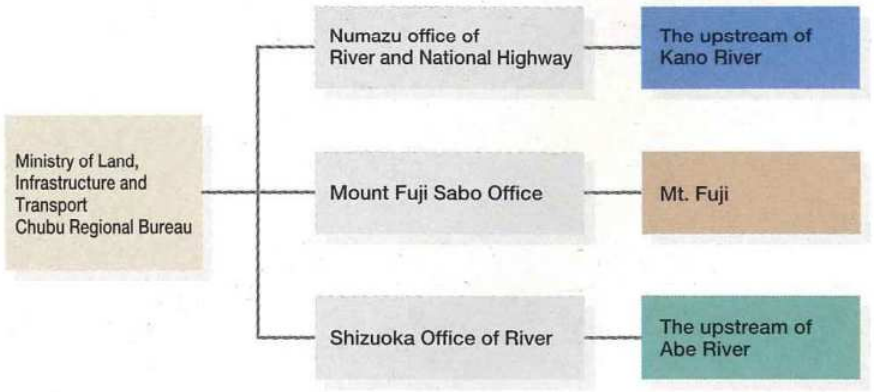
Suganumatenjinshita Steep Slope (Suganuma, Oyama Town)

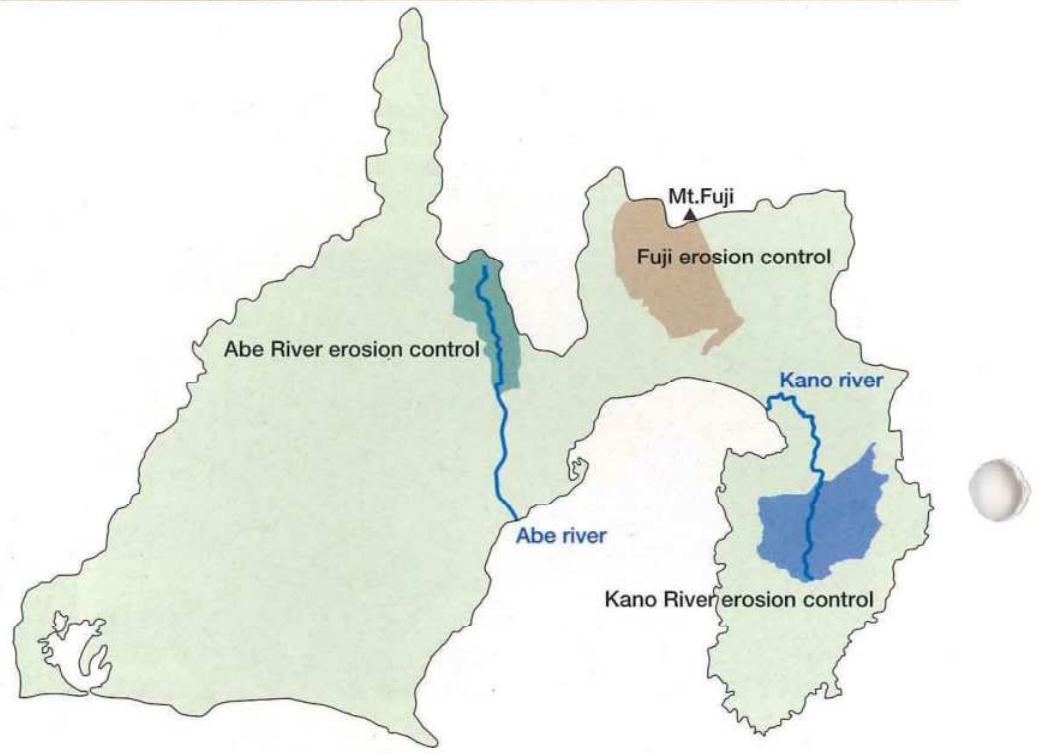
Anothe prefectural subsidy is provided for cities, towns and villages whose dangerous places are not controlled by prefectural government's projects (designation criteria: cliff height less than 10m, more than five houses). To promote the designation of dangerous areas as a cliff landslide susceptive area, the prefecture provides subsidies directly to the cities, towns and villages to cover the expenses.



4 Erosion Control Directly Controlled by Ministry of Land, Infrastructure and Transport

There are large scale landslides in many places, such as "Osawa Collapse" of Mt. Fuji and "Ohya Collapse" of the head of Abe River. These three areas are designated and directly supervised by the Ministry of Land, Infrastructure and Transport.





Map of erosion control directly controlled by Ministry of Land, Infrastructure and Transport

Erosion control of Kano River

Transport Numazu Office of River and National Highway

Aiming at "Preventing debris flow disaster and harmonizing with the rich nature"

Kano River has one of the swiftest currents in our country. It runs 46 km to the north from the middle part of Izu Peninsula. The Typhoon-22 which passed through the eastern shore of Izu Peninsula on September, 26 in Showa 33th (1958), brought heavy rain to the basin of Kano River, causing a mountain to collapse like a "Big collapse of Ikadaba", and it dumped a huge amount of debris. It also damaged a hot spring resort in a valley, and it mudded Tagata plain at the downstream of the river. It sacrificed human lives of 853 dead and missing. It is called "Kanogawa Typhoon" and known as the sixth biggest disaster in our country and immortalized its name in our history. With this big disaster as momentum, designating the upstream of Shuzenji Bridge for a directly supervised erosion control area from the next year, Showa 34th (1959), we have been making efforts to restore the upstream area of the river and promote erosion control for the prevention of debris flows. Therefore the danger of flood from the viewpoint of river drainage has been gradually decreased. However, there are still rivers and streams counting as many as 197 places which are endangered by debris flow. In addition this area is being developed and used because of its location favorable for sight-seeing, hot springs, health resorts etc. Therefore it is predicted that if a disaster occurs, it will cause a large scale damage. Moreover, in this area there are many active volcanic vents and in the places where the ground is loosened from earthquake, avalanches are more likely once localized torrential downpours come up. Because of these reasons, we consider it very important to promote erosion control systems. On the other hand, it is necessary to consider the environmental preservation and utilization of the streams to make a best use of the assets of Kano River, such as beautiful nature around, affluent ecosystem, spas and sight-seeing spots.

Umeki No.4 check dam with measures against debris flow driftwood (izu city)

Sakai River check dam with regard to sight (izu city)

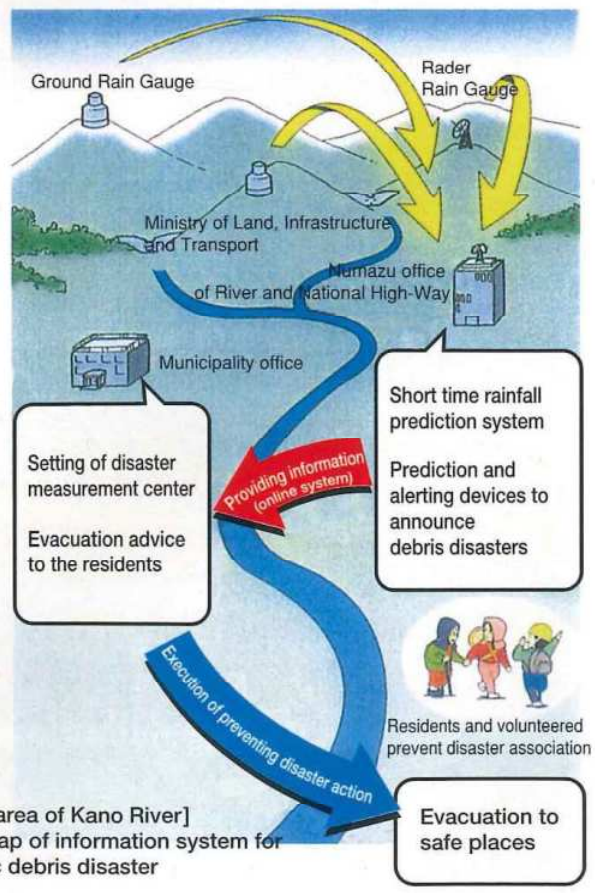
Then,

1 The formation of safe social base
2 Clean and abundance of water
3 Local cultural life

Making the above mentioned as themes

1 Promoting fundamental institutions at the main rivers and streams
2 Promoting institutions for debris flow control
3 Coordinating local plan
4 Promoting erosion control institutions with regard to the natural flow of rivers
5 Promoting monitoring equipment (software measure) for detecting debris flow

We are aiming at improving of erosion control by giving priority to the execution of the themes mentioned above.



[Tagata area of Kano River] Image map of information system for synthetic debris disaster

Erosion control of Mt.Fuji

To protect the Region and Nature of Mount Fuji

Transport Mount Fuji Sabo Office

At the foot of Mount Fuji, there are lots of mountain streams and gorges, they count eight hundred and eight and used to be called "the eight hundred eight swamps". Usually, there is not water flow, but by the times of floods, caused by localized heavy rains in the early winter and late spring, debris-avalanches often happened. Consequently, at the southwestern foot of Mount Fuji, where Osawa is located in the regions of its downstreams, the cities of Fuji and Fujinomiya have suffered disasters of earth and sand flood many times. Therefore, since the year 1968 (Showa 43), the Ministry of Land, Infrastructure & Transportation has started taking measures against the Collapse of Osawa, and began the debris-slide protection programs in the year 1983 (Showa 58).

Preventive measures for the Collapse of Osawa

The Collapse of Osawa is located in the western slope of Mount Fuji, from the top down to 2200 meters height above sea level extending 2.1km, and 500m wide, 150m deep, 1 km² of collapse area, and about 75 millions of cubic meters of earth and sand, it is a very big collapse zone. The Collapse of Osawa shows very hard conditions; it is on a steep slope and high altitudes that makes difficult the transportation of construction materials and even the access to it. Besides, the preservation in harmony with natural environments and sceneries and other different issues that also need to be solved. For these reasons, as one o preventive measures against down streams landslide disasters, an alluvial fan has been settled; the earth and sand widely accumulated are led to a dike, and then, floor in the idle sandy soils is reinforced by engineering works to keep it in the best condition to disperse the avalanche over the alluvial fan zone. In the headwater area, since the year 1982 (Showa 57), The Ministry of Environment in coordination with the Agency of Cultural Affairs and concerning organizations have started investigation and have worked on all sorts of experiments. Taking into consideration the natural environment, a study for the transportation of materials [Fuji HEART System] has been started. Finally, unmanned construction works are being carried out to ensure the safety.

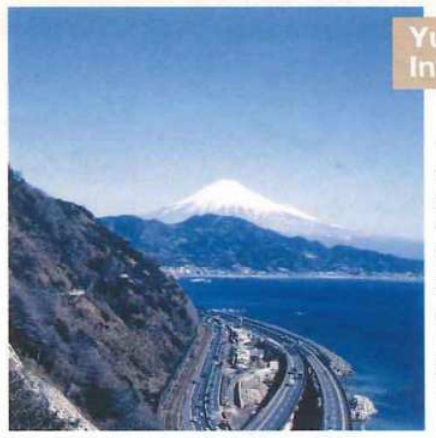
Volcano Control of Soil Erosion

A previous preventive investigation is an essential task in taking quick and effective measures, in the event of a volcanic eruption during and after it. Therefore, the Ministry of Land, Infrastructure and Transport studies, from the viewpoint of all-risks management, to get accurate measures against this disaster.

Check dam using local generating materials

Preservation programs at the south western streams

By the year 1978 (Showa 55), investigation programs for the prevention of disasters in the South western area of the mountıs foot have started, and by the year 1981 (Showa 58) works for landslide prevention begun in the places that need it most. Until now, works on sinking sandy soils (sedimentation) of Inokubo River, Ashidori River, Kazamatsuri River, Yumisawa River, Bonpu River, Senzoku River (tributary of Akafuchi River) and Sudo River have been developed; also sedimentation works and the construction of several contention dams are being promoted.



Yui district landslide and Japan's important part of main traffic networks (Tomei highway etc.)

Yui district Landslide Investigation

Landslide investigation is executed directly by Ministry of Land, Infrastructure and Transport in order to familiarize the reality of landslide, as large landslide marks were recognized in this Ihara county Shizuoka Prefecture where Japan's important part of main traffic networks (Tomei highway, National highway route 1, JR Tokai train line, network news service lines) are densely concentrated, and where Tokai earthquake seismic intensity was estimated and announced.

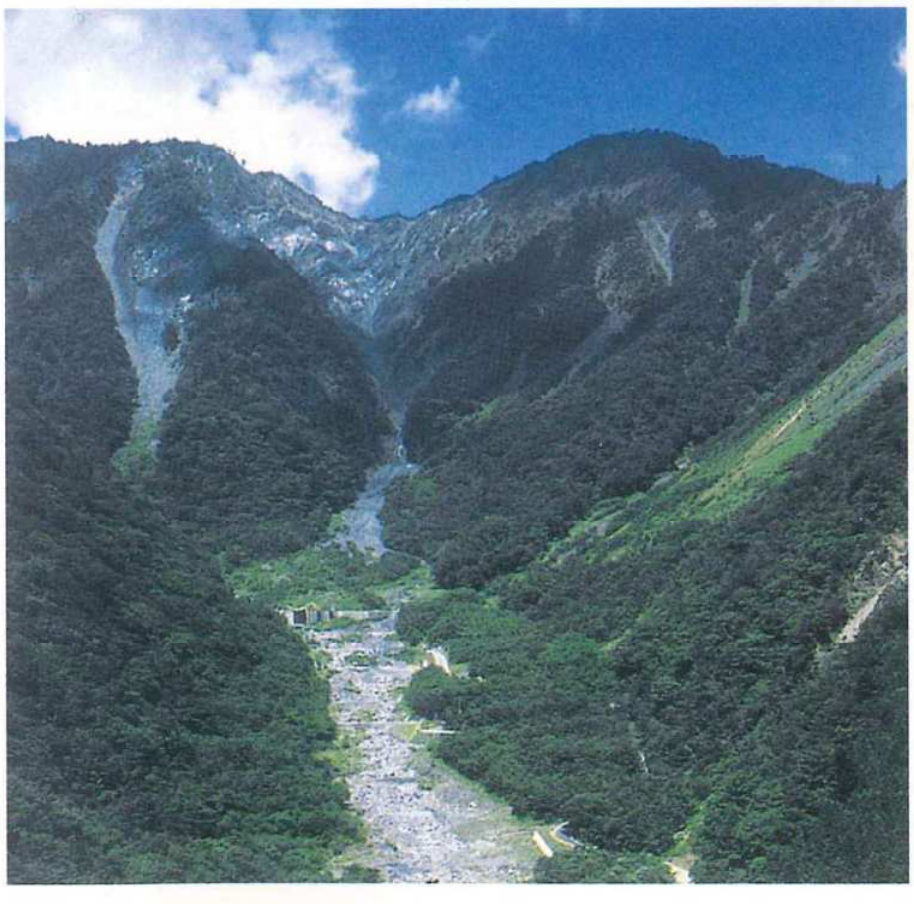
Erosion control of Abe River

Tomorrow of the upstream region of Abe River opened by erosion control

Transport Shizuoka Office of River

View of the mountainside in about Showa 11th (1936)

Present view

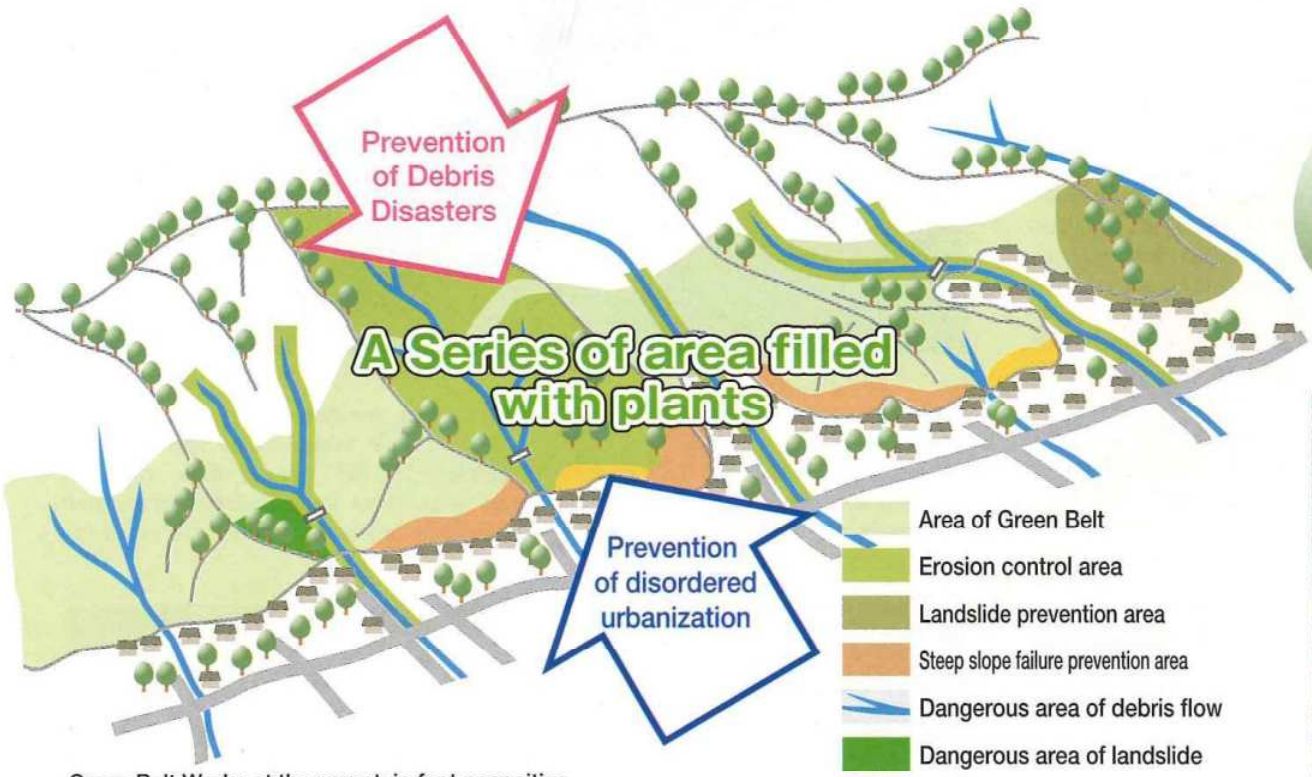


There is a collapse called Ohya Collapse, one of the three biggest collapsed areas in Japan, near the source of Abe River which had prospered as a gold mine in old times. It began to collapse by the big earthquake in Hoei 4th(1707) and is now extending over 800m in height and 1.8km in width whose amount of collapsed sand and rock are measured as much as one hundred twenty million m³ (100 times bigger than Tokyo Dome). Since the fringe of the basin has much over 3000mm rain on annual average, once torrential rain comes, debris flow threatens our living. Therefore, The Ministry of Land, Infrastructure and Transport has been proceeding to prevent disasters by using floor fixing work and mountain foot afforestation work, including check dams at the upstream of Oya river where remarkable collapse occurred. Now that Ohya Collapse is calm, we cannot help but wonder at its magnificent figure. The Office will keep protecting this place which is important as the source of water supplied to Shizuoka City.

4 Promotion of Collaboration

Green Belt Works around the foot of mountain near urban areas

We prepared the mountain slopes adjacent to the northern edges of Shizuoka where the dangerous places of debris disasters are highly concentrated. We have created an area filled with plants ensured with debris disaster prevention fixtures and are desirous to maintain comfortable living and natural environments as well.



Green Belt Works at the mountain foot near cities (accomplished Image)

Function of Green Belt

1 Prevention of Debris Disasters

2 Preservation of Living Environment

3 Preservation of Natural Environment

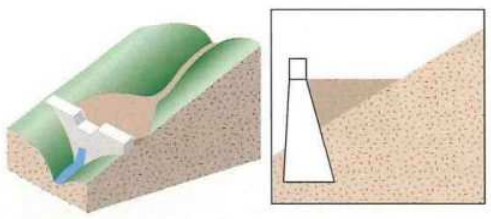
Thinning in "Green Belt"

A bit of knowledge of Erosion Control

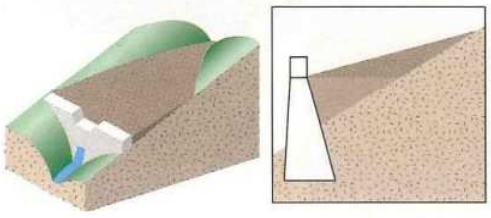
Wisdom for living - Erosion Control

When filled up with rocks and sand, the slope becomes gentle and prevents erosion. And then raise the stream beds, it prevents crosswise erosion.

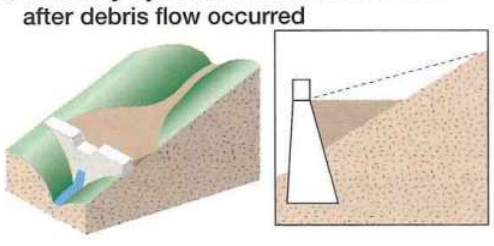
◆Before debris flow occurred



◆Just after debris flow occurred

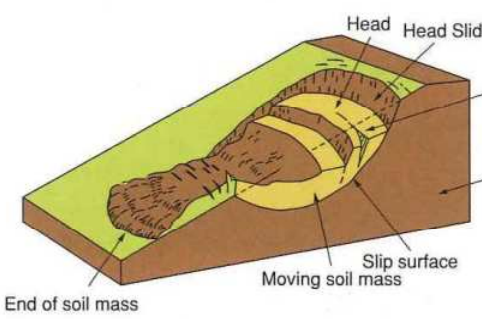


◆Recovery by small-medium sized flood after debris flow occurred

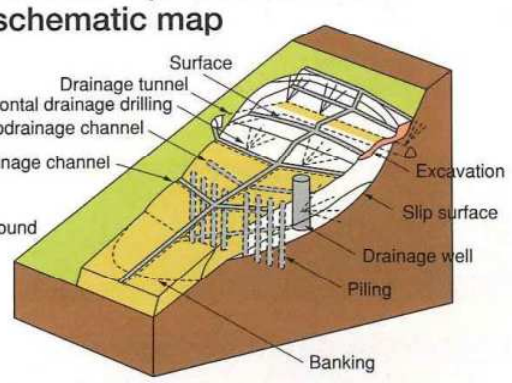


As seen above, the erosion control dam will not only reserve debris from upstream, but also demonstrate its effect after it reaches the level.

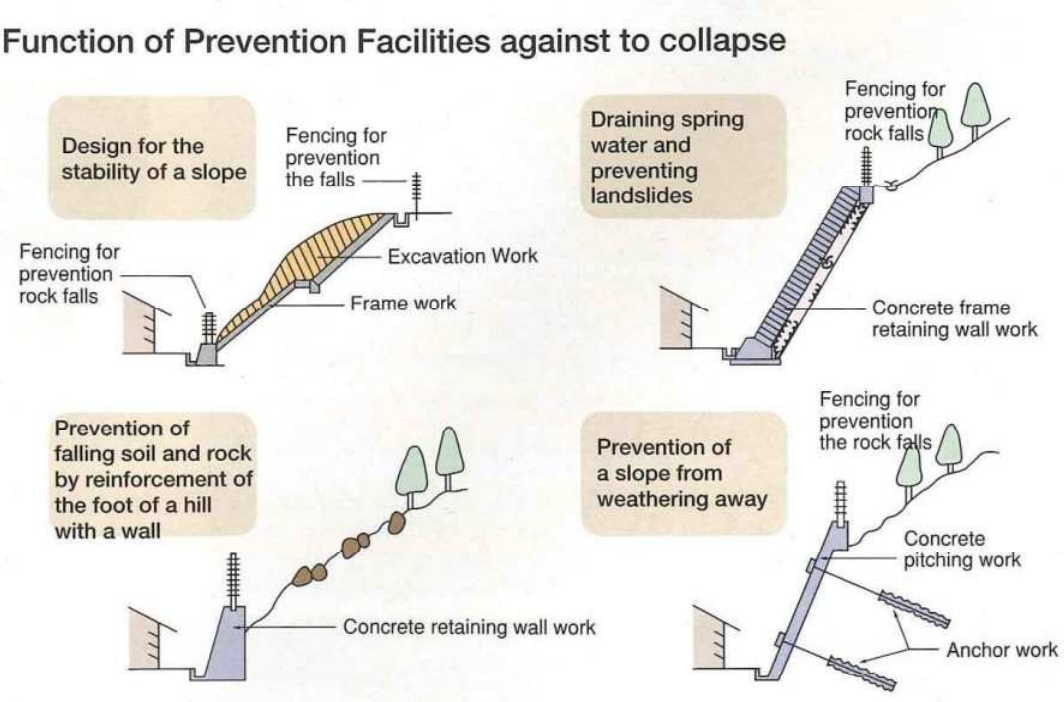
Landslide schematic map



Landslide prevention works schematic map



Function of Prevention Facilities against to collapse



5 Control of Earthquake disasters

Our prefecture has often been affected by earthquakes since prehistoric times. There are Suruga Trough and Nankai Trough in the region from Suruga Bay to the Sea of Enshu which are the borders of the plate. Huge earthquakes repeatedly took place there. In the land region, there are Itoigawa-Shizuoka Tectonic Line and Central Tectonic Line, moreover, many active faults distributed around the mouth of Fuji River and across Izu Peninsula which often cause earthquakes. Recently there have been threatening of the Tokai Earthquake Tonankai Earthquake and Western-Kanagawa Prefecture Earthquake which may bing considerable damage to Shizuoka Prefecture with debris disasters. We are continuing to prepare for earthquakes based on a special action law of a large earthquake large scale earthquake (Law No.63, Showa 55th (1980)) and the law of earthquake disaster prevention (Law No.111, Heisei 7th (1995)), taking into consideration the estimated intensity and imminence.

Erosion control

●To build erosion control dams at the rivers which are anticipated to cause debris flows by an earthquake and also anticipated to damage emergency transportation roads and houses.
●To construct erosion control facilities in urban areas development which are threatened by debris disasters induced by an earthquake.

Landslide

●To construct prevention facilities in landslide where landslide are anticipated to cause serious damage on houses, evacuation routes and emergency transportation roads.

Steep Slope

●To construct prevention facilities for prevention of collapses in the dangerous steep slope areas where steep inclined land is anticipated to bring a serious damage to houses, evacuation routes and emergency transportation roads, and to promote designation of dangerous areas.

Steep slope protection facilities for protecting houses and emergency transportation roads.
Steep slope at Kumomiuenoyama
(Kumomi, Matsuzaki Town)

Tsunami Affected Area,
Tabifunakoshi No.2 Steep Slope
(Tabi, Numazu City)

Usual method

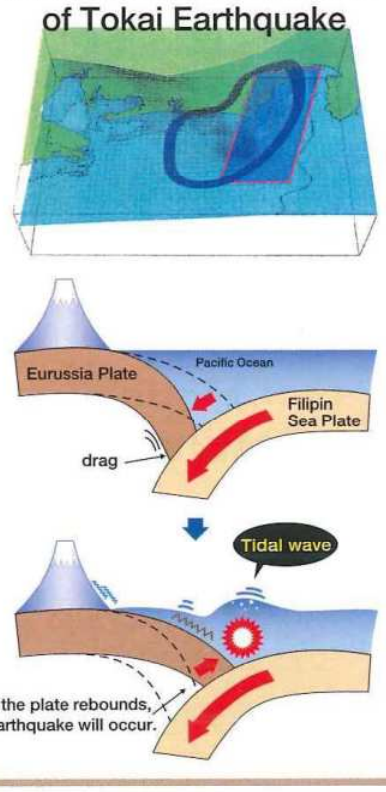
natural slope

slope executed framework

Measures taken against tidal wave

Construction of steps for evacuation

Mechanism of outbreak of Tokai Earthquake

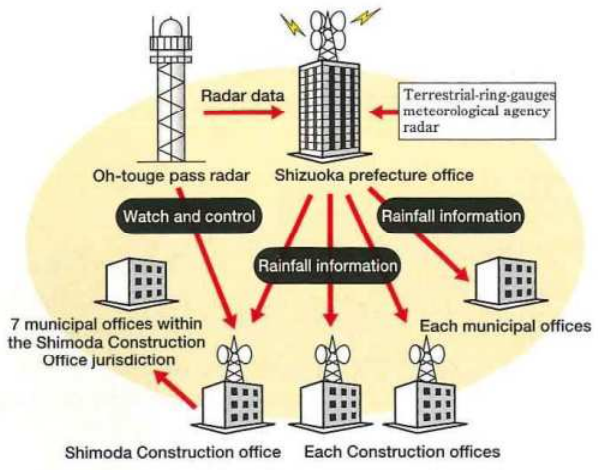


6 Comprehensive measures to pre

1 Information System of debris disasters of Shizuoka Prefecture

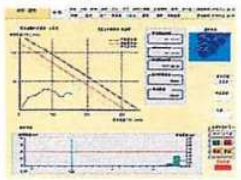
In Shizuoka Prefecture, for the purpose in warning and evacuation from debris disasters, we analyze and estimate the severity of danger of the debris disasters and landslide utilizing terrestrial rain-gauges of Information Network System of Shizuoka Prefecture and/or actual and estimated rainfall data from the Meteorological Agency Radar. At the same time, we deliver various information to the relevant organizations in major cities, towns, and villages.

Shizuoka Prefecture has many places where local torrential downpours may happen. Since the southern district of Izu Peninsula suffered an unprecedented heavy rain disaster in Heisei 3rd (1991), we installed local radar rain-gauges. We collect information on radar rainfalls and terrestrial rain-gauges and we will estimate the severity of disaster based on these information. We also deliver those information to the 7-city/town/village in Shimoda Public Works Area through the exclusive terminal (operation started on January 16, Heisei 13th). At the same time, Geographic Information System (Erosion Control GIS) has been maintained to efficiently control information, such as debris disaster dangerous places, designated erosion location, facilities.Those information will help prevent debris disasters by early evacuation. The Debris Disaster Information Interaction Communication System ensures sharing information between the residents and administrative organization



■Picture of the information system of debris disasters


We divide the prefectural area into many meshes.

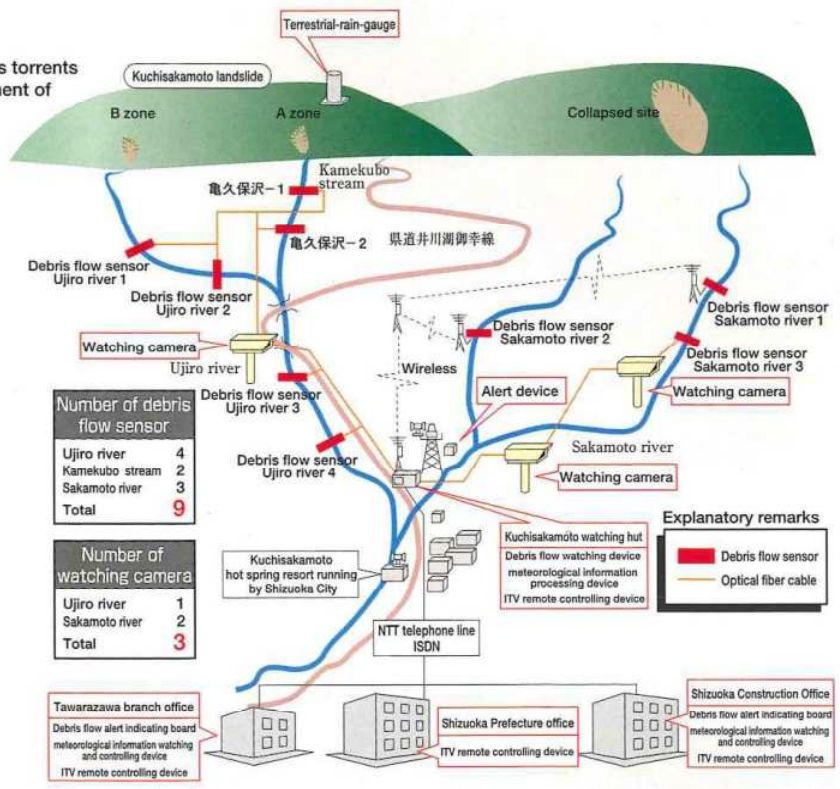

Detail data of rainfall in each mesh


Distribution of dangerous torrents of debris flow and judgment of severity of danger

2 Monitoring System of debris flow at Kuchisakamoto

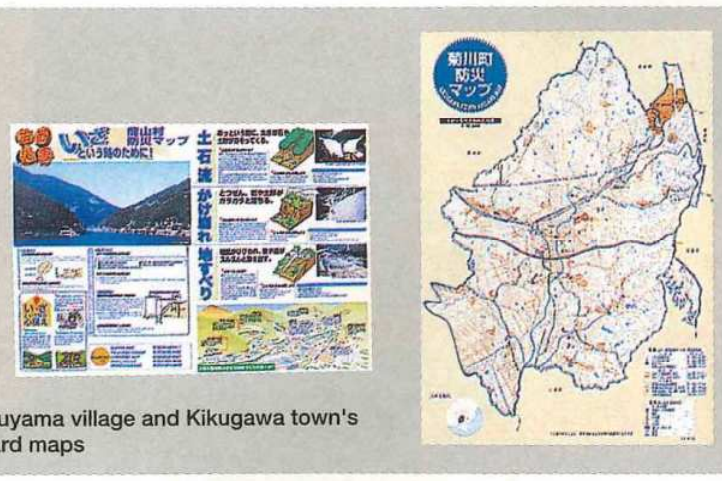
There are many collapsed and landslide places at Kuchisakamoto district where large-scale debris disaster repeatedly occurred in the past.

Together with the construction for erosion control and landslide control, we are also taking measures to support evacuation system employing a debris flow sensor, monitor camera to watch the stream, and automated system to announce rainfall to each residents.



3 Making and distribution of Hazard map

In order to protect residents' lives and property from tragic debris disasters, we have been making and distributing maps illustrating the dangerous areas where debris disasters are likely. Dangerous streams of debris and others are shown. Making dangerous areas known to local residents will be helpful for immediate warning and emergency evacuation activities. We have been making and distributing "Hazard maps" in the cooperation with cities, towns and villages since Heisei 4th (1992).


Tatsuyama village and Kikugawa town's hazard maps

4 Setting up sign boards for appealing dangerous zones of debris disasters

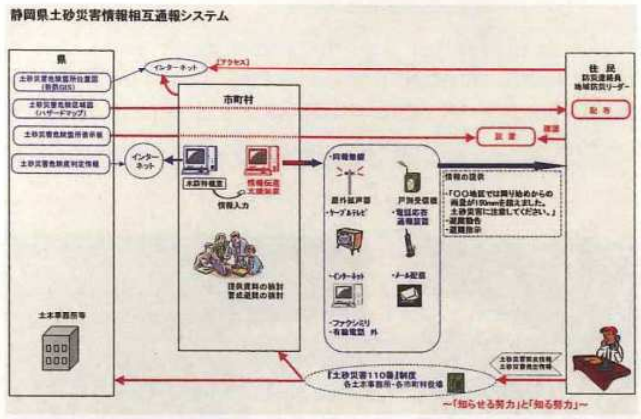
In order to protect resident's lives and properties from tragic debris disasters, we are setting up sign boards for appealing dangerous zones of debris disasters to warn residents for the dangers at the sites of threatening areas. The sign boards are written in many languages for easy understanding by foreigners.

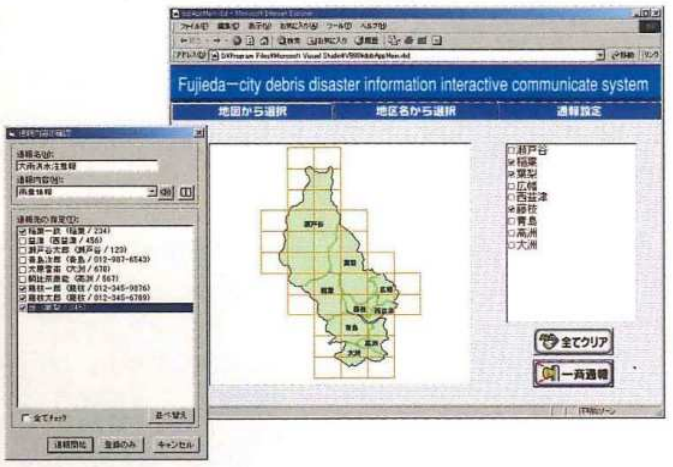

Situation of setting sign board for appealing dangerous zone of debris disaster

vent debris disasters

5 Setting up supporting devices for the communication of debris disaster information

In order to protect resident's lives and properties from tragic debris disasters, we are setting up supporting devices for rapid communication of debris disasters information (such devices as voice conversion system, audio response system, e-mail sending system) which utilize the existing communicating system (such as simultaneous wireless loudspeaker, telephone, e-mail) in municipalities.
The information includes rainfalls and debris flows and alert the residents to evacuate by themselves



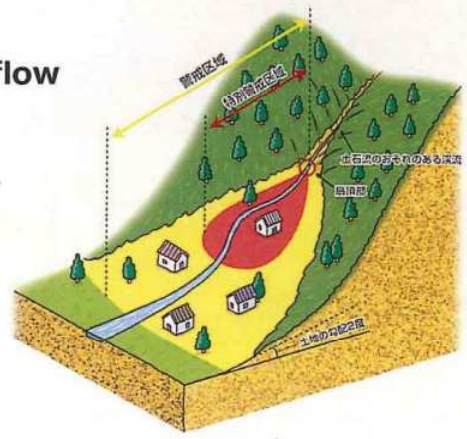


6 Designation of warning zones of debris disasters

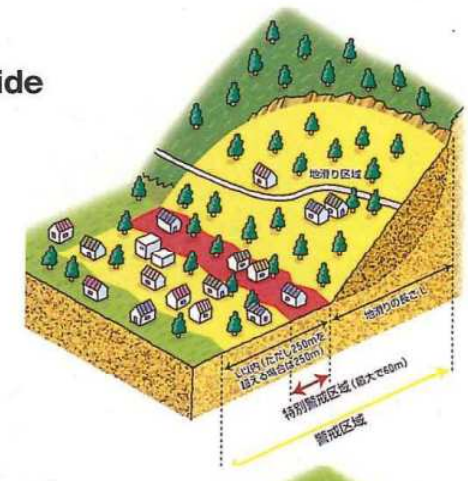
In order to protect resident's lives from debris disasters, Shizuoka Prefectural Sediment Control office promotes many non-construction (soft) projects in accordance with Debris Disaster Preventing Law, such as designating dangerous areas of debris disasters and informing the danger, preparing the warning and evacuating plan, restricting the new house construction, prompting the removal of already standing houses in dangerous area.
Shizuoka Prefectural Sediment Control office is promoting designation of warning zones of debris disasters in accordance with the Shizuoka Prefectural master plan of designation based on Debris Disaster Preventing Law , that plan was set up based on the opinions of representatives of volunteer disaster prevention organizations.

The disaster objects of the Law and image of the designated area

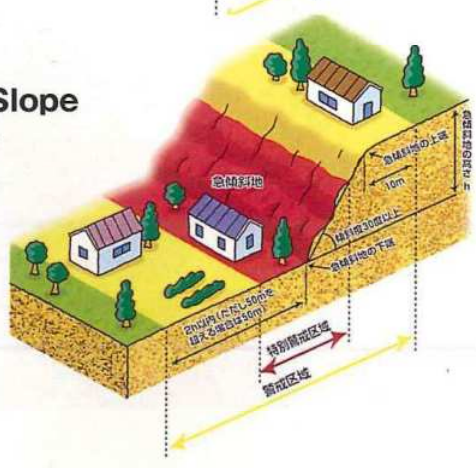
Debris flow



Landslide



Steep Slope Failure



Flow chart of the designation

Primary Guide of Debris Disaster Prevention Plan [by Ministry of Land, Infrastructure and Transport]

Shizuoka Prefectural Master Plan of designation based on Debris Disaster Preventing Law

Explanatory meeting for the residents

Implementation of basic investigation [by Shizuoka Prefecture]

We assess the geographical and geological features on the area that might be endangerd by the debris disasters.

Explanatory meeting for the residents

Warning zone of debris disasters (Yellow zone)

<The area that may be damaged by the debris disasters>

●Preparation of warning and evacuation plan [by Municipalities]
In order to prevent resident's lives from debris disasters, each municipalities prepare warning and evacuation plan, that includes communication of disaster information and enable residents rapid evacuation.

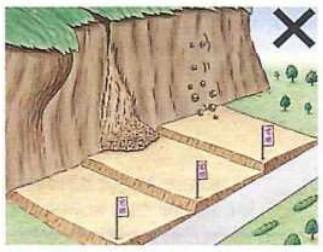
Special Warning zone of debris disasters (Red zone)

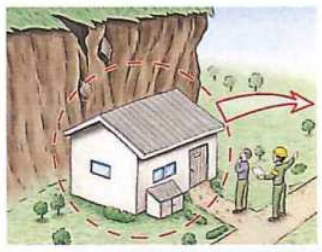
<The area in which houses may be destroyed by the debris disasters and the residents may suffer from remarkable danger>

●System to permit special development [by Prefecture]
Housing land and accommodation development for weak people who are admitted under regulation.

●House structure restriction [by Municipalities which retain administrative architects]
Houses with rooms to live are checked in its design stage whether it will be safe or not when debris flow hits it.

●Removal of already standing houses [by Prefecture]
We advise of removal the owner of the house which is likely to be smashed in debris disasters.





7 Public Information to Prevent Debris Disasters

Debris Disaster Prevention Month

We are strongly promoting the campaign through disaster prevention activities and disaster prevention patrol to confirm the safety of dangerous areas. To deepen the understanding and awareness about debris disaster prevention, we designate June as Debris Disaster Prevention Month. The promotion includes public relation announcement over newspapers, TV, flier distribution and appeals from PR vehicles and Sabo festival. We are also collecting "pictures", "compositions" and "posters" about debris disasters from elementary and junior high school students.

Sabo Festival

Study tour of debris disaster preventing facilities

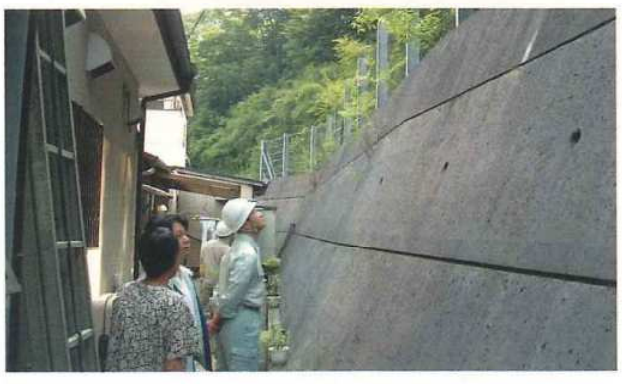
Application of "pictures" "posters" "compositions" about debris disasters

Year		Heisei 11th (1999)		Heisei 12th (2000)		Heisei 13th (2001)		Heisei 14th (2002)		Heisei 15th (2003)	
Division		Number of school	Number of works	Number of school	Number of works	Number of school	Number of works	Number of school	Number of works	Number of school	Number of works
Elementary school	Picture	9	10	7	12	4	4	8	15	13	26
	PPoster	21	37	15	22	5	7	12	31	13	23
	Composition	4	4	1	3	5	23	4	5	6	8
Junior high school	Picture	4	7	3	3	1	2	4	6	6	7
	Poster	28	53	21	46	9	18	17	42	14	26
	Composition	3	31	2	3	7	16	6	14	7	10
Total		69	142	49	89	31	70	51	113	59	100

Prize winners in 2002

Steep Slope Failure Prevention Week

We designate the first week in June as the Steep Slope Failure Prevention Week. We patrol the steep slope failure prevention facilities and their surroundings in the designated areas in cooperation with relevant municipalities in order to check and keep the facilities, warning system, and evacuation plan being all sound and ready for emergencies.



Steep slope patrol

Various Lecture Meetings

Lecture meeting for the leaders of volunteer disaster prevention organizations

Lecture about debris disaster for elementary school students in a general study class.

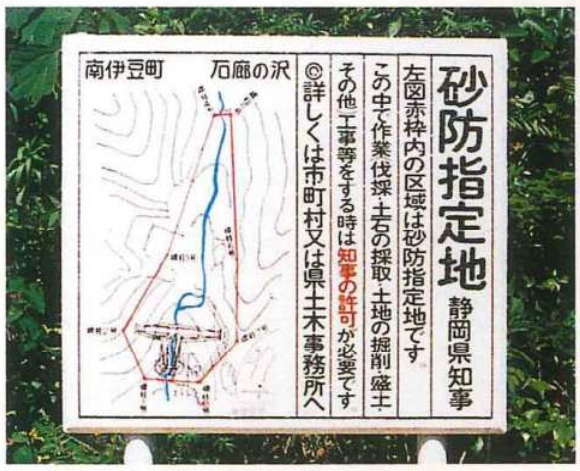
8 Management of the Designated Areas for Erosion Control

We designate the possible hazard areas of debris and control these areas based on the Erosion Control Law (Meiji 30th Law No.29, 1897), Landslide Control Law (Showa 33th Law No.30, 1958) and the Law to Prevent Disaster on Steep Slope Failure (Showa 44th Law No.57, 1969).

As for the management of erosion control areas, landslide and steep slope areas, we are taking measures based on relevant laws to limit or restrict entry to designated areas and to keep monitoring the areas for a quick discovery of disaster signs before outbreak to prevent consequential disasters.

To be as much efficient as we can on managing these designated areas, we established "The Essential Points of Organizing the Patrolmen of Shizuoka Prefecture" in April of Showa 46th (1971). We entrusted the patrolling to civilians, and are making efforts to find out illegal actions in the designated areas, as well as discovering disasters as early as possible.

We also established "The Essential Points of the Steep Slope Patrolling". In January of Showa 51th (1976) and, in cooperation with related cities, towns and villages, we are carrying out patrolling on a regular basis for the prevention of landslides. On December 6, Heisei 9th (1997), we launched a new volunteer group to monitor landslide areas.



Signboard of designated erosion control area

Signboard of designated landslide control area

Signboard of designated steep slope control area

Signboard of debris disaster dangerous area

Sing pole of designated erosion control area


Sign pole of designated landslide control area


Mark Column of designated steep slope control area

●Members for designated erosion control areas patrolling

We are managing to patrol in the Erosion Control designated areas to find illegal activities based on "The Essential Points of Organizing the Patrolmen of Shizuoka Prefecture".

●Erosion control volunteers


National Liaison Conference Inauguration ceremony of erosion control volunteers (June 2, Heisei 9th (1997))

Outline of the Hazardous Area of Debris Disasters

We have estimated the total area covered under the natural disaster program at 56,088.7 ha (about 7% of whole area).
There are many other places in which measures should be taken against debris flows and steep slope failures.

The number of areas in high risk of debris disasters.

Division	Number of dangerous places			
	Japan	Shizuoka Prefecture	Ranking in Japan	Ratio to Japan
Dangerous torrents of debris flow	183,863	4,247	21	2.3%
Dangerous places of landslides	11,288	183	22	1.6%
Dangerous places of steep slope failures	330,156	10,763	10	3.3%
Total	525,307	15,193		2.9%

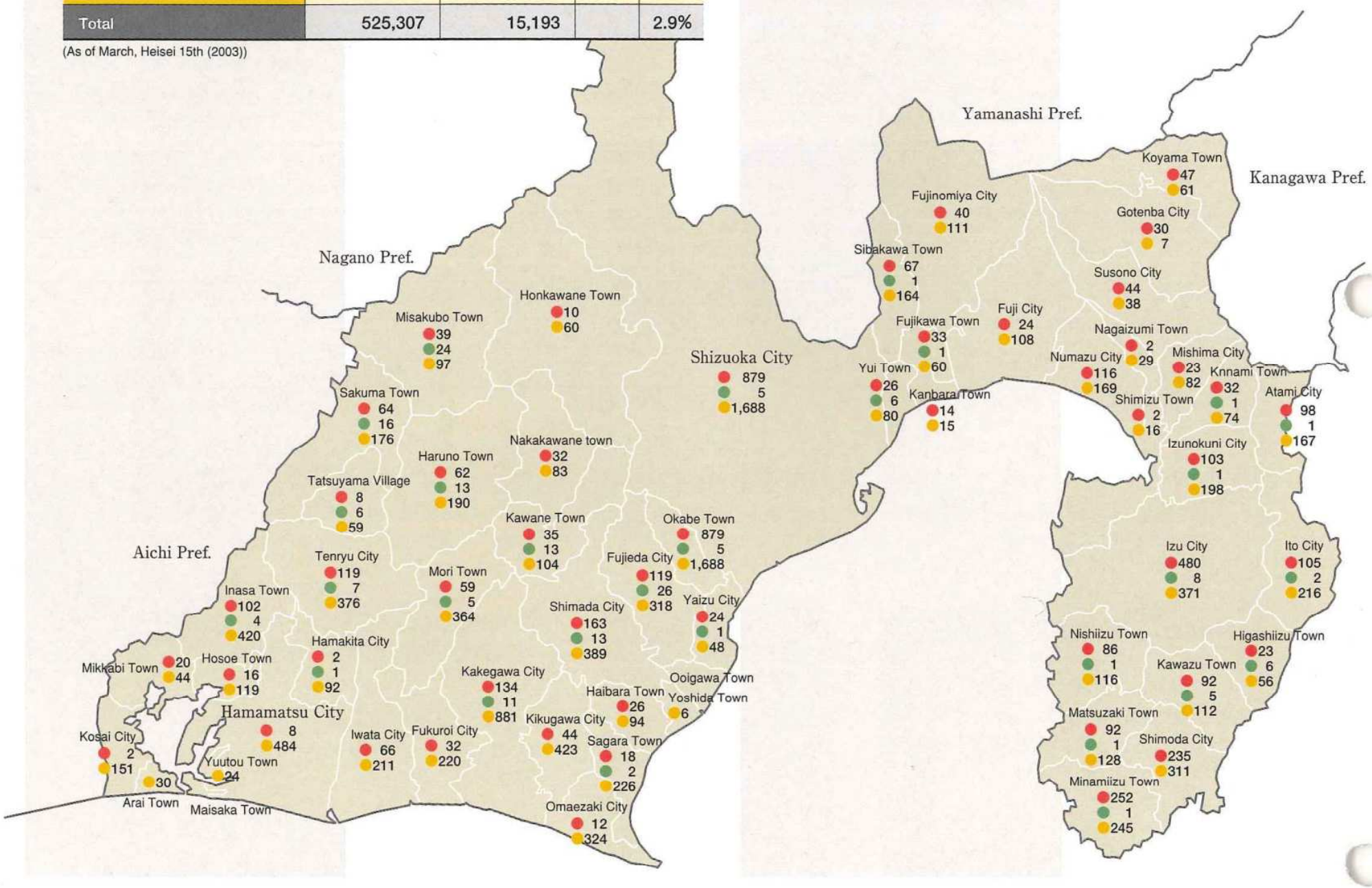
(As of March, Heisei 15th (2003))

Distribution of the dangerous places of debris disasters

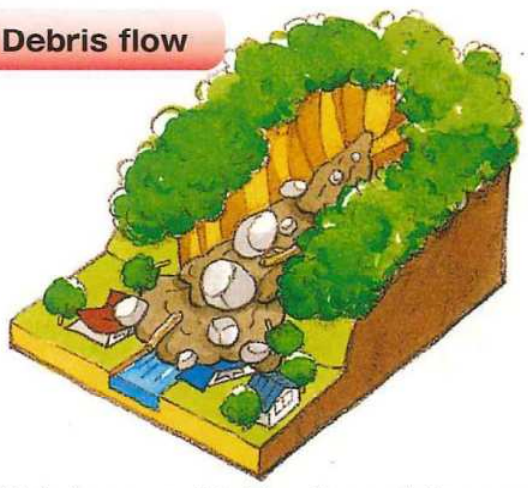
(As of March, Heisei 15th (2003))

Legend

- Dangerous torrents of debris flow
- Dangerous places of landslides
- Dangerous places of steep slope failures

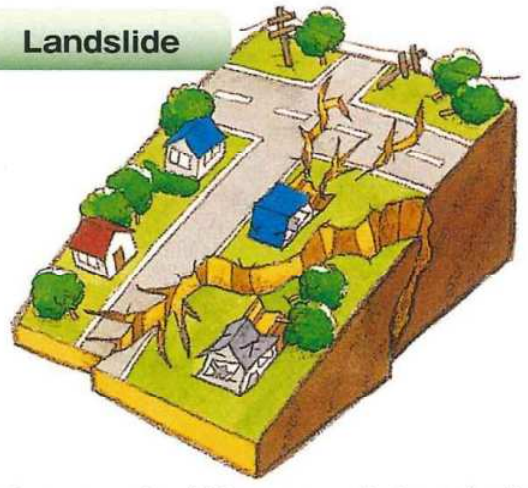


Debris flow



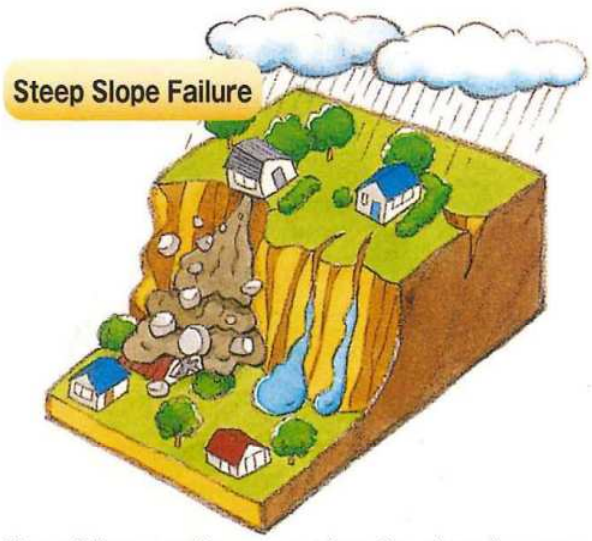
A debris flow accumulated in valleys and slopes gush out together with the water after a heavy rain. It brings a serious damage because of its strong momentum.

Landslide



A phenomenon in which a comparatively gentle slope begins to move slowly due to underground water on the clay layers. Because of a large scale land sliding, once it occurs, it brings a big damage to houses, roads, railways and agricultural fields, and causes flood by blocking rivers.

Steep Slope Failure



Slope failure usually occurs when the slope becomes weakened, because of the water soaked into the ground, and suddenly it falls down. As it happens very quickly and crumbles down in an instant, many people fail to escape and the number of people will be killed. Sometimes earthquake triggers it.

Erosion Control in Shizuoka

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