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UMR1467



Risks, ECOsystems, Vulnerability, Environment, Resilience research unit (RECOVER)

Management

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Research themes

- Hydrometeorological risks
- Fire risk and dynamics of Mediterranean ecosystems
- Ecosystem services
- Safety of hydraulic structures
- Geomaterial behaviour
- Decision support
- Evolution of continental hydrosystems under stress

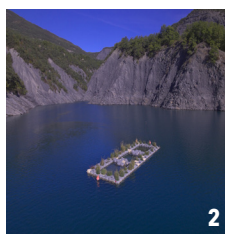
Key figures

- Staff: About 70 permanent members of staff; 20 to 25 PhD students; 25 to 30 contract employees
- Around 100 peer-reviewed journal articles per year
- Teaching: 400 teaching hours per year (including more than 200 for regional institutions)
- A technological research platform in Geomechanics (certified since 2013; COFRAC accreditation for the geosynthetics laboratory since 2017)
- Two certified observation and experimental sites: the Réal Collobrier catchment area (OZCAR infrastructure – Critical Zone Observatory) and the Font-Blanche forest site (with INRAE URFM, AnaEE-France and ICOS site)
- Two accredited fish-rearing facilities and 25 freshwater mesocosms.

Missions and objectives

The Joint Research Unit RECOVER (INRAE and Aix-Marseille University) has a twofold scientific mission, focusing on natural risks and ecosystem functioning. Its goals are to:

- to develop knowledge on risks related to forest fires, hydrology and hydraulic structures, in order to provide decision support in these areas;
- to investigate the dynamics of aquatic and forest ecosystem dynamics under the pressures of global change, to develop tools and methods for assessing the condition of ecosystems, and to propose solutions for their restoration.



(1) Fire in a Mediterranean pine forest. (2) Artificial floating vegetated island designed to enhance biodiversity. (3) Flooding of a river levee system. (4) Flood on the Argens River at Trans-en-Provence in June 2010.

Photos: © INRAE

Global change, multi-hazard (or multi-risk) management at the territorial scale, and compatibility with ecosystem protection constitute cross-cutting themes within RECOVER. The Unit contributes to the ECLA section (lacustrine ecosystems), which operates in close partnership with the OFB (French Office for Biodiversity), several of whose staff members are hosted here. RECOVER has strong expertise and scientific advisory activities, particularly in the field of hydraulic structures. Its research relies on several laboratories (geomechanics, geosynthetics, forest ecology and fire test facility, wildfire science, hydrobiology), with various equipment (remote sensing and spatial data analysis, controlled fish-rearing facilities and mesocosms), and field sites (two experimental levees, the Réal Collobrier site, the FontBlanche site, forest plantations in Saint-Mitre-les-Remparts, and the Zola and Bimont dam reservoirs).

Research

The unit's research is organised around four main themes:

- **Hydrometeorological risks:** understanding hydrological phenomena at fine spatial and temporal scale (Real Collobrier Observatory); study and modelling of intense rainfall events (rainfall generators and pluvial hazard mapping); regional assessment of hydrological hazards (water resources and flood forecasting on ungauged basins); operational tools for hydrological risk management; and assessment of the impacts of global change on hydrology risks.
- **Safety, Risks and Behaviour of Hydraulic Structures (Geomechanics, Civil Engineering, Decision-Making, Risks):** hydromechanical behavior of geomaterials (erosion, sediment transport, instabilities, performance, and durability of geomaterials and geosynthetics); safety of hydraulic structures (structural behavior, coupled mechanical-reliability numerical modeling, monitoring and surveillance, safety management); territorial systems and risks (territorial resilience, nature-based solutions, multi-risk management, decision support, participatory science).



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- **Functioning and restoration of continental hydro-systems:** influence of local and global factors on biodiversity; physiological responses to thermal stress; community structure–functional diversity– and trophic networks, and their sensitivity to disturbances; behavioural, genetic and epigenetic responses; ecosystem assessment tools (indicators of ecosystem condition and functioning) ; methods for ecosystem restoration.
- **Fire risk analysis and vulnerability modeling of ecosystems and territories:** fire-weather relationships and climate change, integrated spatial modeling of fire risk, fuel characterization and moisture content across scales (remote sensing, LiDAR, experimental assessment of species flammability), wildland-urban interface fire behavior, dynamics of forest systems under climate constraints, adaptive management, assessment and modelling of ecosystem services capacity.

Partnership and Expertise

Within Aix-Marseille University, RECOVER is one of the laboratories of the OSU Pytheas (Earth Sciences and Astronomy Observatory), member of the Mediterranean Institute for the Environmental Transition (ITEM) and a key partner of the Institute for Mechanics and Engineering (IMI). RECOVER also has a close partnership with the OFB on the topic of lake ecosystems as part of the ECLA section, as well as numerous national, regional, and local collaborations..

Key international partners: Complutense University of Madrid (Spain), University of Sassari (Italy), Universities of Sherbrooke, Calgary and Carleton (Canada), University of Lisbon (Portugal), BOKU (Austria), Melbourne University and CSIRO (Australia), NINA (Norway), Hanover University (Germany), Academy of Sciences (Slovakia).

RECOVER has extensive national expertise and scientific advisory activities, notably within a convention between INRAE and the Ministry responsible for Ecological Transition, to provide scientific support for public policies. The unit is also involved in international expert activities, in particular through the International Commission on Large Dams (ICOLD). Several researchers within the Unit regularly contribute to standardisation activities (AFNOR) and to the development of technical guidelines (ASQUAL, French committee on Dams and Reservoirs).

Teaching

RECOVER contributes to a wide range of academic courses in its fields of expertise, at both the regional level (Aix-Marseille University, including OSU Pytheas and the Faculty of Science, Avignon University, Côte d'Azur University, University of Montpellier...) and the national level. The courses cover both disciplinary and interdisciplinary topics within initial degree as well as continuing education programs.

RECOVER is affiliated with the following Aix-Marseille University Doctoral Schools: Environmental Sciences (ED 251) and Engineering Sciences (ED 353).



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