

The Research Institute of Life, Earth & Environment investigates the mechanisms of Life on Earth and the interactions with the Environment.

Life is in constant evolution. Our environment is changing rapidly. Societal challenges arise and require a strong involvement of scientists. At ILEE, we explore the evolution of organisms, human populations, natural- and agro-ecosystems. Our objectives include:

- Understanding the fundamental biological processes regulating life on earth.
- Characterising anthropogenic pressures on the environment, including historical and socio-economic aspects.
- Developing sustainable alternatives to manage natural resources, reduce pollution, conserve and restore biodiversity.

ILEE combines a large panel of competences in fundamental and applied sciences. This allows a significant contribution to the understanding of the evolution of life. To face current and future environmental challenges, we search for sustainable solutions, integrating ecological, technological, socio-economic and historical/cultural perspectives.

## Evolution, Adaptation and Biodiversity



Humans impact on our natural environment with consequences for the adaptation & evolution of organisms, composition of communities, biodiversity & ecosystem functioning.

Ecological theory

Models  
Field data  
Experiments

Biological mechanisms

Physiology  
Behaviour  
Proteomics  
Epigenetics

Evolutionary processes

Sexual & asexual reproduction  
Natural & experimental populations

## Pollution and Environmental Toxicology

Individual response

Physiological  
Immune  
Nervous  
Reproductive system  
→ Aquatic organisms

Ecosystem changes

Conceptual → mathematical models  
Case → plankton microcosmic experiments

Sustainable technology

Photochemical and –voltaic devices  
Bioinspired materials

Pollutants (pesticides, pharmaceuticals, neurotoxins, etc.) but also other stressors (chemical, physical or pathogenic) act on individuals and entire ecosystems.



## Characterization and Management of Natural Resources



If not done responsibly, the extraction and processing of non-renewable resources can cause heavy environmental problems.

Non-renewable resources

Geological resources  
Supergene ores  
Aquifer & karstic flow processes

Human utilisation

Relationship between natural resources, architecture & art  
From antiquity to modern age

Renewable resources

Sensible productivity of freshwater species  
Restoration of aquatic ecosystems  
Water quality analysis with ecological indicators  
New georesources

## Ecosystem services

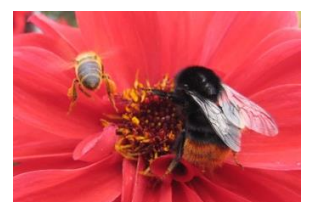
Integrated valuation frameworks

Social  
Economic  
Biophysical values

Methods

ES Mapping  
Modelling  
Integrated ES assessments

The concept of ES stems from a strong sustainability framework and its first aim was to help preserve biodiversity. Today, it is increasingly used to foster sustainable landscape management and planning, to increase the well-being of local actors.



## Sustainable plant and animal production



Looking for alternatives of chemical and pharmaceutical products is essential to face the challenges in plant and animal production.

Plant molecular & cellular biology

Association breeding – agronomical performance

Phytopathology & signal transduction

Elicitor molecules stimulate plant defence  
Spin-off: [FytoFend S.A.](#)

Aquaculture

Immunostimulation  
Plant ingredients instead of fish meal  
Improve fish welfare  
Temperate & tropical species

## Environmental impacts on human populations

Environment & population

Distribution  
Migration  
Vulnerability  
Land use  
Health risks

Vector-borne & zoonotic diseases

Population dynamics  
Disease risks  
Spatial scales

Approach

Resilience indicators  
Game, Census, Focus groups  
Integrated spatial analyses  
Satellite image & mobile data

Droughts, land use, environmental and health risks impact on distribution of human populations and migration. Differing vulnerability influences reactions to hazards. Spatial scales and geographical contexts play a role in population dynamics.



## Environmental History and Law



Since man appeared on earth he began to influence and alter his environment.

History & Perception  
18<sup>th</sup> – 20<sup>th</sup> century

Urbanisation  
Industrial exploitation  
River pollution  
Relationship between men & animals

Socio-historical aspects

« Produits du terroir »  
Natural disasters; volcanic eruptions & earthquakes

Environmental Law

Treaties, regulations, directives  
Mobilized principles  
International level

## Environmental and natural resource management in the South

ILEE collaborates with partners located in Southern countries: Africa, Central and South-America and South-Eastern Asia. Focus lies on:

- Characterization and sustainable management of natural resources
- Production of aquatic ecosystems and the sustainable development of aquaculture
- Impact of environmental changes on human populations
- Environmental history



A strong asset of ILEE is its combination of multiple disciplines offering completely new insights and interdisciplinary approaches on interactions of organisms, species and ecosystems being exposed to anthropogenic impacts. These range from natural sciences such as biology, geography, geology, chemistry and physics to social science disciplines such as architecture, art, environmental history and law.

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