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# Experimental research on restoration of the gravel bed of the Makomanai River, Sapporo Hokkaido (interim report)

Hiroki TAKAHASHI/Noboru MARUOKA/Kiyoshi TAKEUCHI/Keizou WATANABE

The Makomanai River has many rock-bedded sections where the bedrock has been exposed as a result riverbed degradation. This is thought to have been caused by a combined effect of the narrow valley flat, soft rock, decreases in sediment supply due to the check dams constructed in the 1980s, and the fixed water route of the river due to the river improvement carried out in the 1960s. The rock-bedded river channel, lacks river structures created by gravel (sediment) transport and scour–deposition processes and does not have shallows or pools suitable as habitat for benthos and fishes. Flood control problems caused by the scouring of revetment foundations are another matter of concern.

This study is underway, therefore, on technical measures to restore the gravel bed of the Makomanai River based on adaptive management approach.

In this study, a series of model experiments was conducted on various structures and configurations of facilities for accelerating gravel deposition, and, according to the experiment results, possible structures and configurations of experimental facilities were narrowed down and on-site experiments were conducted. Then, after monitoring-based verification, measures to be taken to restore the gravel bed of the Makomanai River were identified.

Key words: rock bed, gravel bed, nature restoration, experimental management, monitoring

# River improvement to restore Thorea okadae habitats : Yasumuro River experience -The 4th report-

Kentaro TAKI/Hideyuki WATANABE/Kazuyuki SAKANOI/Fumihiro TOI/Motoi SEKI/Nobuyoshi SUGINO

In the Yasumuro River, a Class B river running in the town of Kamigori in Hyogo Prefecture, the habitats of riverine species including Thorea okadae (chisujinori in Japanese), a rare algal species, are deteriorating because of such river works as the construction of multipurpose dams and agricultural weirs and channel widening. In order to restore the river environment of the Yasumuro River, in November, 2004, the Nishiharima Residents Bureau of the Hyogo Prefectural Government formulated the Yasumuro River Restoration Plan featuring Thorea okadae as a symbol of restoration and has been implementing various measures according to the plan in cooperation with the local community.

In 2005, flush releases of water by consecutive operation of agricultural weirs and streambed disturbance (a measure popularly called "plowing a river") were carried out experimentally. Because the effectiveness of these measures was verified, it has been decided to carry them out on a continual basis.

This paper briefly reports on the following surveys and studies and test construction conducted in fiscal 2006 according to the Yasumuro River Restoration Plan. In the 2006 study, a two-dimensional unsteady flow analysis model taking into consideration the lodging process of tall herbaceous plants due to the force of flowing water was constructed to reproduce the hydraulic quantities (e.g., water depth, flow velocity, vegetation resistance, bed resistance) in normal times and in times of flood two-dimensionally. Also, river channel shapes for keeping the river environment in a good condition were determined by using the calculation results obtained from the newly constructed numerical analysis model.

Key words : nature restoration, Thorea okadae, lodging process of tall herbaceous plants, horizontal twodimensional unsteady flow analysis, test construction

# Research for riverbed excavation experiment in Awasa district, Chikuma River

Shin-ichiro TATE/Minoru KOBAYASHI/Nobuyuki OHASHI

This paper reports the results of a series of research conducted by the Chikuma River Ecology Research Group over a period of three years on the impact of experimental riverbed excavation in the Awasa district of the Chikuma River on the river ecosystem. Through field surveys, the Chikuma River Ecology Research Group conducted studies on what kind of riverbed excavation should be done in order to restore the river environment of the Chikuma. Because the low-flow channel had been fixed and the high-flow channel had become part of the land and was predominantly covered with alien plants, the high-flow channel was cut down into a stepped shape so that the frequency of submersion rose locally. A major flood occurred during the research process, making it possible to compare a human impact such as riverbed excavation and a natural impact of flood.

The bed of the high-flow channel stripped of vegetation and cut into a three-level step shape made uniform mixture of gravel, sand and silt, and buried seeds began to sprout all at once. In the water edge zones that formed wetland-like environments, native plants including rare species began to grow. After the excavation, aquatic insect species recovered its diversity and the number up to just about same level as the control area in around two and a half months. On the other hand, the alien plants died after the flood water covered the riverbed and native species gave priority over afterwards.

Thus, a series of studies has shown that (1) it is possible to restore the natural riverside vegetation including rare species, (2) the fauna and flora can recover from the impact of excavation of the scale considered in a relatively short period of time and (3) when excavating a riverbed, it is desirable to create the physical environments as diverse as possible.

Key words : riverbed excavation, human impact, flood, natural impact, river ecosystem, alien plants, native species

# Restoring gravel bars in the middle reaches of the Kinu River

Teruaki MASUKO/Yoshio MAEMURA/Tomokazu MISHINA/Seiji UCHIDA

There used to be large gravel bars dotted with boulders and large rocks in the middle reaches of the Kinu River, and those gravel bars provided rare habitat for animals and plants (e.g., Eusphingonotus japonicus, Aster kantoensis) peculiar to gravel bars.
In the post-WWII years, the flood safety of the Kinu River as a whole was improved dramatically as a result of large-scale river improvement projects (e.g., levees, revetments, dams, check dams).
Locally, however, flood control problems such as streambed degradation and bank erosion have become problems in recent years, and the general trend is toward meandering deformation accompanied by a transition from a multi-row channel to a single-row channel. Meandering deformation is directly contributing to a decrease in gravel bars by causing, for example, a decrease in submersion frequency and tree growth.
The intrusion of the exotic species Eragrostis curvula has also altered the habitats of species endemic to gravel bars such as Aster kantoensis and Eusphingonotus japonicus, causing those species to decrease steeply.
This paper reports on an ongoing study on the restoration of gravel bars that provide habitat for species endemic to gravel bars including monitoring that is also in progress.

Key words : Kinu River, gravel bar restoration plan, test construction, monitoring, sand bar, species endemic to gravel bar, exotic species

# Nature restoration plan for the lower reaches of the Ishikari River

Kiyoshi TAKEUCHI/Noboru MARUOKA/Satoshi DAIMON

The area along the lower reaches of the Ishikari River used to be a wetland area dotted with lake. As a result of various river improvement projects including cut-off projects, urban areas and large expanses of agricultural land have emerged, and these areas have become centers of society, economy and culture in Hokkaido. The improvement projects for the Ishikari River have greatly contributed to the development of the river basin but also have had a great impact on the river basin and the environment of the river. The resulting environmental changes are thought to be the cause of the disappearance of Acipenser medirostris, Grus japonensis and Hucho perryi that, according to records, used to inhabit the Ishikari River.

This report concerns the formulation of a nature restoration plan for the lower reaches of the Ishikari River. Because it is difficult to fully restore the nature that existed in the past from today's highly developed state of society and because diverse environments distributed over a large area are to be restored, the plan was designed to include a general scheme for restoring the lower reaches of the Ishikari River and a direction of restoration.

In this study, environmental elements used by representative species of life using the environment of the Ishikari River and how those environmental elements are used were identified for the purpose of investigating (1)the relationship between the historical changes in the river basin and the river and the resulting changes in the physical and social environments and (2) the relationship between the environmental characteristics of the study area and the environment used by various species of life. After investigating these relationships, measures to be taken in connection with ongoing and planned river improvement projects were identified.

Key words : Ishikari River, nature restoration, wetland, lake, riparian woods, indicator species, adaptive
management

# Restoring the gravel bars of the Ina River : verifying a hypothesis by experimental river works（interim report）

Takayoshi TSUZUKI/Yoshifumi KODAMA/Kentaro TAKI/Satoko GOTO

The Ina River used to be blessed with such riverine features as gravel bars and shallows and pools that provided habitat for diverse species of plants and animals. The diverse morphological features of the river and a wide variety of plants and animals formed complex and beautiful riverscapes and provided local residents with places for relaxing and communing with nature. In recent years, however, the environment of the Ina River has been undergoing changes such as a decrease in sand and gravel bars, tree growth and the intrusion of exotic species and is becoming increasingly monotonic and simple.
With the aim of mitigating these problems by use of the natural resilience of the river, the implementation of a nature restoration project for inducing a desirable response (effect) by giving an appropriate impact (improvement) is currently under study so as to restore the diversity of life by conserving and restoring the river environment and helping the river re-create itself.
In this study, experimental river works for gravel bar restoration were carried out in order to take adaptive and phased measures to reverse the declining trend of the grave bar environment, one of the most urgent problems among the problems being encountered in connection with the restoration of the natural environment of the Ina River. This paper reports on the experimental river works.

Key words : Ina River, nature restoration, gravel bar, flood-induced disturbance, experimental river works, frequency of submersion

# Present state and analysis of river restoration in Japan

Susumu DOMON/Masafumi ITO/Jyunzo SAGO

In January, 2003, the Nature Restoration Act, a new law enacted with the aim of restoring lost ecosystems and other natural environments took effect. Under this law, local efforts involving a wide variety of local entities have been underway throughout the country for the conservation, restoration and creation of rivers, wetlands, tidal flats, seaweed beds, rural forests, rural communities, forests, coral reefs, etc. The river departments of the Ministry of Land, Infrastructure and Transport and local governments are also planning or implementing river restoration plans in 47 areas in order to improve river environments.

Local efforts to improve river environments, however, are being made independently, and no effort is being made to share and integrate project information. This report has been prepared for the purpose of sharing information on river environment restoration and performing a basic analysis necessary for the evaluation river restoration efforts. Information was collected from Web sites, pamphlets and booklets, taking into consideration the availability of information on local project information. By using the information thus collected, river restoration efforts in Japan were identified and analyzed.

As a result, it has been found that nature restoration councils were formed in 26 areas, nature restoration projects to be completed by a certain time in the past were implemented in 5 areas, and projects targeted at certain species were carried out in 8 areas. Wetlands account for about 30 percent of all river environment elements to be restored, followed by the continuity of rivers, shallows and pools, the continuity of water bodies associated with river banks, lake shores, gravel beds, tidal flats and reed beds, and water–land transition zones.

Key words : river environment, nature restoration project, nature restoration council, regional cooperation

# From nature-oriented river works to nature-oriented river management

Nobuyuki OHASHI/Yasushi HORIKAWA/Minoru KOBAYASHI/Tatsuji KIMURA / Shinichi YOSHIMURA

The ministerial circular issued in 1990 on the implementation of "nature-oriented river works" initiated natureoriented river works in Japan with the aim of conserving or creating riverine habitats and beautiful natural environments. Although initiated as pilot projects, nature-oriented river works have now become the norm for all river projects. The nature-oriented river projects carried out in the past, however, include projects that effectively combined a flood control function and an environmental function, but they also include many standardized projects that simply imitated methods used for other river sections.

This paper verifies the present state of nature-oriented river works, reviews the past efforts and problems of nature-oriented river works identified by the Nature-oriented River Works Review Committee established in September, 2005, in order to deliberate on a desirable direction of nature-oriented river works in the coming years, and reports the results of deliberations on the measures to be taken to solve the problems indicated by the committee.

Key words : nature-oriented river management, river management, river works following a major disaster

# Classification and mapping of vegetation at Watarase Retarding Basin

Masanori IIJIMA/Yoshifumi KODAMA/Miwa TOMIZAWA/Satoshi KASHIWABARA/Tomoyuki ANMA/Yoshio TSUKAMOTO

The Watarase Retarding Basin has a surface area of about 33 km2 and is one of the largest retarding basins in Japan. Besides playing a key role in flood control and water utilization in the Tone River System, the Watarase Retarding Basin is positioned as one of the major low moors (wetlands) in Japan and provides habitat for a wide variety of plants and animals by forming a rich natural environment founded on reed beds.

Compared with what used to be, however, the present Watarase Retarding Basin has smaller numbers and areas of ponds and wetlands, and the old landscapes formed by open water surfaces surrounded by large ecotones have mostly vanished. It has been pointed out that the environment of the retarding basin has degraded. It is therefore necessary to conduct studies on how the natural environment of the Watarase Retarding Basin can be conserved and restored.

In this study, in order to obtain basic information necessary for the conservation and restoration of the Watarase Retarding Basin, the types of vegetation functioning as the foundation for the ecosystem habitat of the retarding basin were analyzed on the basis of the results of a 2005 belt transect survey on vegetation and fundamental environmental conditions, and an analysis was performed for vegetation mapping of Regulating Reservoir No. 2 of the Watarase Retarding Basin. As a result, the accuracy of analysis for the mapping of vegetation types dominated

by the common reed and the silver banner grass, both of which are tall hygrophytic herbaceous plants, was enhanced by analyzing the fundamental and physical environmental data for the common reed and the silver banner grass separately.

Key words: common reed and silver banner grass, vegetation type, TWINSPAN, decision tree, elevation, groundwater depth, groundwater fluctuation, hyperspectrum

# Soil seed bank survey at Watarase Retarding Basin

Miwa TOMIZAWA/Yoshifumi KODAMA/Masanori IIJIMA/Toshihiro SUZUKI/Asako FUKUSHIMA

In order to devise ways to make effective use of the soil seed bank for wetland restoration at the Watarase Retarding Basin, seed bank surveys were conducted by using soil samples taken at multiple locations in the retarding basin. On the basis of the survey results, this paper reports on the usefulness of the soil seed bank and considerations in using it.

In the 2005 and 2006 surveys, soil samples taken from three different depths at three different locations at the Watarase Retarding Basin were sowed under four different water level conditions. As a result, a total of 5,839 individuals in 157 plant species in 43 families were identified. At all soil sampling locations, about 40 percent, in terms of both the number of species and the number of individuals, of the identified plants were either wetland or aquatic plants. This suggests that the soil at the retarding basin can be used for the restoration of wetland vegetation. Of all endangered species of surface vegetation identified at the soil sampling sites, about 40 percent (8 species) have been found in the seed bank, too. Other endangered species that have hardly been sighted in the Watarase Retarding Basin area, such as Ceratopteris thalictroides and Penthorum chinense, have also been found in the soil seed bank, indicating that the use of the seed bank is an effective way to restore vegetation including these species.

The seed bank survey, however, has also revealed the presence of many alien species that had not been sighted in the surface vegetation at the soil sampling sites, indicating that the seeds of alien species are also stored in the soil at the Watarase Retarding Basin. Among those alien species, Solidago altissima is a perennial plant species that, if established, is likely to greatly influence the surrounding vegetation. It was considered necessary, therefore, to use these alien species only after carefully examining the quantities of the seeds of these alien species and the depths at which those seeds exist.

Key words : soil seed bank, vegetation restoration, wetland restoration, endangered species, alien species

# Determining the cross section of the Ichinomiya River (Chiba Prefecture) by a simple environmental impact assessment method

Susumu DOMON/Hideki TAMURA/Jyunzo SAGO/Kenzo MAEDA

The Ichinomiya River in Chiba Prefecture is a rare, environmentally important river in the Kujukuri area in that it has estuary sand spit (tidal flat). The estuary sand spit has been selected as one of the 500 most important wetlands in Japan (Ministry of the Environment). In view of the flood damage involving the Ichinomiya River in 1989 and 1996, a Special Emergency Project for the Control of Severe River Disaster was adopted for the river.

Although the project was completed, channel excavation has been continued since 2006 in the lower-reach section near the estuary along the urbanized hinterland city of Ichinomiya.

This paper reports on the method of determining the cross-sectional shape, to be formed by excavation, of the estuary excavation section using a quantitative habitat evaluation method. IFIM (Instream Flow Incremental Methodology) is a representative method for quantitative riverine habitat evaluation, but HEP (Habitat Evaluation Procedure) developed in the United States is attracting attention in the area of environmental impact assessment.

In this study, a simplified version of the HEP was used. Scores were calculated as follows. (1) Indicator species were selected on the basis of available information and biological survey results. (2) The value of 1m × 1m mesh areas of habitat for indicator species was rated in terms of an index ranging from 0 to 1. (3) The rating score for an entire habitat was calculated by summing the indices for individual mesh areas. It was decided to use a terraced-bank cross section capable of carrying the current design flood discharge.

Key words : quantitative evaluation method, HEP, river improvement, channel excavation, Ichinomiya River

# Environmental problems and goals of the improvement of the Aiwari River

Mitsuru ABE/Noboru MARUOKA/Satoshi DAIMON

Following the flood of August, 1980, of the Aiwari River, a Class B river flowing through Kitakyushu City, an improvement project for the Aiwari River was launched, and river improvement works including levee construction and excavation have been underway from the lower reaches to the upper reaches of the river. In the Aiwari River, however, an environmental survey was conducted in 2000, and rare plant and animal species including Limonium tetragonum, a halophytic plant species listed in the Ministry of the Environment's Red Data Book as a "Threatened II" species, were found.
In this study, the present river environment of the Aiwari River was investigated, environmental problems to be addressed in connection with river improvement were identified, and measures to be taken to solve the problems were considered. This paper reports the results thus obtained.
As a result of the study, on the basis of the environmental problems of the Aiwari River, four goals were identified: (1) conserving the estuary environment that provides habitat for Limonium tetragonum, (2) creating a wide variety of flows, (3) creating diverse waterside environments and (4) ensuring of water amenity. To achieve these goals, methods and implementation zones were proposed for (1) conserving, creating and relocating the habitat of Limonium tetragonum, (2) forming the base flow channel, (3) creating backwaters and (4) the construction of stepped revetments, etc.

Key words : Aiwari River, channel plan, river environment, Limonium tetragonum, halophyte, tidal flat, fish habitat, base flow channel, backwater

# On the current state and problems of nature-oriented river works using nature-friendly methods in Gifu Prefecture

Kazuhiro MORITA/Yoshimasa OTAKE

This paper outlines the present state and problems of the nature-oriented river works using nature-friendly methods (called "nature-friendly river works" in Gifu Prefecture) carried out in Gifu Prefecture in fiscal 2006 and reports on what was achieved as a result of those river works.

In view of the review of nature-oriented river works made in 2005, the Ministry of Land, Infrastructure and Transport redefined its river management policy from "nature-oriented river works" to "nature-oriented river management" and is planning river projects that are more nature-oriented than conventional projects. In Gifu Prefecture, nature-oriented river projects began in 1990. In 2001, the practices at that time were reconsidered. As a result, the Nature-friendly Method Study Group was established jointly by industry, citizens, academia and the government as a "project for riverfront restoration project," and efforts have been made in the areas of "manufacturing," "human resources development" and "field research." To assist in "manufacturing," the Naturefriendly

Method Certification System was instituted to disseminate information on nature-friendly methods of river improvement that are effective in conserving, restoring or creating the natural environment and thereby encourage the development of nature-friendly products. In this fiscal year, the Nature-friendly Method Certification System was reviewed to identify the present state and problems of nature-oriented river works in Gifu Prefecture. As a result, a number of problems were pointed out. For example, it is often thought that the goal of living with nature can be achieved simply by using nature-friendly methods without clearly defining objectives to be accomplished, and river improvement methods that have been successful for other rivers are used without understanding the mechanism of the rivers to be improved.

Key words : nature-oriented river works, nature-friendly method, review

# River environment as viewed from the results of National Survey on River Environments: an overview of the first to third round survey results

Tetsuya OTSUKA/Satoshi MAEDA/Mitsuru ABE

The third round of the National Survey on River Environment, which began in 1990, was completed in 2005. In this study, the results of the first to third rounds of the National Survey on River Environments were reviewed, and the river environments of Class A rivers were evaluated.

The first to third rounds of the National Survey on River Environments identified 411 fish species, 1,848 species of benthic animals, 3,814 species of plants, 365 species of birds, 27 species of amphibians, 20 species of reptiles, 71 species of mammals and 12,113 species of terrestrial insects. Thus, the riverine biota has been almost exhaustively covered, and the survey has shown that rivers are important habitat for wildlife in Japan.

To evaluate river environments determined according to the results of the National Survey on River Environments, attempts were made at classifying rivers from the viewpoint of fish, evaluating the water quality environment from the viewpoint of benthic animals and evaluating the degree of naturalness of dry riverbed areas. In the TWINSPAN classification of rivers from the viewpoint of the fish biota, rivers in Japan were classified into five types: Hokkaido type, East Japan Sea-of-Japan type, East Japan Pacific Ocean type, West Japan Type I and West Japan Type II. In the study of the water quality environment by the average score method based on the benthic animal survey results, the water quality environments of the middle and upper reaches of Class A rivers were mostly considered excellent. In the study of the degree of naturalness of dry riverbed areas according to the butterfly index based on the terrestrial insect survey results, it was concluded that dry riverbed areas in suburban areas retained some precious pieces of nature. Thus, it has been shown that river environments can be evaluated on a nationwide scale on the basis of data accumulated through the National Survey on River Environments.

Key words : National Survey on River Environments, river environment, evaluation, TWINSPAN method, average score method, butterfly index

# Scoping of project benefit measurement using CVM

Akihiko NAKAYA/Minoru KOBAYASHI/Nobuyuki OHASHI/Mizuki KONNO/Suguru KATSUMOTO/Aki IWASAKI

This paper reports the results of a fact-based study on approaches to scoping, which is important when calculating the benefits of a river environment improvement project by the Contingent Valuation Method (CVM).

A review of examples of benefit measurement revealed that CVM is often used when measuring the benefits from a river environment improvement project. In CVM, the method of determining the scope of WTP (willing to pay) measurement greatly influences benefit calculation. People involved in project benefit measurement, therefore, are in need of externally justifiable criteria for scoping.

For projects that can be expected mainly to enhance utility value as in the case of a project for promoting the use of a river, it is appropriate to determine the scope of measurement on the basis of the results of surveys on the use zones of similar existing projects. In this study, scoping guidelines for different types of projects have been developed according to the results of fact-finding surveys conducted in the use zones of rivers.

For projects that are expected to enhance not only utility value but also non-utility value such as projects for nature restoration or water environment improvement, it has been proposed that the scope of measurement be determined by using the degree of recognition of a river of interest as an indicator. It has also been pointed out that fact-finding surveys should be conducted for each project.

Key words : CVM, benefit, WTP, scope of measurement, river environment improvement, use zone of a river, the degree of recognition of a river

# Robinia pseudoacacia removing effect of root removal after felling trunks and future problems

Kouta TANNO/Satoshi MAEDA/

It is generally known that Robinia pseudoacacia, an exotic species of North American origin, is highly capable of regenerating even after felling trunks. In order to exterminate Robinia pseudoacacia, therefore, it is necessary either to remove the stumps and the rhizomes and other underground parts completely or to kill the plants. The technology, however, to effectively remove or kill the underground parts of this species has not yet been established. In this study, for the purpose of evaluating the effectiveness of Robinia pseudoacacia root removal by use of a backhoe, identifying problems and finding ways to exterminate Robinia pseudoacacia effectively, surveys and measurements including phytosociological vegetation surveys, sprout density surveys and sprouting source measurement were conducted in the year after root removal. On the basis of the study results thus obtained, problems to be addressed and measures to be taken were studied, and four field trial plans for Robinia pseudoacacia regeneration control were developed. These regeneration control plans were carried out during the period from December, 2006, to March, 2007.
For the study river, the Aka River, a restoration project has been underway since 2005. Under the project, efforts are being made to remove Robinia pseudoacacia in order to restore the natural vegetation habitat of the Aka River.

Key words : Aka River, nature restoration, Robinia pseudoacacia, root removal, sprouting

# River channel management and monitoring methods considerate of the ecosystem of the upper reaches of the Tone River

Masanori IIJIMA/Yoshifumi KODAMA/Miwa TOMIZAWA/Masahiro FURUMATSU/Kikuko MIYAZAKI

This paper deals with a method for efficiently monitoring future environmental changes in the upper reaches (85.5K–186.5K) of the Tone River developed by taking into consideration such factors as the relationship with channel characteristics and physical environmental conditions, and the historical changes in the river channel.
In this study, the upper reaches of the Tone River were zoned into three sections, namely, the upper section, the middle section and the lower section, by taking into account the channel conditions and the environmental elements such as human-made structures. The ecosystem characteristics of these sections were determined by making use of data obtained from the results of National Surveys on River Environments, and "characteristic places" were identified by relating fundamental units for evaluating river space habitat functions with space units (space elements for classifying natural landscapes). Species dependent on "characteristic places" were identified as "characteristic species," and habitat maps by which to determine the effects of future changes in the river environment were created. In addition, in order to enhance monitoring efficiency and determine habitat functions, typical sections in the three (upper, middle and lower) river sections were classified as reach scale sections and selected as monitoring sites. By studying the monitoring sites thus determined, river channel management and monitoring methods considerate of the ecosystem of the upper reaches of the Tone River were developed.

Key words : riverbed degradation, frequency of submersion, habitat map, monitoring site

# A study on feasibility of Lake Biwa shore management not dependent on shore-based conservation facilities

Kentaro TAKI/Yoshifumi KODAMA/Takayoshi TSUZUKI/Sadakazu ITO/Yohei KATO

Rapid shore erosion of Lake Biwa began to occur frequently around 1992, and the Shiga Prefectural Government has been working on the development of lakeshore conservation facilities designed basically for integrated shore protection (a combination of jetties, beach nourishment and gentle-slope revetments). However, although lakeshore conservation measures are effective in preventing erosion only in the areas where they have been implemented, there is concern about landscape degradation and adverse effects on the ecosystem caused when the shoreline is stabilized in a saw-toothed shape. There is a need, therefore, for lakeshore management that does not depend on lakeshore conservation facilities. It has been pointed out that patterns of water level changes and changes in sediment supply from rivers are factors causing changes in Lake Biwa's shore configuration, the degree to which these factors affect lakeshore configuration has not yet been elucidated.

In this study, a numerical analysis model capable of keeping track of the sediment transport process from mountains to rivers and lakeshore areas (from a sediment flow system to a littoral drift system) was developed to quantitatively evaluate the effect of each factor on lakeshore configuration. The newly developed numerical analysis model was also used to explore possibilities of lakeshore management that is not dependent on lakeshore conservation facilities. As a result, it was found that a dynamic equilibrium state or a deposition tendency achieved by (1) supplying the sediment deposited at the mouths of tributary rivers by bypassing it in the form of littoral drift and (2) keeping the water level of Lake Biwa at or below BSL+0.3m (BSL=Biwako Surface Level: reference water level of Lake Biwa).

Key words : lakeshore erosion, shoreline, water level fluctuation, the rate of sediment supply, sediment flow system, littoral drift system, the state of dynamic equilibrium

# Development of a river environment management support system

Yasushi HORIKAWA/Satoshi MAEDA/Nobuyuki OHASHI

Information used for river management is diverse and exists in the form of, for example, electronic data or in print form. Among the river environment-related information, the results of the National Survey on River Environments have been stored as electronic data in a nationally standardized format, and the information thus accumulated in an integrated form is available from a system as searchable and analyzable data. Data on the results of other river environment surveys, however, conducted for purposes other than the National Survey on River Environments have not yet been integrated and made available in the form of a standardized database system. Consequently, it may not be possible to share and make effective use of data in an organization if different purposes of survey, implementing entities or years of survey are involved, because of data problems such as scattering, loss, inability to tabulate, perform global checks or search, a lack of preliminary information necessary for a project. In order to enable river administrators to make effective use of information, therefore, it is hoped that not only survey results are made available in a standardized format, but also those survey results and river environment data collected for different purposes are integrated into a database system and a system is developed that provides searchable data to other departments in connection with the design, management and implementation of environmental and other facilities.

It was decided, therefore, to develop, by the prototyping model method, a management support system integrating various functions, such as a GIS-based search function, a function for chronological management of river environment information maps and a data update and registration function, in order to assist in river management tasks associated with design, planning and construction by providing a user-friendly interface, upgrading the database and providing search capability.

Key words : integration and compatibility support system, river environment information, database, GIS

# A study on river environment improvement planning from the viewpoint of river system planning: a case study on the Kano River System

Takehiko IWASAKI/Minoru KOBAYASHI/Koji TAKAHIRA/Norihiro KAWANABE/Kazuhiro NAMIKI

In 2005, according to the belief that when planning for the improvement of a river environment, it is important to do so from the viewpoint of the entire river system, MLIT (Ministry of Land, Infrastructure and Transport) projects for the integrated improvement of the river system environment were instituted by integrating environmental improvement projects for rivers and environmental improvement projects for dam areas. Under the new project system, it became necessary, when submitting a budgetary request for a project, to clarify the purpose, necessity, content and other details of the project by drawing up a long-term plan for the river system concerned including water environment improvement projects, nature restoration projects, utilization promotion projects, etc. This study focused on the development of a well-balanced integrated river system environmental improvement plan by looking at, as a case study, the Kano River in the Kano River System, a Class A river for which a river improvement plan was formulated in December, 2005.

For the development of the draft plan, the present state and problems of environmental improvement were identified through literature research from the viewpoints of the water environment, the natural environment and river utilization, and a direction of long-term improvement and priority in project implementation were considered while trying to achieve consistency with the fundamental river management policy and the river improvement plan. The direction of long-term improvement was considered to meet the following basic requirements: (1) the conservation of the excellent environment of the Kano River, (2) the restoration of deteriorating or decreasing environments and (3) the creation of new environments that are being hoped for because of changing social conditions.

Key words : river system environmental improvement project, water environment improvement, nature restoration, utilization promotion, river improvement plan

# Application of DNA polymorphism analysis technology to the river environment (interim report)

Kazuhisa KIDO/Katsuhiro GOTO/Jyunzo SAGO/Tatsuo OMURA/Kozo WATANABE

The amendment of the River Act in 1997 added a new objective, namely, environmental conservation, to the two main objectives, "flood control" and "water utilization," of river improvement, and a new policy for river administration was indicated. In 2003, the Nature Restoration Promotion Act was enacted with the aim of restoring lost ecosystems and other natural environments. The new law calls for the conservation, restoration and creation of natural environments in Japan including rivers, wetlands, seaweed beds, rural areas, forests and coral reefs.

The Convention on Biological Diversity signed at the United Nations Conference on Environment and Development (Earth Summit) in 1992 views biological diversity at three levels, namely, ecosystem, species and genetic, and calls for conservation efforts at those levels.

The conventional practice in river improvement is to evaluate biological diversity at the species level and plan and implement river improvement accordingly. For better conservation of biological diversity, however, it is necessary to take into consideration genetic diversity, which is the genetic variety among individuals within a species, as an indicator of biological diversity, as well as the variety of species. Genetic diversity can be evaluated by conducting a DNA polymorphism analysis. Focusing on this DNA (deoxyribonucleic acid) polymorphism analysis as a means of genetic diversity evaluation, this study aims to propose a concrete method of application and other specifics.

Prepared as an interim report, this paper reports on the basic studies and analyses conducted before developing a concrete method of application and, because a conclusion has not yet been drawn, on what has been achieved thus far.

Key words : DNA, heterozygosity, genetic diversity, genetic distance, river environment, Hydropsyche orientalis

# A model study on integrated implementation of high-standard levee and urban redevelopment projects

Toshihiko ITO/Toshiya YAMADA/Junichi NAKAGAKI

Although it has been common practice to implement urban high-standard levee projects in relatively large areas such as former factory sites, in the coming years it is necessary to implement high-standard levee projects in areas built up with wooden structures. It is a prerequisite to implement a high-standard levee project in the form of a multipurpose project combining high-standard levee construction and community development. In areas built up with wooden structures, however, community development projects are difficult to implement because the residents of those areas include a high percentage of owners and leaseholders of small building lots. For those land owners and leaseholders, an urban redevelopment project is an attractive option because it makes it possible to secure a floor area comparable to that of the existing structures by making intensive use of land. In this study, a model study was conducted on integrated implementation of high-standard levee and urban redevelopment projects.

Key words : high-standard levee, urban redevelopment, cost allocation

# A study on high-standard levee projects taking advantage of regional characteristics

Tsuyoshi KONNO/Yoshio MAEMURA/Kiyotaka MATSUMOTO/Jun KOIZUMI

This paper reports the results of a study on what a high-standard levee project in a suburban area should be like.

High-standard levees have been planned and constructed as integral part of community planning in view of the future of the riverside community concerned. However, mainly because of the economic slump following the bursting of the economic bubble and the deterioration of the finances of the local governments implementing joint projects, high-standard levee construction, which requires a huge amount of expenditure, has not progressed as expected.

In recent years, the compact city concept, which, by thinking of the area within walking distance as the living sphere, aims to prevent urban sprawl, regenerate the community and make the community a better place to live in, has been drawing attention. In riverside areas located in the suburbs of municipalities, therefore, the task of riverside community development itself has become difficult to achieve.

In view of this situation, this study focused on the region along the upper reaches of the Ara River that is located in the outskirts of the municipalities along the river and that includes many urbanization control areas. In the study, urban facilities that can be developed together with high-standard levees were identified, taking into consideration the river characteristics, and problems expected if a joint project is to be implemented were studied.

Key words : high-standard levee, riverside municipality, joint project, community development, urban facility

# Seismic performance regulations of super levees under level 2 earthquake motions

Hiroshi MORI/Yoshifumi KODAMA

In March, 2007, the Ministry of Land, Infrastructure and Transport issued the guideline for the verification of the seismic performance of river structures including conventional levees (earthen river dikes) under level 2 earthquake motions. There is an urgent need for studies on similar verification of the seismic performance of super levees and the establishment of an evaluation method.

This report introduces an approach to the determination of seismic performance regulations for super levees built on liquefiable ground under level 2 earthquake motions. The accuracy of a seismic analysis method (dynamic deformation analysis) that can be used to evaluate seismic performance was made either by comparison with damage sample data and centrifuge model test results or by finite element mesh density evaluation in connection with the influence on surface displacement or inclination. As a result, it has been shown that the analysis method is capable of reproducing actual failure behavior with fair accuracy. As an alternative to the factor of safety evaluation by the seismic coefficient method, which tends to overestimate the factor of safety, a seismic design verification flow for evaluating seismic performance in terms of deformation, one of the seismic performance attributes of levees, is presented.3

Key words : level 2 earthquake motion, super levee, seismic performance regulation, seismic analysis method

# Riverfront utilization efforts for the Ota River

Fumihiro TOI/Yoshifumi KODAMA/Takayoshi TSUZUKI/Isao SHIOMI/Hiroshi INO

The city of Hiroshima, which has been formed by the delta of the Ota River, is characterized by as many as six rivers running through its urban center, a rare topography in Japan. The percentage of water surface in the urban area is one of the highest among the cities in Japan. As a city of water along with Osaka, Hiroshima is making pioneering efforts to create a city taking advantage of its rivers.

On March 23, 2004, a government circular titled "On Exceptional Measures under the Rules for Permitting the Use of River Zones for Facilities for the Restoration of Cities and Other Areas" was issued in connection with urban restoration projects and regional restoration programs that have been underway in recent years. Thus, it has become possible make flexible use of various systems associated with the use of river zones in order to enhance the utility value of dry riverbed areas and promote community building efforts taking advantage of riverfront space. This means that it has now become possible for private enterprises to hold various events and run commercial establishments such as open cafes in river zones, all of which were not permitted under the old regulations.

This paper reports the impact of a social experiment that has been conducted since last year on the exceptional measures under the rules for permitting the use of river zones of the Ota River in Hiroshima City.

Key words : rules for permitting the use of river zones, social experiment, Ota River, open cafe

# Planning for maintenance cost reduction by allowing private use of a regulating reservoir

Kenichi YAMAKI/Hideyuki WATANABE ／ Toshikazu ASANUMA ／ Shingo SHIINA

The Osagami Regulating Reservoir, which is under construction in the city of Koshigaya, Saitama Prefecture, is a facility designed for the flood control of the Motoara River, a tributary of the Naka River in the Tone River System, and for the retention of stormwater runoff due to the land development carried out for the Specified Land Readjustment Project for Koshigaya Lake Town. One characteristic of this regulating reservoir is that it serves as an artificial lake in normal times to create an amenity-oriented waterfront environment.

It is important that this regulating reservoir retains its excellent waterfront space in the coming years.

A plan has been developed, therefore, for minimizing the maintenance cost and labor burden on the government while maintaining the high standard of river space management for the regulating reservoir.

Key words : Koshigaya Lake Town, Osagami Regulating Reservoir, waterfront space, maintenance, cost reduction, use permitting rules, social experiment

# A study on development of inland waterway transport

Katsuhiro GOTOU/Kazuyuki SAKANOI ／ Jun MOTOHASHI

The role of inland waterway transport (including river navigation and coastal shipping ) (IWT) is being reconsidered from the viewpoints of environment-friendly and energy-efficient , easing traffic congestion, ensuring emergency transportation functions in the event of disasters, and supporting tourism and recreation activities.
The purpose of this study is to identify current trends and problems of IWT in Japan and indicate a direction toward development of IWT from the viewpoints of normal use and emergency use. In normal times, IWT can be used to transport dangerous goods and waste materials in order to contribute greatly to the mitigation of urban environmental problems. In emergency times, there is a possibility that IWT is useful to transport emergency relief goods, stranded commuters, and debris of earthquake-damaged structures. A case study of the Ara River showed that IWT can contribute, to some degree, to relief activities for the riverside municipalities.
As a next step, it is hoped that practical problems on promoteing the use of IWT are identified, methods of partnership of the organizations concerned are clarified, and the role and effectiveness of IWT are publicized, through social experimentation.

Key words : inland waterway transport, logistics, disaster management, regional development, emergency jetty, social experimentation, World Water Forum

# Study on global warming countermeasures in riverside urban areas

Masafumi ITO/Yoshio MAEMURA/Hideki TAMURA

During the one-hundred years ending in 2004, the heat island effect resulting from decreases in vegetative cover and increases in artificial land cover including buildings has caused the annual mean temperature in large cities in Japan such as Sapporo, Tokyo, Nagoya and Fukuoka to rise by 2.2 to 3.0°C. These temperature rises have become a major social problem because they are 1 to 2°C greater than the rises in annual mean temperature in medium and small cities in the country.

In view of this situation, micrometeorological observation was carried out in areas along the Ara River in Kagaguchi City (Saitama) and in Akabane (Kita Ward, Tokyo) with the aim of investigating the effect of river areas such as river water surfaces and high water channels, in which the rate of evapotranspiration is higher than in land-side areas, on the mitigation of temperature in riverside urban areas. This paper reports the results of the micrometeorological observation.

The observation results confirmed the temperature-lowering effect, taking into consideration of the river space of the Ara River and the surface cover provided by the high-standard levees, and cool breezes confirmed the temperature-lowering effect in land-side areas, along with the extent of such influence and its changes over time.

Key words : high-standard levee, heat island effect, micrometeorological observation, temperaturelowering effect

# Evaluating the hydrological cycle conservation system for Hachioji New Town by using the SHER Model

Hideki TAMURA/Yoshio MAEMURA/Daikichi OGAWADA

Prior to the full-scale construction work for the Hachioji New Town project being implemented by Urban Renaissance Agency, the Committee on the Hydrological Cycle Conservation System for Hachioji New Town (chaired by Prof. Katsumi Musiake of Fukushima University) was established to deliberate on ways to reduce the burden on the hydrological system caused by the large-scale urban development planned for the project. As a result, the committee developed a hydrological cycle conservation system (hereafter referred to as "the System").

The development of Hachioji New Town has been carried out in accordance with the policy of the System. The development has now reached the final stage, and various facilities planned as part of the System are nearing completion. In order to verify the effectiveness of the System, the committee met again to evaluate the effectiveness of the hydrological cycle conservation system quantitatively by using the SHER Model, a distributed hydrological model. This paper reports on the quantitative evaluation of the System made by the committee.

The effectiveness of the System at a certain point in future when land use plans are carried out and the planned amount of development to be handled by the System is completed was estimated. As a result, it was concluded that the goals of the flood control plan and the plan for low-water river works could be achieved at the downstream end of the Hyo-e River in the project area. It has therefore been shown that it is important to continue the system development according to the current plan.

Key words : new town development, hydrological cycle, hydrological cycle conservation system, distributed hydrological model, SHER Model, stormwater infiltration facilities, storage facilities, crushed-stone storage and infiltration facilities

# Policy for measures against washed-up trash

Muneaki MASUOKA /Yoshifumi KODAMA/Hideki TAMURA/Tetsuro SHIBATA

In coastal areas in Japan, damage caused by trash washed ashore, such as hampering the functions of coastal conservation facilities and degrading coastal environments, has become a serious problem that requires urgent countermeasures.
In this study, problems associated with washed-up trash were identified by investigating the actual state of washed-up trash and evaluating current coastal management practices in dealing with washed-up trash, and a policy for measures against trash washed ashore was drawn up.
In order to investigate the actual state of trash washes ashore in Japan, a nationwide survey on washed-up trash was conducted intensively over a period of about month to prevent recounting trash washed ashore twice or more. This was the first attempt of its kind in Japan.

Key words: coast, beach, shore, washing ashore, trash, environment, life, citizens, NPO, cooperation, mutual assistance