## **Amenity Rehabilitation or Ecosystem Rehabilitation?**

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Changes in River Management Practices (in Korea)

✓ Models of River Rehabilitation

✓ Cases of (Urban) River Rehabilitation
 Projects

#### ✓ Conclusions

#### **Functions of River (Water)**





#### **Models of River Rehabilitation**

#### Amenity Rehabilitation Model

 Semi-Ecosystem Rehabilitation Model
 - Can be sustained only by human's management (adapted from Dr.Tsujimoto's)

Ecosystem Rehabilitation Model

 Self-sustained

### **Amenity Restoration Model (ARM)**

 Focused mainly on rehabilitation of the aesthetic values of river

- Aesthetic values: amenity, accessibility, recreation, historical/cultural values
- Human-oriented

 More plausible at highly urbanized watershed and highly developed stream corridor

Can be called "park river"

### **Ecosystem Rehabilitation Model (ERM)**

 Focused mainly on rehabilitation of the ecological system of river; i.e. selfsustainability of physical and ecological dynamics of river

- More plausible at sparsely urbanized watershed and less developed stream corridor
- Can be called "ecological river"

#### Semi-Ecosystem Rehabilitation Model

 Focused mainly on rehabilitation of the ecological system of river; but it can be sustained only with human's continuous support (management)

 It can be called "close-to-nature river" (Naturnaher Wasser)

## **Compatibility of Models (to each other)**



#### **Cases of ARM**

#### - The Han River in Seoul (first developed in 1986)





# -The Yangjae-cheon in Seoul (developed in late 1990s)





#### 7<sup>th</sup> ICHE (2006)

#### The Cheonggye-cheon (developed in 2005)









#### (Source: Tokyo Metropolitan Government)

#### Yangtze River, China (from Numata, 2009)





#### Before (1990's)



(Source: Wuhan Water Authority)

## -The Limat River in Zurich (from C. Goeldi, 2009)



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## **Cases of Semi-ERM (A demo-project at Yangjae-cheon, Kwacheon)**



## Alterbach (in Austria)





## Cases of ERM (Red River in USA)



#### 1930





### **Space Allocations for Each Model**

#### ✓ ARM

- Flood control space mostly contains spaces for ecological habitat and historical/cultural spaces

#### ✓ ERM

- Ecosystem space needs not be limited within flood control space.

 It can be larger than flood control space and interconnected with neighboring terrestrial habitats.



#### Spaces for ARM and ERM



**Amenity Restoration Model** (ARM) (modified from Dr. Shin's) **Ecological Restoration Model** (ERM)

**Flood control** 

space



#### **Sustainability of Each Model**

#### • ARM

- Mostly related much to the safety of people, protection of properties and maintenance cost.

#### • ERM

- Indicates the ecological sustainability, which means the ecological system once restored sustains in the future without degradation

#### **Reference Models for Each Model**

#### • ARM

- Hard to delineate the 'original' stream because of a long time-span, and moreover, urbanization and channelization

 Naturally focused on landscape architecture and sometimes the restoration of historical places

#### ERM

- Time-span is usually short and reference model is relatively easily obtained from the maps, pictures and data of the stream at reference time

## **Limitations of ERM in Urban Rivers**

- Physical restriction of restoring the stream corridor which were already permanently changed with buildings and streets
- Extreme variations of stream flow with and without rainfalls (urbanization effect)
- Water quality problem: a serious constraint on stream restoration in urban stream
- High land price near urban streams → Realization of "room for river" is mostly impossible

Citizens' level of eyes: ARM rather than ERM

## **ARM, ERM – Which one people prefer?**



#### **Before rehabilitation (1996)**

Under re-construction for recreational use in Spring 2009



After rehabilitation (1998) Now in September 2009

#### **ARM vs. ERM - People like which one?**



After rehabilitation (2000)

009/09/2

#### **Before rehabilitation (1998)**

Now in September 2009 Under reconstruction in Spring 2009

#### **Problems of ARM in Urban Rivers**

- Susceptible to flood damage due to various amenity-enhancing works (landscape architecture)
- Overuse and misuse of material

   another environmental damage
- Misleading of the concept of river restoration (Ecological restoration is such!?)

# **Ex 1: Flood damage** (340mm for 24 hrs exceeding design rainfall of 385mm) (Yangjae-cheon; August, 1998)





## **Vulnerable during construction**



Scours at immediate downstream of a weir (Changwon-cheon; July, 2009)

## **Neglect of nature's dynamics**



**Under construction (July 2009)** 

Washout during July flood

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An artificial island at Deokpung-cheon

## **Overuse and misuse of material**

## Ex 1: Use of quarried stones for low-flow revetment Ex 2: Use of large boulders at sandy river



#### Ex 3: Overuse of pebbles for low-flow revetment (from Dr. Kim, Haeju)











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## **Conclusions**

River management practices: changed by the priority of stream functions considered

 Two types of river rehabilitation model: ARM and ERM, with semi-ERM delineated

 River space allocation, concept of sustainability and time-span of reference model are different from each model

### Conclusions

 Two models are not usually compatible in most cases; Semi-ERM may be of a compromise

- Limitations of ERM to be implemented in urban river: physical restriction, extreme variation in flow, poor water quality, high land price
- Problems of ARM to be implemented in urban river: susceptible to floods, overuse and misuse of material, and misleading of the concept of river restoration

People's preference to each model differ from different eras and regions – "level of eyes"



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# RUNS

Distance of an American Limits.