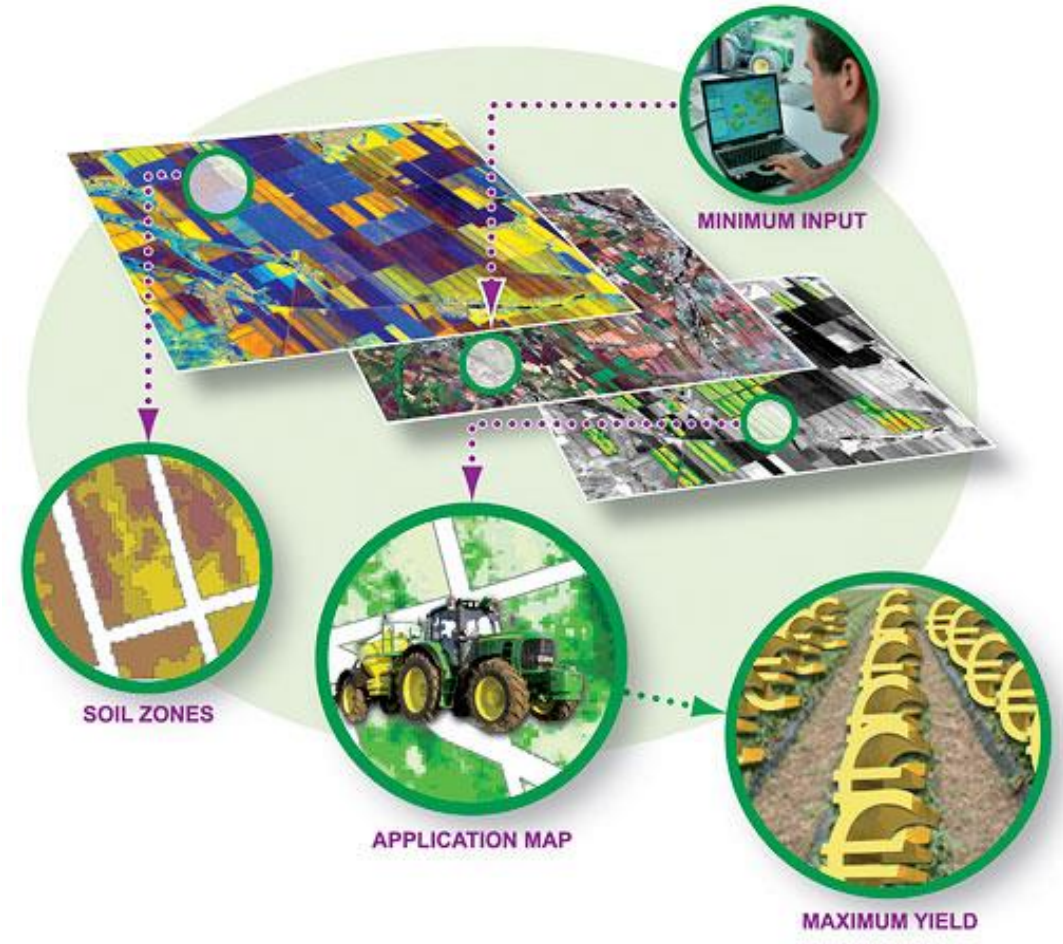
TalkingFields® Products

Satellite images provide overview, show patterns and allow the estimation of in-field **heterogeneity**. Talking**Fields®** uses this information in order to support farmers in their complicated decision-making processes. Our products are valuable sources of information for site-specific farm management. Thus, they are your chance to get started with smart farming.

The analysis of the site-specific vigor of your fields, covering the past 10 years, allows you to discern the characteristic potential of each site. Extensive knowledge about site-specific conditions is essential for site-specific farm management. Talking**Fields®** provides you with all the necessary, spatially explicit information about your fields.

Parameters which cannot be directly observed with remotely sensed data like **dry biomass** and **grain yield** are modeled by talking**Fields®** utilizing a crop growth model which uses remotely sensed data as up-to-date spatial input. Information about the soil type, the planted crop and the current weather conditions is of course included in this process.

Yield modeling gives an early overview of crop development and results in a realistic prognosis of the final yield.



Talkingfields® enables you:

- To get valuable information for your crop management and a basis for your application maps via the **TalkingFields® Base Map**, which shows the persistent relative fertility based on multi-year satellite images in percentages.
- To apply a cost-efficient solution for soil probing using the satellite-based **TalkingFields® Zone Map**.
- To get information about the yield potential (in t/ha) for a specific crop type with the **TalkingFields® Yield Potential Map** in order to better define the target yield.
- To supervise the actual plant development on your fields with the **Monitoring of TalkingFields® Leaf Area and TF Leaf Chlorophyll**
- To plan your plant protection measures and fertilization using the **TalkingFields® Biomass Map** and the **TalkingFields® N-Uptake Map (Canola)**. These products are the main input for your application maps.
- To optimize your economic planning using the **TalkingFields® Yield Map** and **TalkingFields® Yield Forecast**.
- To check the success of your management decisions.

TalkingFields® Base Map

The **TalkingFields® Base Map** shows statistically significant, persistent patterns of relative biomass. The satellite-based **TalkingFields® Base Map** is calculated from multi-year satellite data to exclude influences of current weather conditions and different crop types.

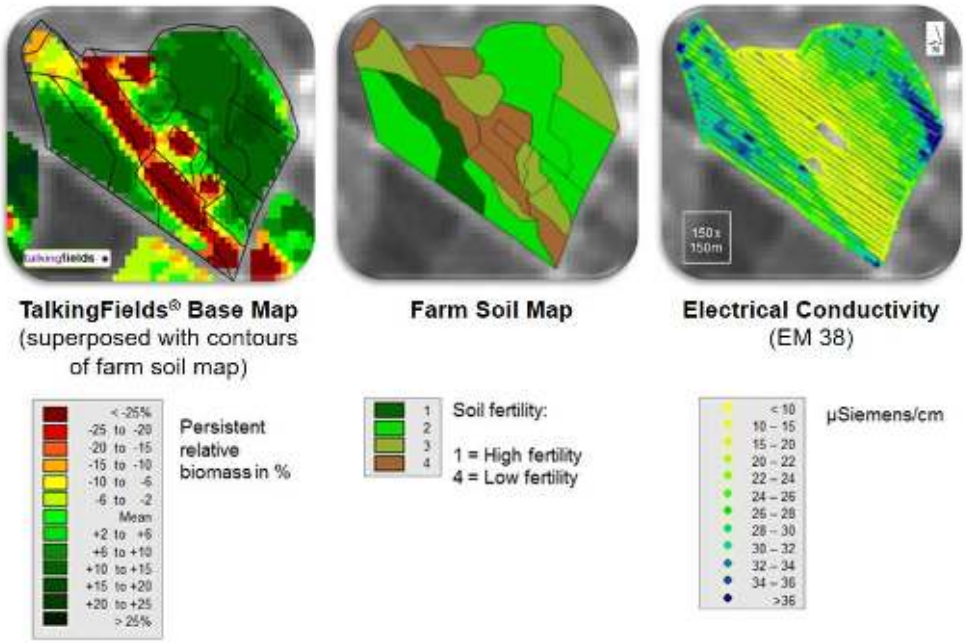
Validation of the TalkingFields® Base Map:

The quality of this product has been proven by several validations. Validation of our measurement methods has been done via direct comparison with other widely recognized methods like e.g. the German Reichsbodenschätzung, EM38 electrical conductivity measurements or yield maps from combine harvesters.

The satellite-based **TalkingFields® Base Map:**

- shows different site-qualities within the fields.
- can be used as information source for the creation of application maps.
- mapping of site-characteristics, also in combination with other methods.
- allows large-scale analyses at a budget price.
- can be used as a basis to evaluate the cost-effectiveness of site-specific crop management

In the images below, you see on the left side the calculated persistent relative fertility, the satellite-based **TalkingFields® Base Map**. The next two images show the results of the farm soil map and the EM38 electrical conductivity measurements. The patterns calculated by our considerably cheaper method widely match the two other measurement methods, without having to buy extensive data sets or having to conduct own measurements in the fields.



Currently, we offer the processing of data for fields with a size of 1 ha and above. Large farms receive a quantity discount. The **TalkingFields® Base Map** can be delivered worldwide.

Should processing of parts of your areas not be possible, then these areas will not be taken into account in the cost calculation.

➢ Thus, you will only pay for the areas for which we can deliver our products.

When ordering this service you will receive the following products:

Product name	Description	Recommended retail price in €/ha (excl. VAT)	Unit	Output format
TalkingFields® Base Map	Shows the persistent relative fertility	5 € excl. VAT* *Discounts are available for large orders.	%	TalkingFields®-XML, Point-Shape-Files, raster data

The delivery of the **TalkingFields® Base Map** includes:

- **TalkingFields® Base Map** showing the persistent relative fertility in percentage values in % (% derivation of the field average, which is defined as 0).
- Spatial resolution in a fixed raster cell size of 10 x 10m.
- Delivery in NEXT Farming Pro compatible format or as point-shape file which can be read by most prevalent agricultural software packages which include GIS functionality.
- Activation of the TalkingFields® Economic Evaluation Tool in your NEXT Farming Pro Version to calculate the savings with site-specific crop

Upon receipt of an order we require the boundaries of the ordered fields **as well as** of non-target areas within the field (e.g. hedges or groups of trees), preferably in TalkingFields®-XML- format.

Additionally, we can of course offer you the agricultural software with which you can import this data and further process it to e.g. application maps. Information on this can be found here: www.farmfacts.de

If you would like to place an offer or have additional questions about our product please contact us by using our email address info@talkingfields.de or our phone number +49 89 45 21 614 22.

Additional information can be found at www.talkingfields.de.

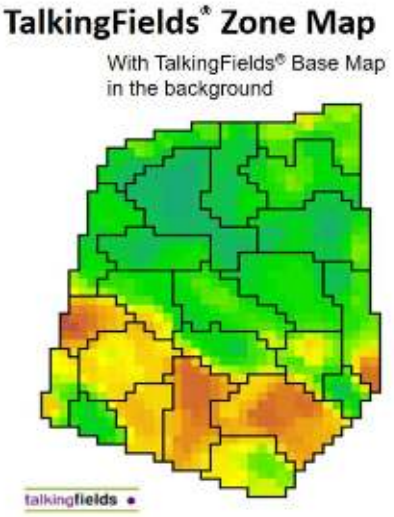
TalkingFields® Zone Map

Besides the **TalkingFields® Base Map** there is the possibility to receive the **TalkingFields® Zone Map**, which can be used as a base for soil sampling.

The example below shows in the background the **TalkingFields® Base Map**, which results from the spectral analysis of the satellite images, overlaid with the **TalkingFields® Zone Map**.

The **TalkingFields® Zone Map allows:**

- The optimization of your soil probing strategy for an improved soil database.
- The reduction of the number of laboratory probes and associated costs.



Areas of similar values in the **TalkingFields® Base Map** are merged into one zone in the **TalkingFields® Zone Map**. These zones enable you to conduct a cost-saving soil probing which represents well the range of soil characteristics within your field.

You decide on the average size of the zones. Thus, the **TalkingFields® Zone Map** can be adapted exactly to your needs.

Currently, we offer the processing of data for fields with a size of 1 ha and above. The **TalkingFields® Zone Map** can be delivered worldwide.

Upon receipt of an order we require the boundaries of the ordered fields **as well as** of non-target areas within the field (e.g. hedges or groups of trees), preferably in TalkingFields®-XML- format.

Additionally, we can of course offer you the agricultural software with which you can import this data and further process it to e.g. application maps. Information on this can be found here: www.farmfacts.de

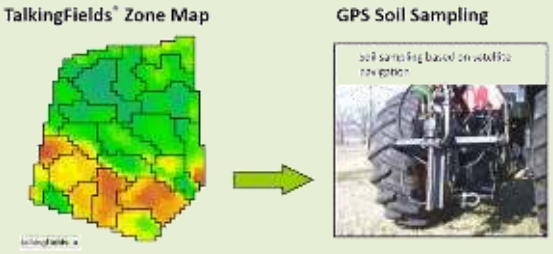
The delivery of the **TalkingFields® Zone Map** includes:

- Digital **TalkingFields® Zone Map** with zone extent and zone number. The desired average zone size can be chosen when ordering the product.
- Digital **TalkingFields® Base Map**
- Average **TalkingFields® Base Map vigor** per zone
- Delivery in NEXT Farming Pro compatible format or as point- or polygon-shape file which can be read by most prevalent agricultural software packages which include GIS functionality.

Combination Package:

Combination Package	Recommended retail price in €/ha (excl. VAT)	Output format
1. TalkingFields® Zone Map + TF Base Map	6 € excl. VAT* *Discounts are available for large orders.	TalkingFields®-XML, Shape-file
2. TalkingFields® Zone MAP + GPS Soil Sampling	On Request	TalkingFields®-XML/Shape-file, NEXT Farming Pro -Import format

- Allocation of soil sampling zones based on TalkingFields® zone Map
- GPS-based soil sampling (20 samples per probe)
- Analysis of PH, K,p, MgO and soil type
- Data preparation of the sampling results in the software
- Application maps based on fertilisation recommendations of the laboratory for CaO, P and K



If you would like to place an offer or have additional questions about our product please contact us by using our email address info@talkingfields.de or our phone number +49 89 45 21 614 22.

Additional information can be found at www.talkingfields.de

TalkingFields® Leaf Area and Leaf Chlorophyll

The service **Monitoring of TalkingFields® Leaf Area and TalkingFields® Leaf Chlorophyll** is an abonnement service that delivers the leaf area (in m²/m²) and leaf chlorophyll (in µg/cm² leaf area) derived from satellite data. These plant parameters are retrieved from satellite data by using a radiative transfer model developed by Vista. The parameters are delivered every 10 days. The best satellite scene acquired during the period of 10 days will be delivered.

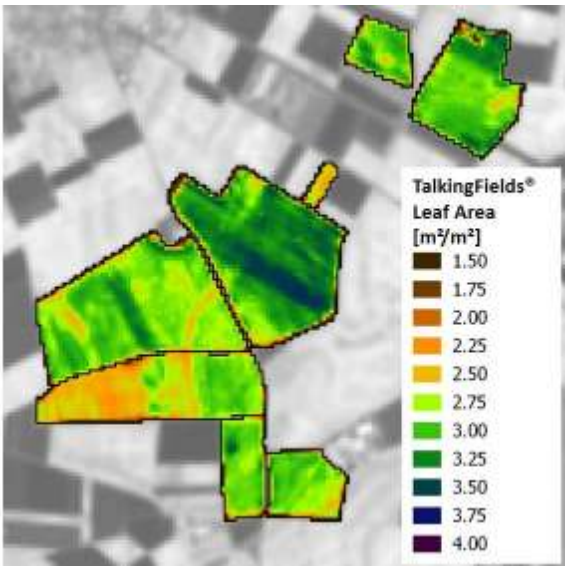
TalkingFields® Leaf Area and Leaf Chlorophyll

- Shows the current leaf area in m²/m² in a spatial resolution of 10*10m.
- Shows the current leaf chlorophyll content in µg/cm² leaf area in a spatial resolution of 10*10m.
- The product will be delivered regularly every 10 days during the ordered vegetation period, while the duration of the vegetation period is defined as 6 months. **TalkingFields® Leaf Area** can be delivered during the entire duration of the ordered period. **TalkingFields® Leaf Chlorophyll** will be delivered for every field that is covered with vegetation.
- The product can serve as a basic source of information for application maps for fertilizer and plant protection measures.
- For the further processing industry the product allows the continuous monitoring of contracted areas.

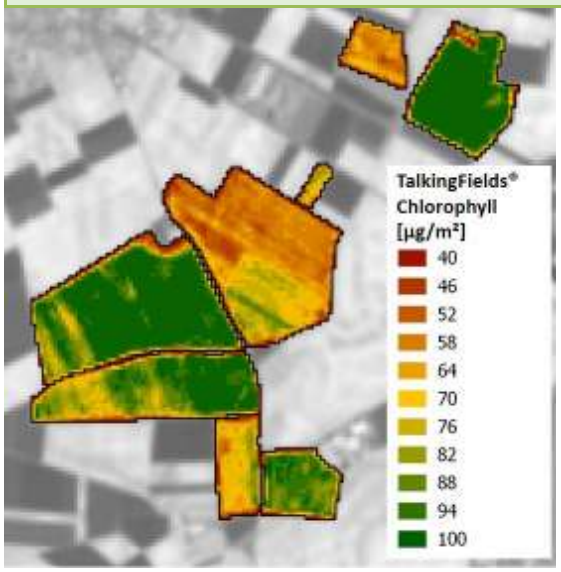
The **TalkingFields® Leaf Area** gives information about the current biomass development of the crops on the field. Therefore, it gives information about the growing conditions and crop density. This knowledge can be used to optimize plant protection measures and to monitor whether plants suffer from pests. The delivered product consists of the plant leaf area in m² per m² of soil surface for a specific moment in time (the selected satellite scene).

TalkingFields® Leaf Chlorophyll delivers the chlorophyll content of the leaves in µg/cm². The chlorophyll content of the leaves correlates with the nitrogen supply status and therefore gives information about the nutrition status of the crops. Areas with a lack of nitrogen that may result in yield reduction can be identified. This information can be used to create application maps for fertilizers. The **TalkingFields® leaf chlorophyll** content is delivered in µg per cm² leaf area and is therefore independent from the current leaf area of the plants.

The image shows **TalkingFields® Leaf Area and TalkingFields® Leaf Chlorophyll** of some fields of winter wheat in the middle of May, so shortly before the last application of N-fertilizer. Some effects of varying pre-crops and varying organic fertilization may be observed. Additionally variations in **TalkingFields® Leaf Area** and **TalkingFields® Leaf Chlorophyll** are visible. The parameters do not show the same patterns accross the fields. Areas with high **TalkingFields® Leaf Area** and simultaneously low **TalkingFields® Chlorophyll** content suggest a low nitrogen nutrition status of the plants that can be corrected accordingly during the following fertilization.



Product name	Description	Recommended retail price in €/ha (excl. VAT)	Unit	Output format
Monitoring TalkingFields® Leaf Area and TalkingFields® Leaf Chlorophyll	Maps of the TalkingFields® Leaf Area and TalkingFields® Leaf Chlorophyll of the crops	8 € excl. VAT* *Discounts are available for large orders.	TalkingFields® Leaf Area: m²/m² TalkingFields® Leaf Chlorophyll: µg/cm²	TalkingFields®-XML, Point-Shape-Files, raster data



Currently the Monitoring of **TalkingFields® Leaf Area** and **TalkingFields® Leaf Chlorophyll** is available for fields with a minimum size of 1 ha for the crop types winter wheat, rapeseed, sugar beet and maize. The products can be delivered worldwide.

Upon receipt of an order we require the boundaries of the ordered fields **as well as** of non-target areas within the field (e.g. hedges or groups of trees) and information about the sown crop type, preferably in TalkingFields®-XML- format.

The delivery of the **Monitoring TalkingFields® Leaf Area and TalkingFields® Leaf Chlorophyll** includes:

- Digital **TalkingFields® Leaf Area and TalkingFields® Leaf Chlorophyll** every 10 days for a maximum duration of 6 months during the ordered vegetation period. We will choose the best satellite scene for you during every 10-day period. The amount of cloud cover is the criterium for the best scene.
- **TalkingFields® Leaf Chlorophyll** will only be delivered for fields covered with vegetation
- Delivery in NEXT Farming Pro compatible format or as point- or polygon-shape file which can be read by most prevalent agricultural software packages which include GIS functionality.

If you would like to place an offer or have additional questions about our product please contact us by using our email address info@talkingfields.de or our phone number +49 89 45 21 614 22.

TalkingFields® Yield Potential Map

The **TalkingFields® Yield Potential Map** provides information about the yield potential for a specific crop type for the given site. The yield potential is the yield that can be reached with optimal nutrient supply and under given circumstances, such as soil properties and climate conditions. No additional irrigation is assumed. These boundary conditions are included in the analysis.

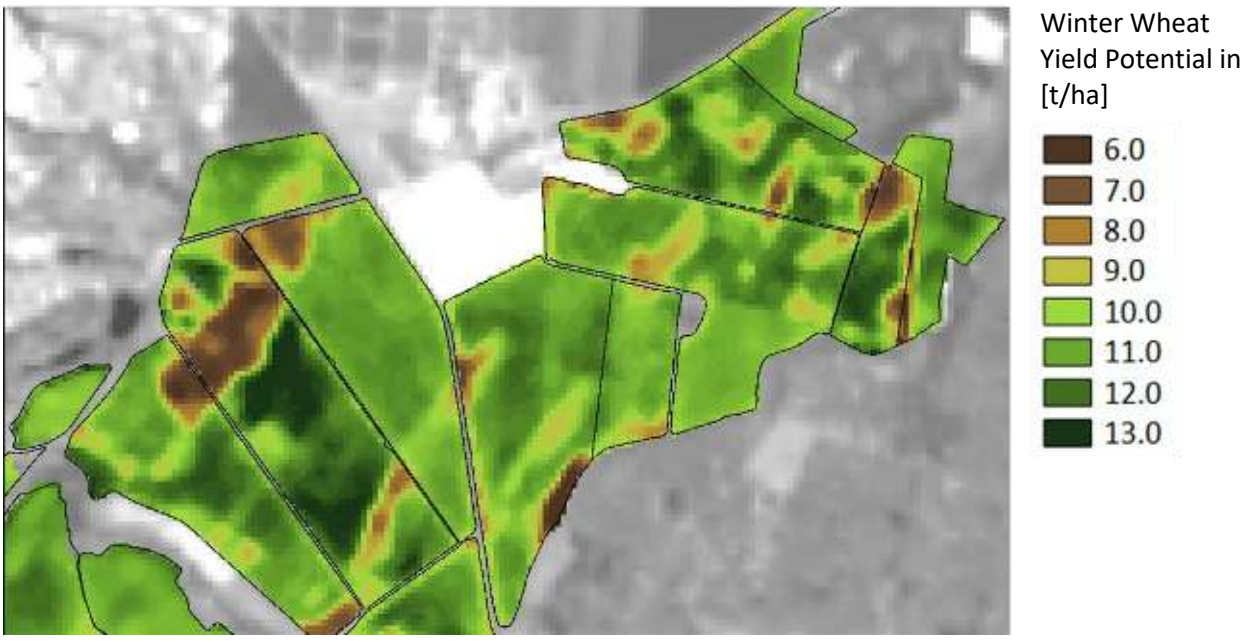
For the calculation of the yield potential, a crop growth model is used in combination with satellite imagery. The yield potential is calculated based on yield simulations for the past 15 years (hence, realistic climatic conditions for the investigated site). The heterogeneity within the field is determined using satellite observations of the past 5 to 10 years.

The yield potential therefore gives information about the yield that can be reached under optimal management.

The satellite-based **TalkingFields® Yield Potential Map:**

- Shows the calculated yield potential for a specific crop type that could be reached with optimum nutrition. The local climatic conditions are included in the analysis.
- Is based on modelling results of the past 15 years.
- The site-specific heterogeneity is derived from satellite-images of the last 5 to 10 years.
- Allows optimized planning of the target yield for fertilization measures.
- The **TalkingFields® Yield Potential Map** is available for the following crops: winter wheat, sugar beet, rape seed and maize

The **TalkingFields® Yield Potential Map** shows the maximum yield that the investigated crop type can reach under the given conditions of the location (e.g. soil properties and climatic conditions such as temperature, precipitation and radiation). The **TalkingFields® Yield Potential Map** contains absolute values in t/ha for each crop type, thereby allowing comparison between different fields. Sites with higher or lower yield potential in comparison to other fields can be identified. The following figure shows an example for the **TalkingFields® Yield Potential Map** for winter wheat.



Currently, we offer the processing of data for fields with a size of 1 ha and above.
The **TalkingFields® Yield Potential Map** is currently available for Germany. If you wish to order the **TalkingFields® Yield Potential Map** for other countries please contact us for further information.

When ordering this service you will receive the following products:

Product name	Description	Recommended retail price in €/ha (excl. VAT)	Unit	Output format
TalkingFields® Yield Potential Map	Shows the yield potential in t/ha for one or more crop types	7€* (excl. VAT) *Combined price TalkingFields® Basemap + TalkingFields® Yield Potential Map. All additional crop types cost an additional 1 €/ha per crop type	t/ha	TalkingFields®-XML, Point-Shape-File, GeoTIFF

The delivery of the **TalkingFields® Yield Potential Map** includes:

- **TalkingFields® Yield Potential Map** for one or more crop types
- Spatial resolution is a fixed raster cell size of 10 x 10m.
- Delivery in NEXT Farming Pro compatible format or as point-shape file, which can be read by most prevalent agricultural software packages which include GIS functionality. The delivery in other formats is possible on demand.

Upon receipt of an order we require the boundaries of the ordered fields **as well as** of non-target areas within the field (e.g. hedges or groups of trees), preferably in TalkingFields®-XML- format.

Additionally, we can of course offer you the agricultural software with which you can import this data and further process it to e.g. application maps. Information on this can be found here: www.farmfacts.de.

If you would like to place an offer or have additional questions on our products we would be pleased to take some time to get in touch with you personally.

Please use our email address info@talkingfields.de or our phone number +49 89 45 21 614 22 to contact us.

Additional information can be found at www.talkingfields.de

TalkingFields® Biomass Map

The **TalkingFields® Biomass Map** provides the small-scale absolute biomass distribution within the field 4 times a year. So far, the biomass estimation is available for winter wheat, winter barley, rapeseed, maize and sugar beet. You can freely choose the dates for which you need the biomass map.

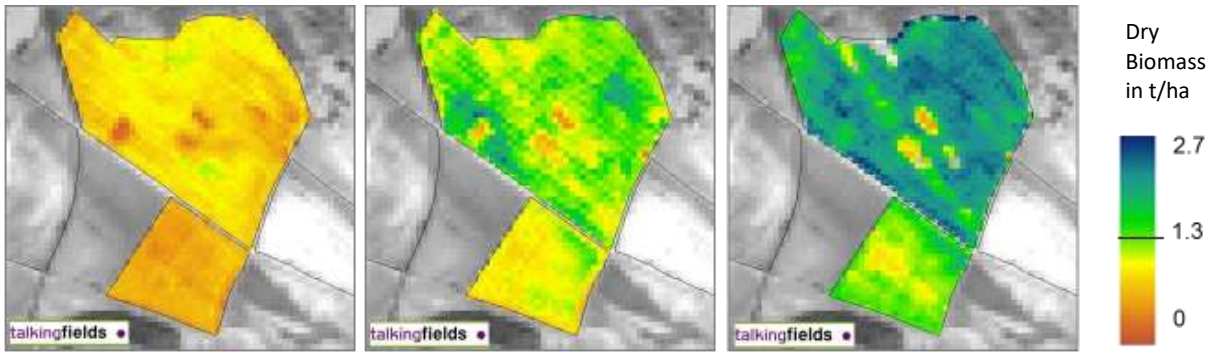
By combining our crop growth model with biomass observations from up to-date satellite imagery, the **TalkingFields® Biomass Map** can be calculated for any desired date.

With the **TalkingFields® Biomass Map**, the increased plant disease risk of dense canopy parts can be taken into account for the creation of application maps for plant protection measures.

The **TalkingFields® Biomass Map:**

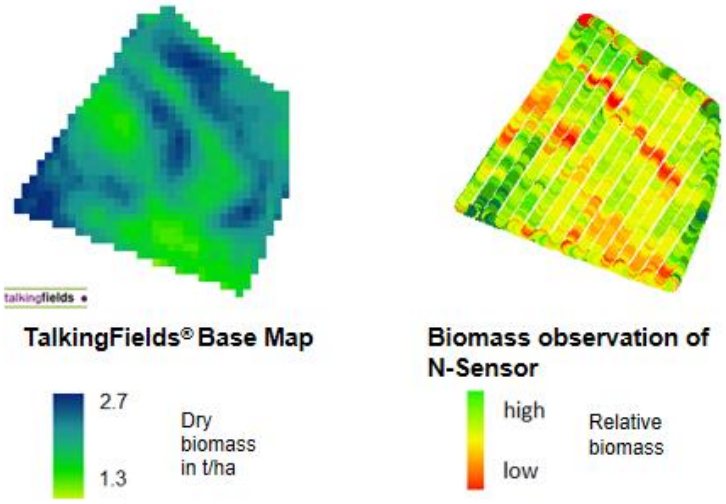
- Gives the biomass in absolute values (kg/m²) for winter wheat, winter barley, rapeseed, maize and sugar-beet fields in a spatial resolution of 10x10m.
- Delivers absolute, spatially and temporally comparable biomass information. The target dates can be chosen freely.
- Allows an optimized risk assessment for plant disease and serves as offline information source for application maps for plant protection measures.
- Allows a continuous monitoring of leased fields for the green energy industry.

The following figure shows the biomass development in spring 2011 for winter wheat. The values of the **TalkingFields® Biomass Map** are absolute and directly comparable.



Validation happens via comparison with field measurements as well as with online sensor values of relative biomass distribution.

In the following image, you can see on the left side the biomass distribution on the **TalkingFields® Biomass Map**. On the right, you can see the field as measured with an online sensor. The spatial distribution of the biomass from both observations is congruent.



In opposition to online sensors, the **TalkingFields® Biomass Map** delivers absolute values. The **TalkingFields®Biomass Map** allows an optimized, site-specific plant disease risk assessment in order to plan plant protection measures. Through its absolute nature, the **TalkingFields® Biomass Map** makes a comprehensive monitoring of the biomass development on all fields possible.

The **TalkingFields® Biomass Map** is available for fields >1 ha. The **TalkingFields® Biomass Map** is currently available for Germany. If you wish to order the **TalkingFields® Biomass Map** for other countries please contact us for further information.

Product name	Description	Recommended retail price in €/ha (excl. VAT)	Unit	Output format
TalkingFields® Biomass Map	Shows the absolute biomass for three dates of your choice	12 € excl. VAT* *Discounts are available for large orders.	kg/m²	TalkingFields®-XML, Point-Shape-Files, raster data

Upon receipt of an order we require the boundaries of the ordered fields **as well as** of non-target areas within the field (e.g. hedges or groups of trees), preferably in TalkingFields®-XML- format.

If you are interested in this product, please contact us for further information at **info@talkingfields.de** or call us at +49 89 45 21 614 22.

The delivery of the **TalkingFields® Biomass Map** includes:

- Four up-to-date biomass maps during the vegetation period
- Delivery in NEXT Farming Pro compatible format or as point-shape file which can be read by most prevalent agricultural software packages which include GIS functionality.

TalkingFields® N-Uptake Canola

The **TalkingFields® N-Uptake Canola** records and makes available the accumulated crop nitrogen uptake (in kg N/ha) by canola during winter dormancy.

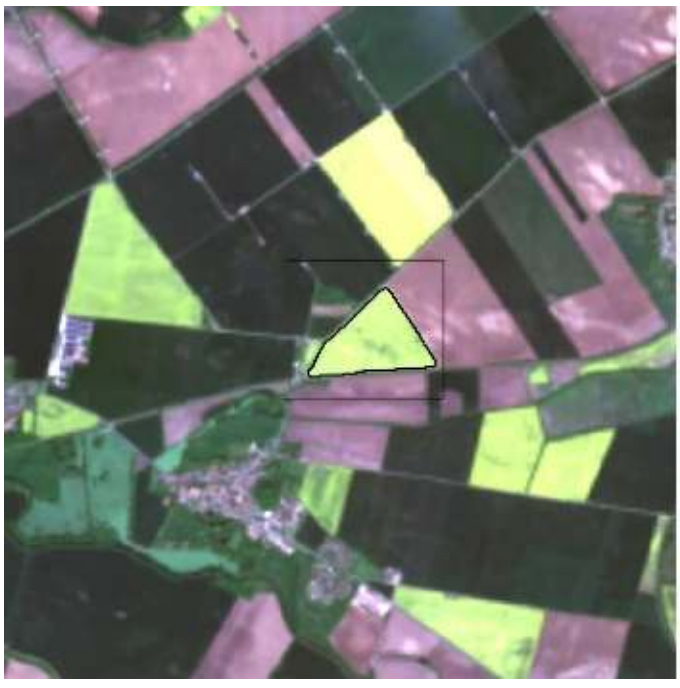
It is derived from satellite data, utilizing a special software developed by Vista GmbH. For this, all available satellite images acquired during the fall and winter months are processed, starting with the sowing date for the current growing season.

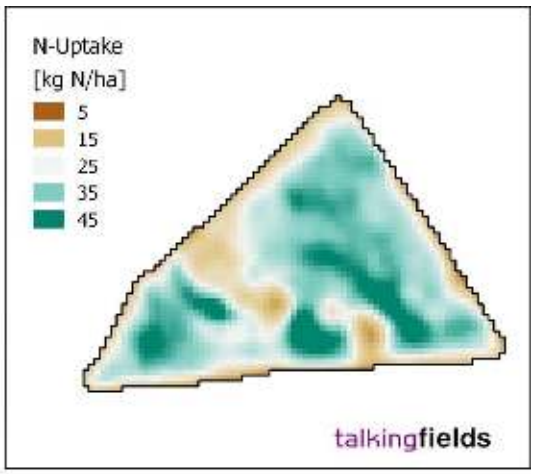
The delivery date of the **TalkingFields® N-Uptake** is at the start of the growing season in spring before fertilization. It provides information on the current nitrogen supply of the crops in kg N/ha and maps out the growing conditions as well as undersupplied areas within your fields. In areas of high nitrogen uptake, the fertilizer application can be reduced accordingly.

TalkingFields® N-Uptake Canola:

- For spring fertilization of canola.
- Maps the accumulated nitrogen taken up by canola crops through the winter months in kg N/ha with a spatial resolution of 10x10m.
- 10m raster basis for the creation of application maps for nitrogen fertilization.
- An optimized fertilization practice relieves your nutrient balance sheet and reduces costs for fertilizers.
- No use of onsite sensor necessary allowing for late orders shortly bevor the fertilization date.
- Allows for the evaluation of extensive areas at a favorable price.

Farmer's experiences show: Through site-specific fertilizer application average cost reductions of 30 €/ha can be achieved, in heterogenous areas reductions of up to 90 €/ha are possible.





left: Sentinel-2 image on May 17, the flowering yellow canola fields are clearly visible
top: N-Uptake of canola crops after the winter dormancy

The **TalkingFields® N-Uptake Canola** is available worldwide for fields with a size of 1 ha and above.

Product name	Description	Recommended retail price in €/ha	Unit	Ausgabe-format
TalkingFields® N-Uptake Canola	Map showing the accumulated crop N-Uptake during the winter months (single delivery in spring)	6* € / ha per growth period (excl. VAT) * Discounts are available for large orders.	kg N/ha	TalkingFields® -XML, Point-Shape-Files, raster data

The delivery of the **TalkingFields® N-Uptake Canola** includes:

- **TalkingFields® N-Uptake Canola** once in spring before fertilization for the ordered vegetation period.
- Delivery in NEXT Farming Pro compatible format, as point-shape file or as raster data.

Upon receipt of an order we require the boundaries of the ordered canola fields **as well as** of non-target areas within the field (e.g. hedges or groups of trees), preferably in TalkingFields®-XML- format.

If you would like to place an offer or have additional questions about our product please contact us by using our email address info@talkingfields.de or our phone number +49 89 45 21 614 22.

TalkingFields® Yield Map and TalkingFields® Yield Forecast

The **TalkingFields® Yield Map** and **TalkingFields® Yield Forecast** for winter wheat, winter barley, rapeseed, maize and sugar beet provide absolute yield values in t/ha in a spatial resolution of 10x10m.

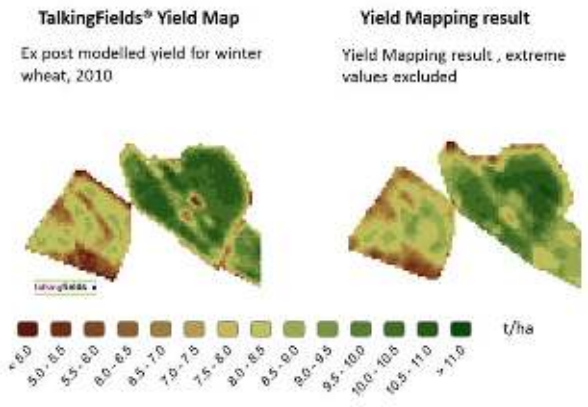
TalkingFields® Yield Map

The **TalkingFields® Yield Map** allows us to deliver high resolution information about the yield level at the harvest date retrospectively. Using meteorological data, a crop growth model and the assimilation of crop observations from satellite images of the respective harvest year, the **TalkingFields® Yield Map** is deducted.

Validation takes place via comparison with yield maps of a combine harvester. In the following image, you can see on the left side the **TalkingFields® Yield Map** and on the right side the results of the yield mapping using a GPS combine harvester.

The **TalkingFields® Yield Map:**

- Delivers comprehensive yield information for winter wheat, winter barley, rapeseed, maize and sugar-beet in values of t/ha.
- Completes and substitutes existing yield maps, also in retrospective.
- Allows a consistent and comprehensive overview of the harvested areas.
- Allows yield mapping without having to harvest with specially equipped combine harvesters.



The spatial congruence of the **TalkingFields® Yield Map** and the conventional yield mapping with the combine harvester is high.

Product name	Description	Recommended retail price in €/ha (excl. VAT)	Unit	Output format
TalkingFields® Yield Map	Retrospectively, delivery at the earliest 4 weeks after harvest	12* € excl. VAT * The price already includes the TalkingFields® Biomass Card, as it is needed to generate the TF Yield Map	t/ha	TalkingFields®-XML, Point-Shape-Files, raster data

TalkingFields® Yield Forecast

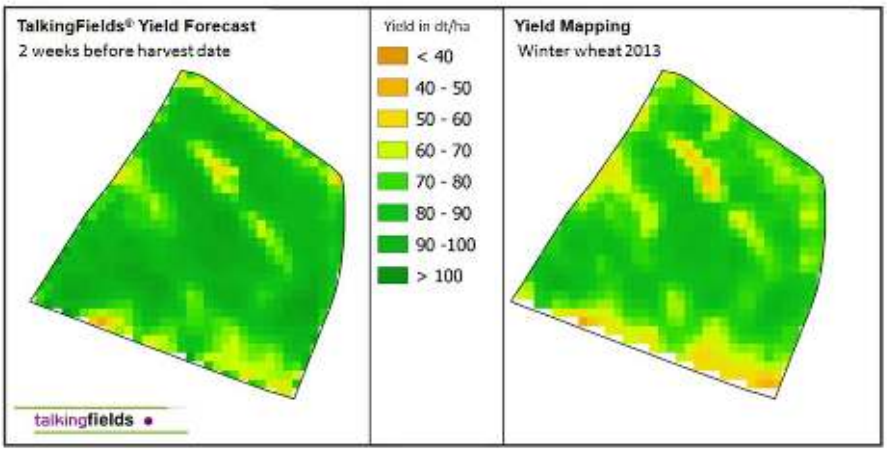
The **TalkingFields® Yield Forecast** delivers a high-resolution yield forecast two to four weeks before the desired harvest date.

Via assimilation of satellite data, current weather forecasts as well as long-term weather observations into the crop growth model, grain yield can be derived even before the actual harvest date.

The **TalkingFields® Yield Forecast** can serve as:

- Support for strategic contract negotiations.
- Effective management tool for harvest logistics and efficient factory utilization for the green energy industry.

The image shows an exemplary **TalkingFields® Yield Forecast** two weeks before winter wheat harvest. Several satellite images during the vegetation period were used to model the crop growth and yield.



The **TalkingFields® Yield Forecast** is currently available for Germany. If you wish to order the **TalkingFields® Yield Potential Map** for other countries please contact us for further information

When ordering this service you will receive the following products:

Product name	Description	Recommended retail price in €/ha (excl. VAT)	Unit	Output format
TalkingFields® Yield Forecast	Yield Forecast 2 to 4 weeks before harvest date	18* € excl. VAT * The price already includes the TalkingFields® Biomass Card, as it is needed to generate the TalkingFields® Yield Forecast	t/ha	TalkingFields®-XML, Point-Shape-Files, raster data

The delivery of the TalkingFields® Yield Forecast includes:

- The TalkingFields® Yield Forecast 2 – 4 weeks before harvest date
- Delivery in NEXT Farming Pro compatible format, as point-shape or as raster data.