

### Environmental Science Research Laboratory

#### Brief Overview

The Environmental Research Laboratory, aiming at supporting stable construction and operation of electric power utilities, building a low-carbon society, and reducing various environmental risks associated with the electric power industry, is engaged in fundamental technology related to atmosphere, marine, hydrosphere, biology, environmental risk, and biotechnology.

#### Achievements by Research Theme

##### Atmospheric and Marine Environment

###### 【Objectives】

The field observation procedure, prediction and evaluation procedures for regional atmospheric and marine environment, related to global warming and urban atmospheric environment, are developed.

###### 【Principal Results】

- The exchange mechanism of air parcel between the area among buildings and the atmosphere was clarified by the wind tunnel experiments, and this result might be used to improve the thermal environmental conditions of urban area [V10001]. These features of three dimensional structure of the flow and temperature were also predicted by the numerical simulation model developed by CRIEPI [V10016].

##### Hydrospheric Environment

###### 【Objectives】

To develop an assessment technique to solve various environmental problems at reservoirs, rivers and coastal areas for the purpose of achieving the efficient management and operation of power plants.

###### 【Principal Results】

- Automatic passing fish detection system using RFID (Radio Frequency IDentification) technology was developed to provide information on movement and behavior of Ayu fish (*plecoglossus altivelis*) within a fishway. The effect of decreasing light levels on the behavior of Ayu fish was examined using developed system. It was found from the result that most of the Ayu fish ascended or descended the channel in response to the change of light levels and their location was associated with water velocity [V10024].

##### Biological Environment

###### 【Objectives】

Development of effective methods to elucidate the effect of construction and operation of electric power plants on wildlife and ecosystems, and of countermeasures for aquatic organisms and terrestrial animals causing troubles in the operation of electric power plants.

###### 【Principal Results】

- We developed practically available guidelines for ecosystem assessment in the development of power plants by proposing fundamental idea and execution procedure of the assessment, and showing case studies estimating the effect quantitatively for golden eagle as a top predator species and Japanese badger as representative species (Fig. 1) [V02].

**Environmental Risk Assessment**

**[Objectives]**

To support environmental risk management in the electric power industry, we aim to develop methods for the assessment and management of environmental risks related to chemical substances and intermediate electromagnetic fields, and technologies for chemical measurements of wastewaters and for effective utilization of solid wastes.

**[Principal Results]**

- Results from exposure experiment using rats indicated that intermediate frequency magnetic fields emitted mainly by home appliances did not have any reproductive or developmental toxicity effects on early embryonic development prior to implantation.

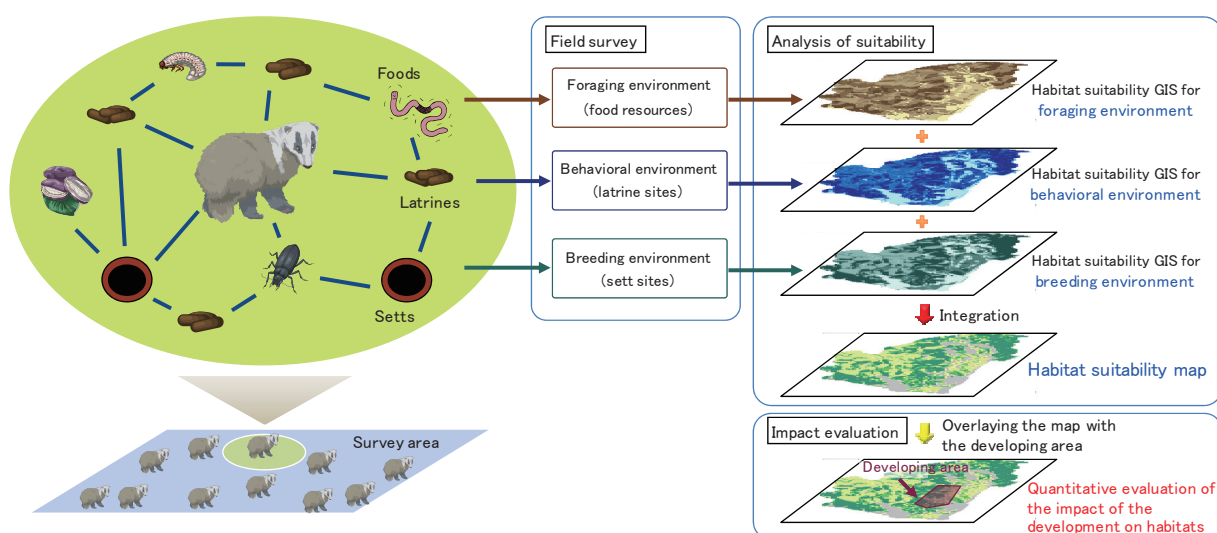
**Biotechnology**

**[Objectives]**

We aim to develop microbial technology for resource recycle and waste water treatment, biosensing technology to trace chemicals and plant production technology as food or energy as biomass.

**[Principal Results]**

- A novel technique for raising seedlings of a red leaf lettuce under irradiation at the regulated wavelength using LED was proposed to increase the yield by improving stress tolerance and adjusting compact morphology of lettuce seedlings [V10032].
- Production efficiency of a conventional microbial process from organic waste to valuable resources such as butanol was enhanced under additional condition that can be potentially controlled by electrolysis. Electrolytic enhancement was proposed as an effective tool to reuse waste by microbial conversion [V10019] [V10028] [V10033].
- Energy balance analysis was investigated for biodiesel fuel production by Jatropha plantations abroad. Jatropha biodiesel fuel was the most attractive candidate for alternative fossil fuel to oil in quantitative analysis of energy profit ratios and CO<sub>2</sub> emissions among other bio-fuels [V01007].



**Fig. 1 Fundamental idea of ecosystem assessment for representative species**

Suitable living division map for Japanese badger as representative species was made based on the analyses of foraging environment, behavioral environment, and breeding environment - three major ecological factors for representative species. Effect of the development on ecosystem can be estimated by combining the map with the construction layout.