

SUMMARY: SURVEY FROM COMMERCIAL STAKEHOLDERS

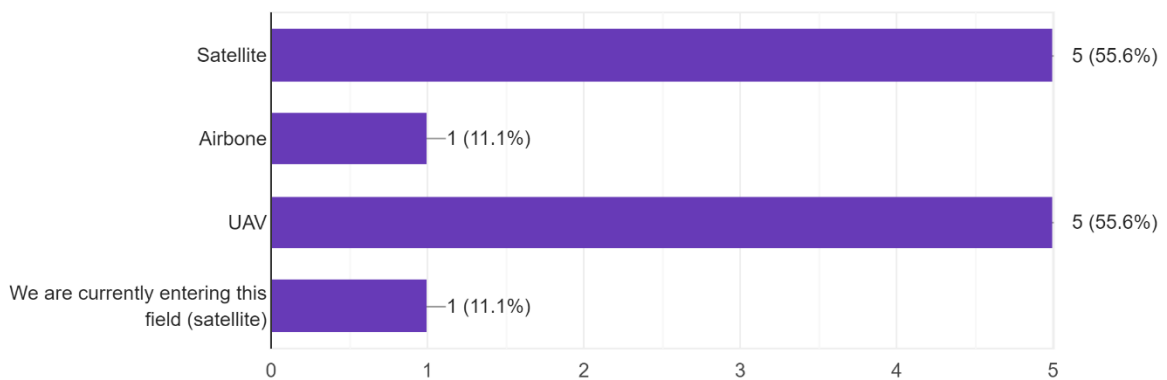
The purpose of this survey was to better understand the needs and usefulness of remote sensing products between different stakeholders to create synergies between SENSECO and commercial stakeholders that showed interest in collaborating with SENSECO. With the survey outcome, SENSECO will discuss how the Action participants' expertise can help stakeholders and vice versa. Selected stakeholders will be invited to a workshop to further discuss collaborations.

We invited a total of 14 companies around Europe and received answers from 9 of them, which are PAINTEC, Protosagro, Aerial Tools, Climate Farmers, Kora Agrilab, Fauna Smart Technologies, WEO, HAIP Solutions GmbH and Hydrosat.

OVERVIEW:

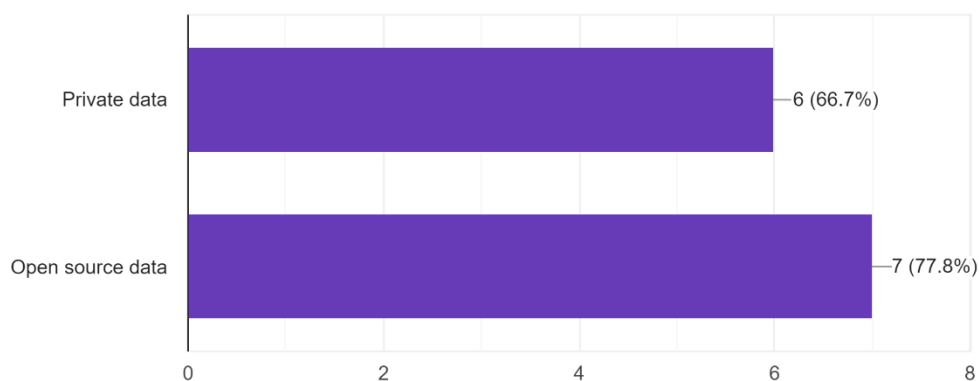
Which type / platform of remote sensing data do you use? (several options)

9 responses

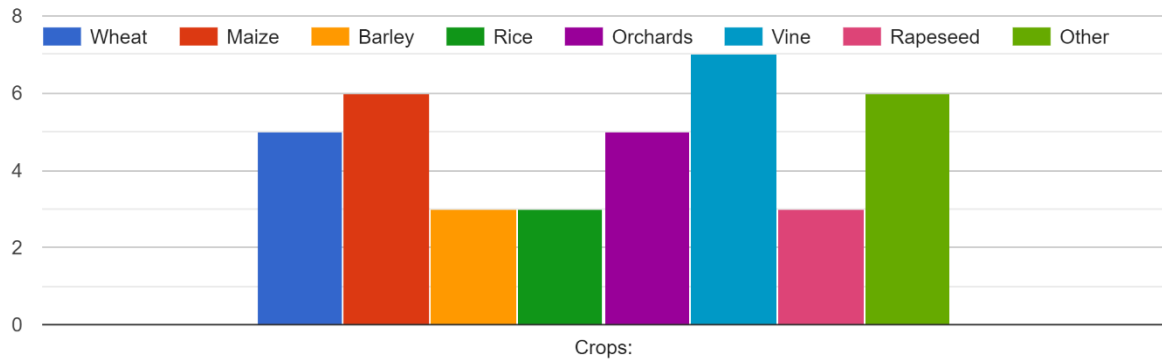


What type of data do you use?

9 responses

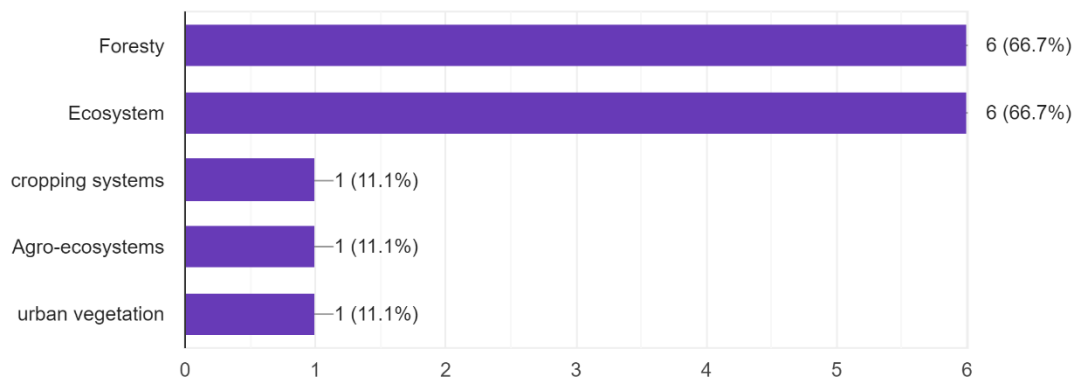


Vegetation Type:



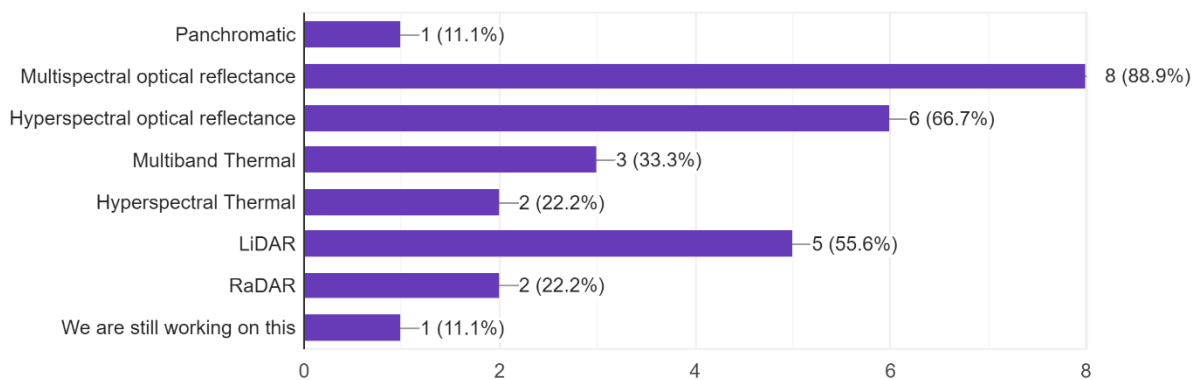
Vegetation type

9 responses



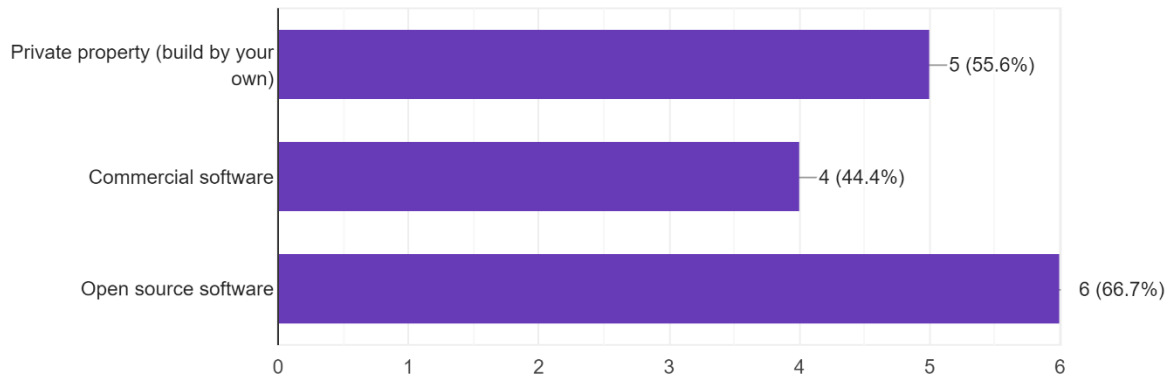
What type of spectral measurement?

9 responses



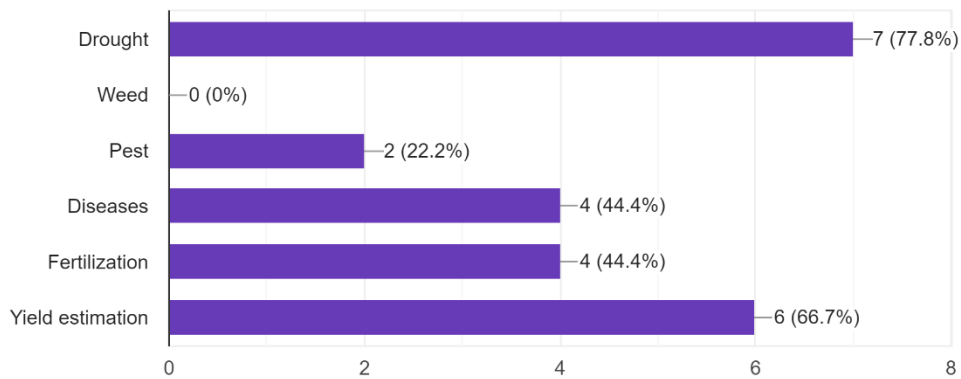
The software used is:

9 responses



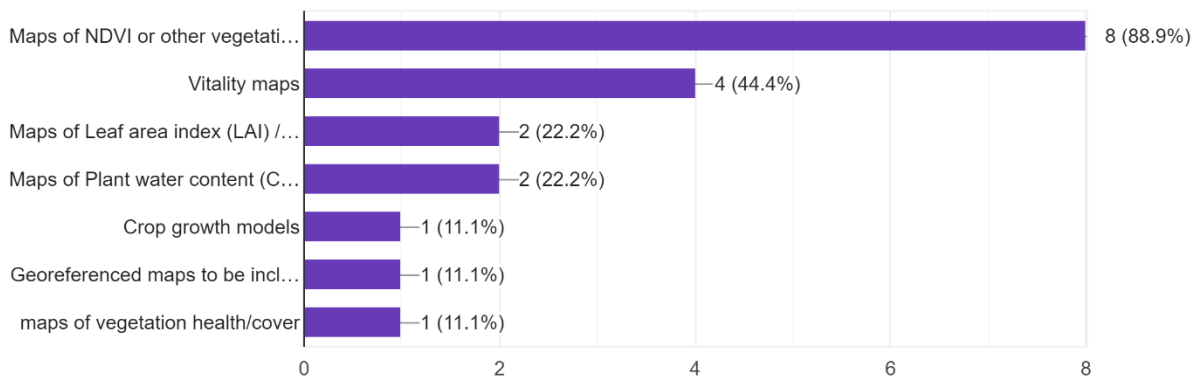
Which is the main application:

9 responses



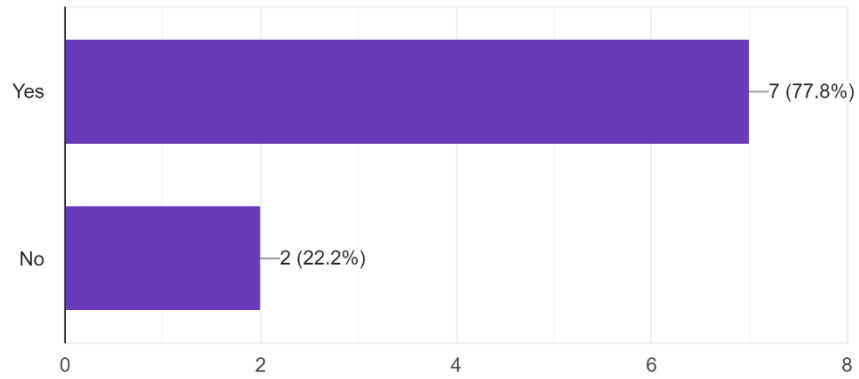
How do you provide the outcome:

9 responses



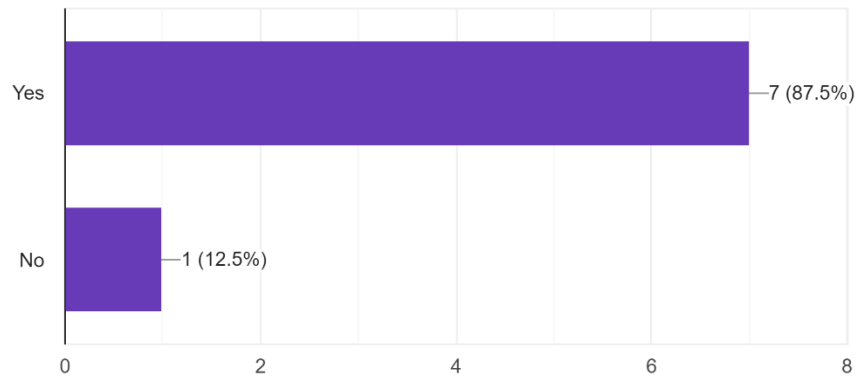
Do you use research in your company?

9 responses



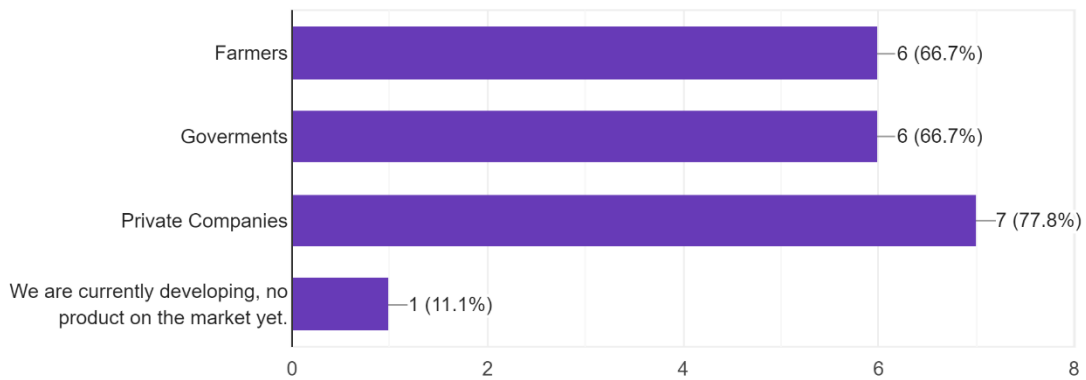
Do you already collaborate with academic partners/research institutes?

8 responses



Who are your customers?

9 responses



MORE SPECIFIC ANSWERS OF EACH COMPANY: (Four sections: Data collection, Data managements, Research & Customers)

PAINTEC is a company with 8 employees from Spain and the main activity is the use of satellites and drones in the agriculture, industry, and rescue sector. They use private and open-source data. They work in forestry, vegetation data like wheat, maize, vine, and others, and in ecosystems. They take multispectral optical reflectance and LiDAR data.

The data management is through commercial software and own software development. They have developed their own digital platform for the agricultural sector, using remote sensing services with drones and satellites, sensors, and exploitation notebooks among others. The main applications are drought, fertilization, and yield estimation. They provide maps of NDVI or other vegetation indices, vitality maps and georeferenced maps to be included directly in the GPS of agricultural machinery. At PAINTEC, they are very interested in the possibility of detecting pests using drone flights or satellite images. It would be a great advance for the sector, and it is a basic need for farmers.

They do not use research in the company. With research resources, they will be able to contrast in an objective way the results of the different investigations. They already collaborate with research institutes providing field work and raw images from drone flights. It is a great opportunity for them to be able to collaborate with different partners as it allows them to continue developing their services with the guarantees that these types of institutions provide thanks to their resources in research, personnel, equipment, etc. The academic partners are CSIC, IGME, INTIA, CITA and they would like to have more information on remote sensing with high resolution satellites.

Their customers are farmers, governments, and private companies. The customers' needs are vegetative information on the operation of the crops in order to be able to work in a zoned way. PAINTEC solution is to use different technologies to improve crop productivity, provide greater cost savings, improve farms profitability, and reduce pollution.

Protosagro is a small company from Bulgaria and the main activity is agriculture. They use UAV private and open source data. They work in several types of vegetation (wheat, maize and rapeseed) and ecosystems. They use multispectral optical reflectance data.

The data management is through commercial and open source software like Drondeploy and Sentinel. The main applications are drought and yield estimation. They provide Maps of NDVI or other vegetation indices and vitality maps. Their challenges inaccurate information compared to ground data and the final result.

They do not use research in the company, and they do not collaborate with academic partners or research institutions. The company would like to know more about applied use of collected UAV data.

Their customers are farmers. Their customers' needs are sustainable agriculture and increased yields. They propose close collaboration and reasonable advice.

Aerial Tools is a start up from Denmark and the main activity is a drone based-service platform for inspections. They plan to use private data. They work on forestry and vegetation data like maize, vine, and others. They take panchromatic, multispectral optical reflectance, hyperspectral optical reflectance, hyperspectral thermal and LiDAR data.

Their data management is through commercial and open-source software like python, MATLAB, Agisoft and QGIS. The main applications are drought, diseases, fertilization, and yield estimation. They provide maps of NDVI or other vegetation indices and vitality maps. For them it is difficult to decide among sensors for specific applications and what is the best sensor brand. It is also challenging to develop algorithms without previous knowledge on a specific application which has not been done before.

They use research in the company. When turning a scientific method into operational use, the difficulties are not well defined or unexplained processes in the scientific method, overcomplicated methods that could be simplified, lack of standardized protocols in terms of UAV operations, sensor use and data processing/analysis. Something missing in research are concrete methodologies for specific applications. They already collaborate with research institutes like the Denmark Technical University that help Aerial Tools team to find new projects and sometimes with resources (e.g. sensors and available spaces for testing), showing initiative and contributions to research. Aerial Tools challenges research institutions with new projects and helps them in creating new research showing openness and support. The company would like to have more information about sensors, applications, data management and analysis, UAVs operations for monitoring crops and synergies between data from UAVs and other remote sensing platforms.

They are still developing their drone, which means that they do not own UAV datasets yet and many of the answers are based on previous knowledge and the expectations they have. In addition, they do not have customers in this sector yet, so the needs and solutions might vary depending on specific applications and customers. Their customers are expected to be farmers and private companies that need to increase crop yield, reduce crop losses due to diseases or environmental factors like drought and reduce expenses. They propose a tailored tool (drone) to monitor crops to improve crop performance and to detect in advance future crop disturbances saving money to our customers.

Climate Farmers is a company with 10-15 employees from Germany and the main activity is the definition of regenerative agriculture, quantification of ecosystem health metrics, offering relevant knowledge and data freely to farmers, supporting farmers financially with carbon + credits. They use satellite open source data. They work in forestry, vegetation data like wheat, barley, rice, orchards, rapeseed, maize, vine, and others, and also with ecosystems. They use multispectral optical reflectance, hyperspectral optical reflectance, RaDAR and LiDAR data.

The data management is through open-source software like GEE, SEPAL and QGIS. The main applications are drought, fertilization, and yield estimation. They provide maps of NDVI or other vegetation indices, also maps of LAI/ Cab. Their challenges are feasibility and suitability of measuring vegetation indices for identifying regeneration. Access to already existing models. Comparability of results over time (considering climate change).

They use research in the company. The information missing in their field are ground-truth data sources, regeneration relevant properties in the context of agricultural activities. They already collaborate with research institutes like Wageningen University that provide knowledge and feedback about soil biology relevant information, contacts and access to publications, and willingness to join consortium for funding proposals. They provide to the research institutes contacts with relevant stakeholder (farmers), agile project management, and ambition. The company would like to have more information about how to use Satellite and Lidar data for analyzing and monitoring the impact of agricultural activities on ecosystems.

Their customers are farmers, governments, and private companies. The customer needs are transparency, trust, accessibility, open data and open-source. They propose a mutual data platform to share relevant information horizontally with all relevant stakeholders and they are looking forward to collaborating with SENSECO.

Kora Agrilab is a company with 4 employees from Spain and the main activity is research plus investigation for SMART and sustainable food systems. They are currently entering this field (satellite) and use open source data. They work in vegetation data like orchards, vine, and others, and also with cropping systems. They want to use multispectral optical reflectance and hyperspectral optical reflectance.

For data management they will use private property, which is under development. The main applications are fertilization and yield estimation, and they provide maps of NDVI or other vegetation indices. They do not have specific challenges because they are under development.

They use research in the company. Kora Agrilab is a kind of spin-off and they are focused on securing EU grants to carry out the development of new products in the field of smart agriculture and carbon farming. So far, they have led all consortiums they built (4). They would like to have more information on commercial opportunities for developers.

They are currently developing, so they do not have a product on the market or customers yet.

Fauna Smart Technologies is a company with up to 12 employees from Denmark and the main activity is improving the farming industry. They use satellite private and open source data. They work with vegetation types like orchards, and vine; also with ecosystems and Agro-ecosystems. They take multispectral optical reflectance, hyperspectral optical reflectance, multiband thermal, hyperspectral thermal and LiDAR data.

The data management is through commercial and open-source software. The main applications are in pests and diseases. They provide maps of NDVI or other vegetation indices, maps of LAI/ Cab and maps of plant water content (CWC).

They use research in the company. For them it is difficult to adjust scientific methods into operational use for applied purposes. The information missing is between satellite imagery and horticulture. They already collaborate with research institutes like Aarhus University, Copenhagen University and Denmark Technical University. Since the core of Fauna Smart Tech is crop protection science, they

collaborate with departments where they can gain knowledge on Remote Sensing. The institutes expect from them information based on Horticulture Science. The company would like to have more information about satellites in horticulture.

Their customers are farmers, governments, and private companies. The customers' needs depend on the type of stakeholder. Farmers: user friendly solutions to farming and green transition, Government: data about farming processes in different regions, Private companies: data. They propose guidance throughout the growing season using satellite data and scientific knowledge.

WEO is a very small company from Luxemburg and the main activity is mapping. They use satellite and airborne open source data. They work in forestry ecosystems and urban vegetation. They use multispectral optical reflectance, hyperspectral optical reflectance, multiband thermal, and LiDAR data.

The data management is through software built by themselves and open-source software like QGIS. The main applications are in drought and diseases. They provide maps of vegetation health/cover. The challenges are that algorithms are not always applicable with openly available data and too specifically dependent on parameter values from ground-truthing.

They use research in the company. When turning a scientific method into an operational one, they experience difficulties on replicability, dependency on ground-truthing, too many inputs needed and scalability. They already collaborate with research institutes like VUB and Università di Palermo. These institutions provide them with in depth research results to develop new methodologies. The institutes expect from them knowledge on user needs, application, evaluation. The company would like to have more information about vegetation management, drought, etc.

Their customers are governments and private companies. Customers' needs are vegetation monitoring. They propose a mapping with satellite imagery.

HAIP Solutions GmbH is a company with 8 employees from Germany and the main activity is Hyperspectral Imaging Solutions for the Environmental Sector. They use UAV private data. They work in all types of vegetation, forestry, and ecosystems. They take hyperspectral optical reflectance data.

The data management is through software built by themselves called the Hyperspectral Analysis Software. The main applications are drought, pest and diseases and they provide Maps of NDVI or other vegetation indices. Their challenges are to find useful end user applications and they often need more scientific proof.

They use research in the company. When turning a scientific method into operational use, they believe that complexity must be broken down to practice, which is not easy. They miss information on hyperspectral algorithms for specific parameters in crops. They already collaborate with research institutes like Institut für Zuckerrübenforschung Göttingen, Julius-Kühn-Institut Geilweilerhof and Leibniz Universität Hannover. These institutions provide them expertise with regards to analysis of hyperspectral imagery and the application in agriculture and the company provides mostly hardware

and know-how about the technology. The company would like to have more information about which use-cases are the most important ones for agriculture to solve

Their customers are governments and private companies. Their customers' needs are information about plant traits. They propose user-friendly hyperspectral imaging solutions.

Hydrosat is a company with 20 employees from Luxembourg and the main activity is thermal remote sensing. They use UAV and satellite private and open source data. They work in several types of vegetation (wheat, maize, barley, rice, orchards, vine and others), forestry, and ecosystems. They use multispectral optical reflectance and multiband thermal data.

The data management is through software built by themselves and open source software like QGIS, GDAL (Python), plus company software. The main applications are drought and yield estimation. They provide Maps of NDVI or other vegetation indices, vitality maps, maps of CWC and crop growth models. Their challenges are reliability of daily (near-real-time) crop stress detection, local field conditions in practice are unknown, unlike in controlled field experiments, meaning algorithms must be much more robust and can't require too much input data.

They use research in the company. When turning a scientific method into operational use, they believe that scientific studies often aim for best possible understanding of a particular topic in controlled conditions, while operational methods must provide reliable results along the full analytic chain without any ground knowledge. They would like to have more research on combining complementary models. They already collaborate with research institutes like Luxembourg Institute of Science and Technology. This institution provides them expertise in modeling, statistical analysis and familiarity with latest research. They conduct field experiments in collaboration, provide insights which types of models would work in operational context, and which are the critical missing pieces. The company would like to have an overview of SENSECO activities and findings.

Their customers are farmers, governments, and private companies. Their customers' needs are various depending on the client. They are constantly looking for new markets and needs that can be addressed with thermal infrared. Their current solution focuses on forecasting agricultural yield and providing crop health assessment and irrigation recommendations.