INTERNATIONAL ASSOCIATION FOR DANUBE RESEARCH

OF THE INTERNATIONAL ASSOCIATION FOR THEORETICAL AND APPLIED LIMNOLOGY

LIMNOLOGICAL REPORTS

VOLUME 35

Proceedings

35th IAD Conference, Novi Sad, Serbia and Montenegro, 2004

Editors

Ivana Teodorović Snežana Radulović

Jürg Bloesch

visio mundi academic press

National Committee of IAD Serbia and Montenegro

International Association for Danube Research

of the International Association for Theoretical
and Applied Limnology

LIMNOLOGICAL REPORTS

VOLUME 35

Proceedings

of the 35th IAD Conference, Novi Sad, Serbia and Montenegro, 2004

Editors

Ivana Teodorović Snežana Radulović

Jürg Bloesch

National Committee of IAD Serbia and Montenegro

Internat. Assoc. Danube Res.	35	41–57	Novi Sad, April 2004

A comparison of watershed management in Japan with the Danube Region in Europe

BREILING, M. [1,2] & HASHIMOTO, S.[3]

[1] Department for Landscape Architecture, Technical University Vienna
[2] International Association for Danube Research
[3] Laboratory for Land Resource Sciences, University of Tokyo

Abstract: Despite different regional circumstances and history watershed management is equally important in Japan and the Danube region. In the first part of this paper we provide a comparative analysis of the two regions paying particular attention to their respective differences in natural river management, economic circumstances and the legislative contexts. In the second part, we describe the current water management of Japan and provide some examples about problem situations of water management in urban and rural areas. While safety demands and water supply issues in particular for agriculture are traditionally well covered in Japanese watershed management, ecologically minded river management and the support and maintenance of biodiversity have not been high priorities despite the existence of some remarkable examples of integrated land and water management, primarily in urban areas of Japan. In the final part of this paper we summarize our arguments about the crucial importance of scientific and practical cooperation between Japan and the Danube Region and why we believe this should be further promoted.

Zusammenfassung: Japan und die Donauregion und sind in vielfacher Weise unterschiedlich, die Aufgabe einer nachhaltigen Bewirtschaftung der Wasserressourcen ist in beiden Regionen gleichermaßen bedeutend. Im ersten Teil presentieren wir die unterschiedlichen Rahmenbedingungen für ein umfassendes Management von Flußeinzugsgebieten. Im zweiten Teil beschreiben wir die gegenwärtige Situation des Wassermanagement in städtischen und ländlichen Regionen Japans mit Querverweisen zur Situation der Donauregion. Sicherheit gegen Katastrophen und die Wasserversorgung der Landwirtschaft mit Reisanbau stehen traditionell an oberster Stelle. Hier besteht Gefahr, daß die ökonomisch wenig ertragreichen Land- und Forstwirtschaften vernachlässigt und aufgelassen werden. Ein ökologisch orientiertes Management von Flußeinzugsgebieten mit besonderer Rücksicht auf Biodiversität existiert derzeit noch nicht, wenngleich es ausgezeichnete Projekte im Kleinen gibt, vorallem im dichtbevölkerten städtischen Gebiet. Im zusammenfassenden letzten Teil, wird auf die Bedeutung einer Kooperation hingewiesen.

Keywords: biodiversity, environmental safety, landscape planning, river management, urban and rural planning

Introduction

In March 2003, the 3rd World Water Forum took place in Kyoto, Japan. A major theme of the forum was river basin wide management (WORLD WATER FORUM, 2003). Japanese development is closely linked to river development, which existed for some 1,500 years. The population increased by more than 20 times during this period and so from this perspective river management was most successful. While safety seems to be well covered in ongoing planning efforts other concerns do not seem as adequately covered. This is a key reason to analyse current river basin management in the host country of the 3rd World Water Forum and to examine how far the aims of sustainable river basin management are fulfilled.

Since 2000 the European Water Framework Directive covering 15 EU countries has been in place (AMTSBLATT 2000). The concept of watershed management was put forward as a European Directive with the obligation to provide water management plans until 2006 with the aim of achieving good ecological status within 2015. The Danube is the largest river within the European Union territory and ecologically-oriented river basin management is a challenging task. A common understanding is perhaps not yet in place, but efforts to harmonise are going on.

In the following pages we compare Japan and the Danube region from different perspectives related to integrated land and water management. First we provide an overview on a regional scale. Second we take the internal differences of each region and explain some of the major problems in each region. Finally we draw conclusions about lessons that can be learned from each other.

Regional Comparison

Japan is a land mass measuring some 378,000 square kilometres with a population of 127 million people and a average population density of 340 people per square kilometre. The country consists of some 4,000 islands with the four main islands Honshu, Kyushu, Shikoku and Hokkaido. Japan is structured into 9 regions with 47 prefectures, which consist out of 3000 municipalities. Each municipality is divided into wards, shi, mura and cho. In total there are 140,000 villages or settlement areas.

The Danube region spreads across some 817,000 square kilometres and contains a population of some 90 million people and a population density of slightly over 100 people per square kilometre. 18 states have a share in the Danube region, 14 states have a share of more than 2000 square kilometres.

A first basic difference between the Danube river basin and Japan is, of course, the landform. The Danube basin is within a continent while Japan is divided into many islands. For this reason we find many and small river basins instead a single large one. The largest single river basin is one deriving from the Tone river with 16,000 square kilometres. Only 13 river basins cover more than 4,000 square kilometres. This size is considered the smallest administrative unit of the Danube

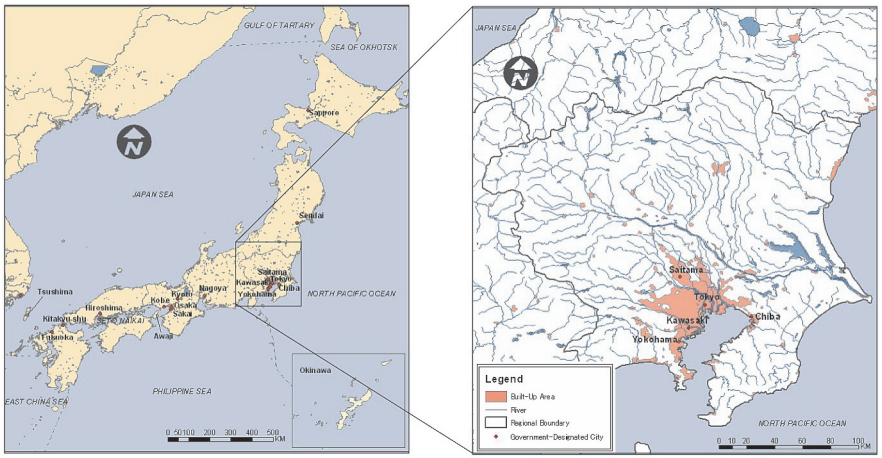

Figure 1. Japan with detail of Tokyo area. Left: Japan stretches along 2000 km in length and up to 300 km in breath. Right: Detail of Kanto area, which shows the shape of water bodies. In the middle the largest Japanese watershed of Tone river.

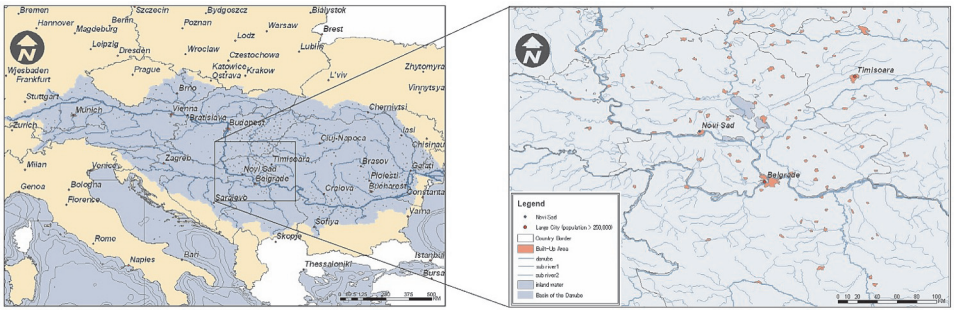

Figure 2. The Danube Region with detail of Novi Sad area. Left: The Danube region consists of a single watershed. 18 nations contribute. Right: Detail of Novi Sad area, which shows the shape of water bodies.

river basin management by the ICPDR, International Commission for the Protection of the Danube River, to administer the European water directive. The Japanese River Bureau of the Ministry of Land, Infrastructure and Transport (MLIT) is the national institution that manages the rivers of national importance (so called Class A rivers) which includes 109 river basins, extending over 240,000 square kilometres of the 378,000 square kilometres or 63.5% of the Japanese land area. The 47 prefecture governments take over responsibility for another 2691 river basins of smaller scale with an average size of 40 square kilometres, or 108,000 square kilometres in total, or 28.5% of the total land area. The remaining 8% of land area is covered by some thousands of very tiny river basins and are situated within municipalities. Class A and B rivers, in total 92% of land area are

subject to the River Law from 1964 (MLIT 2003a). Fig. 3 depicts the different flow characteristics from the Danube, major Japanese rivers and some international rivers.

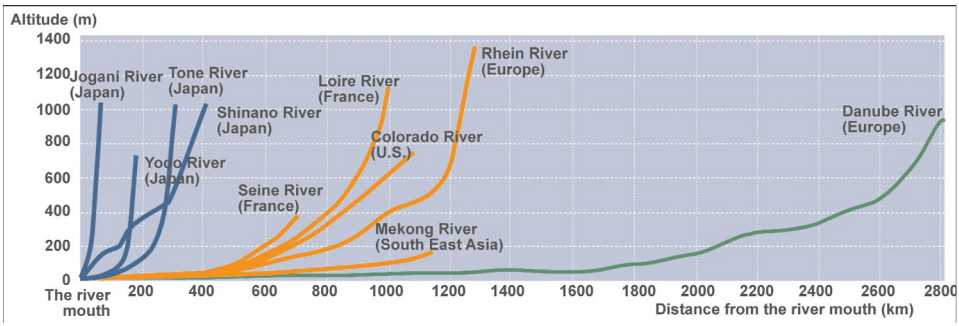

Figure 3. Altitude length diagram of some Japanese and international rivers. The figure indicates the different characteristics between major Japanese rivers (blue), medium large international rivers (orange) and the Danube (green). Based on MLIT (2003b) and ICPDR (2002).

A second difference between the regions under discussion is climate. Climate varies from tropical in the most southern prefecture Okinawa, to temperate areas to the North in Hokkaido. Annual mean temperature at sea level is 16.7°C based on 17 reference stations of Japanese Meteorological Agency during the period 1971 to 2000 with regional variations of the annual mean of 14.7°C. Variations of monthly mean values stretch from 6.6 to 28°C. The Danube region, with a primarily continental climate, is considerably cooler. We estimate some 9°C annual mean temperature at lower elevations and 20°C variation between the coldest and hottest month based on the analysis of some major cities within the Danube Region. The coast on the Sea of Japan side gets more precipitation than the side facing the Pacific Ocean. There are three rainy seasons in June, September and December to February. Winter rainy season usually applies only to the Sea of Japan and commonly this displays itself as heavy snowfall. On average, there are 1,600 mm of annual precipitation in Japan, while 680mm is a mean value for the Danube river basin.

A third difference between the regions is the population and population density. In the Danube river basin, we find on 817,000 square kilometres some 90 million inhabitants. In Japan 127 million people (in 2002) occupy 378,000 square kilometres. The average population density is 340 three times higher in Japan than in the Danube river basin. The hilly areas were first populated in Japan, as the valleys were exposed to frequent floods. Along with rice cultivation flood protection also developed and from around 1,500 years ago the plains became increasingly more populated.

Figure 4. Rain fed irrigation pond (tameike) and rice fields in Awaji Shima. The picture shows one out of many paddy irrigation systems. The so called Tazu system is based on rainfed irrigation ponds, tameike. It is a typical man made secondary nature and increased biological variety.

The forth regional difference is land use. The rich precipitation was one of the reasons Japan could historically develop into a prosperous state. Good rain enabled rice production based on paddy fields, requiring considerably more water than other forms of agriculture. Some 6% of Japanese land area are paddy fields and require a careful water management with irrigation and canal systems. Fig. 4 shows one out of many paddy irrigation systems. During the rice growing period, water levels on the paddy change frequently. Another 6% of the land area is devoted to other agricultural uses such as orchards, vegetables or meadows. Some 4.7 million hectares of agricultural land supplied the 2002 Japanese population with 100% of their rice and up to 40% of the total Japanese diet (STATISTICS BUREAU, 2003a). Two thirds of the country is covered by forest and this serves as a water filter, but also a means of protection against torrents and landslides. In recent years considerable problems with forest management appeared as it is not considered as economically and the state needs to subsidise it. In the Danube region the forest area is considerably less than in Japan, while the agricultural area is much larger. Property structures are in general much larger than in Japan. Within the Danube region, agricultural commodities can be produced closer to world market prices, while in Japan agriculture is highly subsidised by the state. Forestry is not subsidised in the Danube region. Only a minor part of the forest

area, primarily in the Alps and Carpathian mountains, serves a protective function.

The fifth regional difference can be seen in the dissimilar use and availability of water in Japan and the Danube. On average some 605 cubic km of water fall in Japan, while this amount is slightly less in the Danube region measuring some 556 cubic km. Despite this favourable figure for Japan, the water availability is in general considerably less than in the Danube region. This is because water is discharged much quicker to the sea as the longest river, Sinano, is only 367 km long, and the flow is more rapid due to the large altitude differences. This is similarly only to the higher Alpine parts of rivers in the Danube basin. For this reason water levels rise and fall quickly. The ratio between maximum and minimum discharge is between 200 and 400 and it is dubious to rely on the natural availability of water. Domestic water demand is primarily met by river water. The same water can be used and recycled several times before it will finally discharge to the sea. According to estimates by the Japanese river bureau, some 78 km^3 river water and some 13 km^3 groundwater is annually used for domestic, industrial and agricultural uses (MLIT 2003a). For a balanced supply, the construction of reservoirs to store water was necessary during the past.

The sixth regional difference is the socio-economic condition of Japan. In 2002, the per capita GNP was 32,000 US Dollars while the average of the Danube region was perhaps 12,000 US Dollars. The Japanese economic situation is directly comparable to the upstream countries of the Danube river basin, Austria, Germany, and Switzerland. The higher population density combined with a high income, enabled Japan to establish numerous measures (which will be described later in this paper). Annually, some 40 billion US Dollars or close to 1% of the GDP are made available for this purpose in Japan. The economic situation of central and downstream Danube countries is gradually improving and differences are getting less, but they are still enormous, as the poorest country has less than 7% of the disposable income of the richest Danube country (CIA, 2003). Compared to these internal variations for the Denube region within Japan are modest. A citizen of the poorest prefecture Okinawa enjoys still half the income of a Tokyo person with the highest average income of all prefectures (STATISTICS BUREAU, 2003b).

The legal context is also an important difference between the regions. Today, the river law in Japan from 1964 is relevant for 92% of the land area and all Class A and Class B river systems. It defines the River Bureau of the Ministry of Land, Infrastructure and Transport (MLIT) as coordinative body for Class A rivers and the prefecture governments as coordinative body for Class B rivers. The river law is accompanied by 14 other supporting laws. These are: the multipurpose dam law, water resources promotion law, water resources development public co-operation law, special measures law concerning upstream area development, gravel collection law, erosion control law (sabo law), erosion and flood control emergency measures law, flood control special account law, food fighting law, food defence association law, disaster measures basic law, law concerning national trea-

sury share of expenses for rehabilitation of damage to public work facilities, law concerning special financial aid in case of severe disaster, public waters reclamation law and the canal law. The sophisticated legal framework demonstrates the long ongoing tradition with river management problems. The situation in the Danube region is more complex, as we do not only have 18 national law frameworks. Provincial governments can create their own further laws, particularly in the Upper Danube countries, e.g. nature protection or building laws. Basin wide river management cannot simply be based on national laws.

The eighth regional difference between Japan and the Danube area refers to the development of master plans for river environment management. These plans exist in Japan while such plans do not exist in the Danube region with the unique exception of particular Alpine areas obliged to do hazardous zone planning. The master plans for rivers are the basis for the „National Consensus on River Environments" issued by the MLIT. A typical river master plan covers: I) disaster prevention, post disaster measures and an emergency action plan; II) safeguards for water resources for domestic, agricultural and industrial uses; III) erosion and sediment control measures, including coastal protection measures along the coast; IV) the design of a river information system and installation of measurement sites to observe river dynamics or river quality and V) improvements to environmental quality, which covers the creation of recreational areas for urban people as well as the increase of biological variety within a river system. The master plan identifies priority projects for the coming years and procedures of public involvement. Depending on the respective river system, one or several prefectures are involved into the master plans of river environment management. Based on the laws previously described, a master plan for river environment management should additionally comply with other important frameworks, namely international ones such as the convention of the biological diversity (Berne Convention), the convention on the protection of wetlands (Ramsar Convention) and the inclusion of the public (Aahus Convention) into the planning process.

The ninth major difference in case of the Danube basin concerns the fact that several hundred laws are written in at least 15 languages and several international conventions must be combined within an overall framework, namely the European Water Framework Directive. To some extent, the European Water Directive resembles the river management plans of Japan. But it goes beyond the task of safety issues by demanding a good ecological status. To achieve a good ecological status for a river basin such as the Danube is certainly a challenging task because many more actors are involved, negotiations are more laborious and time consuming. The European water framework directive also has some incentives for more ecological concerns in Japanese river and water management. The European Water Framework Directive (EWFD) is a useful devise for navigating the complexity of law as this applies to the Danube and just might be an instructive facility in the Japanese context as well.

Table 1. Major differences of water management in Japan and Danube Region

	Japan	*Danube Region*
Area in km²	378,000	817,000
Population in million people in 2002	127	90
Population Density	340	110
States	1	18 [14 more than 2000 km² share]
River Basins	3,900*)	1
*Ø Annual Mean Temperature in C° for lower elevations***)	16.7	9
*Range of Monthly Means in C° for lower elevations***)	6.6 to 28	–1 to 19
Ø Precipitation in mm	1600	680
Ø Total Precipitation in km³	605	556
Estimated daily p. caput consumption in l	1937	1400***)
Estimated annual water use in km³	91	47
*Ø per capita income in purchasing power parity in 2002 in US $*****)	$28,700	$12,000
Deviation from average	85% to 180%******)	15% to 270%*****)
Legal enforcement of river and water management	15 nation wide laws	Some 30 national and regional frameworks with several hundred legal provisions.
Master plan for river basins	Yes*)	No
Ecology integrating water and land management plans for river basins	No legal provision, on voluntary basis	According to EU Water Framework Directive

*) All Class A and Class B river basins, covering 92% of Japanese land area

**) Based on 17 reference sites of Japanese Meteorological Agency and major cities in Danube basin

***) WMO 1996, Shiklamanov A. Assessment of Water Resources and Water Availability in the World. In case of Japan numbers were directly overtaken. In case of Danube region a correction from the average European value of 1986 l daily use to 1400 l seemed necessary. Industrial average water use is particularly too high for Central and Lower Danube region. As an estimate 600l for domestic and industrial use and 800l for agricultural use was taken. Cited in MAFF 2003.

****) Source: CIA World Fact Book 2003. Figures from Danube countries for 2002. $32,000 (CH), $27,900 (A), $26,200 (D), $19,200 (SLO), $15,300 (CZ), $13,300 (HU), $12,400 (SK), $9,800 (HR), $7,600 (RO), $6,500 (BG), $4,500 (UA), $2,600 (MD), $2,200 (SM), $1,900 (BH)

*****) Source: GDP according to Japanese prefectures in 2000, based on data of Japanese economic planning division, compiled in Statistical Handbook of Japan (Statistics Bureau, 2003b)

System changes and project approaches in relation to watershed management

Water and land management is always based on the overall situation of the systems and any subsequent system change could improve or worsen the existing situation. But systems change differently and with different dynamics. To adjust the wanted outcome to systems we need analysis and planning. In the case of Japan, there is a tension between urban/central and rural/remote that is most challenging. The prime differences within the Danube region are different social, economic and ecological standards in the upper, central and lower Danube countries and major efforts are directed to harmonise these differences to arrive at a common understanding.

While in Japan the tensions between management of urban/central and rural/remote are likely to become even larger within the next 20 years, the situation in the Danube region may converge to more common standards. A major reason is the enlargement of the European Union. Out of the 18 major countries of the Danube region, so far only two, Germany and Austria, have been members of EU. In May 2004, Czech Republic, Slovakia, Hungary and Slovenia will follow. Bulgaria and Romania are in negotiations for membership and Bosnia-Herzegovina, Croatia and Serbia-Montenegro may follow later on. The differences within the Danube region were previously covered; we refer to this work for further details (BREILING 2002 and 2003).

The role of ecologically integrated land and water management is often demonstrated by projects on a more local scale. They are indicators of the underlying systems and the general public attitude. Usually these projects include: the creation of dams, reservoirs, retention areas, floodway and other channel constructions, landscape stabilization measures against landslides and debris flow. In recent decades, priority was given in both regions to economy, safety and stability and less to natural and scenic beauty as can be seen in Fig. 5. The use of concrete along the rivers is common, for example, and we assume that in most cases a more natural landscaping near constructions would be possible if appropriate thought and attention was devoted to this problem.

We now consider two situations in Japanese river management: an urban and a rural one. These show quite different tendencies toward integrated river and water management. Many solutions to better water and land management will result from a combined view on urban and rural problems. Current urban and rural systems seem to be regarded in an isolated way from each other. While we may expect improvements within urban ecology and integrated water management due to an increased level of awareness, we should also be equally concerned about keeping ecological and social functions of water management within rural lands. A disintegration of rural and urban water cycles can also be observed in the Danube region, but the level of disintegration seems to be less serious than in the Japanese context.

Urban areas of Japan cover some 10% of the country but hold more than 90% of the population. Starting from the Tokyo in Kanto area with 30 million people

Figure 5. Flood Protection in Tsushima Island. A flood construction with a unique sense for nature and beauty on a remote island. Annually some 40 billion US Dollars are spent for river improvement measures. Multipurpose environment improvement became more important, despite we can find cases as presented here.

whilst to the west we find the major urban centres of Nagoya with 8 million people, and the Kyoto-Osaka-Kobe in Kinki area with almost 20 million people. Further afield come Hiroshima, Kita-Kyushu and Fukuoka with some 6 million people. North of Tokyo we find Sapporo, the capital of Hokkaido, the largest urban centre with 2 million people and many smaller urban centres just too numerous to mention here. In general, the economic basis and educational level is favourable to undertake many more projects to improve urban water management in a multiple use system.

Even in the centre of Tokyo, we find limited wilderness areas and wetlands. Usually the areas are historical remnants from the seats of feudal lords or religion. In those places urban habitats can develop. Cats, crows and pigeons can be found everywhere in the parks and green areas of Tokyo. There exists a particular division in the municipal government that controls the number of cats and dogs and ensures that alligators do not find new homes in the numerous ponds of the metropolitan area! The Ueno Park and Ueno pond became famous for the

number of duck species (including the duck-shaped plastic boats for lovers!). Walking through the „wetlands" provides an extraordinary contrast to the urban surroundings. In Minato-ku, one of the central Tokyo districts, the park of the natural history museum demonstrates how ecologically sound river restoration can be. The borders between land and water interaction transit smoothly. By using heterogeneous wooden materials and gravel and pebble of different sizes, more species can find suitable habitats and the biodiversity of the city can be altered in positive ways. Only in recent years, issues like natural reconstruction of riverbeds became popular. Use of local materials coming from the environment nearby is important. This can provide a habitat for many species living completely or partially in the water environment. Walking and cycling through Tokyo enables anyone to see the many interesting projects related to water management and how to achieving ecological goals on a limited small scale is possible and rewarding for all. However, as the number of these kinds of initiatives remains limited, it is important that these projects are viewed as and serve as demonstration projects for other projects in a larger systems context. Making the flows of rivers visible in the cityscape could be one positive large-scale project for the future. Unifying the diverse demonstration projects along free-flowing river segments with the urban green sections of the city will also serve as a second outstanding challenge in achieving a more ecological urban system for Tokyo.

Principles of Japanese garden design employing water in key roles and themes, is today a design copied all over the world. This idea would certainly qualify to be extended to the larger scale of river basin management – in particular urban areas where the demand for recreational areas is high and the supply limited. However, more than 4% of Japan must be considered overbuilt areas and as biologically marginal active. Rainwater cannot infiltrate into the ground and quickly discharges to the river systems. In most cases the channels are made from concrete in urban areas and in these situations water flows are further accelerated. The „sealing" of urban and traffic areas to a maximum level in order to facilitate heavy loads of traffic is usual in Japanese metropolitan areas. Fig. 6 represents a common situation in urban areas.

Figure 6. Furukawa river in Azabu juban, Minato-ku, Tokyo. Urban water is embedded in concrete. Future projects may deal with the task to increase the environmental quality of such places and to reintroduce nature to a maximum extend. To some extend this is a positive example as the river is visible. In many other cases it remains overbuilt.

Some solutions of keeping rainwater in the city and enabling the entry into the soil – that were successfully introduced in upper Danube countries Austria, Germany or Switzerland – require a minimum of open space that is perhaps not available in Japanese metropolitan zones. Currently, the wa-

ter of urban areas is practically unused. In a worst case scenario, wasted water contributes to flooding. Once again, providing more space for free floating and infiltrating water systems with vegetation can be advantageous from many points of views. In case of heavy rainfalls the water is stored. This can cool the cities by several degrees in the summer. This cooling contributes to human health and productivity. These kinds of strategies assist in saving energy, otherwise used for climate conditioners for example. Urban fringe areas close to the city experience greater cooling when near paddy fields as is mentioned in the work of YOKOHARI and others (1996). The psychological effect of urban water and urban greening should not be underestimated. People in metropolitan areas can escape to a more natural situation during lunch breaks and enjoy again the beauty of natural bodies of water, even in a limited form. Much work has to focus here if future river management plans are to be better integrated with city and landscape planning.

The rural context covers some 90% of the land with less than 10% of the population. All scarcely populated and remote areas belong to this category. The situation in rural areas is quite different from those of the city. In the city we can rearrange more ecological functions through particular projects and perhaps we can even succeed in getting a more ecologically functioning urban system. In rural areas we currently have well-established systems that serve many purposes: the protection of food, the provision of safety and the creation of many man-made secondary habitats. But there is the danger in losing these kinds of functions as people continue to migrate to urban areas or they become old and die. Only a portion of currently used agricultural area is likely to be used in the future. For other areas, a controlled wind-down from used to unused territory is now required. Without a planned transition, there is a risk in losing many good functions and ecological values. In Fig. 7 you can see the transformation from paddy to wetland area.

In case of Japan, significant amounts of water are used for agriculture. It is estimated that all irrigation ponds of Japan hold more water resources than some 700 artificial dams. This issue becomes important when the future of Japanese agriculture is discussed. Japanese agriculture is expensive and a source of intensive resource consumption. If food production was the sole reason for of such high usage Japanese agriculture would have probably already stopped. But the safety and control of rural lands was also a key argument and agriculture functioned to safeguard and keep significant populations in place. Without human control the landscape could easily destabilise and threaten the settlements in urban areas in flat zones. Erosion control is a crucial role, but most farmers are 65 years or older now and the younger generation does not want to inherit this work despite heavy subsidies. Agriculture is simply not viewed as good business. During the last 40 years, one half of the farms, or 3 million units, stopped their activity. It seems just a matter of time until the majority of the remaining 3 million farms (2002) cease agricultural work.

Figure 7. Wetland restoration on previous paddy field in Tsushima Island. Herons (*Egreta alba*) in Tsushima Island on a paddy field. Migratory birds stop here due to the location half way between Korea and Japan. In the background an abandoned paddy, now a new wetland, used as water purification, agricultural water supply and wildlife environment.

Forest management is already a serious problem today. The small units of one to five hectares are not profitable and the previous source of energy and natural fertilizer supply is no longer needed. The recent dieback of pine trees is a good example. Pine wilt disease is caused by invasion of the beetle *Monochamus alternatus* that is parasited by pinewood nematode *Bursaphelenchus xylophilus*. Neglect and mismanagement enabled the rapid spread of parasites all over Japan. Some 5% of forest is affected and causes decreased resilience to extreme climatic events, often occurring with the rainy period in September. This, in turn, causes increased costs in flood protection, if one attempting to provide the same previous level of safety. The situation is generally different in the Danube region. The relationship between agriculture and flood protection does not exist. The scale of food production is larger and the territory of major production centres is flat. In many Danube countries, in particular in the former Yugoslavia, the value of agriculture is substantial. There, the economies are still suffering from the effects of the previous war. The water quality of the canalisation system in the intensively used areas can be a problem. In Serbia, the water quality in irrigation channels has improved during the long absence from artificial fertilizer and pesticides. The coincidence of several factors show positive effects on the general water quality. The short rivers of Japan have high relief energy and rice covering half of all agricultural land takes up nutrients.

The change within Japanese agriculture is related to the increase of energy demand. One hectare of paddy field required 3 GJ energy input in 1961; it rose up to 70 GJ in 1991 (AHAMER 1995). This figure indicates the degree of mechanisation, including fertiliser and pesticide use. The labour productivity of a farmer has increased, instead of 2000 hours work with one hectare in the 1950s, the

farmer manages the same land in 400 hours per hectare in the 1990s (KARUBE et al., 1995). As the average farm size – apart of Hokkaido – is only 1 hectare, farming does no longer fill the day with work. People migrated to the cities in order to find full occupation and appropriate salaries. The process of mechanization and resource utilization did not reach the same level in the Danube region. Machines are too expensive as compared to the possible gain from the agricultural activity. Apart from the upstream Danube countries, no major agricultural subsidies are paid to farmers yet. Thus, the importance of agriculture is still very high, most likely due to lacking work opportunities in other economic sectors.

But agricultural intensification has also had a further adverse impact on water quality and biodiversity of animal species in Japan. The combined multiple-use of agriculture and forestry, the so-called Satoyama landscapes (FUKAMACHI et al., 2002; TAKEUCHI et al., 2003) has disappeared and with it a variety of species. With the intensification of agriculture the forest was neglected first. Many plant and animal species e.g. the water beetle *Dytiscus sharpi* have already disappeared, as they were dependent on particular conditions created by the secondary environment provided by Satoyama and low chemical input agriculture. Current agro-environmental policies attempt to again give priority to biodiversity and in very few cases the previous pattern of land use is reconstructed to fit the needs of particular insects, for example, water beetles that depend on low input rice cultivation and the coexistence of particular weeds.

Yet another example is the effort to protect a variety of different species of dragonflies – these animals depend on a particular scale and landscape pattern within particular ponds (ICHINOSE 2002, SHEAUCHI et al. 2003, YAMANO et al. 2002). And again, the protection of wild cats became an issue in Tsushima, a remote island in Nagasaki prefecture. The existence of a cat on top of the ecosystem pyramid is a guarantee in maintaining a whole range of species as well. However, here the conflict of interests between agriculture and nature conservation is still an ongoing issue. In the case example of Satoyama, the Danube countries can learn a lot from Japan. Still one can find unique forms of land uses in particularly in lower and central Danube countries, for example in the Danube Delta. Connected to the land use system are particular conditions for plant and animal specialists, who could adjust to this land use over centuries. When the current land use disappears, they will likely become extinct.

Lessons that can be learnt

Japan and the Danube region are isolated from each other on the globe. However, the distance between them is shrinking with ever more people having a chance to visit the other region. This enhances our opportunities for cooperation and learning. Water management is equally important in both regions, but traditions and circumstances are different. Europe and in particular the Danube region can learn from Japan how to manage a complex and risk prone environment, while Japan in its turn could investigate the extent to which ecological and

safety requirements can be combined. A co-operation would be of mutual interest and we hope that our ideas can contribute to it.

The current law and planning framework should be rationalized. These legal frameworks need to become less complex and give more room to facilitate and accelerate change. Legal change alone will not suffice. Already now, there exist 15 special laws for river management in Japan and several hundreds of laws in the Danube region. The European water framework directive has been crucial and helpful in overcoming the confusion related to these different laws. Adopting a similar framework authority similar to the European Water Directive would be quite easy for Japan with its centralised country and its comparatively small prefectures and river basins. A legal obligation to alter the master plans for rivers to include ecological-oriented principles would be a second suggestion for an ecological reorientation of the current planning framework. And for Europe, the existing Japanese river master plans for the larger rivers could serve sub-regions in the Danube basin as a basis to prepare their own river management plans.

The Danube region is probably the most diverse river basin in the world and 18 nations contribute to it. The task would be much easier, if we were encouraged to compare Japan with the Upper Danube countries. Despite the differences there are also so many similarities, as the socio-economic conditions are much more similar between Japan and the Upper Danube Region, than between the Upper Danube Region, the Central and Lower Danube Regions. Certain ecological--minded ideas like the natural re-design of riverbeds seem to be popular in Upper Danube countries and in Japan. These preferences could be related to the emergence of a certain lifestyle and the awareness of many of those people experiencing that lifestyle who have already satisfied their basic needs of life. As the number of poor and less educated people is higher in the central and lower Danube countries, it is more difficult to gain acceptance for such ecological ideas in these kinds of socio-economic contexts. On the other hand, many of the „mistakes" made in wealthier countries have not necessarily been repeated in poorer ones. In general, the money for major economic ventures was lacking in poorer areas and the landscape has been kept in a more original near-natural state because of it. The preservation of nature is always cheaper than its reconstruction and rehabilitation and we should support any preservation initiatives if only for this reason alone.

Japan has a long established, successful tradition of managing rivers and river basins. Without sophisticated river and water management, the Japan of today would look very different. However, while safety demands are widely satisfied, the priorities have changed drastically during the last decades. The population concentrates now in cities, while it was historically been more evenly distributed. In rural Japan the majority of land area is likely to become scarcely populated if not depopulated. This creates and impairs new challenges for river management and public safety. Problems with landscape stability are likely to arise in a not too distant future and will require immediate countermeasures to avoid damaging city regions.

Enhancement of biodiversity is another issue that must gain priority within river management frameworks in Japan. Awareness about biodiversity came recently, as a consequence of signing and ratifying international agreements such as the Berne Convention and Ramsar Convention. Protection of endangered species must start long before they become nearly extinct. Most of what we know about the threat to our biodiversity refers to known species such as migrating sturgeons. We know little or nothing about the threat to poorly understood or yet-to-be identified species. In this context, an exchange of scientists who are familiar with the likely process of extinction due to changing land uses experienced in Satoyama in Japan could be the basis of a co-operative research project in the Danube region. This will not only restore endnagered species in Japan, but the knowledge and experience gained in Japan could be used to save certain endangered species from extinction in the Danube region, simply by giving appropriate attention to this problem now. The possibilities for collaboration are both multiple and exciting for both regions.

Acknowledgement: The authors thank Dr. Jürg Bloesch, EAWAG Switzerland, Prof. Allan Kellehear, La Trobe University, Melbourne, Australia and Mr. Ken-ichi Hatanaka, Lab for Land Resource Sciences, The University of Tokyo, for their comments and suggestions.

References

AHAMER G. (1995): Overview of some selected trends in land use change for Japan and Sweden. Ordered consultancy work. Graz 1995.

AMTSBLATT DER EUROPÄISCHEN GEMEINSCHAFTEN (2000): Richtlinie 2000/60/EG des europäischen Parlaments und des Rates vom 23. Oktober 2000 zur Schaffung eines Ordnungsrahmens für Maßnahmen der Gemeinschaft im Bereich der Wasserpolitik.

BREILING M. (2002): Reconsidering Landscape and Water in the Danube Region: Challenges for More Sustainability. In Breceanu G., R. Stiuca edts. 34th IAD Conference in Tulcea/Romania, August 2002. http://www.breiling.org/publ/tulcea.pdf

BREILING M. (2003): Trinkwasserqualität als Produkt von Landschaft und Wasser in der Donauregion – Überlegungen in Richtung Nachhaltigkeit. In Jahr des Wassers 2003 „Gemeinsam in eine umweltgerechte Zukunft" Symposium für moderne Wasser- und Abwasserwirtschaft. Proceedings S. 25–28. Budapest, May 27th, 2003. Bohmann Verlag, Wien. http://www.breiling.org/publ/wasser2003de.pdf

CIA Central Intelligence Agency (2003): World Fact Book. Online version http://www.cia.gov/cia/publications/factbook/index.html

FUKAMACHI K., H. OKU, T. NAKASHIZUKA (2002): The change of a satoyama landscape and its causality in Kamiseya, Kyoto Prefecture, Japan between 1970 and 1995. In Landscape Ecology 16: 703–717.

ICPDR (2002). Joint Danube Survey, Technical Report of the International Commission for the Protection of the Danube River, p.23, Vienna.

ICHINOSE T. (2003): Water quality and fluctuation pattern in water level of small irrigation ponds in the rural area in Hokudan-cho, Hyogo Prefecture. (In Japanese).

KARUBE J., S. HAEGAWA, Y. TOYOMITSU, K. ADACHI & A. TADA (1995): Basic Aspects of Paddy Fields. In: Paddy Fields in the World. Pages 247 to 268. S. 266, 267. Editors T. Tabuchi, S. Hasegawa on behalf of Japanese Society of Irrigation, Drainage and Reclamation Engineering (JSIDRE). Tokyo.

MAFF Ministry of Agriculture, Forestry and Fishery, Committee of Agricultural and Rural Development, The Council of Food, Agriculture and Rural Areas Policy (2003): The Global Diversity of Irrigation. On line version http://www.maff.go.jp/nouson/keikaku/kikaku_syoiinkai/mizusigen/panf_e.pdf

MLIT Ministry of Land, Infrastructure and Transport (2003a): River administration in Japan. Online http://www.mlit.go.jp/river/english/river.html

MLIT Ministry of Land, Infrastructure and Transport (2003b): Rivers in Japan and the Yodo River. Online http://www.kkr.mlit.go.jp/yodogawa/data/01us.html

SHEAUCHI C., M. ASADA, T. ICHINOSE (2003): Topography and the Tazu system of Awaji Rainwater Storage Pond (Tameike) – a comparison study of the farming social structure in Hokudan-cho, Hyogo Prefecture.

STATISTICS BUREAU of the Ministry of Public Management, Home Affairs, Posts and Telecommunications (2003a): Statistical Handbook of Japan 2003.

STATISTICS BUREAU of the Ministry of Public Management, Home Affairs, Posts and Telecommunications (2003b): Economic Growth Rate and Prefectural Income Per Capita (F.Y.1995–2000). In: Statistical Handbook of Japan 2003. online: http://www.stat.go.jp/english/data/nenkan/zuhyou/y0314a00.xls

TAKEUCHI K., R.D. BROWN, I. WASHITANI, A.TSUNEKAWA, M. YOKOHARI [Eds.] (2003): Satoyama, the traditional rural landscape of Japan.

WORLD WATER FORUM (2003): Summary Forum Statement. http://www.world.water-forum3.com/en/statement.html

YAMANO K., M. KATAOKA, T. ICHINOSE, N. MINO., F. HIRATA (2002): Relationship between distribution of dragonfly species and environmental factors in small irrigation ponds in Hokudan-cho, Hyogo Prefecture. (In Japanese).

YOKOHARI, M., R. D. BROWN, Y. KATO, H. MORIYAMA (1996): Effects of Paddy Fields on Summertime Air Surface Temperatures in Urban Fringe of Tokyo, Japan, Landscape and Urban Planning 38 (1–2): 1–11.

Authors' address:

Dr. Meinhard Breiling
Department for Landscape Architecture, Technical University Vienna
Operngasse 11, A-1040 Wien, e-mail: meinhard.breiling@tuwien.ac.at

Dr. Shizuka Hashimoto
Laboratory of Land Resource Sciences, Graduate School for Agricultural and Life Sciences, The University of Tokyo, Yayoi 1-1-1, Tokyo 113-8657 JAPAN,
e-mail: ahash@mail.ecc.u-tokyo.ac.jp