

Cross-Disciplinary Collaboration and Technological Progress

- A case with ecology -

Japan Society of Civil Engineers

President KONDO Toru

Development of Engineering

- Any field which takes the perspective of different disciplines improves its own knowledge and technology quickly/
 - discovery of semiconductor development of electronics
 - Progress of molecular biology development of biotechnology
- The engineering will not progress without the collaboration with science.
- Biology is one of the fields which civil engineering should introduce into.
- Introduction of collaborative research with biology

Civil Engineering up to Now



- Progress based on non-biological science
 - Physics like structural mechanics, fluid mechanics, etc., as main base
 - Securement of the breaking strength and the safety of facilities
 - Stable functioning of facilities (flood-control to prevent river overflow, smooth vehicular traffic)
- Lack of knowledge about the ecosystem



Comparison between Engineering and Science

- Purpose of science (ecology): Seeking truth
 - The primary target is to clarify exceptions
 - Microscopic observation
- Purpose of engineering (civil engineering): Practical use
 - Systematization with the truth solved by science and the experiential knowledge
 - Systematization with the experiential knowledge only (in some cases)
 - Macroscopic observation



Introduction of Ecosystem into Civil Engineering

- With our recognition of these exceptions, what kind of ecosystems can we consider?
 - Engineering hypothesis on ecosystem
- How should we research the ecosystem with our recognition of the exception?
 - Establishment of an engineering research method on the ecosystem
- How can we recover the ecosystem with our recognition of the exception?
 - Assessment of compensation measures for the ecosystem alteration

Ecosystem

A term to describe a discrete unit that consists of living and non-living parts, interacting to form a stable system. Fundamental concepts include the flow of energy via food-chains and food-webs, and the cycling of nutrients biogeochemically. Ecosystem principles can be applied at all scales. Principles that apply to an ephemeral pond, for example, apply equally to a lake, an ocean, or the whole planet.

Oxford “ A Dictionary of Ecology ”

Ecosystem Research in Ecology & Civil Engineering

- Investigation method of the ecosystem

- To assume index species
- To assume food-chains contain index species
- To investigate the ecological community which contains index species
- To examine the assumption

- Assessment method of ecosystem

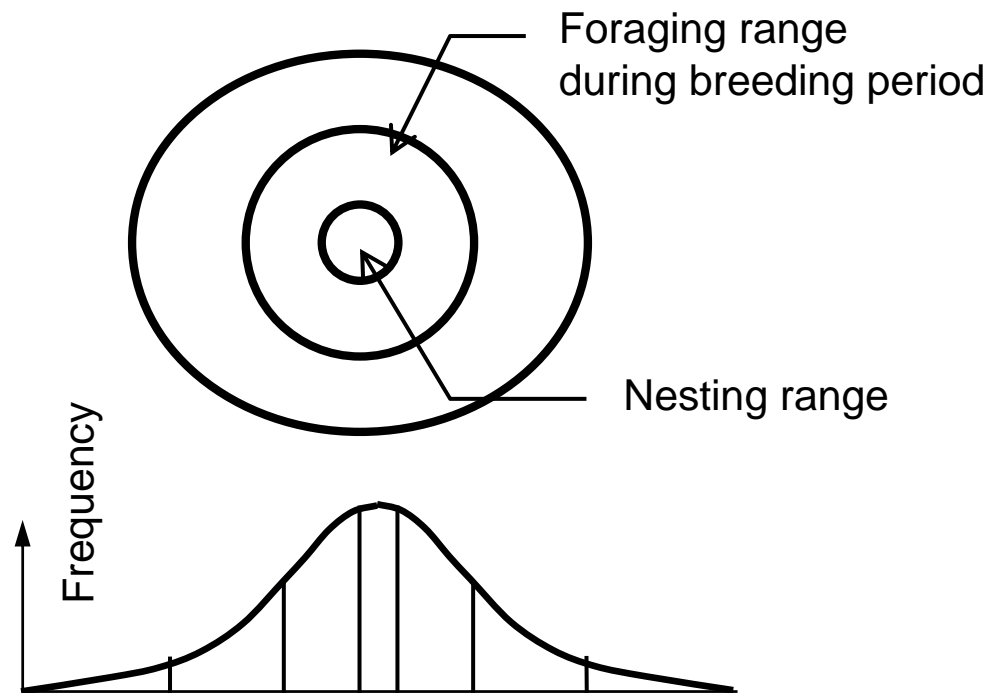
- To keep environment that index species can breed

- Methods of reducing human impact on the ecosystem

- To reserve nests & rest areas of index species, and to reserve areas that index species can hunt & gather living things as food during the breeding seasons

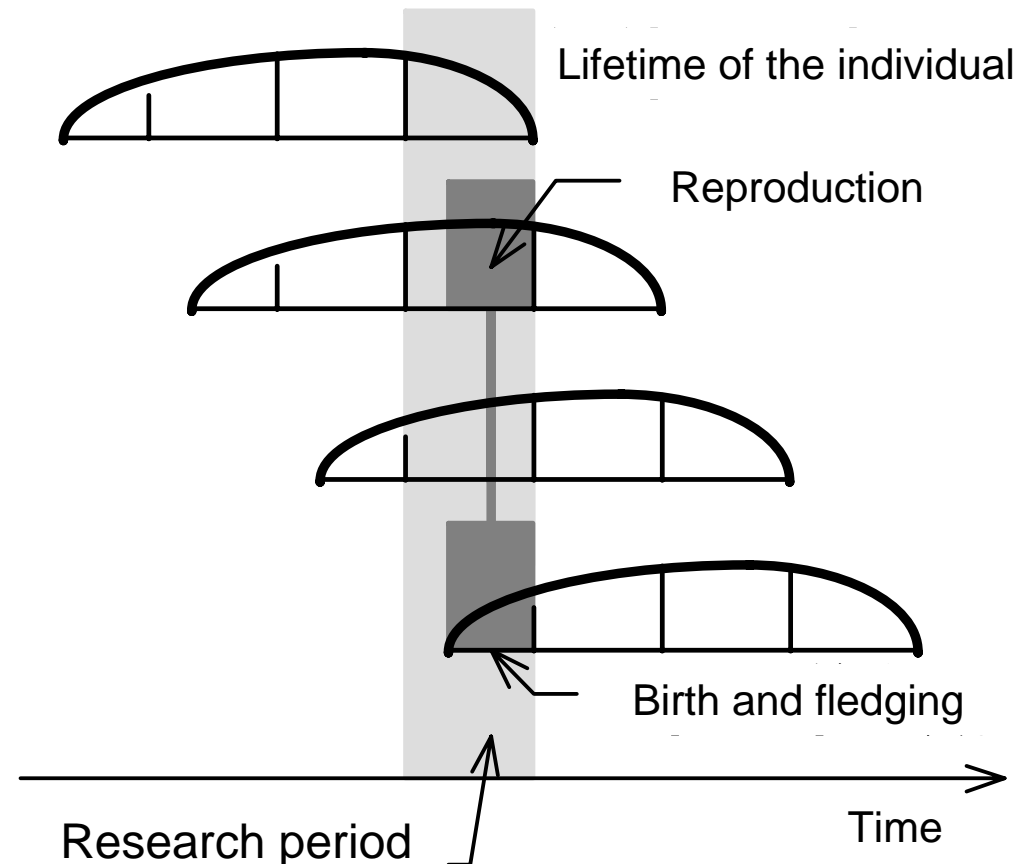
Spatial Approach to Ecosystem

- Focusing on the highly frequented living areas
- Focusing on the nesting range and the foraging range during breeding period
- Degree of substitutability
- Not considering the less frequently used areas

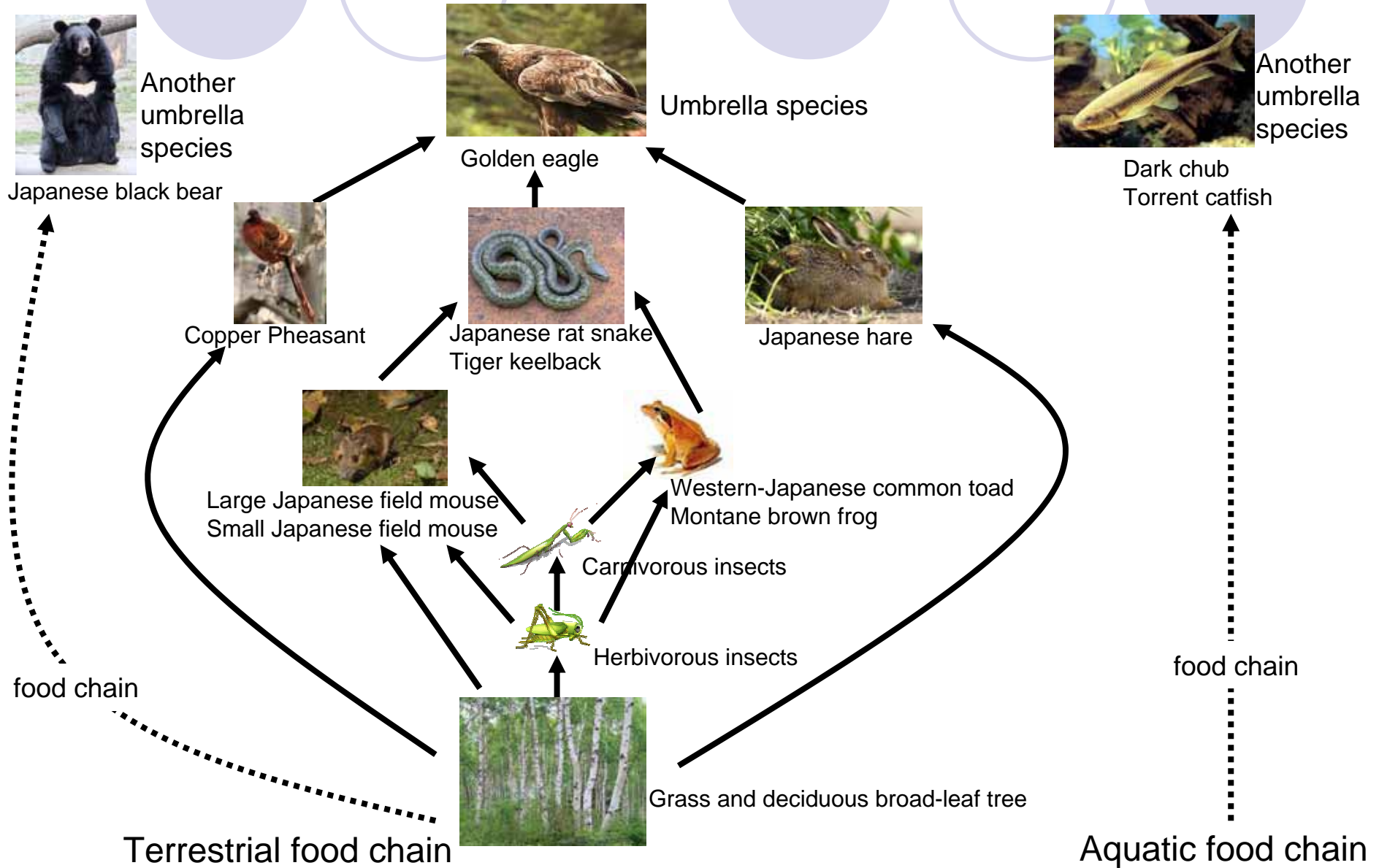


Periodical-Axis Approach to Ecosystem

- Focusing on breeding, birth of next generation, and growth
- Not considering the non-breeding period
- Not observing the entire life span of an individual
- Not considering the evolutionary changes of species



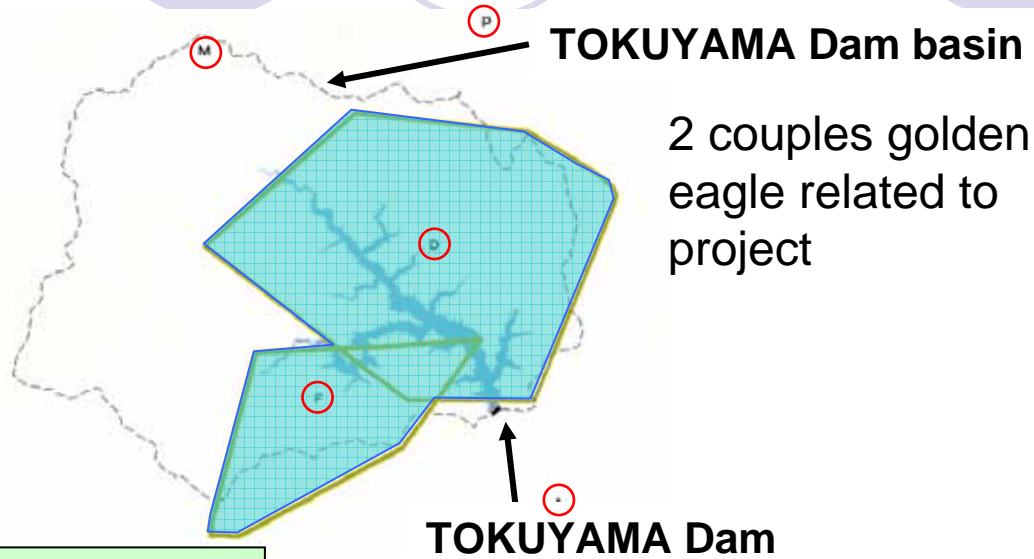
Food – Chain and Index Species



Raptor in TOKUYAMA Dam basin

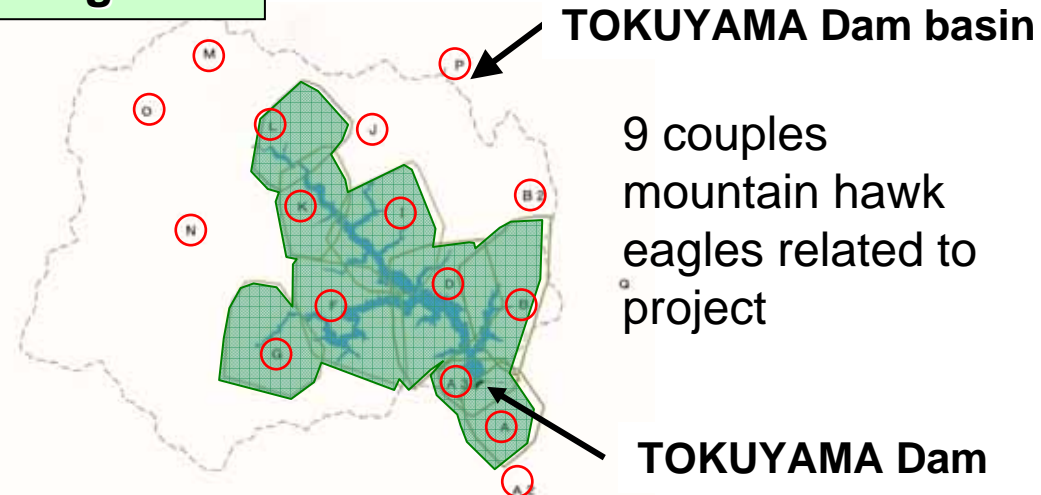
golden eagle

Confirmed 5 couples around TOKUYAMA Dam



mountain hawk eagle

Confirmed 17 couples around TOKUYAMA Dam



Different values between ecology and civil engineering

- Civil engineering side · · · There is no relation between technical theory and sense of value.
- Biology side · · · It is cruel for those who have been targeting the biology in their life
- Civil engineering side recognizes the biology side having the sense of value on ecosystem. Do not broach that disaster prevention and life are important
- We should recognize that the sense of value is different between each other



Future Civil Engineering

- Does civil engineering aim for changes in the land?
 - New engineering based on ecology
- Establishment of the management technique for the land
 - Harmony of development and land conservation



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Thank you for your listening

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