Experts Survey on Constructed Wetlands (AHP)

Constructed wetlands are green infrastructures, example of nature-based solutions which has sustainable ecological services providing supporting, provisioning, regulating and cultural services. These services were possible through the comprehensive efficiency evaluation of the constructed wetland. However, the efficiency evaluation of constructed wetlands has been very limited, and only water treatment efficiency have been considered. Therefore, the results of this survey will be used to derive a comprehensive efficiency evaluation index for evaluating the efficiency of an constructed wetland. For this evaluation, objective items were decided after consulting experts in each field, and prioritized and weighted each index, taking into consideration the importance of each item. The comprehensive efficiency evaluation for constructed wetlands in the future is conducted for future use. Your cooperation and response is very much appreciated.

Analytic Hierarchy Process

AHP(Analytic Hierarchy Process) stratifies a given decision-making problem and compares each element in the immediate lower layer from the viewpoint of an element in the upper layer to obtain the relative importance or weight using pairwise comparison.

[Method of Comparison]

Compare the two evaluation items by checking (✓) depending on the importance relative to each other

When comparing 'Item 1' and 'Item 2', select which is more important. If 'Item 1'is more important, please select the degree of importance in 'Item 1' (left part), and if 'Item 2' is more important, please select the degree of importance from the 'Item 2' (right part). The circled numbers indicate the importance of each item. If the items are equally important, you can check '① or equally important'.

Evaluation item	Importance								Equally Important	Importance								Evaluation item
평가항목1	⑨	✓	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	평가항목2

☐ Constructed wetland evaluation indices

Index	Item	Sub-indices
Treatment efficiency (2 items)	Water purification	SS, BOD, COD, TN, TP, etc.
	Flow regulation	Ease of inflow and outflow, stagnation, etc.
Cultural efficiency (2 items)	Accessibility to the public	Adequate parking lots, proximity to roads, proximity to cities and residential areas
	Social benefits	Trails, utilities and recreational facilities (i.e. rest areas, sports facilities, restrooms, etc)
Ecological efficiency (3 items)	Algal bloom	Status of green algae occurrence
	Aquatic habitat	Fish habitat, other living organisms (i.e. plants, benthic organisms, etc)
	Terrestrial ecosystem	Plants, terrestrial and aerial animals
Operation and landscape management efficiency (5 items)	Slope protection	Slope erosion, embankment protection, etc.
	Plant management	Removal of dead plants, landscaping and water management, weed control, etc.
	Sediment/waste management	Sediment management, soil dredging, waste management
	Facility maintenance	Deck management, trail maintenance, amusement facilities management, etc.
	Odor control	Occurrence of foul odor

1 Evaluation of Relative importance of Constructed Wetland Indices

Index	Item	Sub-indices
Treatment efficiency	Water purification	SS, BOD, COD, TN, TP, etc.
	Flow regulation	Ease of inflow and outflow, stagnation, etc.
Cultural efficiency	Accessibility to the public	Adequate parking lots, proximity to roads, proximity to cities and residential areas
	Social benefits	Trails, utilities and recreational facilities (i.e. rest areas, sports facilities, restrooms, etc)
Ecological efficiency	Algal bloom	Status of green algae occurrence
	Aquatic habitat	Fish habitat, other living organisms (i.e. plants, benthic organisms, etc)
	Terrestrial ecosystem	Plants, terrestrial and aerial animals
Operation and landscape management efficiency	Slope protection	Slope erosion, embankment protection, etc.
	Plant management	Removal of dead plants, landscaping and water management, weed control, etc.
	Sediment/waste management	Sediment management, soil dredging, waste management
	Facility maintenance	Deck management, trail maintenance, amusement facilities management, etc.
	Odor control	Occurrence of foul odor

☐ Compare the two evaluation items by checking (✓) depending on the importance relative to each other

Evaluation item	Importance								Equally Important	Importance								Evaluation item
Treatment efficiency	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Cultural efficiency
Treatment efficiency	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Ecological efficiency
Treatment efficiency	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Operation and landscape management efficiency
Cultural efficiency	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Ecological efficiency
Cultural efficiency	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Operation and landscape management efficiency
Ecological efficiency	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Operation and landscape management efficiency

2 Evaluation of relative importance of sub indices **for Treatment efficiency**

Index	Item	Sub-indices
Treatment efficiency	Water purification	SS, BOD, COD, TN, TP, etc.
	Flow regulation	Ease of inflow and outflow, stagnation, etc.

☐ Compare the two evaluation items by checking (✓) depending on the importance relative to each other

Evaluation item	Importance								Equally Important	Importance								Evaluation item
Water purification	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Flow regulation

3 Evaluation of relative importance of sub indices **for Cultural efficiency**

Index	Item	Sub-indices
Cultural efficiency	Accessibility to the public	Adequate parking lots, proximity to roads, proximity to cities and residential areas
	Social benefits	Trails, utilities and recreational facilities (i.e. rest areas, sports facilities, restrooms, etc)

☐ Compare the two evaluation items by checking (✓) depending on the importance relative to each other

Evaluation item	Importance								Equally Important	Importance								Evaluation item
Accessibility to the public	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Social benefits

4 Evaluation of relative importance of sub indices for **Ecological efficiency**

Index	Item	Sub-indices
Ecological efficiency	Algal bloom	Status of green algae occurrence
	Aquatic habitat	Fish habitat, other living organisms (i.e. plants, benthic organisms, etc)
	Terrestrial ecosystem	Plants, terrestrial and aerial animals

☐ Compare the two evaluation items by checking (✓) depending on the importance relative to each other

Evaluation item	Importance								Equally Important	Importance								Evaluation item
Algal bloom	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Aquatic habitat
Aquatic habitat	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Terrestrial ecosystem
Terrestrial ecosystem	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Terrestrial ecosystem

5 Evaluation of relative importance of sub indices for Operation and landscape management efficiency

Index	Item	Sub-indices
Operation and landscape management efficiency	Slope protection	Slope erosion, embankment protection, etc.
	Plant management	Removal of dead plants, landscaping and water management, weed control, etc.
	Sediment/waste management	Sediment management, soil dredging, waste management
	Facility maintenance	Deck management, trail maintenance, amusement facilities management, etc.
	Odor control	Occurrence of foul odor

☐ Compare the two evaluation items by checking (✓) depending on the importance relative to each other.

Evaluation item	Importance								Equally Important	Importance								Evaluation item
Slope protection	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Plant management
Slope protection	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Sediment/waste management
Slope protection	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Facility maintenance
Slope protection	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Odor control
Plant management	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Sediment/waste management
Plant management	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Facility maintenance
Plant management	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Odor control
Sediment/waste management	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Facility maintenance
Sediment/waste management	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Odor control
Facility maintenance	⑨	⑧	⑦	⑥	⑤	④	③	②	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Odor control