

## **Confusion of Terms in South Korea: How Does the “Four Main Rivers Restoration Project” Affect Riparian Landscapes?**

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In South Korea, the government has big and--for the tax-payers--costly plans. A master plan for the so-called “Four Main Rivers Restoration Project” was presented to the public on June 8<sup>th</sup>, 2009 (fig. 1, 2; [http://www.mlrm.go.kr/ebook/4river\\_masterplan/EBook.htm](http://www.mlrm.go.kr/ebook/4river_masterplan/EBook.htm)): USD \$17.8 billion will be spent by 2012 for flood regulation during summer, to store water for dry periods, to enhance landscape integrity, biodiversity and recreational value of riparian landscapes. But – how could these very different aims be combined, linked and put into practice?

Through 2012, 16 new dams will be built to retain the waters of the four largest rivers of South Korea: Han, Nakdong, Geum, and Yeongsan. (fig. 1) For the tributaries, two new flood retention basins and three water storage basins will be constructed. The dams of 96 existing water storage basins will be raised to enhance the irrigation capacity for the rice fields. The dikes (side dams) of the four main rivers will be refastened on a total length of 377 kilometers.

Previously it was also planned to connect the rivers Han and Nakdong by a shipping channel. This idea came up during a visit of the South Korean President Lee in Germany when visiting the existing channel connecting the rivers Rhine, Main and Danube. After strong opposition from people and university professors, this plan was abandoned in 2009.

The sections of the four main rivers which will be transformed to storage lakes will be deepened to increase the retained water volume (Masterplan, p.73). Along a length of 691 km, 570 million cubic meters of sand and gravel will be dredged. The banks of the tributaries will be strengthened along a length of 243 km, and the height of nine existing irrigation dams will be raised. Along the water courses, bike trails, athletic fields, and parks will be constructed to promote tourism.

Work on the project started in 2009. In the meantime, approximately 36 % of construction the barrages and 20 % of the total work was already complete by June 30<sup>th</sup>, 2010 (fig. 2, 3). The environmental impact assessment had to be very superficial; only four months were available to assess the ecological consequences of the huge project, to collect the data, to analyze them, and to draw the conclusions.

By means of the “Four River Restoration Project,” completely new man-made ecosystems will be created. Some degraded stretches will be restored, but in other stretches the existing semi-natural habitats and species will be replaced. This complete alteration of the river drainage patterns and riparian landscapes is called “restoration” or “revitalization” by the South Korean government. It is communicated to the public as part of a „Green Deal,“ which initiates environmentally friendly projects by spending tax money. Therefore the meaning of these two terms and their use in the framework of this project will be analyzed in this paper.



Fig. 1: Location of the four major rivers of South Korea and the planned and already-partially constructed new dams within the “Four Main Rivers Restoration Project” (Source: Birds Korea, 2009b)



Fig. 2: Construction site of the Buyeo barrage on the Geum river. The Buyeo barrage is 7 m high and 620 m long (500 m is stationary and mounted and 120 m is maneuverable). The retention volume is 23.5 million cubic meters. After completion, the average river depth will be 4.6 m, the average width 294 m. © Byoung-Sung Choi



Fig. 3: Construction site of the Ipo barrage on the Han river. The Ipo barrage is 6 m high and 591 m long (206 m stationary mounted and 295 m maneuverable part). The retention volume is 17 million cubic meters. © Byoung-Sung Choi

### **What do the terms “restoration” and “revitalization” mean?**

Ecological restoration “... is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. . . . Restoration attempts to return an ecosystem to its historic trajectory. Historic conditions are therefore the ideal starting point for restoration design.” (SER, 2004) According to that definition, a degraded, damaged or destroyed habitat will become re-developed to its former state.

Muhar et al. (1995) define river restoration as the “... totality of measures which change man-induced alterations of rivers ... in such a manner that the ecological functioning of the new state resembles a more natural river”. This includes the enhancement of the integrity of the river habitats, self-regulation (resilience) and self-regeneration, and the preservation of intact resources. Visitors should be able to enjoy the uniqueness, diversity and beauty of semi-natural river landscapes.

The related term “revitalization” means “imparting new life or vigor.” (<http://www.thefreedictionary.com/revitalize>, accessed June 1, 2010) In the context of landscape ecology, it means that an originally “vital,” intact ecosystem or landscape was destroyed before, losing its “life.” (see Anderson, 1995) After that, outside measures bring it back to life again, reverse the previous destructive effects and improve the ecosystem services. The vision is of a more intact, utilizable landscape, and not necessarily a more natural state. (Boon et al., 1992) The expected outcome of the South Korean project has more affinities to revitalization than to restoration.

It must be pointed out that the utilization of these two terms has a two-fold meaning and function for the stakeholders using them: revitalization as well as restoration describes in an analytical way the change of a landscape or an ecosystem. At the same time, they evaluate: “Revitalization and restoration are good, they bring back or enhance life!”

### **What characteristics do already implemented revitalizations have?**

A number of successful projects can be found which improved the state of rivers and riparian landscapes, and were called “revitalization” projects:

- In the city of Los Angeles, the “**Los Angeles River Revitalization Master Plan**” was developed. (<http://www.lariverrmp.org/>, accessed april 20, 2010) This plan aims to revitalize the Los Angeles River. Large sections of that river, having a total length of approximately 80 km, were transformed into a concrete channel. (City of Los Angeles, without year) Over time, with the rail yards, warehouses, and other industrial uses that line the river’s edge, the river has become both literally and figuratively isolated from most people and communities. Most residents could not see the river any more. In 2002, the Los Angeles City Council established a participative project on major revitalization efforts such as recreation, neighborhood identity, wildlife habitat, water replenishment, jobs, tourism and civic pride. (<http://www.lariverrmp.org/>, accessed April 20, 2010)

- In 2006, the “French River Connection” was begun to revitalize the French River (26 miles in length) in Massachusetts. (French River Connection, 2006) The river once was heavily polluted. For long distances it followed a long, secluded and narrow reach and was bordered by industrial complexes. Based on the “**French River Revitalization Concepts**,” parks and a walking trail system were established,

historic buildings renovated, boat launches developed, and illegal dumping was halted.

([http://frenchriverconnection.homestead.com/files/French\\_River\\_Revitalization\\_Concepts.pdf](http://frenchriverconnection.homestead.com/files/French_River_Revitalization_Concepts.pdf) , accessed April 20, 2010)

- In 2008, the Root River Council and River Alliance of Wisconsin presented a plan called **“Back to the Root: An Urban River Revitalization Plan”** to revitalize eight kilometers of the “dirty, industrial, contaminated” Root River. (Root River Council, 2008) The objectives were to (1) reorient the city of Racine to its river; (2) encourage prompt robust, innovative development and growth with a mix of residential, retail and recreational projects; (3) champion redevelopment efforts that will improve and protect the natural habitat and the water quality of the river; and (4) promote the participation of citizens and promote good public process in decisions affecting redevelopment of the waterfront. ([www.backtotheroot.org](http://www.backtotheroot.org), accessed April 20, 2010)

- A well-known, but not completely correct example from South Korea is the so-called revitalization of the Cheonggye river in the center of Seoul (fig. 4). This water course was channeled between 1957 and 1961, and a multi-lane, multi-storey road was built above the river. In 2005, this small river was transformed by Seoul’s former mayor (and current South Korean president) into a very popular recreation area of nearly six kilometers in length. Total costs were approximately US \$281 million. (source: <http://www.nuku.de/archives/2005/10/03/cheonggyecheon-neuer-fluss-durch-seoul.html>, accessed June 27, 2010) Because the Cheonggye river during the winter period is nearly completely dry, most of the needed water is pumped from the distant Han river, augmented by the drainage water of the subway, and disinfected because of pollution. For such a measure, however, the term “revitalization” is inappropriate; it would be better to call it “creation.”

Conclusion: What all these revitalization projects have in common is (1) they were carried out in big cities and industrial areas; (2) they were applied to improve the state of channeled, artificial, and sometimes piped or engineered river courses in urban regions; and (3) the improvement predominantly is aiming at providing aesthetic amenities, e.g., in newly created, clean, green, accessible park-like landscapes. In urban areas, semi-natural conditions cannot be the aim of restoration measures. In urban regions, it is mainly the social functions of riparian areas that come to the fore.



Fig. 4: With the demolition of a multi-lane, multi-storey highway which was built in the 1960s, the Cheonggye river was transformed into a popular recreation area. The core element is a new, artificial river crossing the center of the city of Seoul. The promenades along the river are used by a large number of citizens. © Hea-Jee Im.

### **Can these four South Korean rivers be “revitalized”?**

Rivers in seasonal climates naturally have seasonally different water discharge, stream velocity, and transportation energy of the water. Additionally, the riparian landscapes of South Korea are shaped by floods during summer (maximum rainfall in July and August) and dynamic processes. (fig. 5)

Riparian species and ecosystems have adapted to this periodicity. Their existence depends on erosion, transport and sedimentation. (Ellenberg 1996, Naiman et al. 1998) The species and the riparian ecosystems are adapted to these seasonal changes. The sedimentation creates new soil surfaces which allow light-demanding pioneer species to establish, e.g., willows (*Salix spec.*), poplars (*Populus spec.*) in the holarctic floristic kingdom, or balsa- (*Ochroma pyramidale*)-forests in South America. If the fluid dynamics are disturbed, many riparian species found in alluvial sites will disappear. Many animal and plant species found in alluvial sites are flood-tolerant specialists, combined with traits of pioneers.

The South Korean rivers Han, Nakdong, Geum, and Yeongsan today and for many years are in a more or less natural or semi-natural state, particularly outside the big city of Seoul (fig. 5, 6). This contrasts with the starting point of all other revitalization projects. Even now the Korean rivers provide aesthetic, attractive landscapes and valuable habitats for unique ecosystems and are host to a number of rare and endangered species. Examples of endangered species are the Long-billed Plover (*Charadrius placidus*) and the Scaly-sided Merganser (*Mergus squamatus*), which is

severely endangered throughout the world. The riparian systems and wetlands of the Nakdongkang and Keumkang rivers are the most important hibernation areas and resting places for birds migrating from Siberia to subtropical Asia (Birds Korea, 2009 a, b, c; Abb. 7), including the Hooded Crane (*Grus monacha*) and the White-naped Crane (*Grus vipio*). Other threatened taxa are the Korea-endemic fishes *Iksookimia choii* and *Acheilognathus signifer*, and plants like *Aster altaicus* var. *uchiyamiae*.

Conclusion: The four Korean rivers cannot be classified across-the-board as “degraded, destroyed or dead”, as the South Korean government insists. Except for certain areas which are polluted or regulated, they can be classified as near-natural, therefore by definition they cannot be “revitalized” or “restored;” in most sections, such processes are not needed.



Fig. 5: Kyoungcheondae-region at the Nakdong river, the most beautiful landscape of that river. The existing dike will be relocated 50 meters away in order to widen the river. The sand banks will disappear by dredging, because it is planned that the dammed river should become deeper. © Byoung-Sung Choi



Fig. 6: The protected river section Hoeryongpo at the Naesung river is believed to be one of the most beautiful riparian landscapes of South Korea. Although there will be no direct construction works, the “Four River Restoration Project” will completely change the landscape in the future: to ensure a continuous water flow during the dry months in the downstream situated Nakdong river, the Youngju barrage will be built in the upper reaches of the Hoeryongpo section. The Youngju river section then has to be protected from silting up by another support dam. All these barrages will act as a sediment trap. Sand input from upstream will stay away from the Hoeryongpo section. The export of sand, however, will continue, and even become accelerated, caused by a more rapid current and “pulling effect” from downstream: Only about five km away, the Nakdong river will become dredged rather deeply. Vertical erosion will cut through the river at the Hoeryongpo section and erode all sandbanks. © Byoung-Sung Choi





Fig. 7: The population of the Scaly-sided Merganser (*Mergus squamatus*) has been declining for many years. At present, approximately 200 breeding pairs can be counted in East Asia (and therefore worldwide). The species is severely endangered. Source: <http://de.wikipedia.org/wiki/Schuppens%20A4ger>. Photo: Thurner, B.S., Hof.

### **“Revitalization” in South Korea = “Destruction and Re-Creation”?**

The planned and already implemented “Four Main Rivers Restoration Project” will completely change the flooding regime and river morphodynamics. (Groffman et al. 2003; Ellenberg 2009) The seasonal fluctuation of high and low water level will be reduced. Periods with fast flowing rivers will disappear completely, and the processes of erosion, transport and sedimentation will be completely altered. Sediments will not anymore be transported downstream. The dammed lakes will be filled up in time with sediments and will have to be dredged in the future. Amphibian riparian ecosystems and shallow river habitats will be lost, causing the extinction of the adapted species. Stagnant water bodies combined with nutrient import will replace rivers and support the growth of algae, causing seasonally low oxygen content of the water body during summer.

Conclusion: This so-called “revitalization” project therefore replaces the existing natural river dynamics with artificial channels and lakes, i.e., nearly static aquatic ecosystems without sediment transport. Completely new ecosystems will be formed, with a lacustrine instead of a riparian aquatic flora and fauna. Such technocratic measures of the South Korean government cannot be called “revitalization.” In fact,

they destroy existing valuable river sections and habitats, and replace them by new, artificial barrier lakes.

**Why does the South Korean government use the term “revitalization”?**

The “Four Main Rivers Restoration Project” has been sold to the public as a “green” project. However, it can be shown that this does not reflect the reality (see above). The question remains: what other motives and which functions may exist which could justify such a large and costly project?

Revitalization as well as restoration can be described as re-creating an ecosystem or landscape with high integrity, including improved water quality. Important causes of water pollution in South Korea (like in other industrialized countries) are (1) wastewater discharge from households and industry; and (2) intensive agriculture and washout of nutrients and pesticides in rural regions. To mitigate both problems wastewater treatment plants will have to be established. Less intensive agricultural practices are also needed, and only extensively used and permanently vegetated buffer strips along the water courses should be foreseen as a way of reducing water pollution. A similar approach is being implemented since 2000 in Europe in form of the “Water Framework Directive.” ([http://ec.europa.eu/environment/water/water-framework/index\\_en.html](http://ec.europa.eu/environment/water/water-framework/index_en.html), accessed June 6, 2010) Channeling rivers does not prevent water pollution; rather it does increase the negative effects of pollution because of slow water flow.

Flood retention may be another objective of building barrages and dams. Successful flood retention management needs retention basins with permanently low water levels, but high storage capacities in the beginning of flood periods, which have the capacity to be filled during flood peaks. Slow flowing channeled rivers and barrage lakes either will be ineffective for flood retention or they will have a seasonally fluctuating water level with muddy lakeshores, an aspect which will not be appreciated much by tourists and fishermen.

Damage by flooding frequently is man-made; like in most other industrial countries, flood damage is primarily caused by a permanently increasing land use pressure in riparian landscapes (including the creation of urban and industrial areas in such landscapes), thus reducing the floodplains and their flood retention capacity. Artificial dams along channeled rivers may protect settlements and infrastructures for decades, but disastrous centennial floods will cause even greater damages. Rivers need space to expand!

Transforming rivers to channeled barrage lakes can contribute to an improvement in the water supply during dry periods. Because of the monsoon rains in July and August, the water supply will be needed mainly in spring and early summer. This argument is serious and important.

In the Korean cities within the reaches of the Four Rivers, however, there is no lack of water. Only those living on small islands or in mountainous regions near the upper headwaters of the rivers suffer from a water deficit. The water which will be retained by the Four Main Rivers Restoration Project will never reach these remote regions. These facts are obscured by the promotional rhetoric of the Korean government. With such obfuscation, many people in these rural areas have come to believe that the Four Main Rivers Restoration Project will improve their situation in the future.

Transport by ships could be another argument. But Korea does not need to construct and to maintain such large costly channels, since all big cities are located near the sea.

Last but not least, the South Korean project promotes a kind of recreation and tourism which is the opposite of environmental education and ecotourism: the nation

will become trained to enjoy an artificial world, instead of being educated to understand and protect their natural environment.

**Conclusion:** At present, the rivers and riparian landscapes of the four largest rivers of South Korea will be completely changed. With respect to the effect on the ecosystems, the government is calling that “restoration.” It could be shown that this labeling is inapplicable and misleading for these measures. It would be correct and fair-minded to call these construction measures a “reshaping of South Korean riparian landscapes.”

In the light of the big discrepancy between the claims of the master plan and reality it can be concluded that behind the misleading terminology, other interests probably exist. The “Four Main Rivers Restoration Project” is based on the destruction of existing riparian ecosystems and landscapes. The choice of attributing to that project the aim of “revitalization” or “restoration,” while at the same time concealing the concomitant destruction of nature apparently indicates that the government wants to use only the positive effects of these terms, probably to increase the acceptance of the project among the public.

Such a behaviour can be called with full justification “directing the people’s will,” which can be translated as “demagogy.” Such a line of reasoning and its related actions is the opposite of “good governance;” it is “ideology.”

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