# Research Institute of Life, Earth & Environment (ILEE)

**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**: Conceptional → mathe-matical 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.

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## 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 18th – 20th 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.


Contact:

Patrick Kestemont (President) & Johan Yans (Vice-president)

patrick.kestemont@unamur.be – johan.yans@unamur.be

Scientific Manager – ilee@unamur.be

http://ilee.unamur.be/


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