# Data Sources

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**GOAL**

This section provides an overview of the data types – collected from a variety of sources – currently used for decision making in commercial agriculture.

**VALUE STATEMENT**

The data sources presented in this summary identify freely downloadable (provided by federal agencies) or farmer-driven data sources. In this section, the farmer will learn how to identify and access useful farming data sources with the goal of using the data for daily farm-related, decision-making processes, such as when, where and how to plant (e.g., seeding rates); when and how to apply inputs (e.g., fertilizers, herbicides and fungicides); and when to harvest (e.g., timely harvest for susceptible areas).

## Ag Data Source 101

This data source could be divided into agronomic data and machinery data. The agronomic data module can be subdivided as related to its source into Soils, Crops, Weather and Remote Sensing components. The machinery data module can be segmented into Machinery Operations and Machinery Applications.

**Table 1.** Overview from the data types – collected from a variety of sources – currently used for decision making in commercial agriculture. The data source can be dissected into agronomic and machinery types.

| Type | Data Types | Sources | Data Timing | Application |
|---|---|---|---|---|
| AGRONOMY | Soil | SSURGO | Off-season | Know different soil type |
| | | Grid sampling | Off-season | Soil test, physical and chemical properties |
| | | Water sensors | In- or off-season | Measure the water content |
| | | VERIS | | Mapping soil characteristics |
| | Crops | Scouting | In- or off-season | Scouting for weeds, diseases, insects |
| | Weather | Mesonet | In- or off-season | Daily weather data |
| | | NOAA | Off-season | Historical weather data |
| | Remote sensing | Satellite | In-season | Built the vegetation indices to track vegetation health status |
| | | LIDAR | Off-season | Mapping soil topography |
| | | UAV | In- or off-season | Built the vegetation indices to track vegetation health status |
| MACHINERY | Crops | Grain moisture sensors | Harvest | Moisture for yield correction |
| | | Yield monitor | Harvest | Real-time yield and combine operating parameters |
| | | Planting monitor | Seeding | Real-time seeding and planter operating parameters |
| | | Liquid and dry application | Liquid and dry product | Real-time application and machine operating parameters |
| | | Other sensors | | |

# Agronomic Data Sources

## Soils

**Soil Type:** This source identifies data layers related to soil features, soil type and characterization of soil factors and soil nutrient testing.

The Soil Survey Geographic Database, SSURGO, provides detailed information on soil properties and qualities useful for planning and management of soil (Figure 1).

**Links:**
https://datagateway.nrcs.usda.gov/

**Figure 1.** Visualization of soil features – SSURGO database.

## Crops

This source identifies data layers related to crop features, plant traits (e.g., stand counts, plant height and size), identification of pests (e.g., crop scouting) and characterization of plant nutrient status (e.g., plant nutrient analysis).

Crop scouting is related to the process of assessing pest incidence and crop performance, estimate economic loss and implement a corrective practice.

**National Agricultural Statistics Service (NASS) Database:**

NASS database provides agriculture survey and census data published by the U.S. Department of Agriculture. The data can be customized by crop, state, district and county.

**Links:**
https://quickstats.nass.usda.gov

## Weather and Climate

Climate data provides long-term atmospheric and weather conditions, such as precipitation and temperature.

**Example of climate data related to crop growth:**
a) Growing degree-days; b) Drought index; and c) Climate normals. Available sources of climate data: PRISM data (Figure 2), NCDC and MRCC.

**Links:**
https://www.weather.gov/

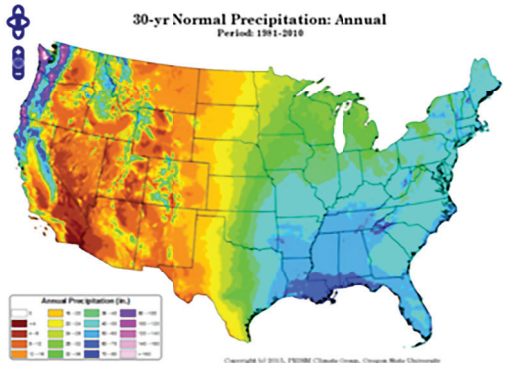


**Figure 2.** Normal Precipitation, PRISM Climate Group, Oregon State University.

## Remote Sensing Imagery

Remote sensing is a technique to obtain remotely sensed data with satellites, airplanes, unmanned aerial vehicles (UAV) platforms and field sensors. From the satellite aspect, there are several satellites with different spatial, temporal and spectral resolution, such as MODIS, Landsat, Sentinel, Rapid Eye, among others (Figure 3).

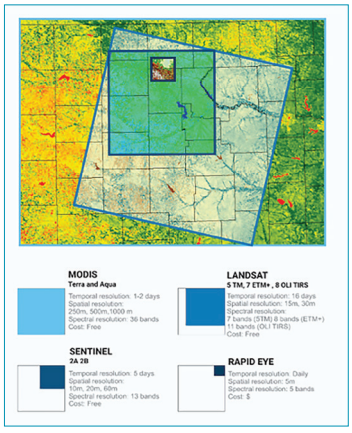


**Figure 3.** Satellite data sources, temporal, spatial and spectral resolutions.

# Machinery Data Sources

## Machinery Operation

This data source refers to how a machine performs during a specific operation, for example, data like fuel consumption, speed, etc.

During field operation of machine systems, sensors are available for monitoring level/quantity of liquid and dry products in the tanks, flow rate, moisture, application pressure and other physical properties of dry and liquid products; grain quantity in the seed carts during seeding, grain levels in the bin and grain quality sensors during harvesting. The sensors help maintain accurate flow of liquid and dry products and maintain adequate system requirements, such as air pressure in the pneumatic spreaders to deliver products at the point of application and to monitor grain status in combines. Performance and logistics data of both tractors and precision machinery can be captured using numerous **CAN-BUS data**.
As an example, tractor and machinery CAN-BUS can provide performance data like fuel consumption, slip, engine load and input application rates, etc.

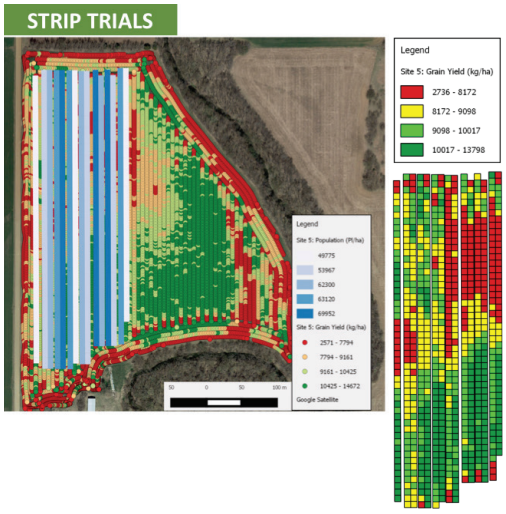


**Figure 4.** Yield map.

## As-applied Application Data

This data source provides a lot of insight on state of machine efficiency and accuracy during input application, harvesting, etc. It has data ranging from seeding rate prescription, row unit ride quality to downforce application. This data is brought in through farm management information systems to analyze operating efficiencies at a later stage.

**Yield data** is very important in building datasets to make decisions in future inputs (Figure 4). Yield maps allow producers to overlay harvest data with hybrid/variety maps, nutrient maps and soil maps to determine yield performance. Similar datasets are generated by other machine systems, including dry fertilizer applications, precision irrigation systems and others. Overall, all the data helps producers develop knowledge-based decisions for future crop inputs.

**Telematics and wireless data transfer** have increasingly become more common for all agricultural operations. This allows producers to upload as-applied data to their home computer or service provider via the Internet in real time. This technology is also being utilized for remote diagnostics, troubleshooting and to monitor the equipment's operating parameters.

**Table 2.** Sensor options for data collection.

| MACHINE OPERATION | OBSERVATION | SENSOR TYPE |
|---|---|---|
| Soil preparation and pre-planting | Soil EC, soil organic matter | Infrared |
| | Field topography | GPS |
| Planting | Seed metering unit | Electric motors with encoders |
| | Seed singulation | Optical sensor |
| | Row unit acceleration | Accelerometer |
| | Soil moisture and organic matter | Smart firmer (Infrared sensor) |
| | Planting state for coverage | Potentiometers |
| | Gauge wheel load | Load cell |
| | Downforce implementation | Hydraulic pressure sensor |
| | Speed | GPS or radar sensors |
| | Geo-positioning | GPS |
| | Grain level in the tank | Ultrasonic sensor |
| Liquid and dry application | Liquid flow rate | Flow meter |
| | Liquid pressure | Pressure transducer |
| | Speed and geo-positioning | GPS |
| | Boom height | Ultrasonic sensor |
| | Liquid level | |
| | Air pressure | Pressure transducers |
| | Speed of spinner on spreaders | Proximity sensors |
| | Speed of conveyor metering dry products | Encoders |
| In-season crop health | Crop vigor | Multi-spectral, broadband color infrared sensors |
| Harvesting | Grain flow | Load cell, hall effect and optical sensor |
| | Header height | Potentiometers |
| | Grain moisture | Capacitate sensor |
| | Speed and geo-positioning | GPS |
| | Grain bin level | Ultrasonic |
| Other | Weather | Wind speed, wind direction, temperature and humidity sensors |

For more information and links to additional resources, visit www.unitedsoybean.org/techtoolshed

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