



How a public institution is addressing the country's adaptation to the effects of the climate change through the bilateral research

Coriolis conference - 12 December 2024

Thierry Braine-Bonnaire

Content overview

1

The Carnot system in a few words

2

Cerema, its **six fields of activity**, its **twelve research teams** and its **Carnot Institute, Clim'adapt Continuum expertise <-> research**

3

Cerema's scientific excellence at the service of the country's **adaptation to the effects of the climate change**

4

Holistic vision to avoid maladaptation

5

Complementarity of the **technosciences and the humanities and social sciences**

6

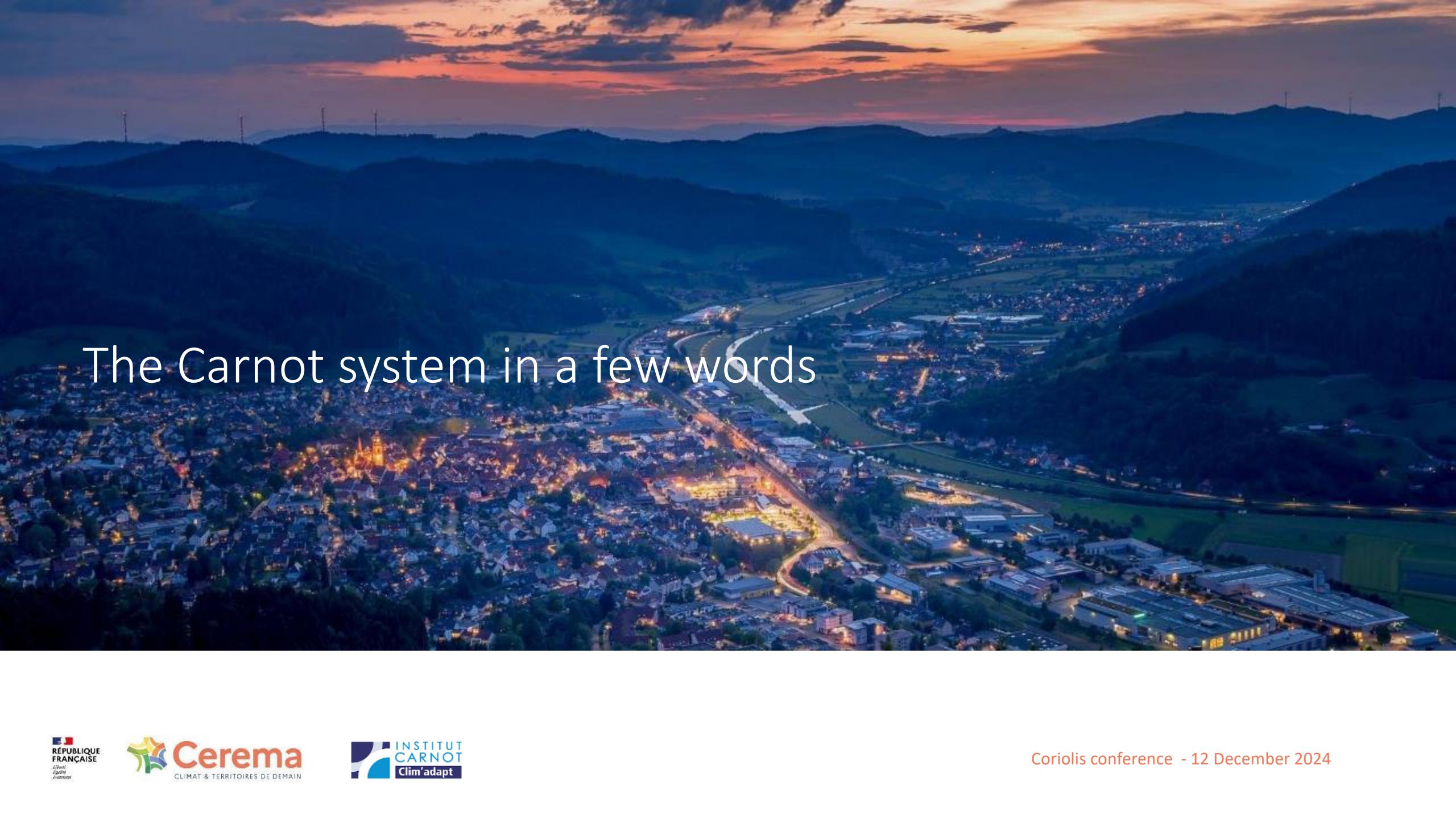
Interface between the companies and the local authorities

7

How to **measure the impact**

8

Bibliography, to go further



The Carnot system in a few words

The Carnot system in a few words

1

Founded in 2006

The Carnot Label was designed to develop partnership-based research, meaning research conducted by public laboratories in partnership with socio-economic players to serve their needs.

2

Carnot institute

A Carnot Institute is a research structure that is committed to developing quality partnership research. He is recognized for his scientific and technological skills and his ability to respond professionally to the research and innovation needs of companies.

3

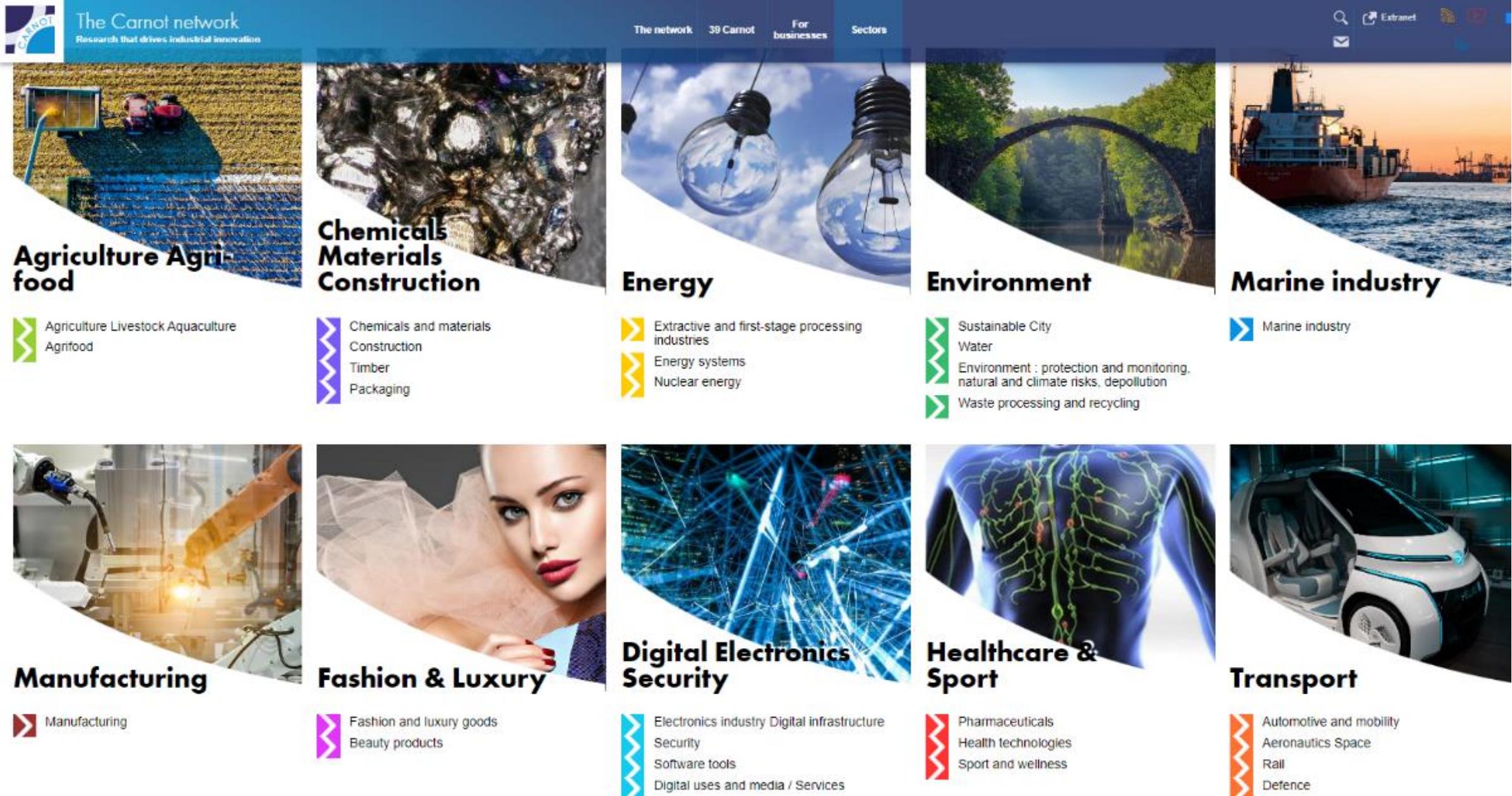
39 Carnot institutes

There are 39 Carnot institutes in total, each focusing on specific areas of research and innovation.



Asked to improve steam engines, Nicolas Léonard Sadi Carnot (1796-1832) established the second law of thermodynamics, which governs the workings of devices that we all use on a daily basis.

The Carnot system in a few words



The Carnot network
Research that drives industrial innovation

The network 39 Carnot For businesses Sectors

Extranet

Agriculture Agri-food

Agriculture Livestock Aquaculture
Agrifood

Chemicals Materials Construction

Chemicals and materials
Construction
Timber
Packaging

Energy

Extractive and first-stage processing industries
Energy systems
Nuclear energy

Environment

Sustainable City
Water
Environment : protection and monitoring, natural and climate risks, depollution
Waste processing and recycling

Marine industry

Marine industry

Manufacturing

Manufacturing

Fashion & Luxury

Fashion and luxury goods
Beauty products

Digital Electronics Security

Electronics industry
Digital infrastructure
Security
Software tools
Digital uses and media / Services

Healthcare & Sport

Pharmaceuticals
Health technologies
Sport and wellness

Transport

Automotive and mobility
Aeronautics Space
Rail
Defence

A wide-angle aerial photograph of a city at dusk or night. The city is densely built with numerous lit houses and streets. A major highway with a curved interchange cuts through the urban area. The background features a range of mountains, with the sky above showing a gradient from orange to dark blue. The overall scene is a blend of urban and natural landscapes.

Cerema



Coriolis conference - 12 December 2024



Cerema: adapting to climate change

Public institution of expertise

Cerema is the public institution of expertise for the adaptation of the territory to the effects of the climate change.

Shared governance

It is the only national institution whose governance is shared between the State and the local authorities, of which more than 950 are members.

Wide presence

It is present in mainland France and in the overseas territories thanks to its 27 locations and its 2500 agents.

CEREMA – SIX FIELDS OF ACTIVITY



THE TWELVE CEREMA RESEARCH TEAMS



THE TWELVE CEREMA RESEARCH TEAMS

RHITME	Hydraulic Risks and Environmental Impacts at the Land-Sea Interface	TEAM	Transfers and interactions linked to water in built environments
EL	Light and Lighting	STI	Intelligent Transport Systems
UMR MATRIS	Mobilities, Planning, Transport, Risks and Society - <i>This team is a joint research unit with the University of Cergy</i>	BPE	High performance buildings in their environment
PsyCAP	Applied Psychology	UMR MCD	Materials for a sustainable construction
REPSODY	Response of Soils, Sites and Structures to dynamic stresses - Earthquakes and vibrations	UMR AE	Environmental acoustics
GéoCoD	Geomaterials and Geomechanics: couplings and dynamics for geotechnical structures and risks	ENDSUM	Non-Destructive Evaluation of Structures and Materials



Cerema and its Carnot institute, Clim'adapt



Coriolis conference - 12 December 2024

CLIM'ADAPT, THE CARNOT INSTITUTE OF THE CEREMA



Cerema's scientific excellence at the service of the French economy and its adaptation to the effects of climate change

The Clim'adapt Carnot Institute helps companies and local authorities to meet the climate challenge and make their transition to a low-resource, low-carbon and environmentally friendly economy.



= Cerema, seen from the perspective of **bilateral contractual research**



THE CUSTOMERS OF CLIM'ADAPT



They belong to two categories:

- the **local authorities**
- the **companies**, of all sizes, French and foreign

Startup

SME

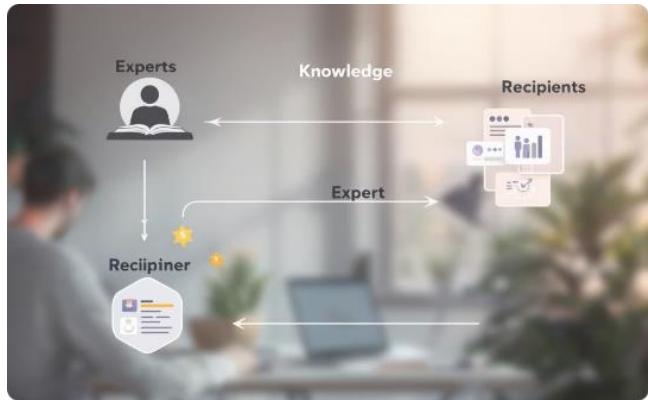
intermediate-sized

large groups



A system dedicated to innovative startups and SMEs

METHODS OF INTERVENTION



Knowledge or technology transfer

Response to a specific request from a company

Addressing particular challenges, such as a lock to be broken

Long-term commitment

Joint laboratory
Industrial Chair



METHODS OF INTERVENTION

UNE BELLE HISTOIRE DE PARTENARIAT...



GEOCORAIL

CONCEPTION D'UN MODÈLE NUMÉRIQUE 2D PUIS 3D
DÉCRIVANT LE PROCÉDÉ GEOCORAIL ET D'UN OUTIL
DE DIMENSIONNEMENT



Le procédé Geocorail consiste à former un conglomérat rocheux en milieu sous-marin grâce à une réaction électrochimique de l'eau de mer et au captage de sédiments. La R&D réalisée par le Cerema repose sur l'élaboration d'un outil de modélisation électrochimique modulable permettant notamment le dimensionnement de structures anodiques et cathodiques.

UNE BELLE HISTOIRE DE PARTENARIAT...



ENGIE
Green

MISE AU POINT D'UN PROCÉDÉ D'ESTIMATION AUTOMATIQUE DE L'ÉMERGENCE SONORE D'UN PARC ÉOLIEN

Le partenariat consiste en la mise au point d'un procédé d'estimation automatique de la contribution sonore d'un parc éolien, à partir de mesures réalisées *in situ* et d'un algorithme d'intelligence artificielle. L'objectif du procédé est de permettre un gain significatif de productivité d'un parc éolien, tout en assurant le respect de la réglementation acoustique.



UNE BELLE HISTOIRE DE PARTENARIAT...



SOI
SALINS

CONVENTION DE MÉCÉNAT SCIENTIFIQUE SUR LES SCIENCES DE L'INGÉNIER ET DE L'ENVIRONNEMENT APPLIQUÉES À L'ADAPTATION AU CHANGEMENT GLOBAL DES ZONES BASSES LITTORALES



L'objectif général est de développer autour du Cerema, à travers le recrutement de doctorants, une recherche de niveau international sur les sciences de l'ingénier et de l'environnement appliquées à l'adaptation au changement global des zones basses littorales.



Cerema
CLIMAT & TERRITOIRES DE DEMAIN

INSTITUT
CARNOT
Clim'adapt

Cerema: institut Carnot Clim'adapt

Cerema's scientific excellence at the service of the country's adaptation to the effects of the climate change Clim'adapt

1/2



Anticipating natural hazards
example of floods, fall of boulders, shrinkage and swelling of clays



Securing infrastructure
for instance :
checking the bridges of the country, roads and shrinkage and swelling of clays



Offering sustainable mobility
Road resilient to climate change
Decarbonization of mobility
Impacts of mobility on territories platform
Active modes – cycling and walking
Urban Logistics
Road safety



Optimising the use of land
Territories adapted to the climate of tomorrow program
Low Carbon Territories Program
Geoportal of the renewable energies

Cerema: institut Carnot Clim'adapt

Cerema's scientific excellence at the service of the country's adaptation to the effects of the climate change Clim'adapt

2/2



Adapting to coastal erosion
how will the French coastline
look like in 2028, 2050, 2100 ?



Developing nature in the city
Nature-based solutions for the
adaptation of territories to climate
change,
Zero net artificialisation,
Restoring permeability,
Implementing the National
Biodiversity Strategy,
Fight against urban heat islands



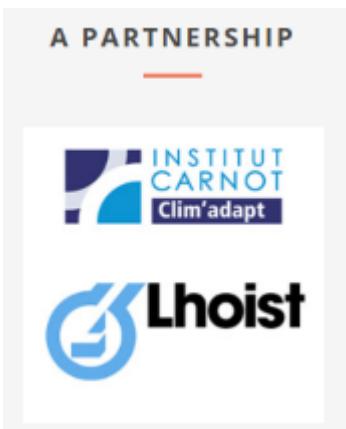
Saving energy in buildings
working on both mitigation
and adaptation,
Development of new sectors of
ecological construction
materials for buildings
Geoportal of the renewable
energies

Cerema: institut Carnot Clim'adapt

Holistic vision to avoid maladaptation

The complementarity of the areas of expertise makes it possible to verify that an adaptation solution targeting one aspect does not have a counterproductive impact on another.

Example of Lhoist : the use of lime slurry to combat road bleeding during heat waves (Softening of bitumen, Radiative properties, albedo)



Cerema: institut Carnot Clim'adapt

Complementarity of the technosciences and the humanities and social sciences

This complementarity is very valuable in integrating society's expectations and social acceptability into subjects with a very technical dimension.

This allows to anticipate the well-known topics of the rebound effect or the nimby.

*Example of the **Pavin Fog and Rain Platform**: Evaluating and developing products in degraded weather conditions*



Research teams:

- *Intelligent Transport Systems*
- *Light and Lighting*
- *Mobilities, Planning, Transport, Risks and Society*

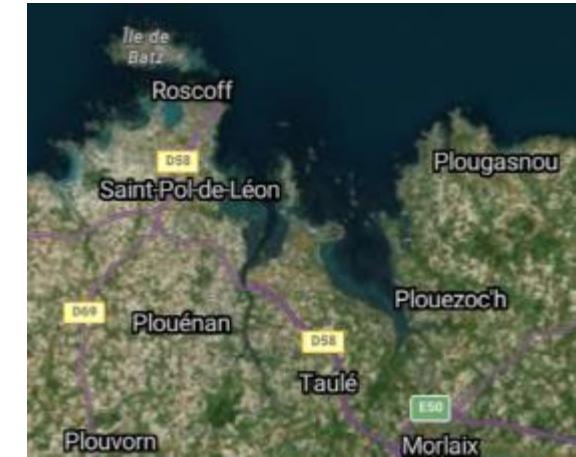
Cerema: institut Carnot Clim'adapt

Interface between the companies and the local authorities

Being at the interface between local authorities and companies makes it possible to connect

- small companies looking for a testing ground for their solution and
- local authorities with a problem to solve and open to innovation.

Example : The bay of Morlaix, in Brittany, is silting up and has to be regularly dredged. CeremaLab, the support structure for innovative start-ups and SMEs, has launched, with the city of Morlaix and aimed at the local economic ecosystem, a call for projects to recover all or part of these sediments.



A wide-angle aerial photograph of a city at dusk or night. The city is densely built with numerous lit houses and streets. In the foreground, a large industrial or office complex with many lit windows is visible. The city is nestled in a valley, with a river or canal running through it. In the background, a range of mountains is visible under a sky filled with orange and pink clouds from the setting sun.

How to measure the impact of actions ?

How to measure the impact

Measuring the impact of adaptation measures to the effects of climate change is crucial to assess their effectiveness and adjust strategies accordingly

Performance indicators

Define clear and measurable indicators, such as reducing economic losses due to natural disasters, improving the resilience of infrastructure, or increasing the availability of drinking water

Impact Assessments

Conduct pre- and post-implementation studies to compare results and identify improvements or persistent challenges

Modelling and simulations

Using climate models and simulations to predict the effects of adaptation measures on different future climate scenarios

Surveys and testimonies

Collect qualitative data from local communities and stakeholders to understand their perception of the measures and their impact on daily lives.

Cost-benefit analysis

Assess the costs associated with implementing the measures against the expected benefits, in terms of risk reduction and improved quality of life.



To go further



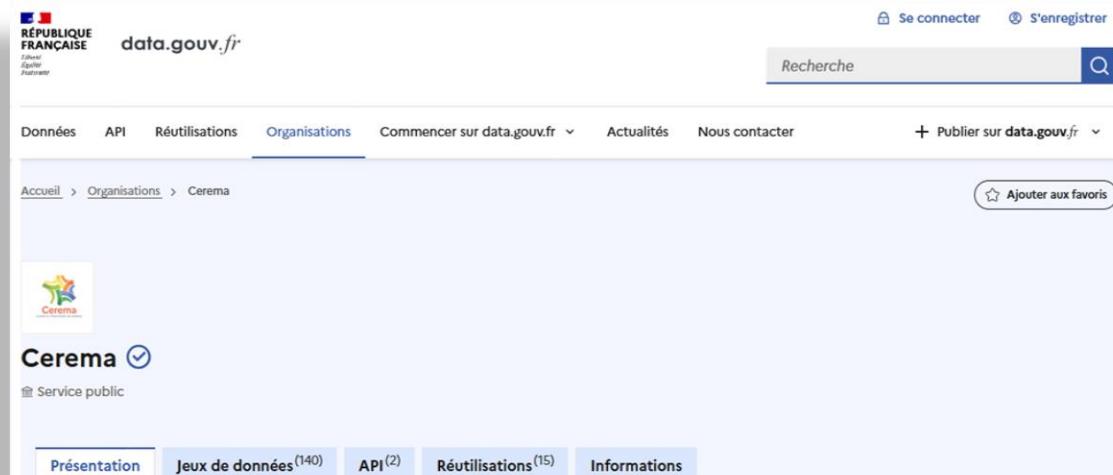
Coriolis conference - 12 December 2024

Bibliography, to go further

Cerema has produced a very rich documentary database (more than 10 000 references, in open access)

Below, quality readings, grouped thematically (most in French language)

- *Move*
- *Protecting and developing the nature*
- *Water, a precious commodity and a risk*
- *Reducing our carbon emissions*
- *Adapting to the effects of climate change*



The screenshot shows the Cerema organization page on the data.gouv.fr platform. The top navigation bar includes links for 'Se connecter', 'S'enregistrer', 'Recherche', and 'Publier sur data.gouv.fr'. The main navigation menu has 'Organisations' selected. The Cerema page features a logo, a brief description as a 'Service public', and links for 'Présentation', 'Jeux de données (140)', 'API (2)', 'Réutilisations (15)', and 'Informations'.



Thank you for your attention

Thierry.Braine-Bonnaire@cerema.fr

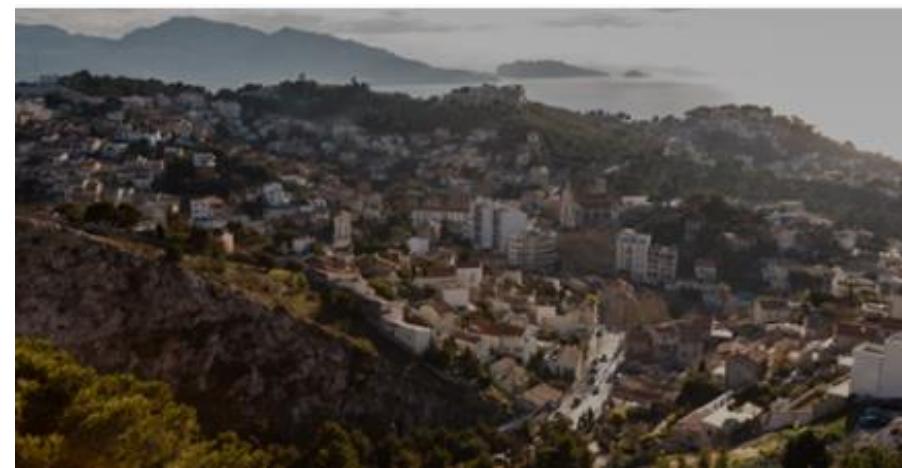
Back up

RHITME Hydraulic Risks and Environmental Impacts at the Land-Sea Interface

The scientific issues concern the characterization and forecasting of hydro-sedimentary hazards at the land-sea interface, from continental hydro-geosystems to estuaries and the open coastal zone.

The research program is structured around three axes:

- River-sea interactions for water level and flow forecasting
- Morphodynamic responses: coastline and interactions with estuaries
- Hazards and environmental impacts in navigated rivers



EL Light and Lighting research team

Its research programme is structured around three areas:

- Modelling the human visual system (HVS) using imaging techniques and image processing algorithms;
- Optimising road lighting installations;
- Assessing the visibility of road infrastructure objects.



The scientific project of the UMR MATRiS is developed along four lines:

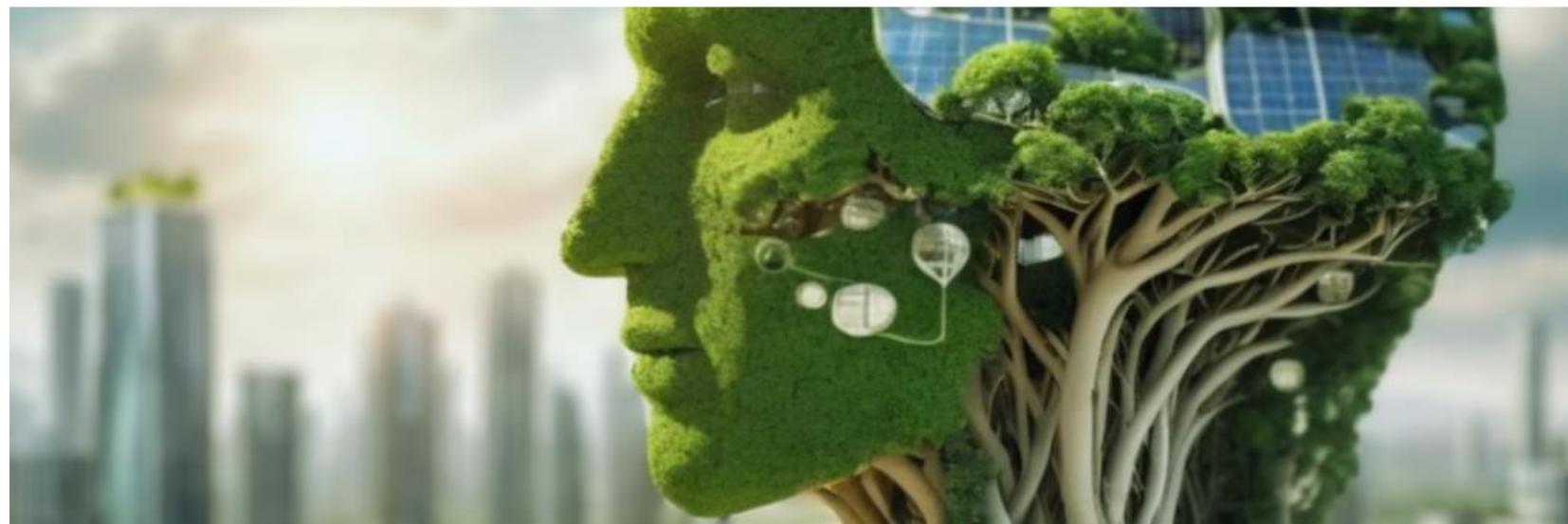
- Analysis of the interdependencies between transport networks, mobility and land use
- The processes of making public transport policies, interplay of actors, territorial impact and evaluations
- Risk-proof planning practices and networks
- Mobility routines and their adaptations (passengers and goods)



PsyCAP Applied Psychology Research Team

The PsyCAP Team's scientific objectives are as follows:

- To study and analyse the human behaviour, to understand and predict it
- Better understand and promote the individual and social acceptance of innovative developments (techniques, technologies, services and structures)
- Produce knowledge and methods to support the changes incurred by technological and/or structural evolutions and innovation.



REPSODY Response of Soils, Sites and Structures to dynamic stresses - Earthquakes and vibrations

The project is organized along three axis:

- On site dynamic experimentation
- Digital prediction of seismic and vibratory movement
- Empirical prediction of seismic and vibratory movement



GéoCoD Geomaterials and Geomechanics: couplings and dynamics for geotechnical structures and risks

The GéoCoD research team project consists in characterising the mechanical behaviour of geomaterials when they are subjected to various loads or external aggressions, and then defining protection solutions and protective dimensioning methods.

The mechanical behaviour of the geomaterials and structures is therefore defined according to the interaction between multi-physical phenomena (Axis 1), and then according to dynamics (Axis 2):

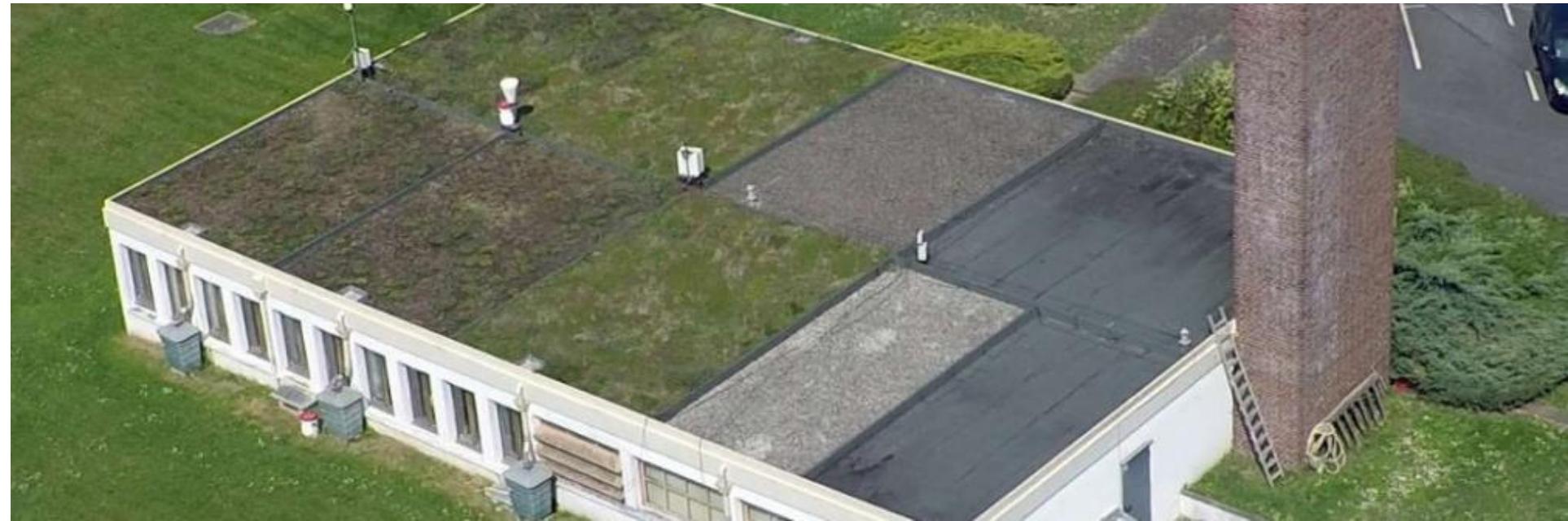
- Consideration of hydric, chemical, thermal and mechanical interactions in the behaviour of geomaterials and sites.
- Dynamic behaviour of soils, rocks, structures and sites.



TEAM Transfers and interactions linked to water in built environments

The TEAM research work is divided into three areas:

- Multi-scale hydrological functioning of built environments
- Pollution of the environments: water/soil/vegetation transfers and treatment structures
- Climate regulation processes in the urban environment



ITS Intelligent Transport Systems, towards greater safety and integration into sustainable regions

The research activities of the team are organized around two scientific areas:

- towards safer efficient infrastructures for the mobility of the future
- towards automated driving



BPE High performance buildings in their environment

The BPE team is focusing its research efforts on:

- The elements of buildings (envelope, systems and bio-sourced materials) and their overall performance as an integral part of the building, therefore taking into account interactions linked to local conditions and uses
- The assessment of the overall real performance in an approach that ranges from the building in its context to a group of buildings (major property assets, urban islands or districts, including those that are “energy plus”...)



UMR MCD Materials for sustainable construction

The main research themes implemented by UMR MCD are organised into 3 major areas applicable to different types of materials (including in particular those used within cementitious and bituminous materials):

- The interaction mechanisms of alternative materials:
- Durability of materials in their environment
- Life cycle analysis - Circular economy - Environmental impacts



The UMRAE themes:

- The sources of noise in the environment
- The noise propagation in the environment
- The impact of noise on humans and biodiversity



Le Cerema, membre de l'UMR "Acoustique de l'environnement"

**umr
ae**

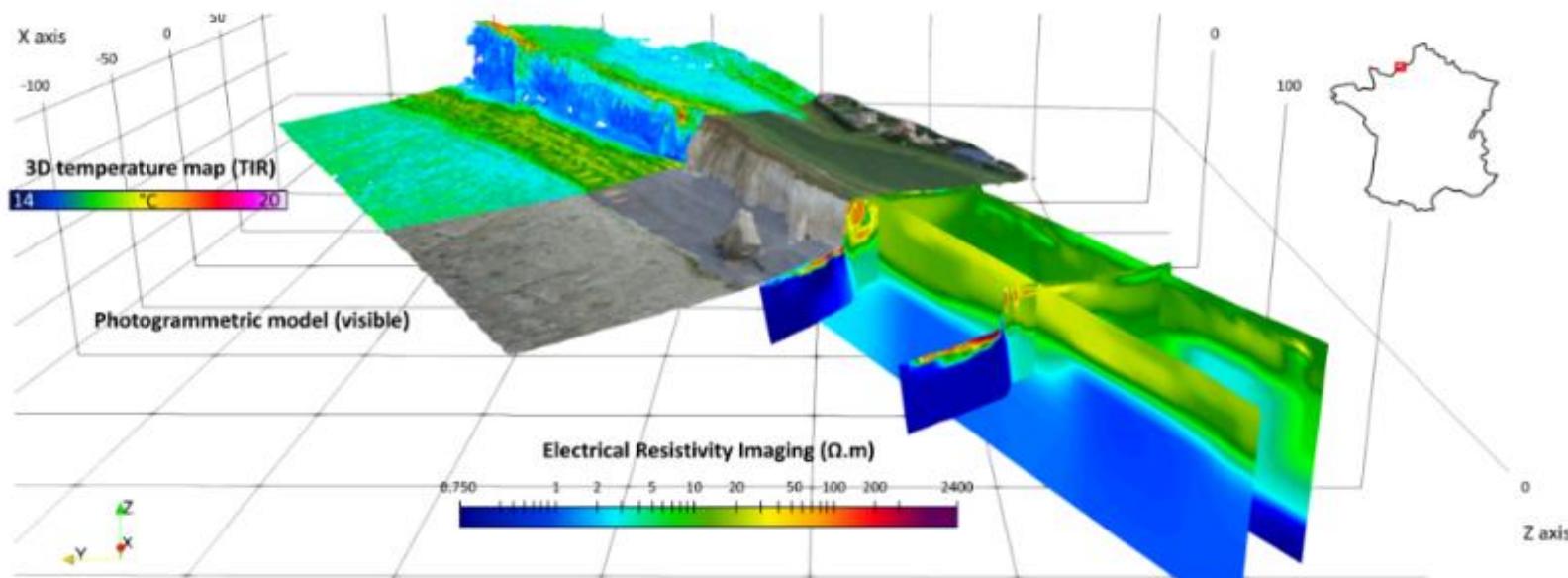
 **Cerema**
CLIMAT & TERRITOIRES DE DEMAIN

 **Université
Gustave Eiffel**

ENDSUM Non Destructive Assessment of Structures and Materials

The scientific problem of ENDSUM is divided into three parts:

- The physical characterization of environments
- The development of measurement and data processing tools
- The development of diagnostic, prognostic and visualization methods



MOVE

Les ressources

RÉSILIENCE DES INFRASTRUCTURES
Fiche n°2

FICHE TECHNIQUE

DIX ÉTAPES POUR AMÉLIORER LA RÉSILIENCE DE VOS INFRASTRUCTURES DE TRANSPORT

Méthode Approche Systémique d'Adaptation des Infrastructures de Transport

RÉPUBLIQUE FRANÇAISE
Gouvernement National

Cerema
CLIMAT & TERRITOIRES DE DEMAIN

INSTITUT CARNOT
Clim'adapt

Les cahiers



DÉCARBONER
LES MOBILITÉS QUOTIDIENNES

Enjeux et leviers pour l'action territoriale

RÉPUBLIQUE FRANÇAISE
Gouvernement National

Cerema



Les ressources

DONNÉES DE MOBILITÉ POUR LA MODÉLISATION DES DÉPLACEMENTS
Fiche chapitre

FICHE TECHNIQUE

COLLECTE ET UTILISATION DE DONNÉES DE MOBILITÉ POUR LA MODÉLISATION DES DÉPLACEMENTS

Des enquêtes ménages-déplacements aux données massives

RÉPUBLIQUE FRANÇAISE
Gouvernement National

Cerema

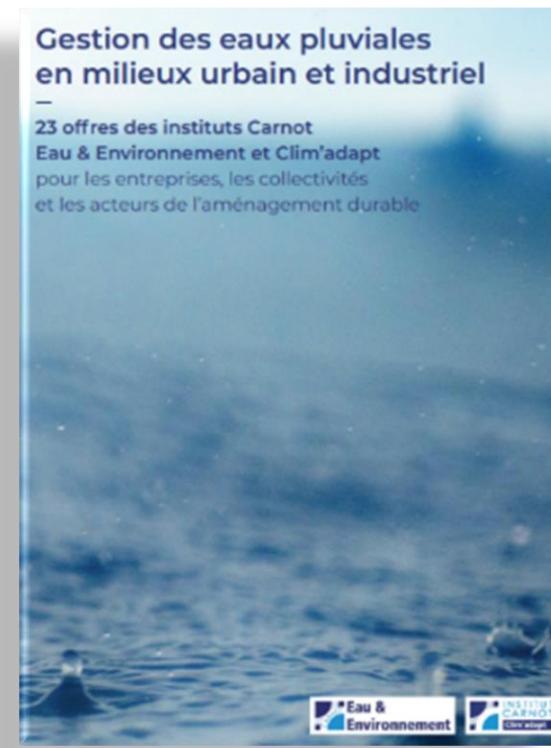
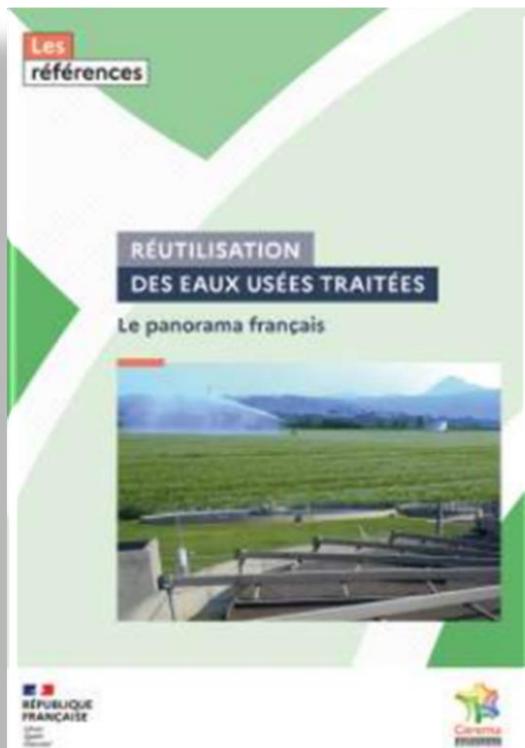
MOVE



The screenshot shows a map of Belgium with numerous blue pins indicating rail stations. A legend at the top right includes 'Portail voyageurs' (highlighted in red), 'Portail marchandises', 'Résultats', 'Méthodologie', and 'Téléchargement'. A green banner at the top provides a history of updates. A search bar at the bottom right allows users to search for stations or territories.



WATER, A PRECIOUS COMMODITY AND A RISK

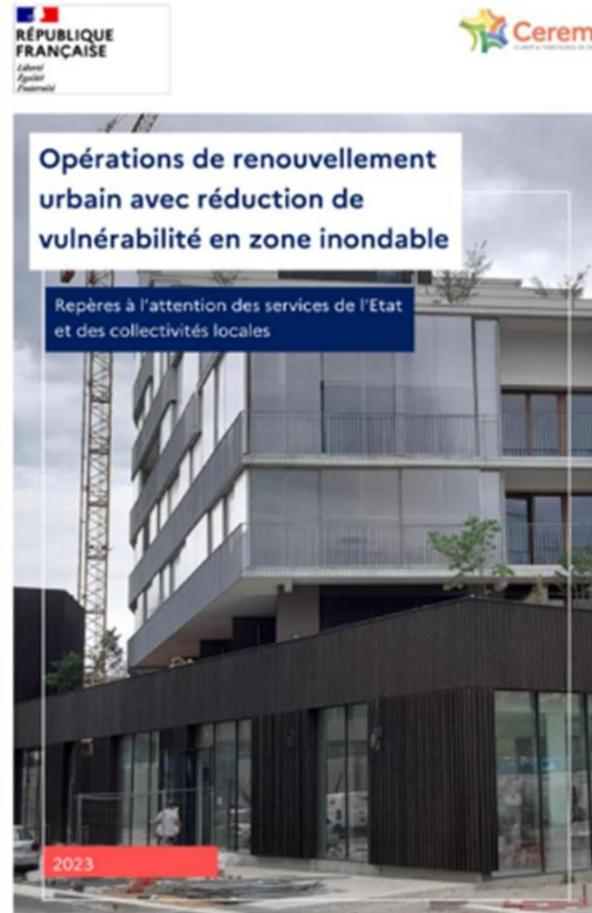


WATER, A PRECIOUS COMMODITY AND A RISK

Opérations de renouvellement urbain avec réduction de vulnérabilité en zone inondable

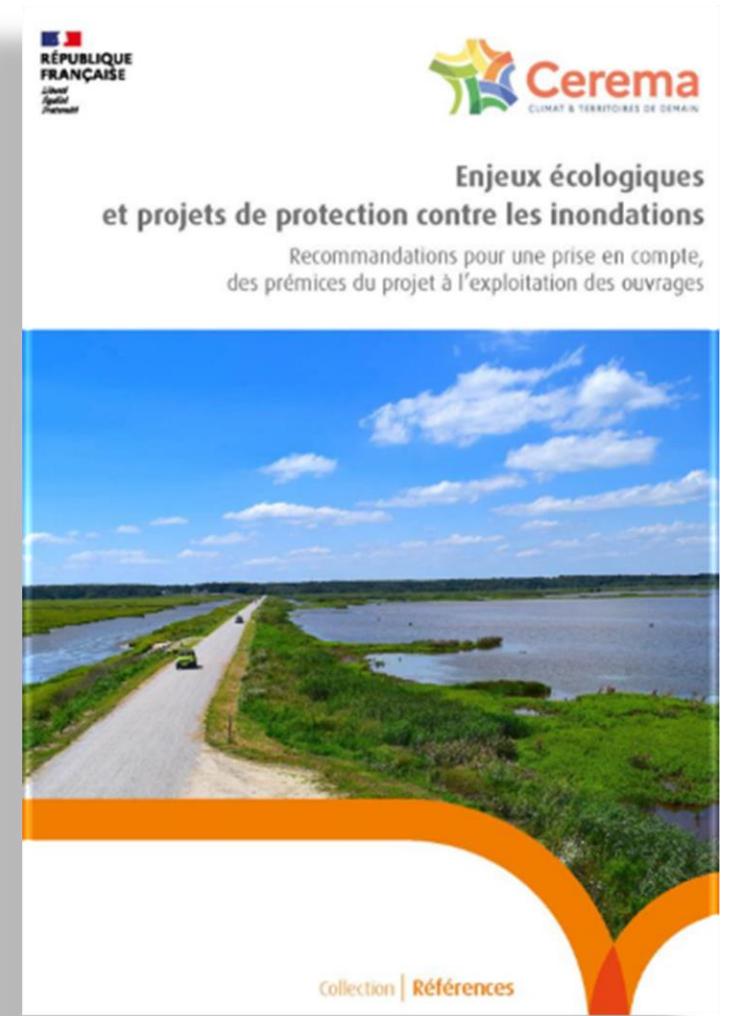
Repères à l'attention des services de l'Etat et des collectivités locales

2023

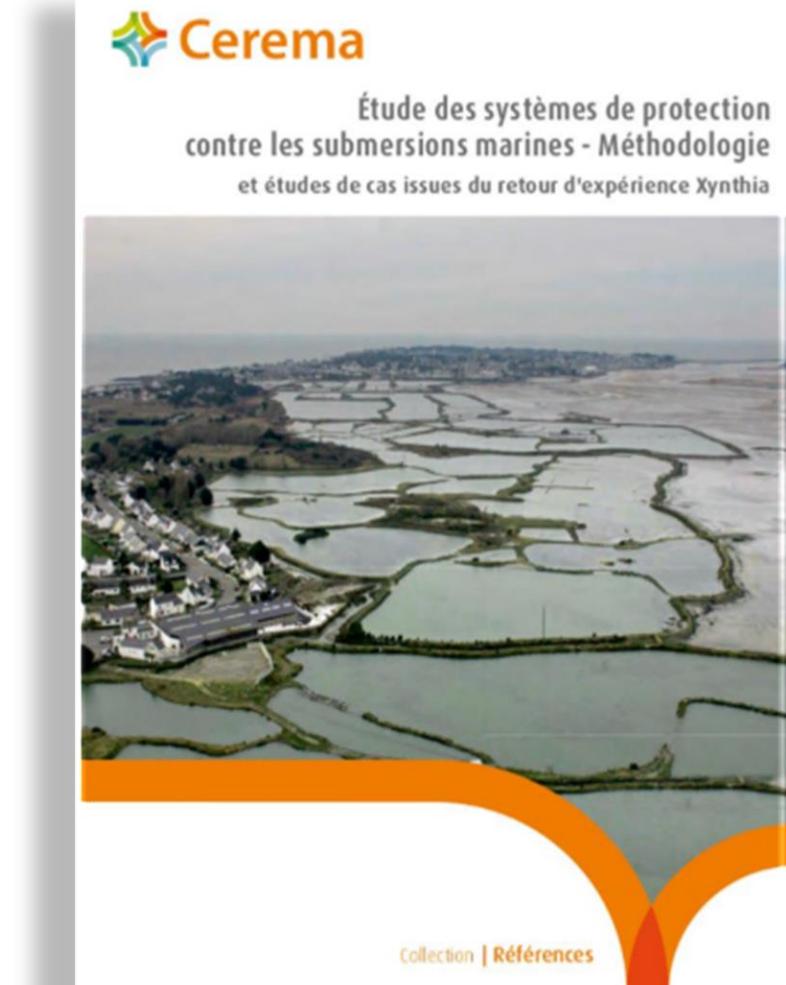


Enjeux écologiques et projets de protection contre les inondations

Recommandations pour une prise en compte, des prémices du projet à l'exploitation des ouvrages



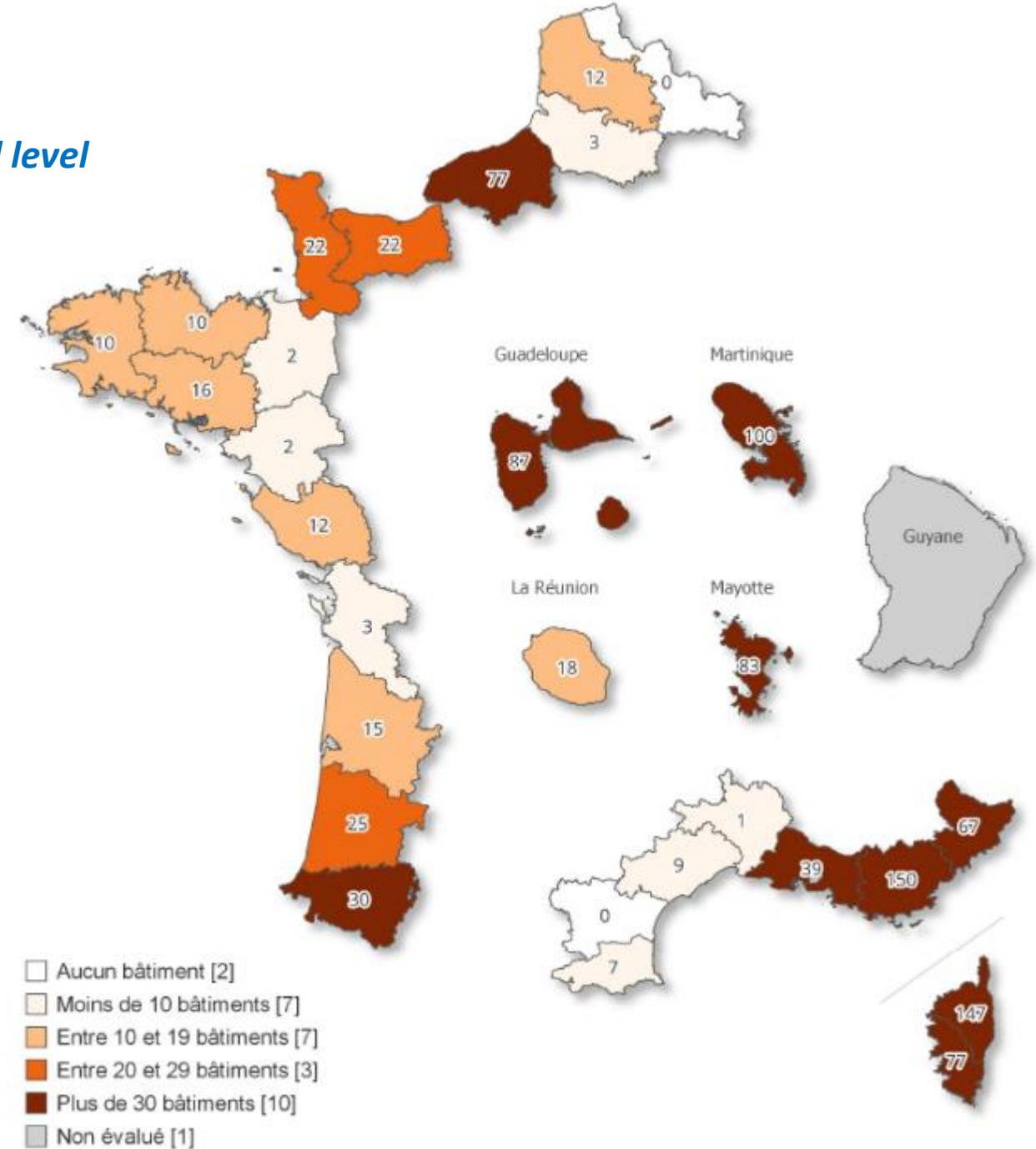
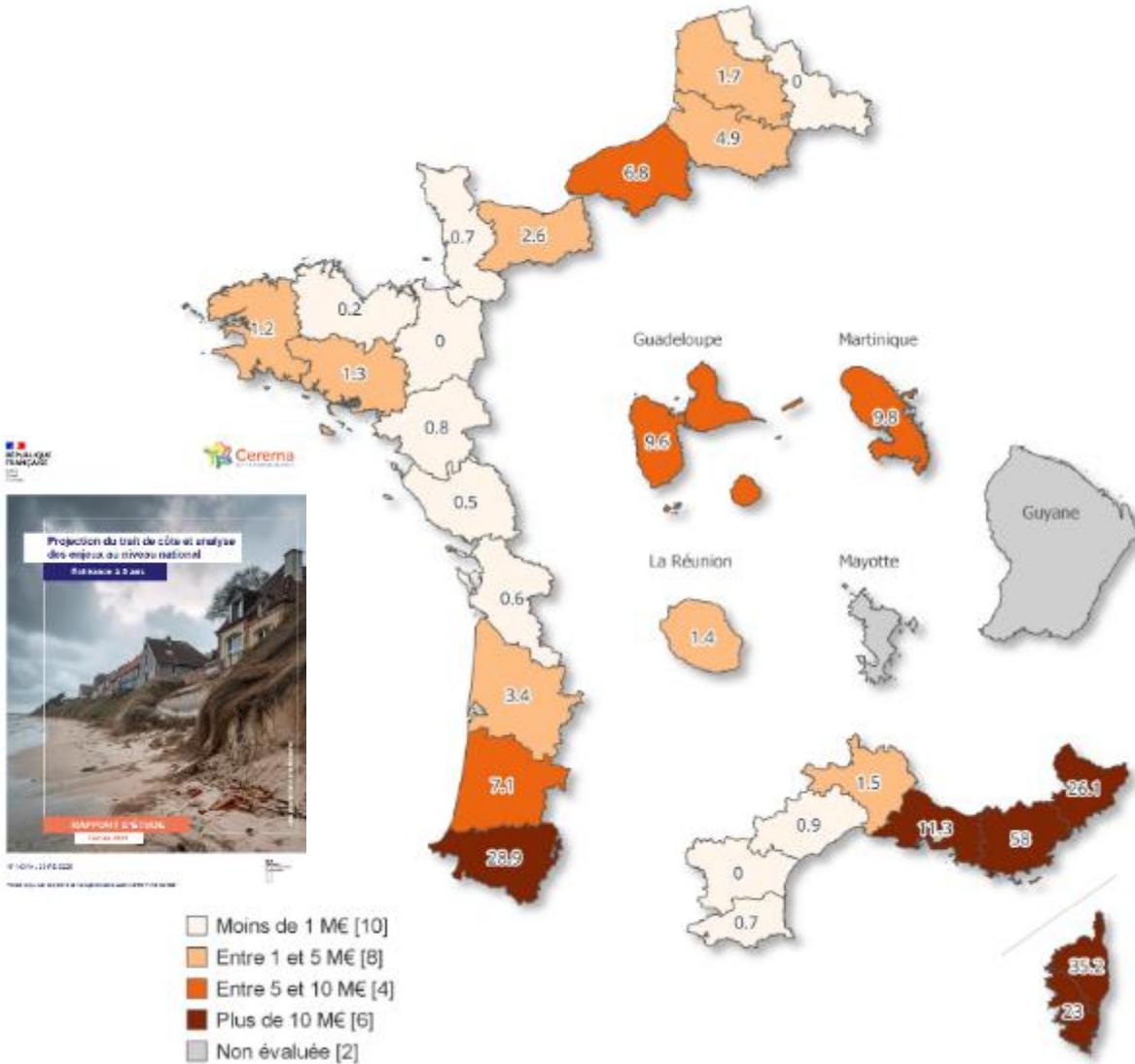
Étude des systèmes de protection contre les submersions marines - Méthodologie et études de cas issues du retour d'expérience Xynthia



COASTLINE

Coastline projection and analysis of issues at the national level

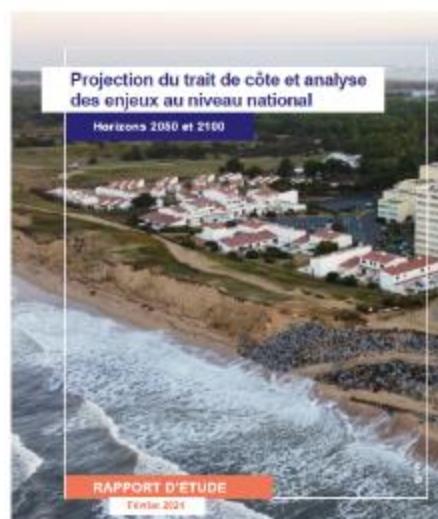
Horizon 2028 - Buildings impacted, in number and value



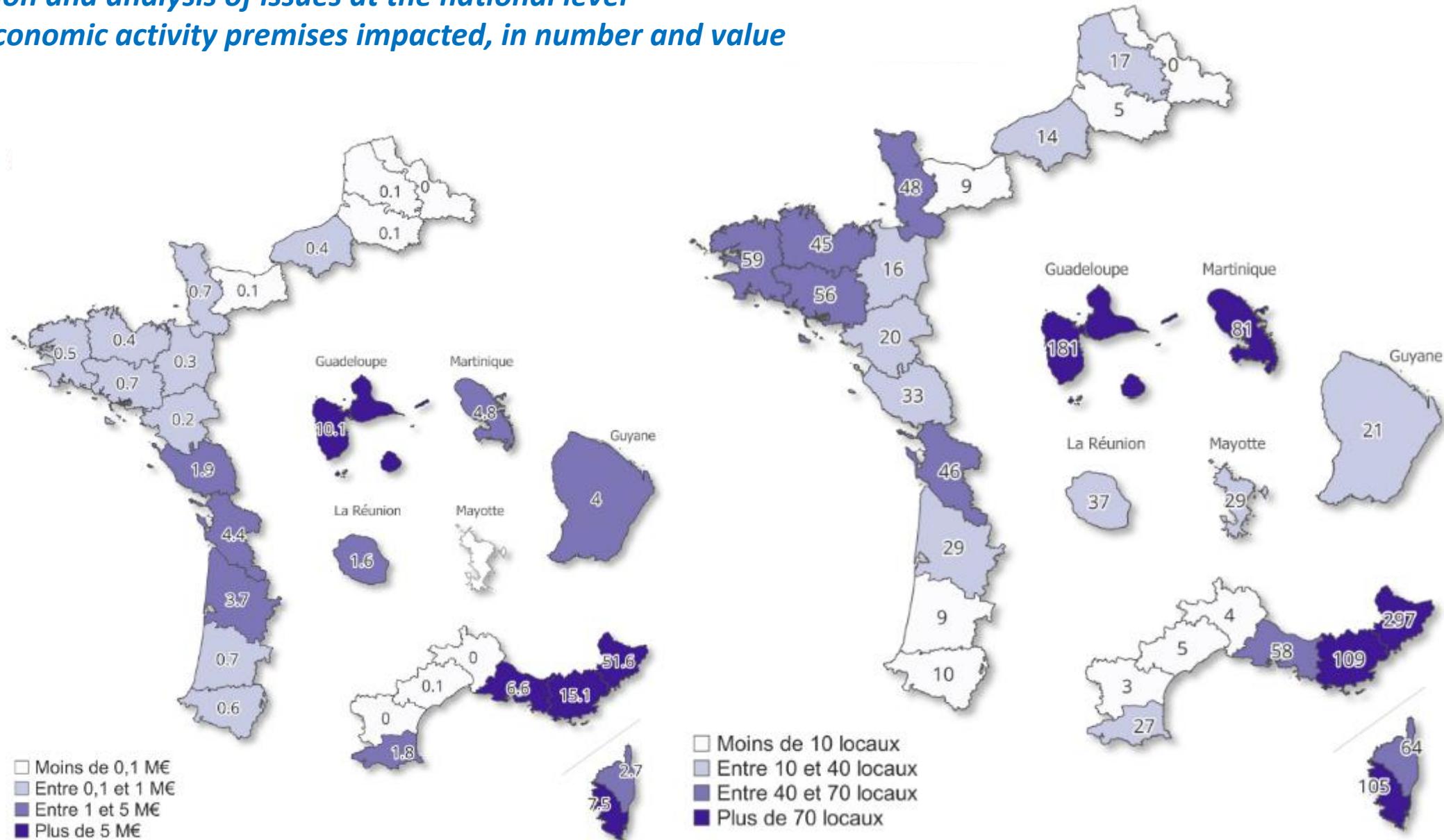
COASTLINE

Coastline projection and analysis of issues at the national level

Horizon 2050 – economic activity premises impacted, in number and value



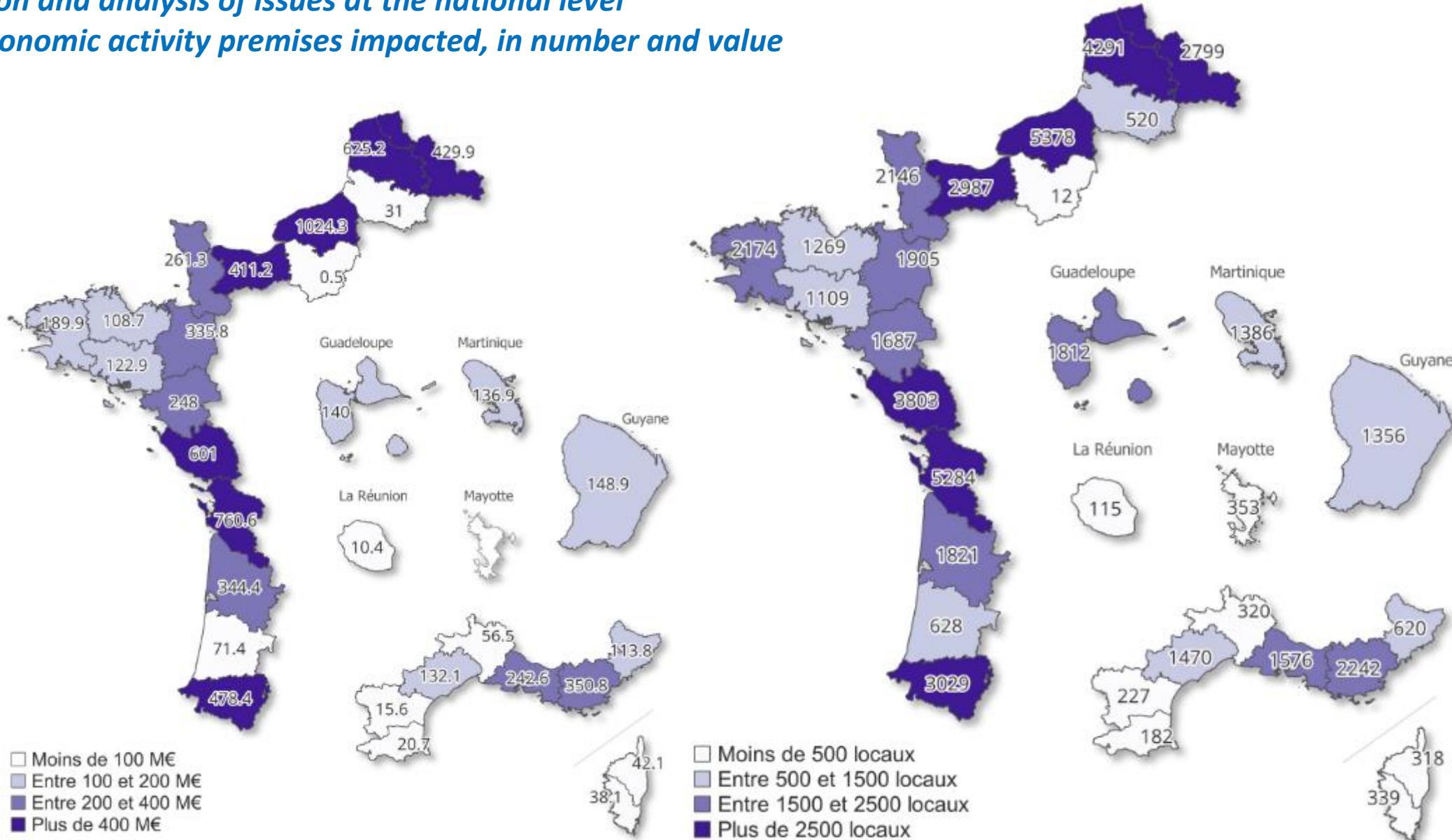
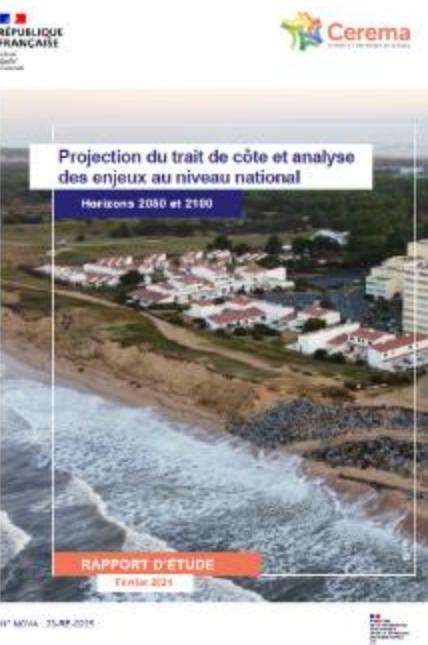
INNOVA - 35 RP 2020
Outil pour la gestion de la sécurité civile



COASTLINE

Coastline projection and analysis of issues at the national level

Horizon 2100 – economic activity premises impacted, in number and value



PROTECTING AND DEVELOPING THE NATURE - ZAN

   **Cerema**
Données pour les territoires

Données Outils Usages Accompagnement Actualités



Présentation des données foncières

Datafoncier, des données complètes pour l'aménagement des territoires

  **Cerema**
CLIMAT & TERRITOIRES DE DEMAIN

Outils de l'aménagement
Centre de ressources

Outils Parcours thématiques Actualités

Accueil > Outils

UrbanVitaliz

20 février 2022

UrbanVitaliz est un service numérique qui vise à faciliter la réhabilitation des friches. Il peut notamment faciliter la reconversion de foncier complexe.



  **Cerema**
CLIMAT & TERRITOIRES DE DEMAIN



 **URBANSIMUL**

Un outil cartographique innovant d'analyse et d'aide à la décision pour accompagner les collectivités

UrbanSIMUL est un outil 100% en ligne, gratuit et collaboratif pour :

  **Cerema**
CLIMAT & TERRITOIRES DE DEMAIN

Que recherchez-vous ? 

Nous contacter Espace adhérents

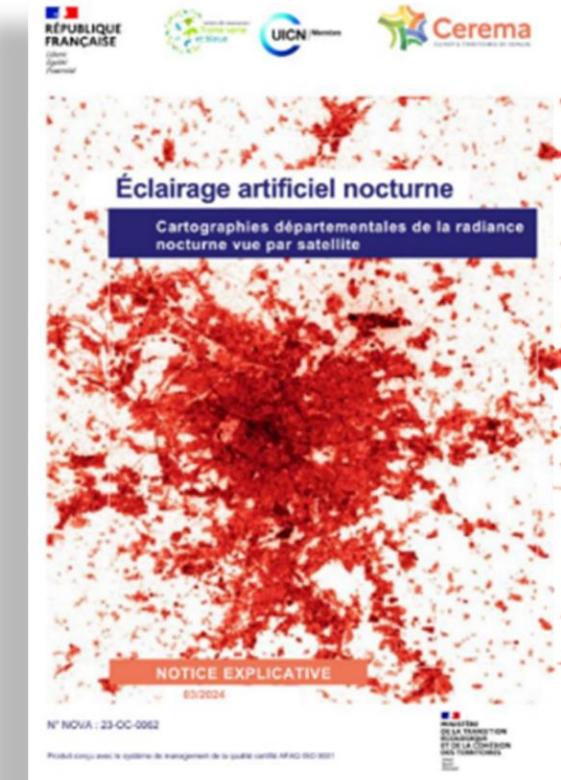
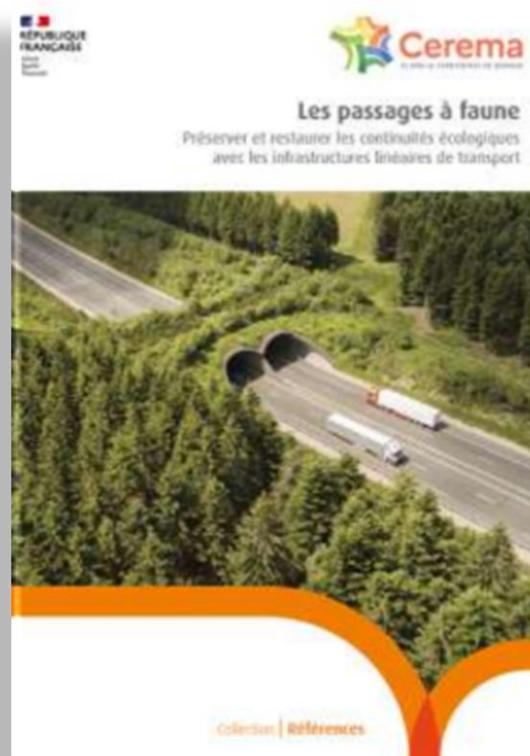
LE CEREMA ACTIVITÉS ET SERVICES COLLECTIVITÉS ET TERRITOIRES RECHERCHE, INNOVATION & INTERNATIONAL NOS RÉSSOURCES LE MAG

Accueil > Actualités > Cartofriches : près de 11.000 sites en friches répertoriés et caractérisés, une nouvelle interface cartographique

DANS LES TERRITOIRES

Cartofriches : près de 11.000 sites en friches répertoriés et caractérisés, une nouvelle interface cartographique

PROTECTING AND DEVELOPING THE NATURE



PROTECTING AND DEVELOPING THE NATURE IN THE CITY

LE CEREMA PROPOSE DES « PARCOURS »
THÉMATIQUES PRÉDÉFINIS
OU LES COMBINE POUR CRÉER
VOTRE PARCOURS PARTICULIER.
EXEMPLES DE PARCOURS
THÉMATIQUES POSSIBLES:



IDENTIFIER
les espaces disponibles et les espèces adaptées au regard des services recherchés (ombrage, rafraîchissement, gestion des eaux pluviales, renaturation des sols, intégration des arbres dans les aménagements et ouvrages urbains).



INTÉGRER
des trames vertes, bleues, turquoises, brunes et noires, désartificialiser et renaturer les sols, gérer les eaux pluviales et sélectionner les espèces d'arbres.



RAFRAÎCHISSEMENT DE LA VILLE

DES ARBRES DANS LA VILLE

VILLE ÉPONGE

BIODIVERSITÉ

VILLE APAISÉE

RÉPERTORIER
les îlots de chaleur et besoins en îlots de fraîcheur, gérer les eaux pluviales, restaurer les sols, végétaliser.



ÉLABORER
une stratégie de désimperméabilisation, gérer les eaux pluviales et restaurer les sols.



PARTAGER
l'espace public entre mobilités douces et espaces végétalisés, concevoir une zone calme paysagée, assurer la gestion de l'eau et mettre en place des cours d'écoles résilientes.

REDUCING OUR CARBON EMISSIONS



Réduire l'impact carbone des bâtiments



Rénovation BBC et exigence du Dispositif Eco Energie Tertiaire



Gérer son patrimoine immobilier



Décrypter la réglementation bâtiments



RECHERCHE & INNOVATION

Solutions d'adaptation des bâtiments au changement climatique

TerraBrenne: les terres ressources pour l'éco-construction et la réhabilitation en Brenne



ÉVÉNEMENTS

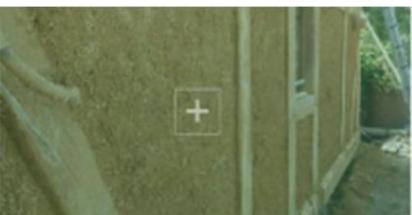
Webinaire RE2020 avec les lauréats de l'AMI "Construire avec les matériaux biosourcés et la terre crue" de la Fédération Bretonne des Filières Biosourcées

→



ÉTUDES & MÉTHODES

Solutions d'adaptation des bâtiments au changement climatique
Mieux connaître les performances acoustiques des matériaux biosourcés afin de promouvoir leur utilisation dans le bâtiment



RECHERCHE & INNOVATION

Economie circulaire du BTP
EcoTerra: Un projet de recherche sur les performances des bétons terre-chanvre



ÉTUDES & MÉTHODES

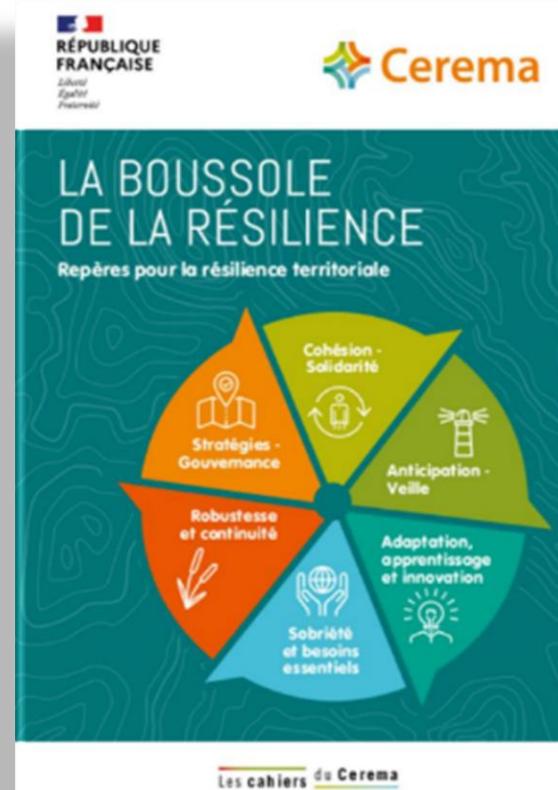
Qualité des environnements intérieurs et ventilation
Le Cerema mesure les performances du béton de chanvre comme isolant dans les Hauts-de France



RECHERCHE & INNOVATION

Gestion de patrimoines immobiliers
Un consortium pour développer l'utilisation des bétons et mortiers végétaux

ADAPTING TO THE EFFECTS OF CLIMATE CHANGE



*Sentier du littoral - Sentiers de nature
Ports de plaisance - Bases nautiques d'avenir*



**TERRITOIRES RÉSILIENTS
AGIR MAINTENANT
POUR TRANSFORMER DEMAIN**



**CLIMAT,
L'URGENCE À S'ADAPTER**

ADAPTING TO THE EFFECTS OF CLIMATE CHANGE

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE
ET DE LA COHÉSION
DES TERRITOIRES
Emmanuel
Macron

Centre de ressources
pour l'adaptation au
changement climatique

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Canicule



Erosion du littoral



Feux de forêt



Inondation



Retrait-gonflement des argiles



Sécheresse



Submersion marine