RESTORATION OF URBAN WATERWAYS AS A GREEN INFRA

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Green Infra

(USEPA) water conservation and waterways restoration (such as rainwater harvesting, bio-swales, permeable pavements, green streets and alleys, and land conservation of riparian areas and wetlands)

(EU Commission) a strategically planned network of high quality natural and semi-natural areas with other environmental features (such as parks, open spaces, woodlands, wetlands, grasslands, river and canal corridors and private gardens)

Contents

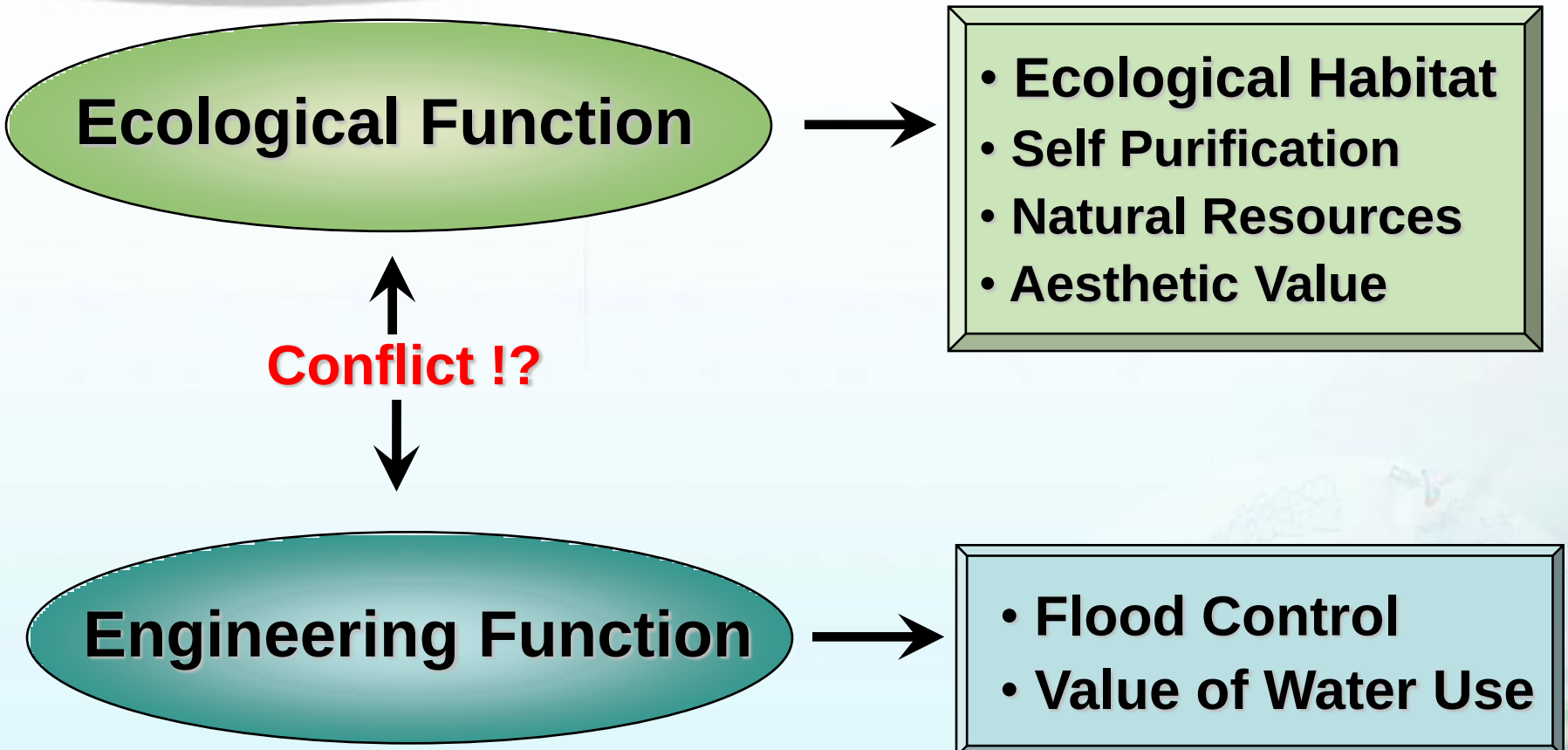
Statistics of Urban Streams In Korea

- ✓ Total length of streams/rivers: 65, 000km
- ✓ Total length of mid- and large streams (called "National/Regional Rivers" and managed by the "River Act": 30,000km
- ✓ Remaining small-scale streams (called "Small Streams" and managed by the "Small Stream Improvement Act"): 35,000km
- ✓ Among those managed by River Act, urban streams are 3,000km long.
- ✓ Over 90% of total population dwells in urban areas, indicating the importance of urban streams as green infras to provide a better quality of life in urban areas.

Anthropogenic Impacts on Streams In Korea

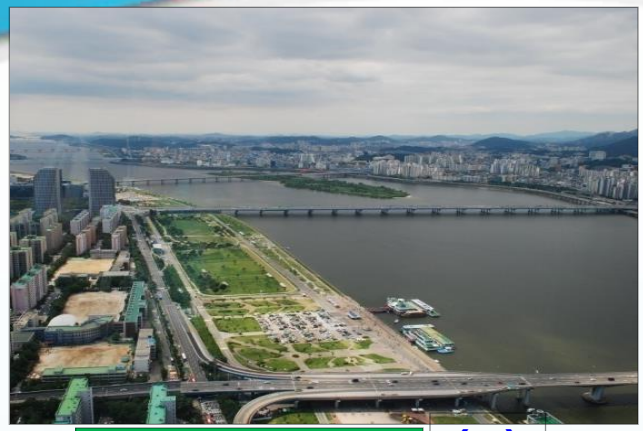
- ✓ Accelerated industrialization and urbanization since 1960s altered the natural river ecosystems, particularly in the urban areas
- ✓ About 80% of the streams (needing flood protection) are channelized.
- ✓ Urban river basins have been fully or partially covered impermeably with buildings and streets.

Functions of River (Water)



Changes in River Management Practices

(b)



Park River(d)

(d)

Natural River(a)

Disaster-Prevention River(b)

River Restoration

Close-to-Nature River(e)

Occupied River(c)

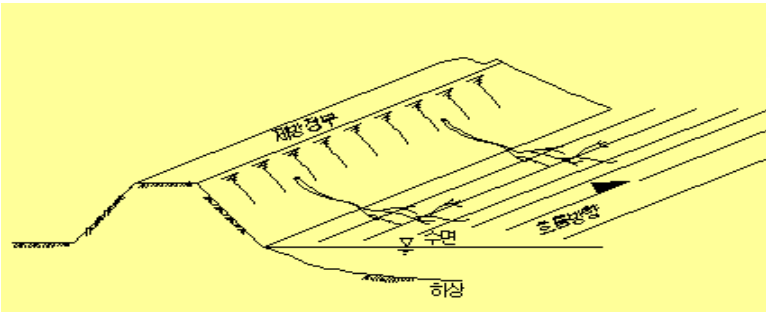
(a)

(c)

(e)

Close-to-Nature River Works
- A Tool for River Restoration -

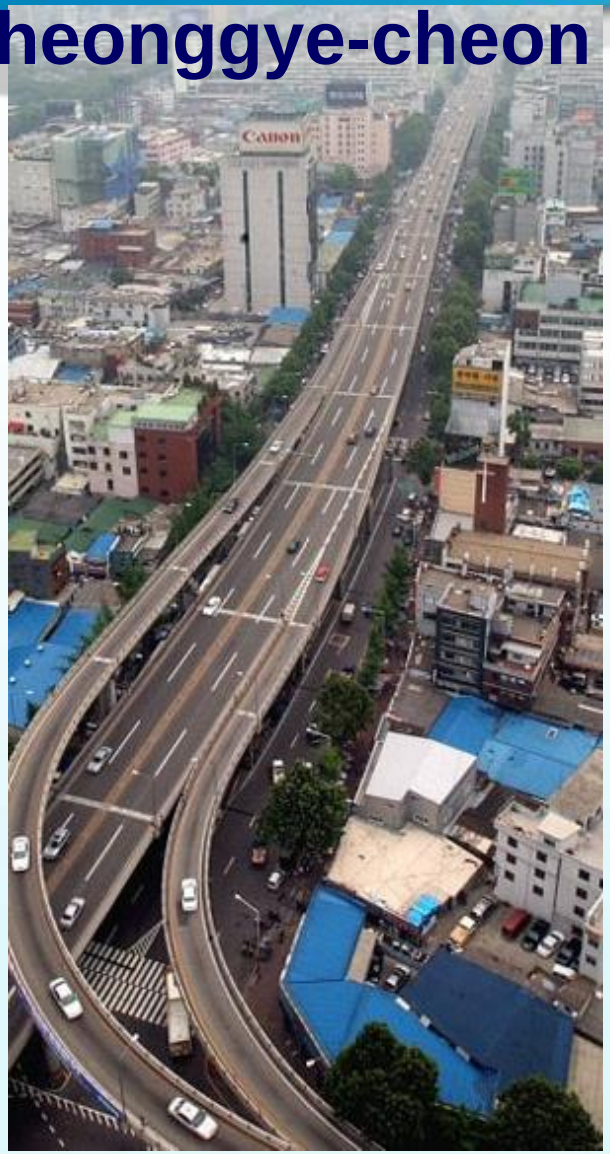
- **Close-to-nature of river shape and material used for river works**
- **Naturalness increases as times go**



Case of Urban Stream Restoration (Ⅰ)
- Yangjae-cheon (1996)

Case of Urban Stream Restoration (Ⅱ)

- Cheonggye-cheon (2005)



Issues around Urban Stream Restoration Practice – Two Different Views

View 1 ("upper perspective" group)

- ✓ Present level of stream restoration practice is at the "*park river*" level
- ✓ Looking down on it as another artificial type of river works, far from restoring the river's ecological functions
- ✓ Mostly ecologists and environmentalists

View 2 (“lower perspective” group)

- ✓ Providing with spaces for recreational activities (such as walking, roller-skating, and fishing in the stream) is preferable to restoring the stream ecologically.
- ✓ Additionally, floods are worried.
- ✓ Usually local residents and river managers

After

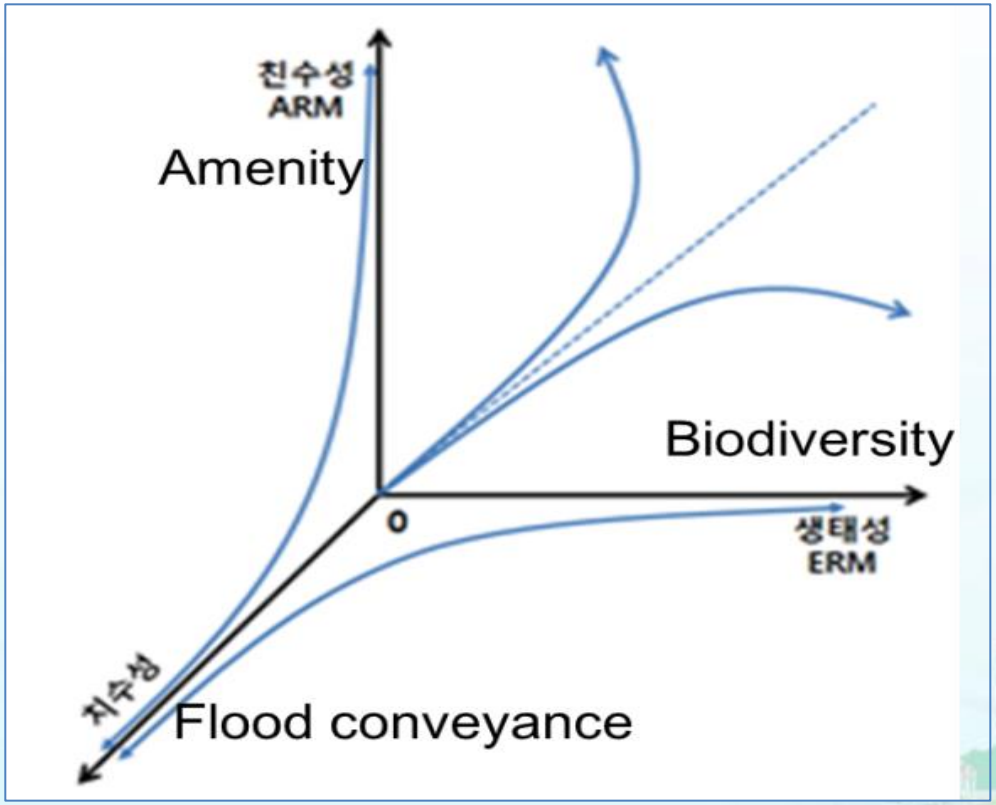
Under re-co
use in Spri

After construction in September 2009

After re

Under reconstruction in Spring 2009

Conflicts between Engineering and Ecological Functions



Schematic View of Relations among Flood conveyance, Biodiversity and Amenity

Models of Stream Restoration

- Amenity Restoration Model
- Ecosystem Restoration Model

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 Restoration Model (ERM)

- ✓ Focused mainly on rehabilitation of the ecological system of stream, **i.e. self-sustainability of physical and ecological dynamics of stream**
- ✓ More plausible at sparsely urbanized watershed and less developed stream corridor
- ✓ Can be called **"close-to-nature river"**

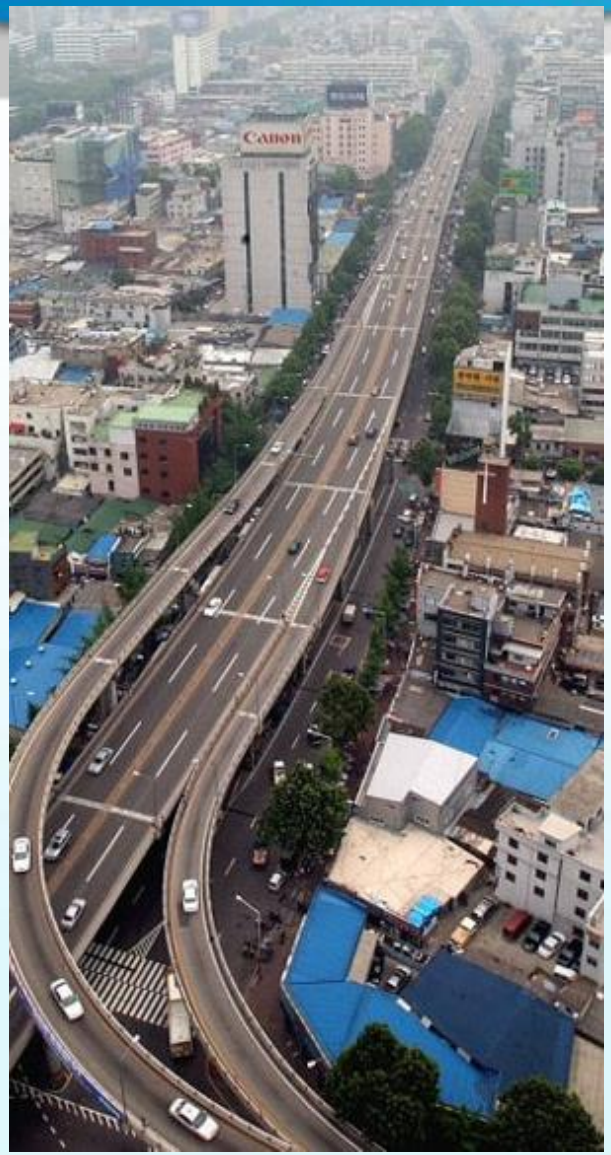
Cases of ARM

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

(A bird eye view)

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

The Cheonggye-cheon (developed in 2005)



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Taehwa River (restored in 2003)

From heavily polluted river to swimable river

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Sumida River, Japan (from Numata, 2009)

Before (70's-80's)

(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)

Space Allocations for Each Model

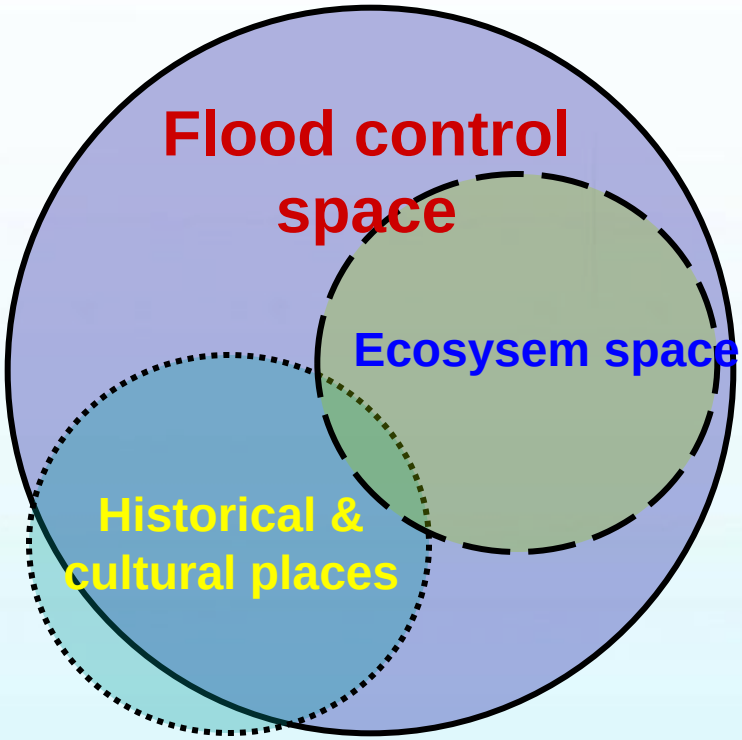
- ✓ **ARM**

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

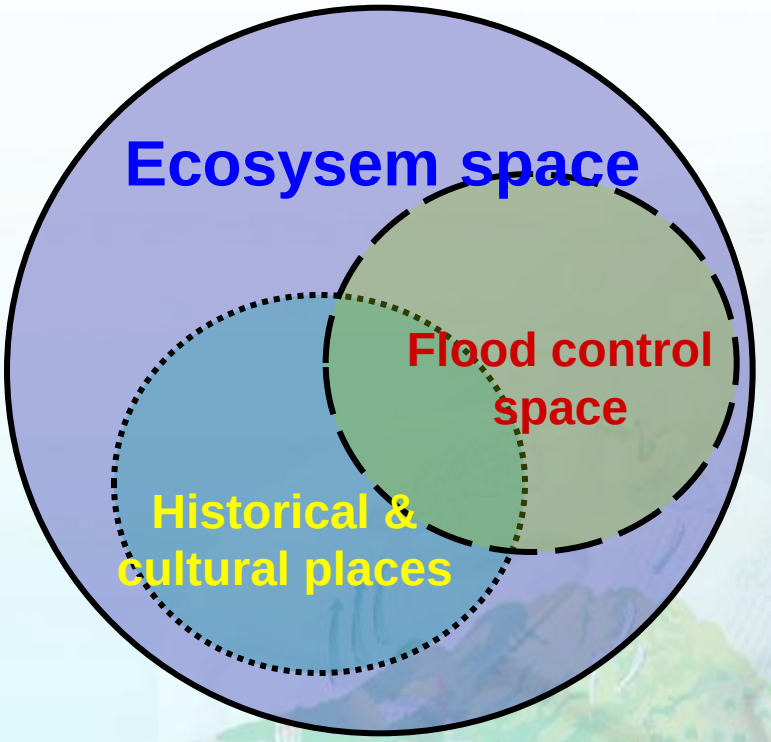
- ✓ **ERM**

  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)

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Sustainability of Each Model

- **ARM**

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

- **ERM**

  Ecological sustainability, meaning the ecological system once restored sustains in the future without degradation, is preferred.

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**

Cases of Semi-ERM (Gwacheon, Korea)

Alterbach (in Austria)

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Summary

- ✓ Restoration of urban waterways: clean water, better human well-being, enhanced tourism and recreational opportunities, strengthened ecosystem resilience, improved habitats for aquatic wildlife, and ecological riparian corridors

- ✓ Two different views of stream restoration can be represented by ERM and ARM, respectively.

- ✓ There are some difficulties to apply ERM in urban streams in Korea due to several critical reasons; decrease in flood conveyance and more needs on recreations in the stream.

- ✓ Flood venerability can be mitigated using typical green infra tools such as rainwater harvesting, permeable pavements, green streets and alleys, and land conservation of riparian areas and wetlands

- ✓ Present approaches (ARM and semi-ERM) to urban stream restoration enhance tourism and recreational opportunities, improve habitats for aquatic wildlife to a certain degree, and increase property values along the restored stream in many cases.

Thank you