SCIENTIFIC OUTREACH REPORT

Ammonia in Brittany's Ambient Air Life 2021

Farmers and scientists united to

Reduce Ammonia Emissions from Agriculture & Improve Air Quality

2021 - 2025
An innovative four-year project led by :

air BREIZH Observatoire de la qualité de l'air

CHAMBRE D'AGRICULTURE BRETAGNE

Acknowledgments

The LIFE-dbaa project team thanks all project collaborators: the volunteer farmers, Agricultural Equipment Cooperatives (CUMA) and Agricultural Contracting Companies (ETA) of the pioneer group-keys partners in the project's success, the Regional Federation of CUMA of Brittany for their valuable contribution, the teams at Agaric IG and EMQU Solutions for developing agrivision N'air, and Voyelle for graphic and visual design.

We also thank RMT Bouclage for endorsing the project, and SPACE, COMIFER-GEMAS, CEREMA, Atmos'fair, Pollutec, Asfera, and EU Research for helping us highlight our results.

In collaboration with :

CUMA OUEST LA PUISSANCE DU GROUPE

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BOUCLAGE Recyclage, Fertilisation, Impacts Environnementaux

abaa Life 2021

Project description

Project duration : 01/09/2021 – 31/08/2025

Led by :

Air Breizh – Observatoire de la qualité de l'air

Chambre d'Agriculture Bretagne

Localisation : Brittany France.
20 municipalities between Pays d'Iroise Community and Brest Metropolis make up the project's pilot area (see p.5).

Budget : €2,666,260

Funding:

- **LIFE-EU program**
- **Region of Brittany**
- **French Ministry of Ecological Transition**
- **Britanny Regional Agricultural and Rural Development Programme**
- **Brittany Regional Health and Environment Plan**
- **Self-funding : Air Breizh and Brittany Chamber of Agriculture**

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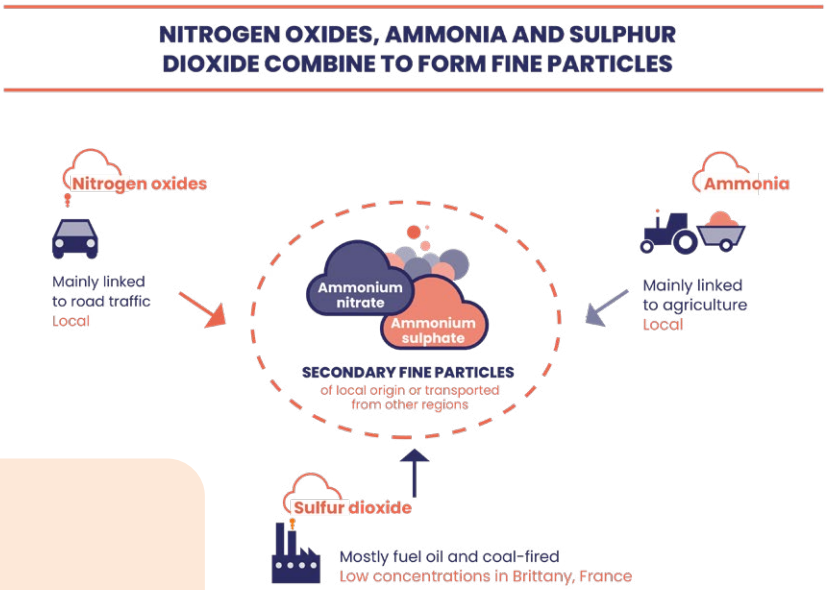
Reducing Ammonia Emissions : A Challenge for Air Quality

Air pollution from fine particles is a public health issue. These particles come from natural sources (pollen, sea salt, wildfires...) and human activities (heating, transport, industry, agriculture). Agriculture, being essential to food production, is also part of the solution to improve air quality-especially by reducing ammonia emissions. Ammonia is mostly released by agricultural activities (94% in France). Though not toxic in ambient air, it is a precursor of fine particles. France aims to reduce ammonia emissions by 13% between 2005 and 2030. These emissions also represent a nitrogen loss -vital for plant growth- and impact biodiversity, especially sensitive species like lichens and mosses. Brittany is particularly affected, contributing 18% of national ammonia emissions. The abaa project, launched in 2021 by the Chamber of Agriculture and Air Breizh, aims to tackle this issue by combining farmers' and scientific efforts. The project's innovative results will be shared nationally and across Europe.

What is ammonia?
What is its connection to fine particles?

Ammonia, a gaseous compound containing nitrogen, is **mainly emitted in agriculture**, regardless of the type of livestock farming, including organic farming. Nitrogen input from manure, slurry, or mineral fertilizers, is essential for plant growth. Fine particles known as secondary particles can form through chemical reactions in the atmosphere between ammonia and nitrogen oxides, mainly linked to road traffic, or sulfur dioxide from industrial sources.



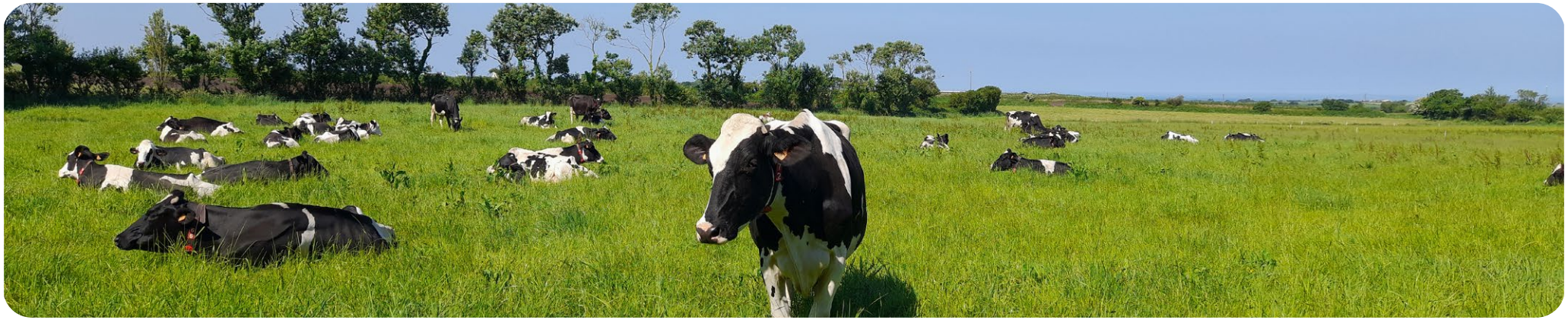
The objectives of the ABAA project

- Study and improve methods to estimate ammonia emissions and forecasting ammonia concentrations in the air
- Develop methods and tools for farmers and their advisors, in collaboration with a group of pioneering farmers in a pilot area in Brittany (between Pays d'Iroise Community and Brest Metropolis) to better utilize manure and slurry while reducing ammonia emissions
- Implement these methods in Brittany and across France and even Europe
- Share knowledge within networks of experts (livestock farming, agronomy and air quality)

The ABAA project pilot area

The pilot area covers around 20 municipalities between Pays d'Iroise Community and Brest Metropolis. It is home to a variety of livestock farms and manure spreading methods, as elsewhere in Brittany. It is also an area where ammonia emissions are higher than somewhere else.

This area was chosen for the project because the farmers there have shown a real ambition to reduce ammonia emissions in order to reduce their impact on the environment and improve the fertilization of their crops and their livestock farming practices. Their voluntary commitment and collective momentum were essential to the implementation of the planned actions.



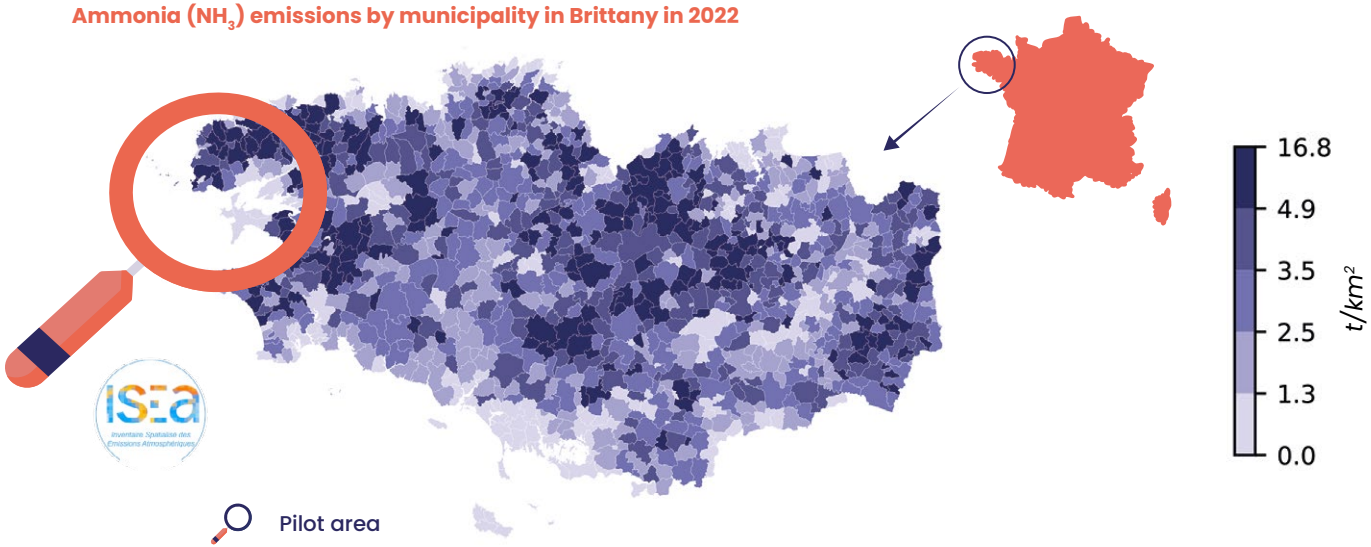
To know

- 11%

Between 2008 and 2022, ammonia emissions have decreased by 11% in Brittany.

Source: Air Breizh, ISEA v6.1, 2022

Ammonia (NH_3) emissions by municipality in Brittany in 2022



1

A pioneering group of farmers, CUMA and ETA at the heart of the project

First action: diagnosis of ammonia emissions on farms

A group of 21 farmers, 7 CUMA* and 2 ETA was formed in the pilot area to work on reducing ammonia emissions both individually and collectively. Recruitment was carried out in two stages. Initially, farmers in the sector spontaneously expressed their interest in the project. In the second stage, other volunteer farmers were recruited with the aim of ensuring proximity to the plots involved in order to facilitate the tasks (measurements, organization of spreading, etc.). The first field action of the project was to assess the ammonia emissions of each farm in the group.**

The objective is twofold: to estimate ammonia emissions on the farms of the pioneer group at the start of the project and to identify reduction levers that have not yet been implemented or that can be improved.

** Coopératives d'Utilisation du Matériel Agricole / Agricultural Equipment Cooperatives – structures created by farmers to purchase equipment jointly, such as spreading equipment*

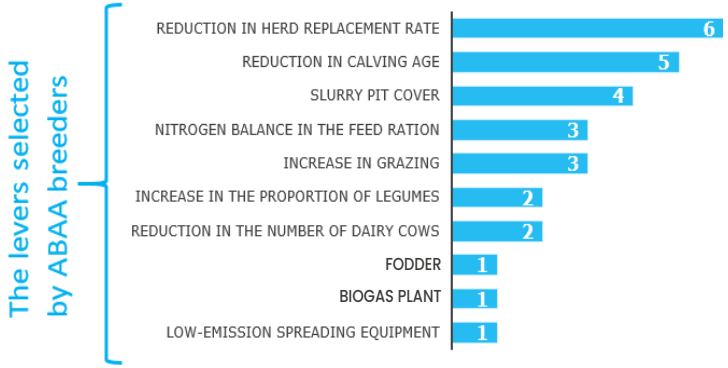
*** Entreprises de Travaux Agricoles / Agricultural Contracting Companies – structures to which farmers delegate certain tasks, such as certain types of spreading*

This estimate of ammonia emissions at the farm level was made using environmental diagnostic tools developed by technical institutes specializing in cattle and pig farming (CAP'2ER® and GEEP®, respectively) and the mobile app agrivision N'air developed in the frame of the cbaa project (see page 23). Based on the results of their ammonia emissions assessment and the context of their farm, each breeder in the group chose to implement one or more levers.

Based on all the diagnosis of ammonia emissions from farms, two strategies have been identified to reduce emissions:

- **Reduce nitrogen inputs** (balance animal feed, increase grazing, adjust fertilization to crop needs, etc.).
- **Reduce nitrogen losses to the air** (cover slurry pits, use low-emission equipment, manage ventilation in livestock buildings, reduce the number of animals that do not produce meat or milk, etc.).

Levers identified to reduce ammonia emissions on the group's dairy farms and number of farms that have applied them



To keep in mind

- The individual approach makes it possible to identify personalized strategies for reducing emissions.
- The levers identified with the group's dairy farms have enabled, on average per farm, a reduction of nearly 12% in ammonia emissions compared to the initial diagnosis.

3 main levers for reducing emissions identified with farms

Based on each farm's action plans, three levers that had not yet been tested by the farms were identified as priorities and feasible (see graph on page 8). Working groups were then formed to collaborate on the application of these levers.

Optimizing herd nutrition

Why ?

Limit consumption of imported feed concentrate.

How ?

Better understand the nutritional value of fodder and adjust rations to the needs of cattle.

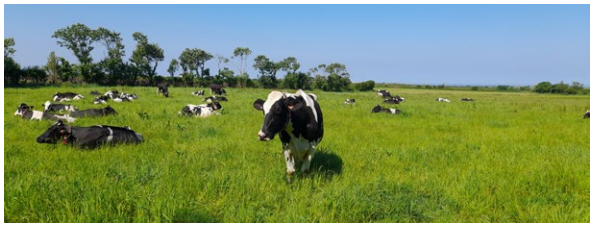
Increase grazing time

Why ?

Lower emissions in pastures than in buildings because:

- Grass limits ammonia volatilization.
- There is less handling of manure and slurry.
- Cow urine and feces are less mixed in the meadow, so ammonia emissions are lower in pastures than in buildings.

Reduce the number of animals that do not produce milk (heifers, cull cows, etc.).



Why ?

Reduce the amount of manure and slurry to be managed on the farm.

How ?

Reducing the age at calving, reducing herd replacement rates...

Group meeting on December 6, 2024, in Plouarzel: results of applying levers to cattle and pig farms, technical input on pit covers, and visit to a farm with a floating pit cover and biogas recovery.

To keep in mind

The individual action plans identified following the farm assessments highlighted common levers, despite the diversity of the systems studied. This result led to the establishment of working groups between farmers to act more effectively on the implementation of these levers.

The strength of the collective to facilitate the implementation of levers for progress

3 to 4 workshop days were organized each year on various topics:

- Identification of easily achievable **solutions** and gaps to be filled in order to facilitate the implementation of levers.
- **Workshops** on technical solutions (livestock management, agronomy, joint organization of spreading, etc.).
- **Visits** to farms and equipment manufacturers...

Group meeting on June 2, 2025, in Plouarzel: results of measurements from the three stations in the area (see pages 12-13-14) and preparation of an open day at one of the group's farmers to present the project results to other farmers in the area.

Examples of farmers' expectations	Examples of proposed actions
Learn more about the impact of choosing low-emission spreading equipment on crop yields (see page 22)	Establishment of experimental platforms for spreading manure on corn, rapeseed, and grassland (small test plots)
Obtain new references on certain practices for managing manure and slurry in cattle farming	Measurements of ammonia in the air for different scraping frequencies in cattle buildings and when stirring manure in the pit before spreading
Optimizing herd management to reduce ammonia emissions	Establishment of working groups among milk producers on feeding, increasing grazing, and reducing the number of animals that do not produce milk (see page 9) Individual monitoring of each farm by an advisor from the Chamber of Agriculture
Optimizing the organization of joint spreading operations	Advice provided by the coordinators of the CUMA Ouest network

To keep in mind

Discussions, experiments, technical workshops, and training sessions enabled the farmers in the group to learn about emission reduction measures so that they could implement them as easily as possible and adapt them to their specific constraints.

2

Measuring to understand : a network of ammonia measurements across the pilot area

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A network of measures to improve knowledge

To address air quality issues in the Brittany region, Air Breizh measures various pollutants using its monitoring network consisting of 15 permanent measuring stations spread across the region. In parallel with this monitoring network, a local and temporary system for measuring ammonia and fine particles was deployed for one year in the pilot area.

This temporary network of ammonia measurements was set up to:

- **better understand the behavior of ammonia in the atmosphere:** dispersion, variability in time and space of its concentration (mass per m^3 of air),
- **better understand the contribution of ammonia to the formation of fine particles:** chemical reactions between ammonia and other gaseous compounds in the atmosphere that form ammonium nitrate.

	Site	Characteristics	Measures
	K Kergoff (22)	Perennial (since 2019) Air Breizh network station in the countryside	Ammonia (NH_3) Fine particules (PM10), weather and other regulated pollutants
ABAA pilot area sites	N North Site	Temporary (2023-2024) On a farm from the pioneering group: dairy cattle, crops including vegetables	Ammonia (NH_3) Fine particules (PM10), Chemical composition of particules, weather
	O West Site	Temporary (2023-2024) On a farm from the pioneering group: dairy cattle and grasslands	Ammonia (NH_3) Fine particules(PM10)
	S South Site	Temporary (2023-2024) On a farm from the pioneer group: broiler chickens and a manure composting station	Ammonia (NH_3) Fine particules (PM10)

Measurement device deployed between spring 2023 and spring 2024 on three farms in the pilot area alongside the permanent Kergoff station:

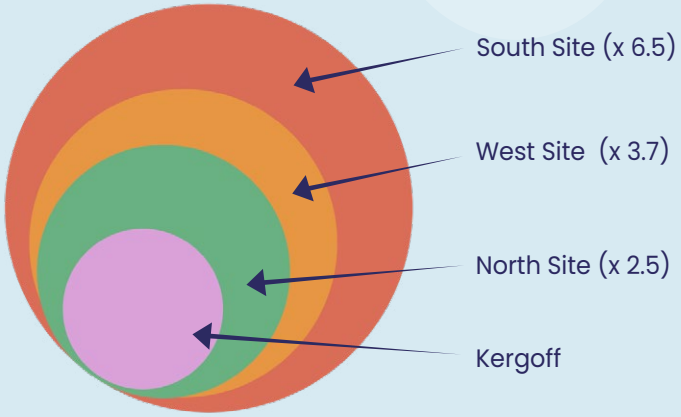
Example of a mobile station for measuring ammonia and PM10 fine particles, installed on the South site.

The chemical composition of the particles :

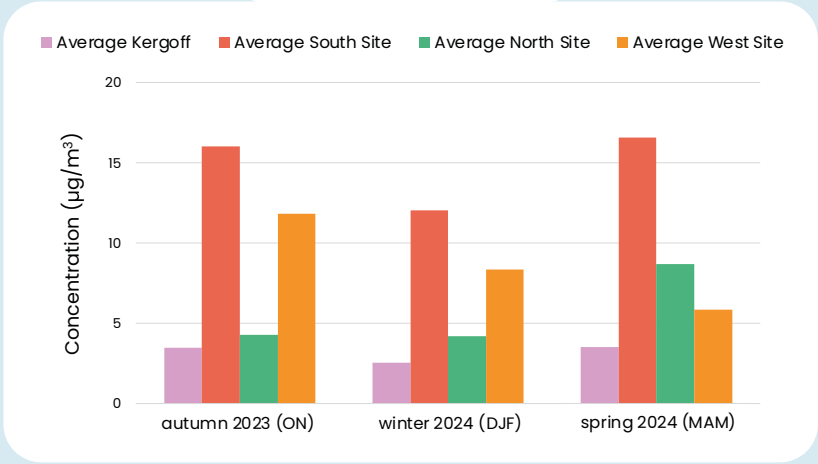
- provides information on the origin of the particles (sea salt, agriculture, heating, road traffic, etc.),
- allows us to understand the contribution of ammonia: its reaction with other gases in the atmosphere forms ammonium nitrate.

Key results of measurements of ammonia concentrations

Comparison of daily maximum ammonia concentrations between the Kergoff site and the three sites in the pilot area (from September 26, 2023, to June 5, 2024)



Seasonal ammonia concentrations at the three sites in the pilot area and in Kergoff (October 1, 2023 to May 31, 2024)



Summary of results on ammonia concentrations

- Higher concentrations are measured at the three sites in the pilot area than at the rural station in Kergoff. Unlike the Kergoff station, these temporary measurement points are located directly in farmyards, where there are multiple sources of ammonia nearby.
- Seasonal variation is observed: agricultural activities and weather conditions favorable to ammonia formation (volatilization) depend on the seasons.
- Variability between sites is associated with the specific characteristics of farms and their immediate environment:
  - North Site: influence of slurry and manure spreading on corn in the spring and uncovered slurry pits,
  - West Site: influence of spreading manure and slurry on grassland in autumn and winter,
  - South Site: presence of a poultry farm and a composting station, leading to the highest concentrations in the area. These values are not toxic to health, but there is an impact on vegetation.

To keep in mind

- Ammonia concentrations depend on the type of site (urban, rural, agricultural, etc.).
- Ammonia concentrations vary between agricultural sites depending on the activities of the farm and other activities in the surrounding area.

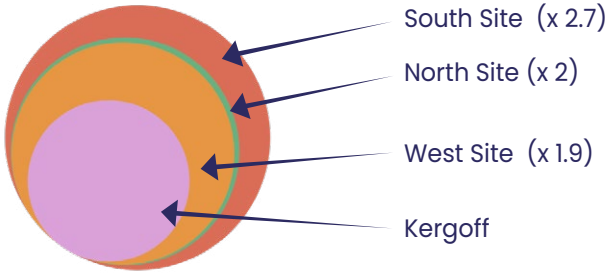
Key results of measurements of PM10 (fine particulate matter) concentrations

PM10 are particles with a diameter of less than 10 µm.

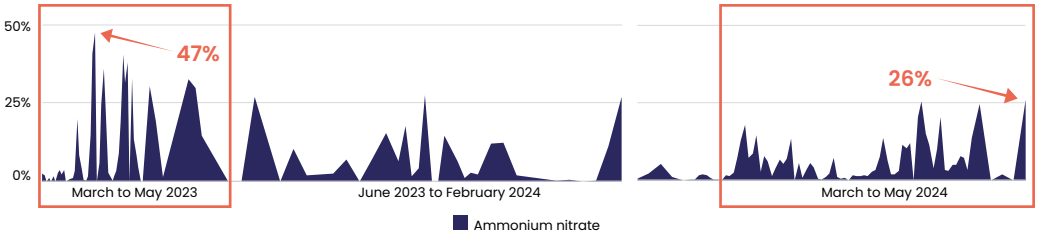
The project has found:

- **relatively similar concentrations between the four measurement sites due to a variety of PM10 sources (sea salt, soil cultivation in fields, heating, road traffic, etc.),**
- **lower concentrations at the rural Kergoff station: this site, in central Brittany, is less affected by sea salt particles,**
- **slightly higher concentrations at the southern site than those measured at the other sites, probably due to local activities such as the composting plant or poultry house.**

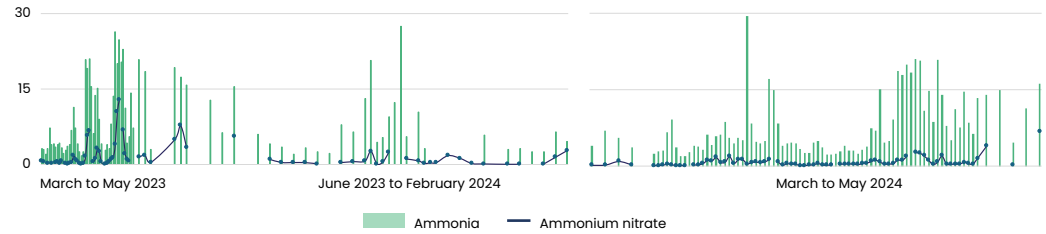
Comparison of daily average concentrations of PM10 fine particles between the Kergoff site and the three sites in the pilot area (from September 26, 2023, to June 5, 2024)



Percentage of ammonium nitrate measured in PM10 fine particles at the northern site



Ammonia and ammonium nitrate concentrations measured at the northern site (in µg/m³)



Ammonia contributes to the formation of fine ammonium nitrate particles. In spring 2023, up to 47% of PM10 particles are ammonium nitrate particles:

- accordance with the spreading period,
- in connection with weather conditions favourable to the formation of ammonium nitrate: temperatures below 20°C, high air humidity.

However, the percentage of ammonium nitrate measured is lower in spring 2024 (up to 26%) because weather conditions were less favorable.

However, in general, ammonium nitrate concentrations (in blue) are higher when ammonia concentrations are higher (in green).

To keep in mind

- The concentrations of PM10 fine particles measured at the various sites are consistent due to the diversity of particle sources.
- Ammonium nitrate concentrations follow the same seasonal pattern as ammonia concentrations.

3

Planning for action: gaining a better understanding of emissions and air quality

Study of ammonia emissions inventory in the pilot area

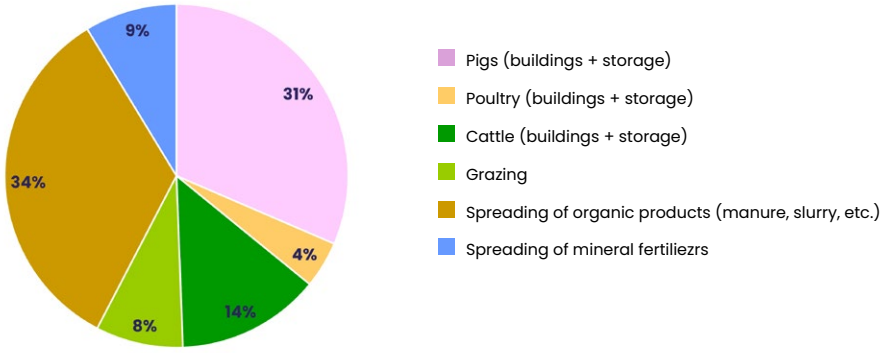
The spatialized inventory of atmospheric emissions (ISEA) is a calculation of annual pollutant emissions into the atmosphere over a geographical area (municipality, region, etc.).

The objectives of a spatial inventory:

- Provide an overview of pollutant emissions to the public and decision-makers.
- Develop, monitor, and evaluate the regulations put in place.
- Contribute to air quality modeling (see page 18),
- Add to the network of air quality monitoring sites to cover the entire territory.

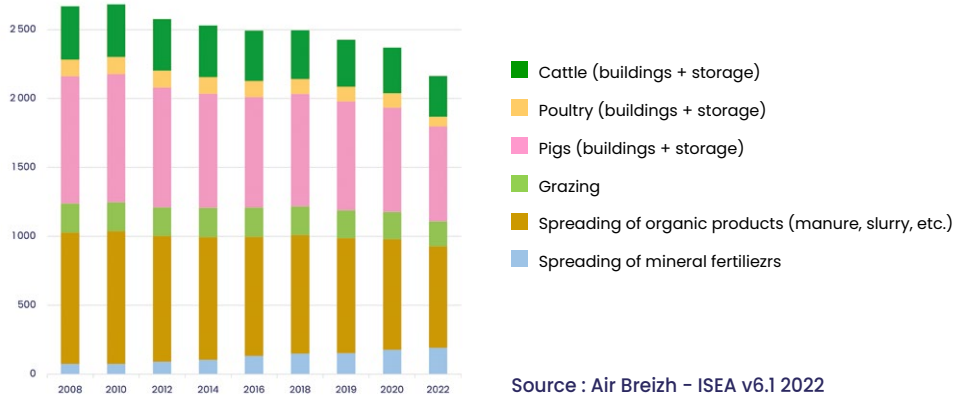
Since 2008, Air Breizh has been calculating the inventory in Brittany every two years for nine sectors of activities and 30 atmospheric pollutants and greenhouse gases.

Origins and distribution of agricultural ammonia emissions in the pilot area in 2022



Source : Air Breizh - ISEA v6.1 2022

Changes in the distribution of ammonia emissions across the pilot area (in tons)



Source : Air Breizh - ISEA v6.1 2022

To keep in mind

Emissions in the pilot area, as in the Brittany region, remained stable until 2018 and then fell sharply: in the pilot area, there was a 18% reduction between 2008 and 2022 (Source: Air Breizh, ISEA v6.1, 2022).

More accurate data to improve emissions inventory (NH_3)

Some spreading equipments can reduce ammonia emissions in the field, for example by burying slurry directly in the soil (see page 21). In the national methodology for calculating emissions, a theoretical distribution of spreading according to equipment is taken into account, due to a lack of available data. As part of the cbaa project, a survey of spreading equipment used by seven CUMA was carried out in the pilot area.
Ammonia emissions were recalculated taking into account the results of these surveys, i.e. the type of spreading equipment actually used in this area. This confirmed the impact of spreading equipment on ammonia emission calculations. The survey also provided more detailed information on the spreading equipment used, as there is very little data available on this subject.

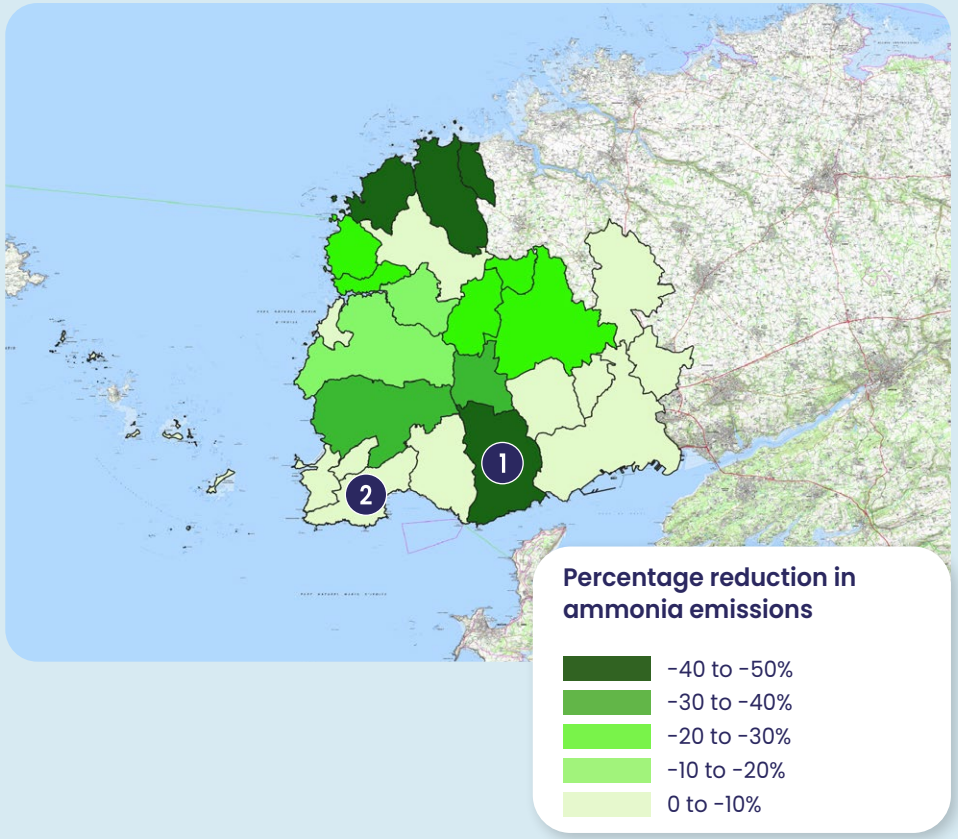
On this map, the darker green a municipality is colored, the greater is the reduction in ammonia emissions, taking into account the spreading equipment actually used by the CUMA (cooperative for the use of agricultural equipment) in the pilot area compared to the theoretical distribution of equipment.

1. In the municipality of Plouzané, a 40-50% reduction in ammonia emissions has been observed by providing information on the spreading equipment used by the CUMA rather than the theoretical distribution.
2. However, in Plougonvelin, a reduction of only 0 to 10% is observed when entering the spreading equipment used by the CUMA rather than the theoretical distribution. The theoretical distribution is therefore certainly fairly close to what the CUMA uses in this municipality, but the theoretical distribution could be refined in the municipality of Plouzané.

To keep in mind

- In the pilot area, taking into account the spreading equipment actually used by the CUMA reduces the ammonia emissions calculated in the inventory.
- To further refine the results obtained, data on ETA spreading equipment will be taken into account in a future project (CREAA project funded by ADEME).

Percentage reduction in ammonia emissions by municipality, based on the spreading equipment used in the pilot area compared to the theoretical distribution of equipment used (2020)



Improvements in simulations of ammonia in the atmosphere

Modeling is a complex calculation system that takes into account scientific knowledge about the behavior of chemical compounds in the atmosphere, depending on meteorological conditions (air mass movement, temperature, humidity, etc.).

Modeling therefore makes it possible to simulate air quality at any point within a given territory. Models are complementary tools to measurements and calculations of pollutant emission inventories, enabling the estimation of concentrations of various pollutants at any point within a given geographical area, for past, present, or future periods.

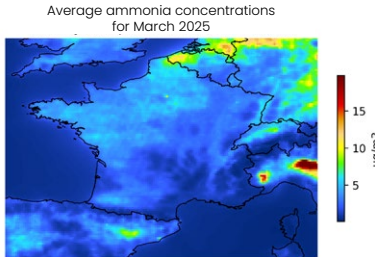
The simulations carried out by these tools provide a **better understanding of local pollution phenomena,** in particular:

- predict air quality and anticipate pollution episodes,
- calculate chronic or instantaneous exposure of populations,
- project the distribution of pollutants in the future based on regulatory changes.

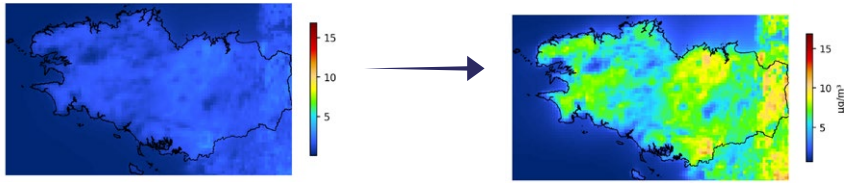
The measurements taken in the field are used to "validate" the calculations made by modeling. As part of the cbaa project, they were used to evaluate the performance of the models available in Brittany.

They have also been used to correct a model by integrating data into the model.

Example of the Copernicus ensemble model



Example of results obtained as part of the cbaa project
Correction of the ESMERALDA model using ammonia concentration measurement data from Air Breizh (March 2023)



Ammonia concentrations BEFORE correction

Ammonia concentrations AFTER correction

To keep in mind

- Modeling makes it possible to estimate concentrations at any point within the territory and over a shorter or longer period of time.
- The accuracy of these calculations varies greatly from model to model and is assessed by comparing them to measurements.
- The measurements can also be used to correct modeling data. As part of the project, ammonia measurements deployed in Brittany have reduced the underestimation of ammonia concentrations simulated by the model. This work is continuing as part of the CREAA project funded by ADEME.

4

Making the most of manure and slurry: less ammonia, more efficiency

A new tool for evaluating the effectiveness of spreading equipment

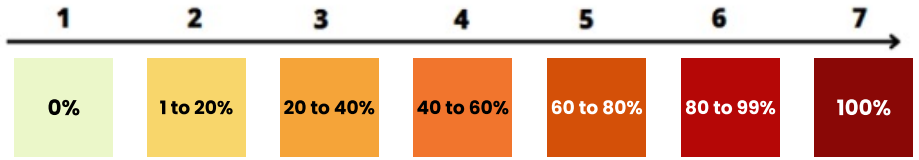
To better understand the effectiveness of different slurry spreading equipment in reducing ammonia emissions depending on their context of use, a new tool was created as part of the project: the frame method. The contact surface between the air and the slurry is one of the factors that promotes the volatilization of ammonia into the air. The type of equipment used for spreading has an impact on this factor, but the conditions under which this equipment is used also play a role. Manure spreading equipment is divided into three main categories (nozzles, trailing hose applicator, injectors), and the protocol developed aims to evaluate their effectiveness within each category more precisely according to the conditions of use.

The frame method: a barometer of the risk of ammonia emissions during a spreading operation

- **General principle:** quantify the percentage of soil surface covered by slurry after spreading.
- **Method:** there are frames available, each consisting of 25 squares measuring 10 x 10 cm.

- During spreading, the percentage of the soil surface covered by slurry is noted for each of the 40 frames arranged on the fertilized plot.
- The 1,000 scores (25 boxes x 40 frames) are averaged to give an overall score for the spreading site.
- The spreading conditions are described in detail: equipment, tractor, physical condition of the soil, condition of the crop, weather conditions, etc.

Rating of the percentage of soil surface covered by manure according to 7 classes ranging from 0% to 100%, rated by numbers from 1 to 7.

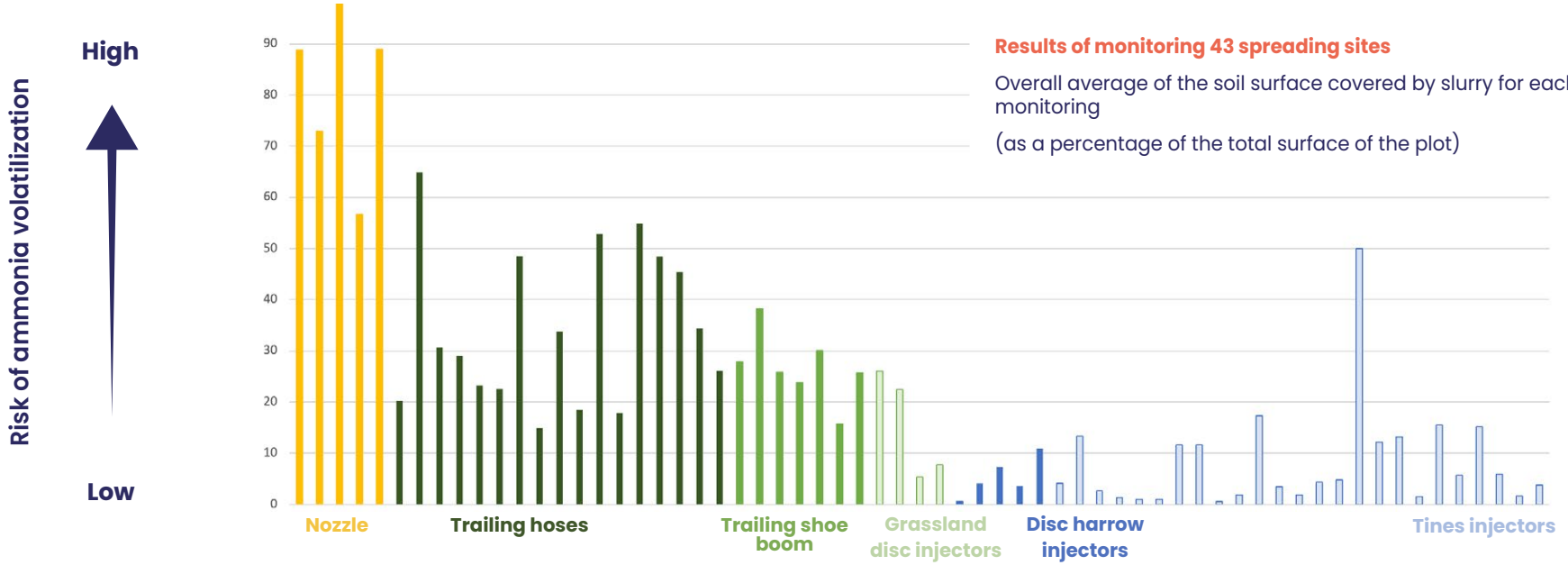


Frame used to record the percentage of soil surface covered by slurry and example of scoring. Slurry is visible as brown patches on the grass.

Reading the notes: In the first box at the top left, between 1 and 20% of the soil is covered by manure. In the second box to its right, between 40 and 60% of the soil is covered by manure. Etc.

A more refined approach to the efficiency of spreading equipment

The framework method developed as part of the project confirmed the effectiveness of certain low-emission spreading equipment. Forty-three spreading sites were analyzed using this method.



Schematic representation of the mechanism for spreading slurry using the equipment in question. Source: Joskin

To keep in mind

- Results consistent with scientific references that validate the method: the risk of volatilization is higher when spreading with a nozzle than when spreading with trailing hoses or with tine and disc injectors.
- Significant variations are sometimes observed for the same spreading equipment: conditions of use have an impact on volatilization. These observations have led to the following recommendations: for example, lower trailing hoses as close to the ground as possible, do not spread on water-saturated soil, and check that the tractor's power is adequate for the spreading equipment.

A toolkit for farm advisors

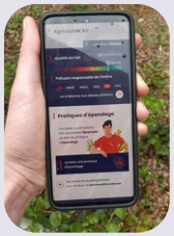
Four tools were created and/or evaluated during the project and constitute a set of useful tools available to advisors to help farmers reduce ammonia emissions. The figures below show their use and results for the same comparison of spreading tools (the same spreading with three different tools on the same plot).

Four tools available to advisors to measure the risk of volatilization.

Dräger tubes

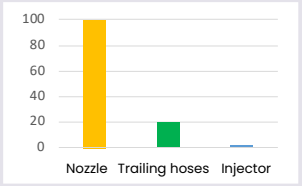
A quick and visual tool (blue <=> ammonia).

The mobile app agrivision N'air



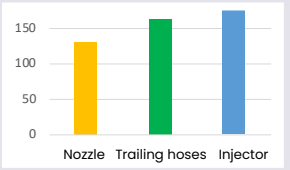
A calculation of the quantities of ammonia emitted into the air.

The frame method



A barometer of the risk of volatilization based on the conditions of use of the spreading equipment.

Laboratory analysis of plant samples



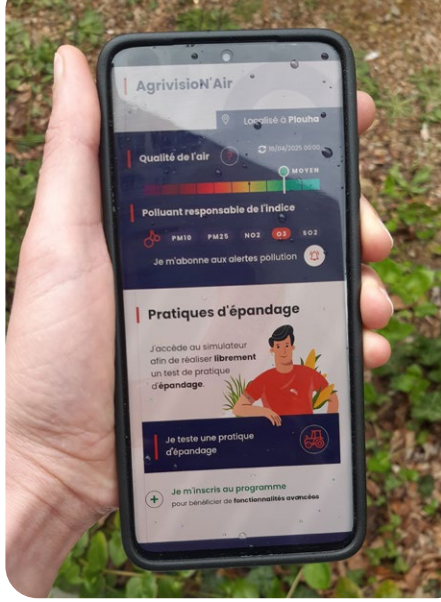
Nitrogen absorbed (kgN/ha)

The biomass produced and the amount of nitrogen absorbed by the plant are measured. Nitrogen that has not volatilized has been used by the plant and has an impact on crop yield and quality.

To keep in mind

The four tools created and/or evaluated in cbaa are consistent with each other. They all provide information on the risk of volatilization with different levels of accuracy and constraints on use. The diversity of tools allows advisors to choose the most appropriate tool for each situation.

An innovative app for farmers: AgrivisioN'air



A new mobile app has been developed, which has won two national awards: agrivisioN'air
This app is a decision-making tool designed to facilitate consideration of volatilization in the organization of spreading sites. Tested by the pioneer group, the app simulates nitrogen losses linked to ammonia volatilization during spreading, based on the weather forecast for the next three days.

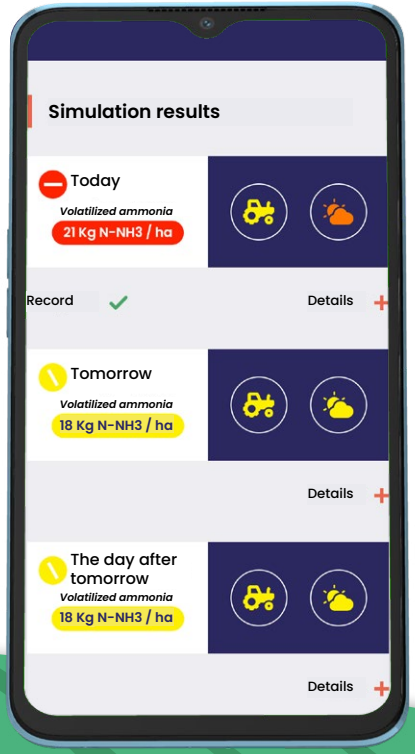
agrivisioN'air

INNOV SPACE 2023

AGRI'VISIONS Semons l'innovation
1er prix « Outil pour les agriculteurs » Trophée des innovations 2024

AgrivisioN'air has won awards in two national competitions

The farmers in the cbaa pioneer group tested the tool and helped to improve it.



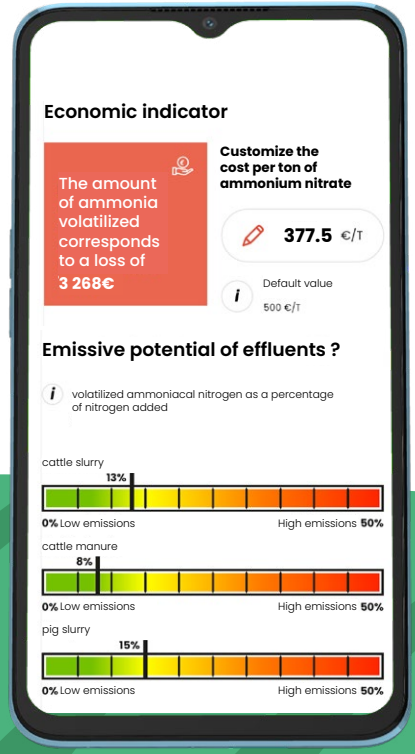
Its features

A three-day forecast of nitrogen loss through volatilization for short-term action:

- Change equipment
- Shortening the incorporation time
- Choosing the best day ...

Personalized and educational summaries of practices implemented during the year to take action in the medium term:

- Investment in equipment
- Strategy for organizing spreading sites
- Managing fertilization at the plot and farm levels...



Train farmers and agricultural advisors

Teaching methods and training materials were developed as part of the dbaa project to enable farmers to learn about and understand the levers for reducing emissions on their farms. They were also designed for advisors to enable them to use the tools for assessing the risks of volatilization during spreading and the methods for supporting farmers.

For farmers:

Educate yourself on the challenges and levers for reducing ammonia volatilization during spreading and develop a personalized action plan.

Goals:

- Understand the issue of air quality and the role of ammonia
- Identify priority levers for reducing emissions and establish an action plan for your farm
- Identify and learn how to use decision-making tools to take action on your farm

For agricultural advisors:

Get trained in the tools and methods for assessing the risks of ammonia volatilization during spreading.

Goals:

- Understand the issue of air quality and the role of ammonia
- Identify and learn how to use assessment tools:
  - on the risks of volatilization during spreading
  - on the effectiveness of spreading equipment in reducing volatilization
- Peer exchange on the adoption of these tools and their use in advising farmers

Demonstration of a disc injector on grassland

Spreading with tine injectors for corn on an experimental platform

Visit to a farm with floating pit cover and biogas recovery

5

Sharing knowledge and perspectives

Active communication to raise awareness of the project and take action

A research project does not stop at experimentations. To ensure that the results benefit as many people as possible and address the challenges of reducing ammonia emissions, various communication initiatives were carried out throughout the cbaa project. These actions aim to bring together new partners, but also to share knowledge, tools, and results with different audiences: farmers, agricultural advisors, air quality and agriculture stakeholders, local authorities, decision-makers, press, etc. Because air quality concerns all of us and education is essential on complex subjects, scientific outreach materials have also been produced for the general public.

More than 10 events organized to reach different audiences

Mid-term seminar on December 15, 2023, in Brest (29) for the project team and partners.

Press conferences on May 30, 2022, in Plouzané (29) and October 12, 2023, in Plouarzel (29).

Air quality and agriculture meetings for scientists and local authorities on December 3, 2024, in Rennes (35).

Booth dedicated to the award-winning AgrivisioN'air app in the Agretic area at Space 2023 show in Rennes (35).

Some communication materials to learn more about the project

- A website dedicated to the project, where you can find all the project materials on reducing ammonia emissions, news, results, videos, questions and answers, etc.
- A concise educational resource entitled "Agriculture and air quality: let's talk about it" in the form of questions and answers
- Project presentation brochure available in French and English
- Regular newsletters

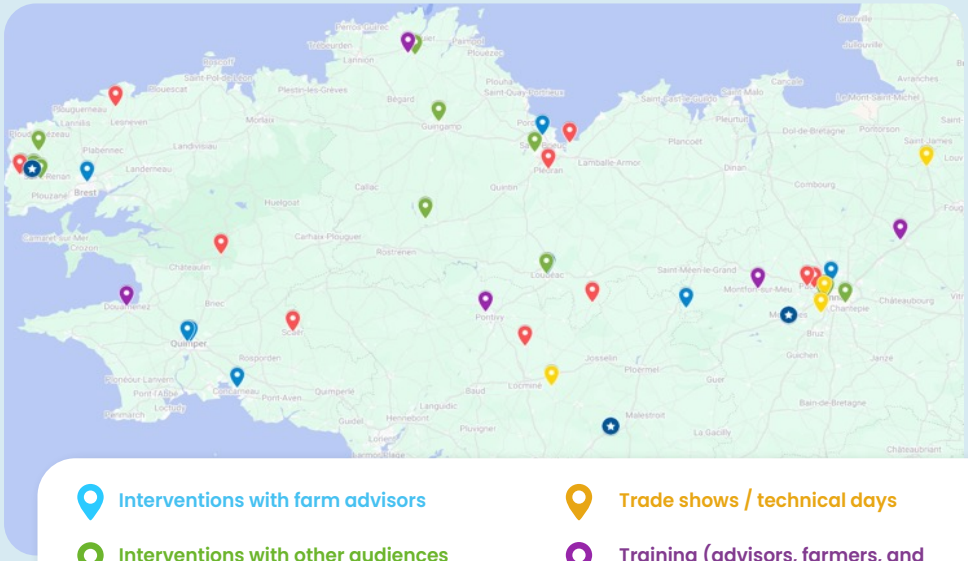
More than 10 presentations at scientific conferences and webinars to share knowledge with various networks of experts in agronomy and air quality.

- RMT Bouclage 2023 et 2024
- COMIFER-GEMAS 2023
- Atmos'fair 2024
- Pollutec 2024
- French Air Technical Days 2023 and 2024
- Congrès Français des Aérosols 2022 et 2025
- Webinars CEREMA 2023 et REPRAN 2024

Expanding the project by transferring tools to other territories

45 transfer actions already carried out in Brittany for farmers and their advisors, and two new ammonia measurement sites:

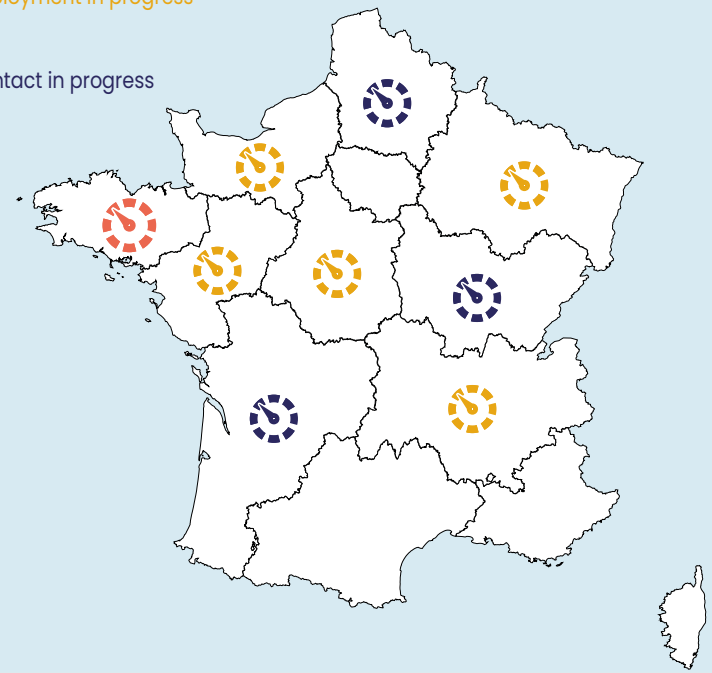
Situation in June 2025



- Interventions with farm advisors
- Interventions with other audiences (local authorities, agricultural high schools, etc.)
- Demonstrations of spreading equipment
- Trade shows / technical days
- Training (advisors, farmers, and future farmers)
- Temporary ammonia measurement stations

Five regions are already implementing the application agrivisioN'air among farmers in 2025 :

- Tool available
- Deployment in progress
- Contact in progress



Demonstration of spreading equipment in Plouarzel (29) in February 2023

To keep in mind

- In 2025, the application agrivisioN'air is being transferred to five French regions.
- Awareness-raising and training initiatives are continuing throughout Brittany.
- Ammonia measures rolled out across the entire Brittany region.

Upcoming result: Life Cycle Assessment of the pilot area

The Life Cycle Assessment (LCA) method is used to evaluate the environmental impacts of a product from cradle to grave. For example: assessing the greenhouse gas emissions of a car, from the extraction of its materials, through its use, to its destruction.

This method has been adapted to assess the environmental impacts of all activities in a given area, for an initial situation and by simulating scenarios for changes in these activities. For example: greenhouse gas emissions in a municipality before and after the introduction of cycle paths, thermal insulation of housing, and reduction in car speeds.

For the dbaa project, this method was implemented across the entire pilot area to assess the impact of changes in agricultural practices on ammonia emissions, as well as other factors such as nitrate leakage into water and greenhouse gas emissions from farms in the area.

The life cycle assessment of the project in the pilot area allows:

- **to estimate the impact of the identified** levers across the entire area,
- **to simulate different scenarios** for changes in practices,
- **to verify that the recommendations made to improve air quality do not adversely affect other environmental issues** such as water quality or climate change.

cbaa Life 2021 continues: prospects

- A will on the part of the pioneering group of farmers to expand their commitments with new initiatives: taking action on energy consumption and carbon storage and continuing their collective momentum with an Economic and Environmental Interest Group currently being set up
- An improved inventory of ammonia emissions to monitor changes in emissions and compare them with regulatory targets for 2030
- Ongoing work on surveys of spreading equipment use across the region
- Continued improvement of atmospheric models for ammonia
- A transfer of the agrivisio N'air tool to five French regions in 2025 and a wish to roll it out nationally
- A more complete link between agrivisio N'air tool and mes parcelles tool to facilitate data entry
- A new group of methane-producing farmers committed to reducing ammonia emissions in the Rennes Metropolis area, and a wish to replicate this model in other territories
- A transfer of the tools and this support model with a target of two training sessions for advisors per year
- The organization, each year and in each department, of a demonstration of spreading
- A presentation of the territorial LCA method at the COMIFER GEMAS 2025 congress, followed by an evaluation of the results with the addition of economic data

CREAA

A new partnership project

CREAA (Comprehending and Reducing Agricultural Ammonia Emissions) has been the winner of ADEME's AQACIA call for projects since November 2023.

It follows on from cbaa in order to continue the actions undertaken since 2021 with partners: Air Breizh, the Brittany Chamber of Agriculture, and INRAE.

The project team cbaa

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Antonin Mahévas
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Nicolas Moreau
Modeling engineer

Association approved by the French Ministry of Ecological Transition to monitor air quality in Brittany, whose missions fall within a national and European regulatory framework.

Our missions:

- Monitor and anticipate air quality levels in relation to regulatory thresholds,
- Alert and inform state services, our members and the public about air quality in the region,
- Study and assess air pollution linked to industrial, agricultural and tertiary activities using various tools (measurements, digital modelling, emissions register),
- Communicate and raise awareness to support and promote changes in citizen behavior and actions developed on the territory.

https://www.airbreizh.asso.fr

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Founded in 1924, the Brittany Chamber of Agriculture is a consular body whose missions are defined in the Rural Code. It is supported by almost 150 elected members and 600 staff working in close proximity to the field.

Our missions:

- Accompany agriculture in its economic, societal and climatic transitions,
- Advise, train, pilot and manage R&D projects,
- Anticipate developments, innovate, share references,
- Support farmers in the evolution and adaptation of their businesses,
- Represent interests of the agricultural sector to public authorities and collaborate with all professional agricultural organizations and local authorities.

https://bretagne.chambres-agriculture.fr

Find all the project's actions and results on the website https://lifeabaa2021.eu/

The ABAA project has received funding from the European Union's LIFE programme, the Region of Brittany, and the Ministry of Ecological Transition, as well as from the Brittany Regional Health and Environment Plan and the Brittany Regional Agricultural and Rural Development Programme.

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