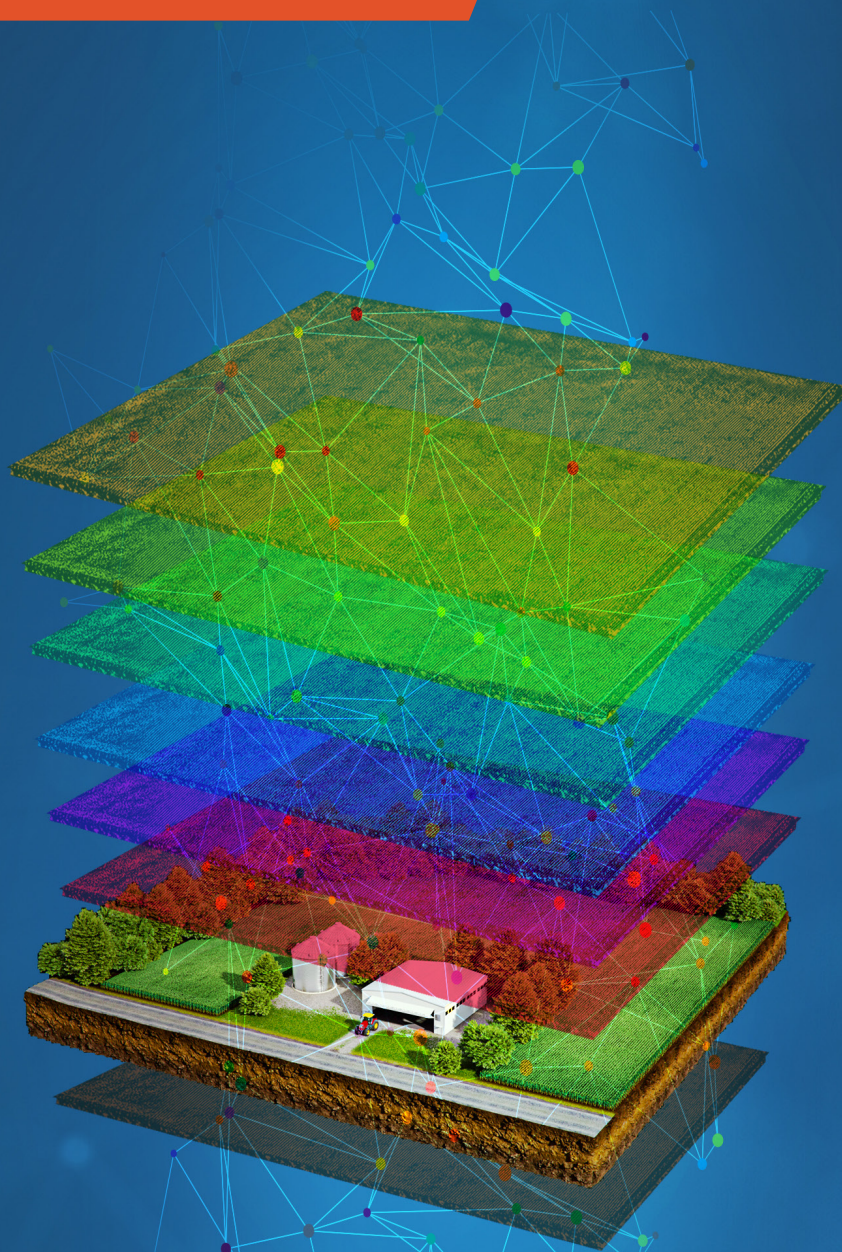


WHITE PAPER



THE AGMRI PLATFORM

Leading the Ag Digitization Revolution through AI



HOW IS MY CROP DOING?

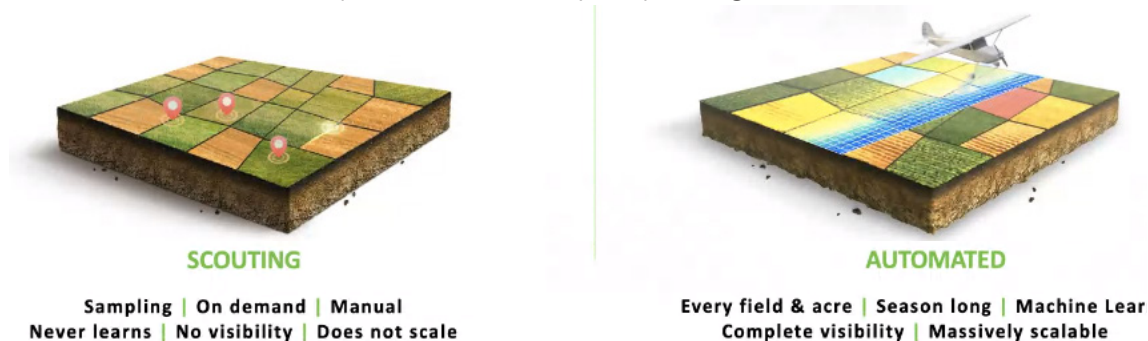
How is my crop doing? Every farmer will probably ask themselves that question, in one form or another, dozens of times across the growing season. Attempting to answer it with a high level of precision is not always easy, and it becomes exponentially harder at larger scales—across a retail territory, county, or state.

To even begin to arrive at an answer, farmers need to scout their fields. This is a costly and time consuming process, especially if done frequently or on a large scale. More than that, manual or even drone scouting is at best a representative sampling. It is effectively impossible to thoroughly scout every acre of every field, meaning that no matter what, some important things will be missed. Signs of disease are often subtle, easily missed by the human eye. The acres the scouts did observe were weed free, but perhaps some of the acres they skipped were not. Once the scouting is done, farmers and agronomists may need to interpret the findings. Is that discoloration of the leaves due to a nutrient deficiency, waterlogging, or crop disease? Farmers might need to scout again. Results may be inconclusive. Time is always of the essence.

But what if farmers, retailers, and operations managers could get access to clear, comprehensive insights into the state of their fields, entirely automatically? What if they could drastically increase the efficiency and precision of their scouting operations, without compromising accuracy? What if this could scale to millions of acres without losing effectiveness? This and more is provided by Intelinair's AGMRI platform.

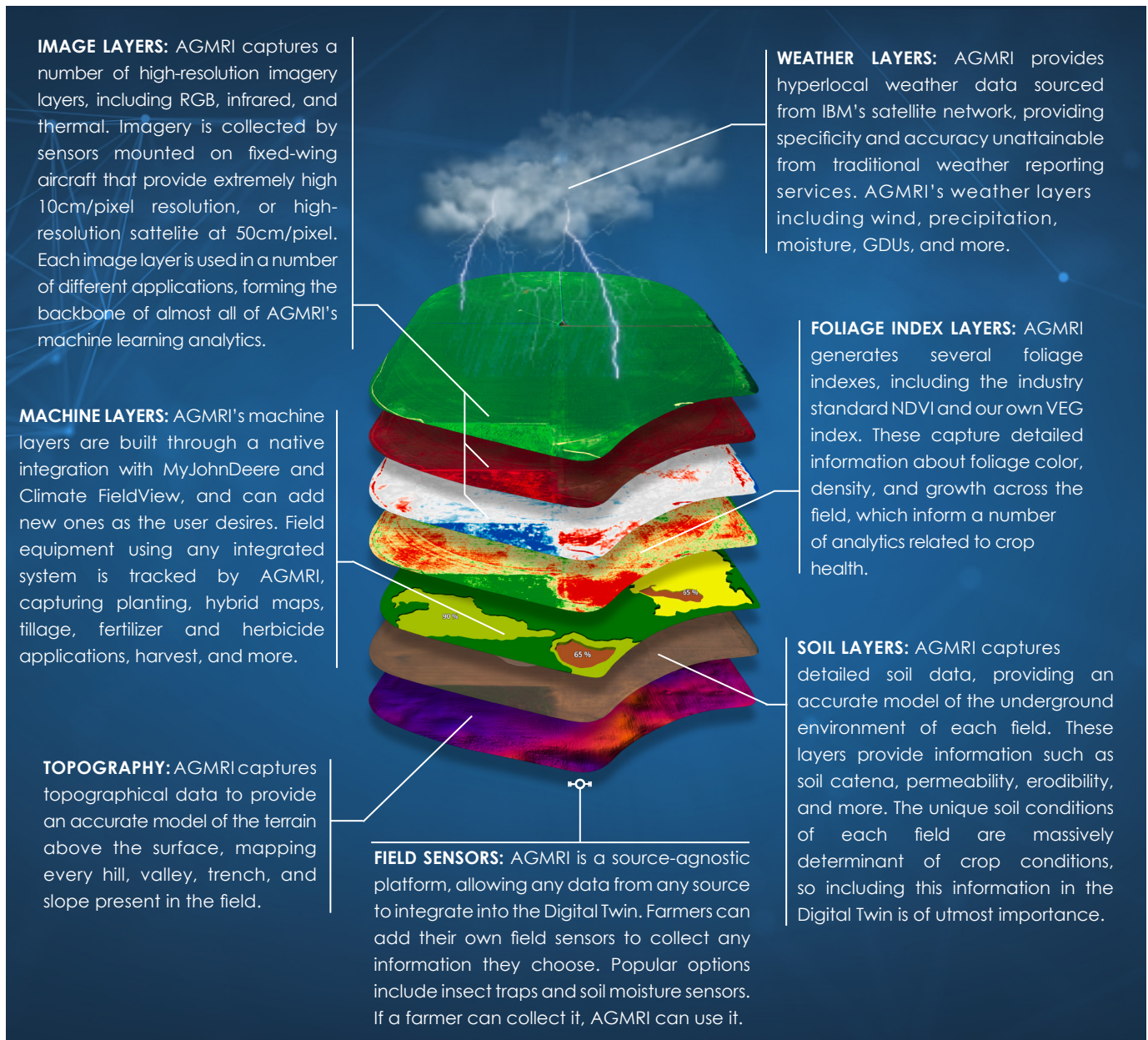
WHAT IS AGMRI?

AGMRI is the revolutionary decision support platform for Ag that uses artificial intelligence and high-resolution aerial imagery to analyze field conditions and produce meaningful insights for farmers, agricultural retailers, and more. Everything that takes place on a farm from planting to harvest requires access to consistent, accurate, and timely information. Applying post-emergence herbicides requires identification of the presence, location, and density of the weeds needing to be sprayed. Making replant decisions requires timely determination of emergence success early enough for the replanted seeds to mature. The AGMRI platform provides users with a comprehensive yet accessible understanding of their field that compliments and augments the capacities of manual scouting. Complex analytics are abstracted to the user via a visually intuitive interface which includes relevant maps, badges, and alerts. This brings to the surface important details that users need to see, giving them immediate answers to the question "how is my crop doing?" at the touch of a button.

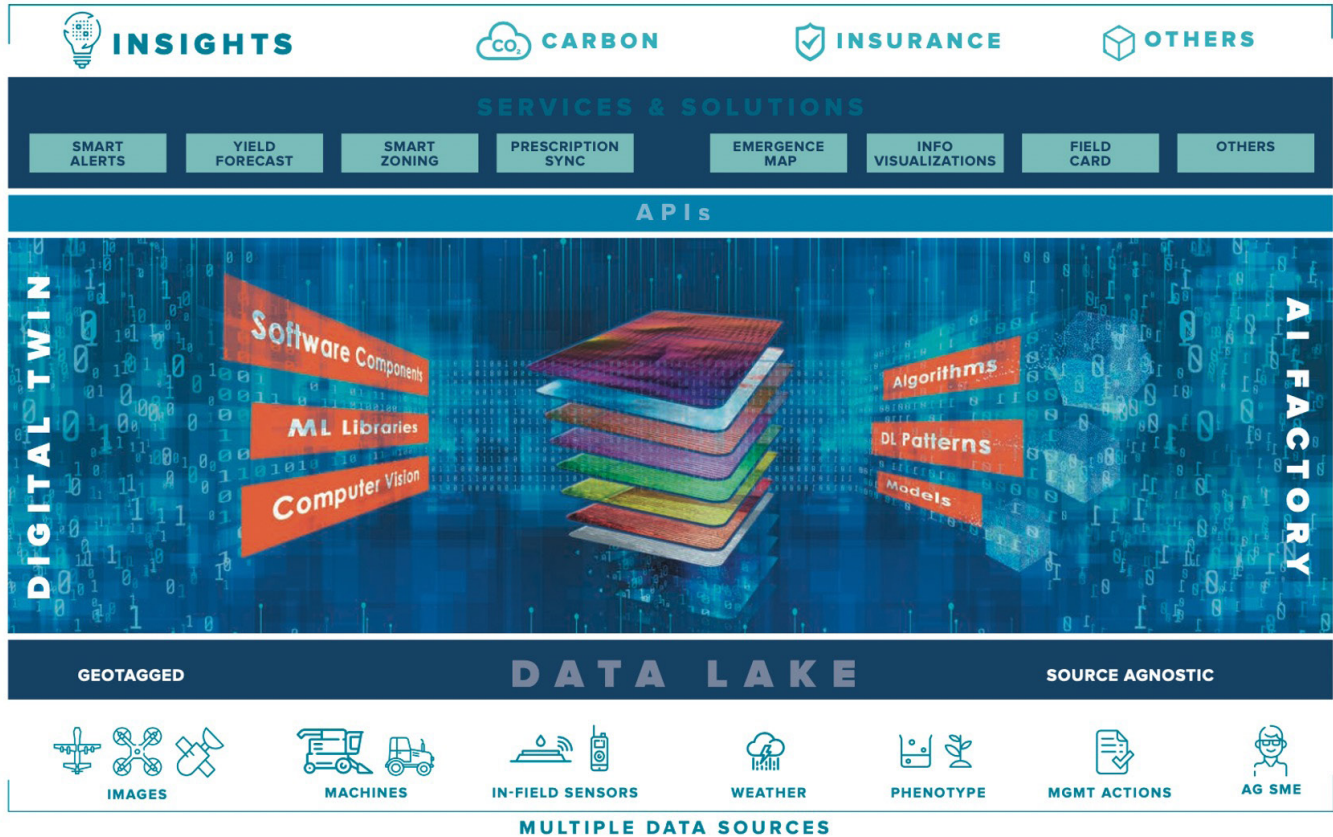


THE DIGITAL TWIN

AGMRI provides insights through an aggregated and interpreted data pool called the Digital Twin. One can think of the Digital Twin as an exact model of a field in digital space. Since no two fields are ever the same, AGMRI creates a unique model for each field under its purview, built from all available information including soil composition, field topography, color, thermal, and infrared imagery, crop health indices, and machine and weather data. The Digital Twin organizes these myriad data into “layers,” each of which represents a single slice of what is going on in the actual field at the time. If rain creates a large pool of standing water in the real world field, there is a layer that represents that on the model. If ten acres experience poor emergence, another layer will represent that. Altogether, the Digital Twin forms a near-perfect virtual model of the field for AGMRI to analyze with powerful machine learning algorithms, providing high-quality, true-to-life insights.



The Digital Twin aggregates all of this information into a unified data pool, but as impressive as it is, raw information is most often of limited use on its own. AGMRI's true value is in its intelligent analytics. Using the Digital Twin as a data source AGMRI derives actionable insights and alerts to keep farmers informed on the state of their crops all season long.

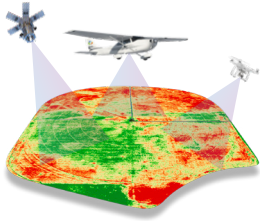


AUTOMATED INTELLIGENCE

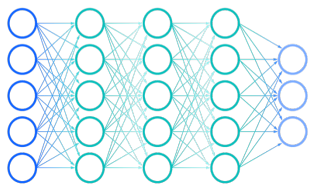
AGMRI is an Industry 4.0 AI factory centered on the Digital Twin. The platform leverages a number of computer vision and deep learning algorithms to analyze the massive amounts of data in the Twin and produce insights that inform users' management decisions. We have identified many agricultural patterns that indicate crop stress conditions on a field, and have successfully trained the AI to detect more than 30 of them. This allows AGMRI to automatically pinpoint managed areas, weed clusters, planter skips, bare soil, standing water, nutrient deficiencies, disease pressure, and more.

AGMRI's computer vision and deep learning algorithms use these detection patterns to draw conclusions about field conditions. While the systems function differently, they work in tandem to identify field patterns and provide the most accurate insights. To demonstrate how each system works, consider the following example of AGMRI's row tracing analytic.

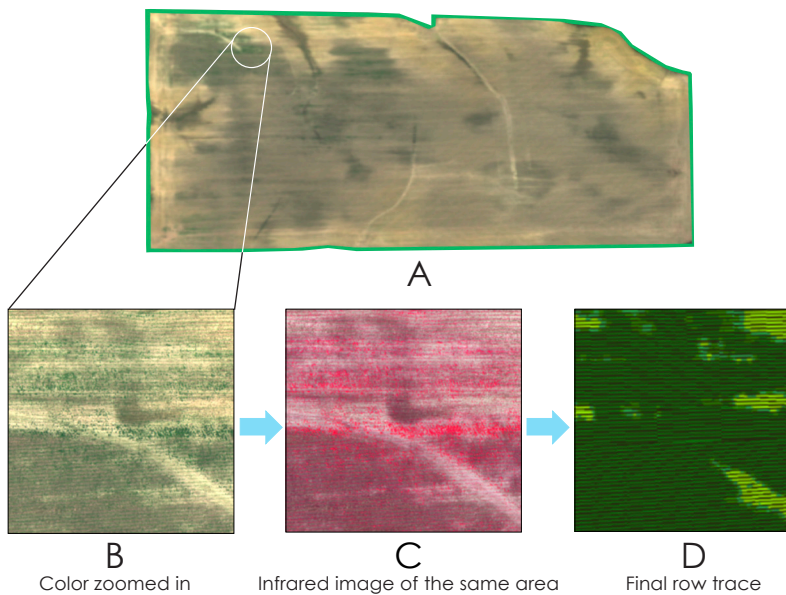
Row tracing forms the backbone of many of the analytics provided by the platform. AGMRI traces rows by searching imagery layers for patterns indicative of linear plant growth, utilizing computer vision and deep learning processes to do so.



Computer Vision: Computer vision works by searching for specific, pre-defined signs of crop rows in the image layers. For the purposes of row tracing, the algorithm will include patterns such as crop-colored pixels across image layers, and As-Planted data from the machine layer, while it will exclude bare soil, rocks, and standing water. After analysis, only areas that include patterns related to crop rows will be left, leading to a successful row trace.



Deep Learning: AGMRI's deep learning algorithms use neural networks trained on tens of thousands of images of identified crop rows across several image spectra. The network "learns" what actual crop rows look like from the images it is trained on, and is then able to decide for itself exactly which image patterns to include and exclude in its detection. This allows an extra layer of accuracy by searching for unconventional patterns that the more rigid computer vision algorithms might miss.



ROW TRACING

Image A shows a color image of an 82 acre soybean field. At this resolution, rows and fine details are nearly imperceptible. Zooming in close, we can see individual crop rows (B). AGMRI compares the green pixels in this RGB image to the darker pixels in the infrared image (C) to create the final row trace (D). This forms the foundation for the weed detection process.

When combined, these two systems can detect a myriad of field problems and conditions that can then be delivered to farmers as actionable maps and alerts.

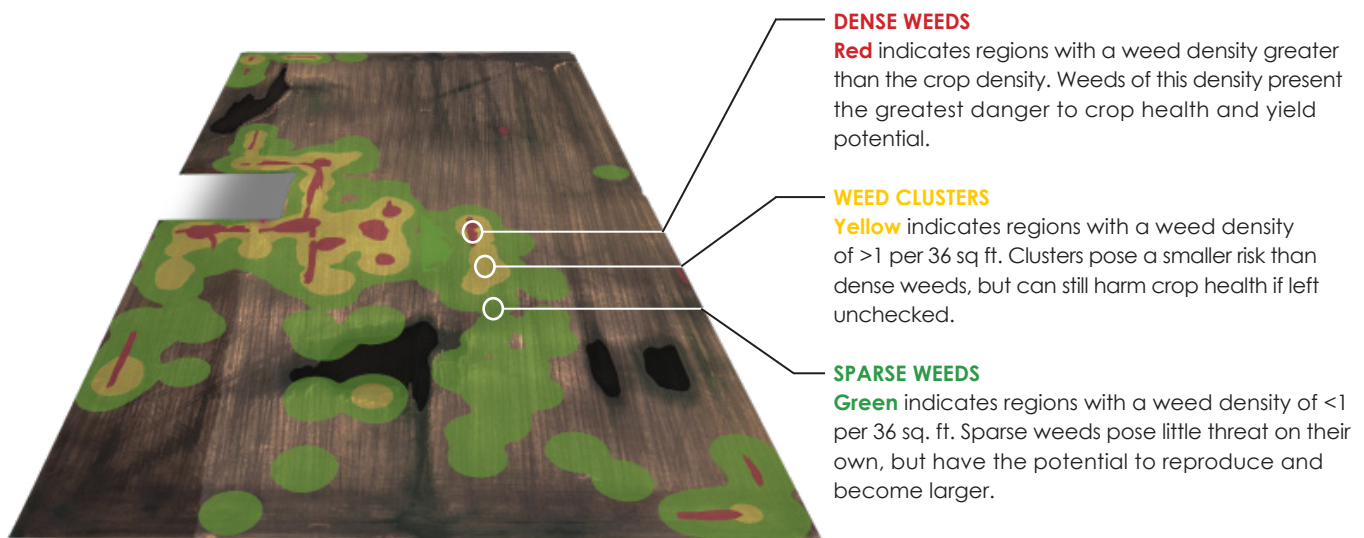
ACTIONABLE INSIGHTS

AGMRI automatically aggregates data through the Digital Twin, processes it with artificial intelligence, and finally delivers it as simple, actionable insights. These insights come in the form of maps and alerts, providing a continuous, comprehensive understanding of the state of the field across the entire season with a single tap.

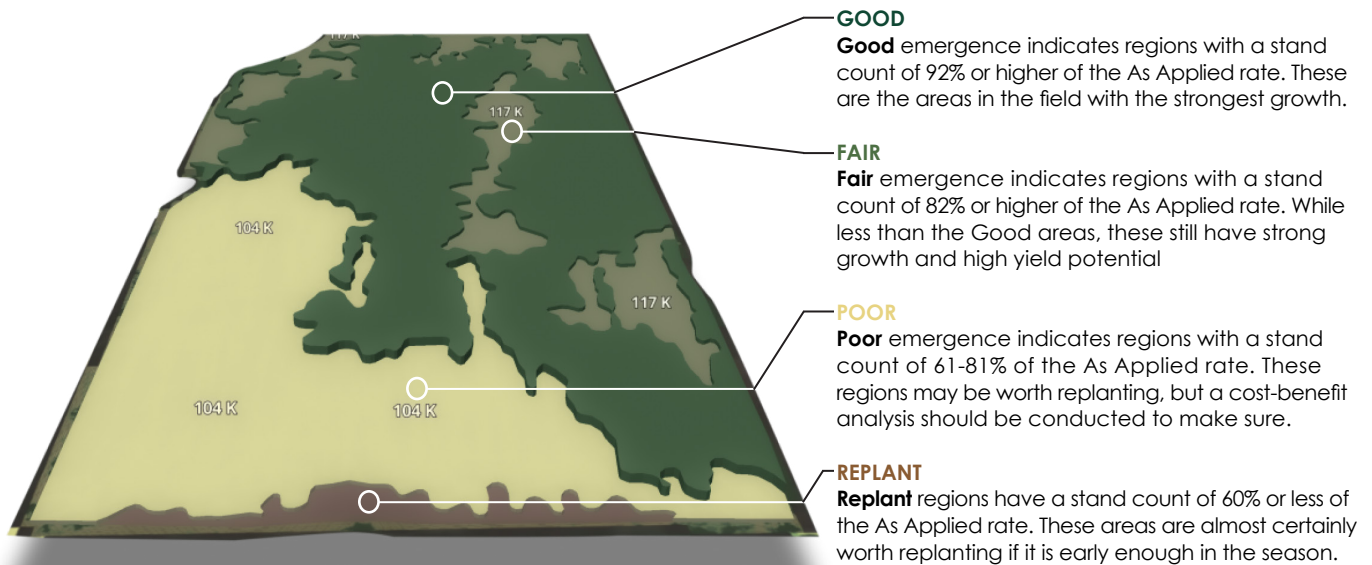
Maps

AGMRI provides four interactive analytic maps during the growing season to provide a complete and transparent view of their respective field conditions for the user. Each of these maps additionally power their own set of unique actionable alerts, which will be discussed in the following section.

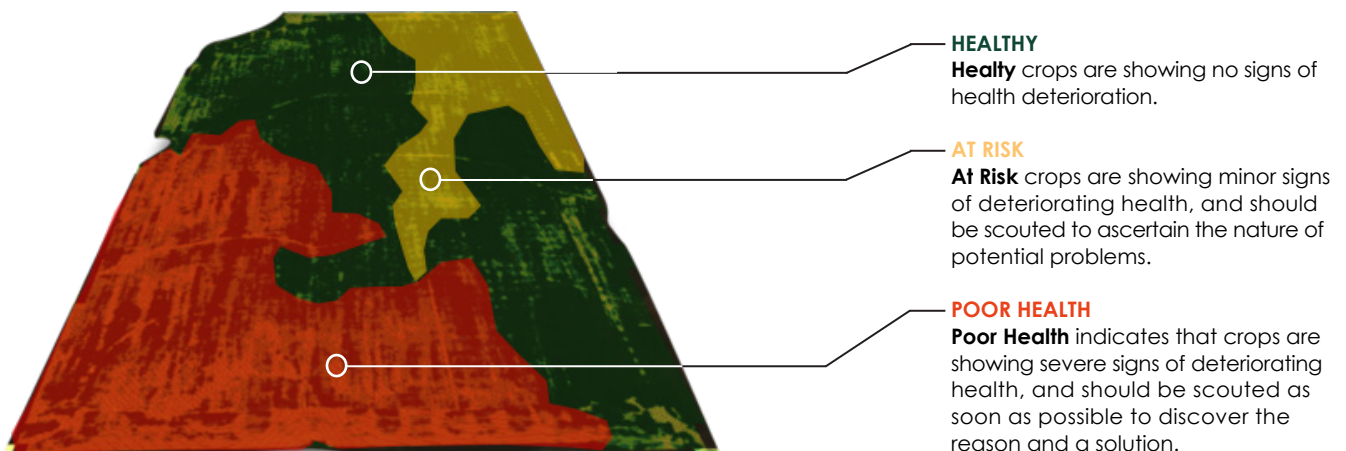
Weed Map: The weed map provides a full view of weed pressure from pre-plant until canopy close. Detected weeds are divided into three color-coded categories based on density. This map enables users to quickly ascertain where weeds are growing and whether or not they pose a threat to profitability. This information can help users determine the most effective weed management measures to take. The weed map powers the weed pressure and weed escape alerts.



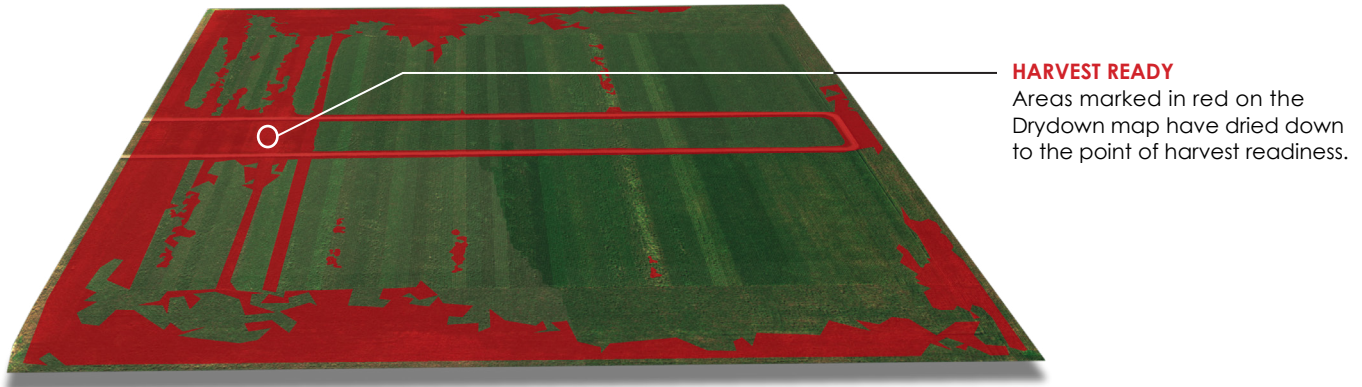
Emergence Map: AGMRI's second map is the emergence map, which is active from the first signs of emergence to the early growing season, generally around V4 in corn. This map provides a comprehensive view of emergence across the field. For the first few weeks AGMRI provides a binary map of "good" and "at risk" emergence, providing early intelligence on the highest and lowest performing regions of the field. Towards the V2-V4 stage this develops into a more complete map, which includes approximate stand counts and four tiers of emergence success. The emergence map provides users with important information to guide replant operations and yield estimation. The emergence map powers the low emergence and replant opportunity alerts.



Health Map: The crop health map is active from the end of emergence until drydown. This map provides an in-depth look into crop health across the field, showing regions with strong growth in green, and compromised areas in yellow and red depending on severity. AGMRI is capable of detecting signs of disease, nutrient deficiency, and pest pressure several weeks before foliage color change is observable to the human eye, making the crop health map a powerful tool for quickly identifying and responding to those threats. The health map powers the low crop health and disease pressure alerts.

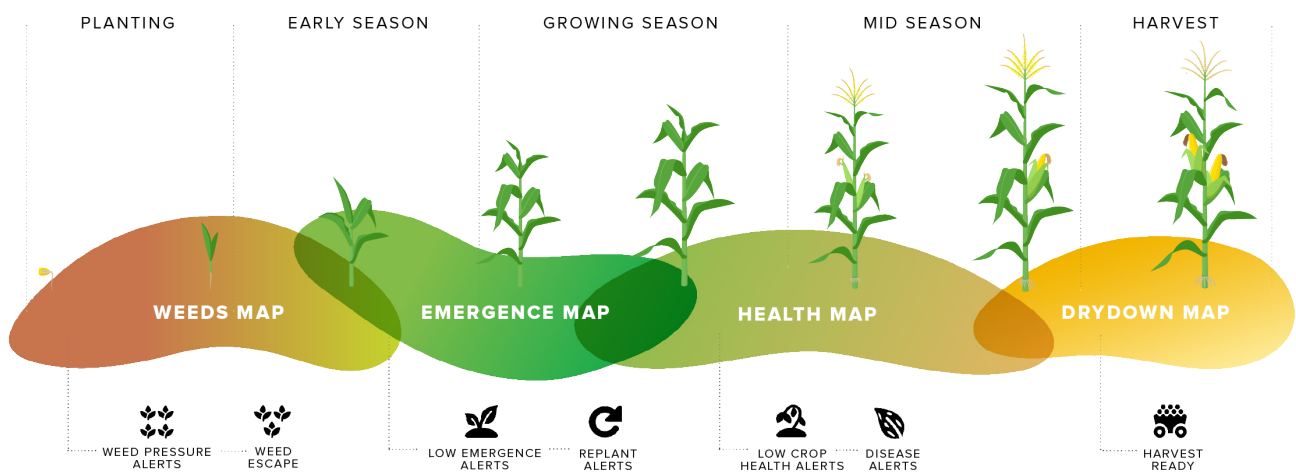


Drydown Map: AGMRI wraps the season with the dry-down map, which detects moisture levels across the field, identifying harvest readiness within various areas. This map empowers farmers to prioritize their harvest operations based on which fields show the most readiness at any given time. The drydown map powers the harvest ready alerts.



Alerts

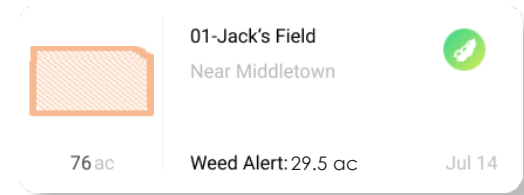
While AGMRI's maps provide overviews of conditions across the entire field, alerts give specific, timely notice on individual issues that require immediate action. AGMRI provides seven alerts, each related to its own unique issue and with its own conditions for activation. When an alert triggers, AGMRI pushes a notification to the users' mobile device and generates an alert card in the app. Alert cards provide detailed information about the nature of the identified issue, including the type of alert, name of the field that triggered it, number of acres affected, and the locations on the relevant map where the issue is taking place.



This system allows farmers to quickly identify and respond to issues in their fields before they significantly harm yield potential. AGMRI's alerts are actionable, providing users with several follow-up options on the issues detected, including virtual scouting and machine sync. The seven alerts, along with their triggers and benefits, are as follows:

Weed Pressure

When weeds are detected in 20 acres or 20% of a field, AGMRI generates a weed pressure alert. This gives farmers timely notice of fields suffering from intense weed pressure, enabling them to plan herbicide applications or other control operations quickly, ensuring yield potential is harmed as little as possible.



Weed Escape

When AGMRI detects weeds in an area the machine layer shows was recently sprayed with herbicide, AGMRI generates a weed escape alert. Weeds that survive herbicide applications can quickly repopulate across fields if left unchecked, which can undo much of the benefit of the spray. This alert gives farmers the opportunity to quickly identify and treat these weed escapes in their field before they cause additional issues.

ALERT—SERIOUS ISSUE
Weed Pressure

29.5ac 38.8% 6/02/21

01-Jacks Field
Walden Farms, Jack Walden
76ac Corn 3/15/21

AGMRI has detected weed pressure in parts of this field

AGMRI has detected signs of weed pressure in 29.5 acres (38.8%) of this field. Sparse weeds are marked in green, weed clusters are marked in yellow, and dense weeds are marked in red on the weed map. We recommend scouting the to determine an appropriate course of action.

[Grower card](#) [Directions](#)

Virtual scout

IN-APP ALERT

When viewing an alert in the AGMRI mobile or web app, users are presented with the complete details of the situation, including affected acreage, field name and location, as well as an annotated display of the map relevant to the alert. From this page, users can select follow-up options, such as virtual scouting or field directions.



Low Emergence

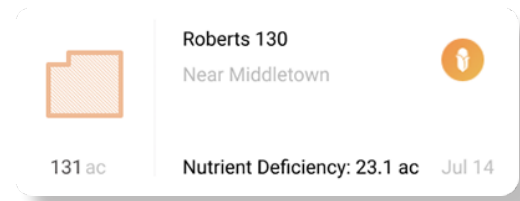
When poor emergence (<81% stand count) is detected in 20 acres or 20% of a field, AGMRI generates a low emergence alert. This gives farmers timely notice of specific areas suffering from poor emergence, providing an opportunity to scout specific areas for potential causes and determine the viability of a replant.

Replant Opportunity

When AGMRI detects extremely low (<60%) or no emergence in 20 acres or 20% of a field, a replant opportunity alert is generated. Replant operations can recoup a large percentage of the potential yield losses caused by poor or failed emergence; however, replanting must be completed early enough in the season to allow the replanted seeds time to mature. This alert provides timely warning of regions that would benefit from a replant so farmers can quickly mitigate or manage the situation.

Low Crop Health

When poor crop health is detected in 20 acres, or 20% of a field, AGMRI generates a low crop health alert. This alert identifies specific field regions suffering from exceptionally poor foliage growth. This gives farmers the opportunity to perform a targeted scouting operation of the plants in question, determine the cause of the foliage loss, and quickly begin to develop a solution.



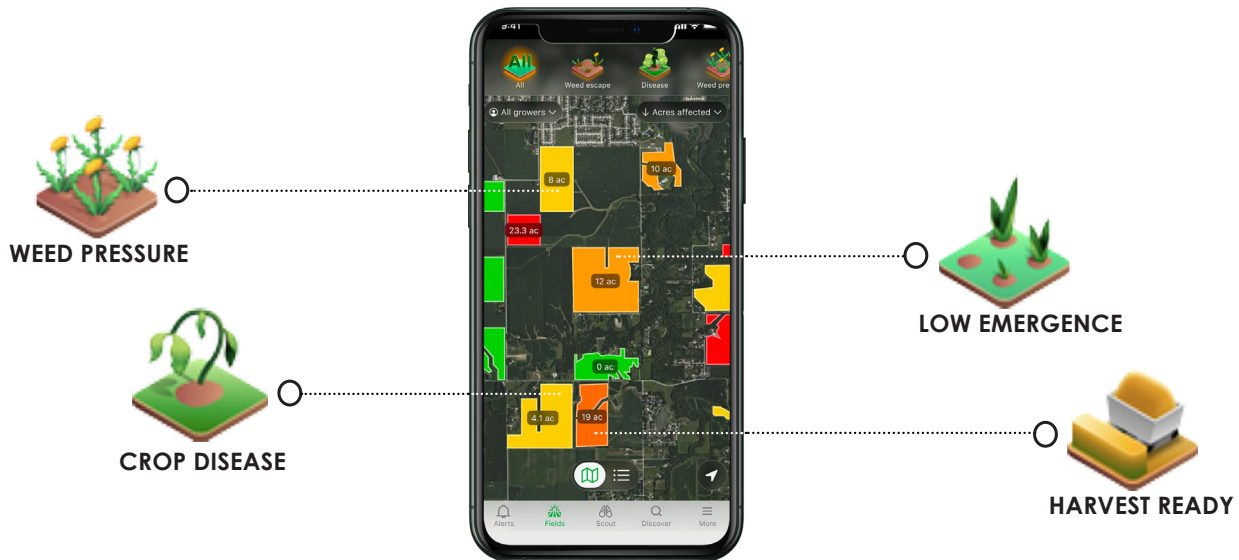
Disease Pressure

When AGMRI detects potential signs of disease pressure in 20 acres, or 20% of a field, a disease pressure alert is generated. Much like how humans run fevers, crops increase their internal temperature when under disease pressure. This alert intelligently detects crops with higher than average internal temperatures and correlates them with other field sensor data, providing warning of potential disease pressure up to two weeks before visible symptoms appear. This gives farmers early warning and time to apply a fungicide or other treatment to reduce the potential for a disease outbreak and yield losses.



Harvest Ready

When more than 50% of field acreage has dried down to harvest-ready levels, AGMRI generates a harvest ready alert. This gives farmers timely notice of fields that have significant amounts of harvest-ready crops. Knowing which fields or portions of fields are ready for harvest allows farmers to prioritize and optimize their harvest plans.



SOLUTION SUPPORT

In addition to actionable insights, AGMRI provides a pair of supporting tools that can help farmers gain more information about detected problems and begin implementing solutions. These tools are Virtual Scouting and Machine Sync.

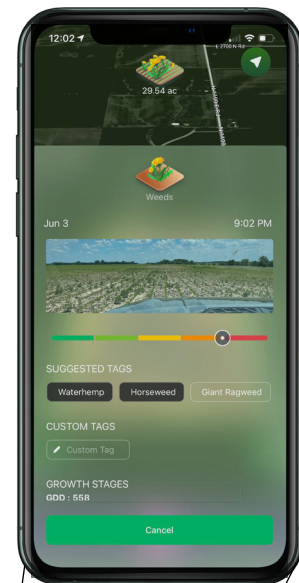
Virtual Scouting

AGMRI provides targeted virtual scouting powered by the previously discussed maps and alerts. Unlike competing platforms which merely provide imagery, AGMRI's alerts direct users to the precise location of issues in their fields, allowing them to virtually scout exactly where it is needed. The platform's extremely high image resolution imagery delivers a virtual bird's-eye view of the user's crops, with the ability to zoom in to see actual plants or weeds entirely remotely. AGMRI's virtual scouting features include:

Multi-layer Scouting: Users can view their fields in any of AGMRI's many image layers, including full color, infrared, NDVI, VEG, and more. AGMRI's 10cm/pixel resolution allows users to virtually navigate maps and visually locate specific issues identified by alerts.

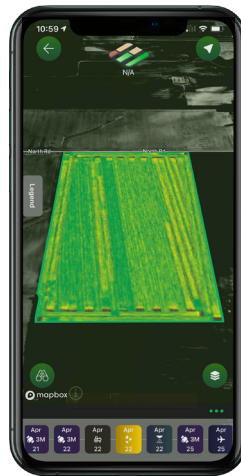
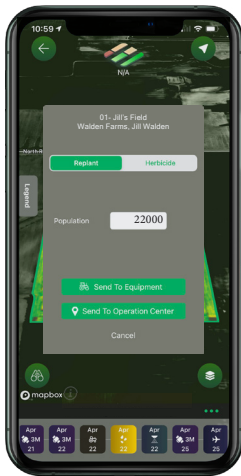
Smart Tagging: Users can create scout reports tied to specific locations or regions in their field. These can include text notes and images, as well as several intelligently suggested smart tags based on the alert being scouted. Users can additionally create their own custom tags if they so choose. These tags can provide at-a-glance information on specific issues across the entire farm.

Seamless Collaboration: The insights gleaned from scout reports can be shared with and viewed by anyone provided access, allowing farmers, equipment operators, and field workers to easily collaborate and arrive at effective solutions.



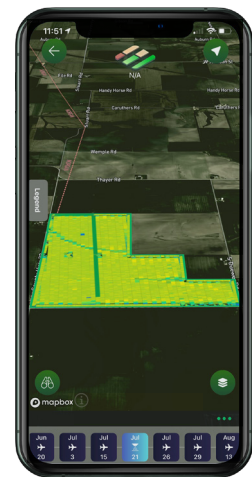
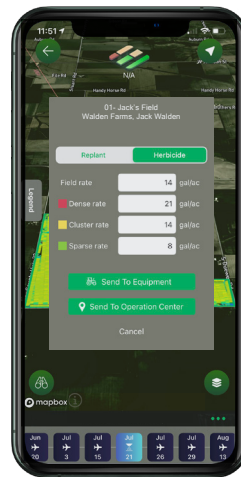
Machine Sync

AGMRI has native integration with MyJohnDeere™ and Climate-FieldView™. Farmers who use either system can directly send spray instructions to their field equipment, using insights from AGMRI's maps as a guide. Currently, users can create a herbicide application order or replant order from the weed or emergence map, respectively. All applications performed with synced vehicles are automatically added to AGMRI's Machine Data layer, allowing users to view them in the app.



Replant: Farmers can use the emergence map to create a custom replant order. Users assign a seed population rate for selected acres with low emergence. Once it is sent, the order provides field equipment with GPS coordinates of all the regions to be replanted, allowing automatic navigation and seeding.

Herbicide Application: Farmers can use the weed map to create custom herbicide spray orders. Users assign separate spray rates for each of the three weed densities identified on the map, as well as a generic field rate for other acres. Once it is sent, the spray order provides field equipment with GPS coordinates of all weeds detected in the field, allowing automatic navigation and spraying.

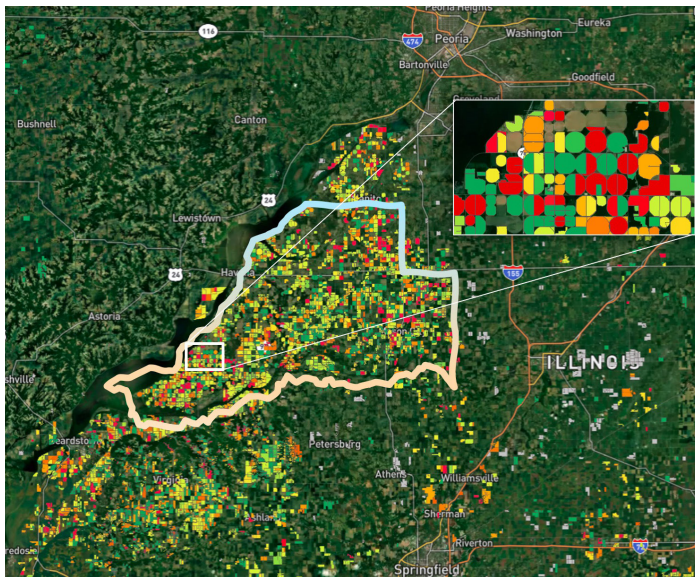
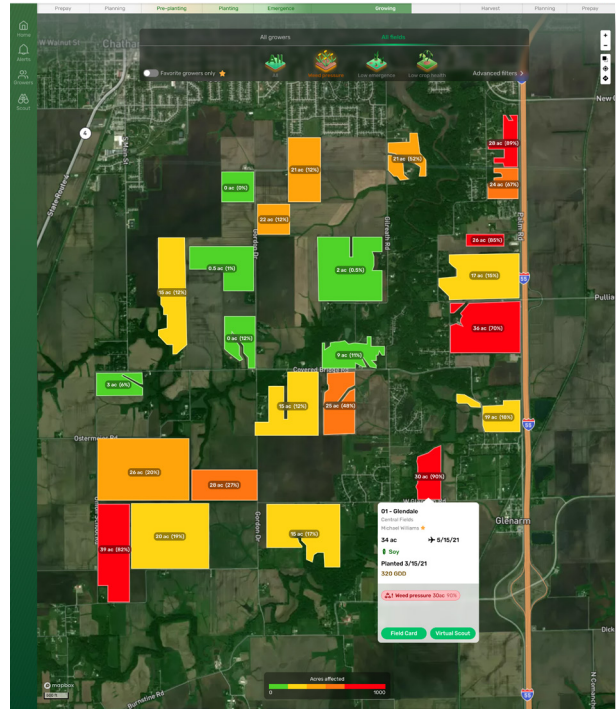


ENTERPRISE SCALE

AGMRI can support ag retailers and farm managers of large operations. AGMRI Enterprise provides all of the platform's insights on a larger scale. Users gain additional functionality for their full operational management needs, including:

Aggregate Maps and Alerts: AGMRI Enterprise creates a complete set of maps for all fields under the users' purview, providing a clear, at-a-glance view of weed, emergence, health, and harvest conditions across the entire operation. Ag retail managers receive alerts for all of their fields, allowing them to efficiently follow up on time-sensitive issues no matter the size of their territory.

Priority Lists: Users can create lists to organize fields by alert acreage, prioritizing those most in need of attention. For example, users can see the top ten fields in their territory suffering from the greatest disease pressure, lowest emergence, and any other alert or map insight they desire.



Prospecting: Users can activate AGMRI's prospecting mode to discover problems and opportunities in their area, gaining a fuller understanding of their territory. Geolocated aggregate data keeps retailers informed when nearby areas exhibit issues related to any of AGMRI's maps or alerts.

Retailer Benefits: AGMRI's insights and alerts ensure that ag retailers and advisors are the first to know whenever issues arise in their customers' fields. When a participating customer receives a smart alert, so will the retailer, allowing them to make recommendations. This timely information allows retailers to provide the right products at the right time to protect against potential yield loss.

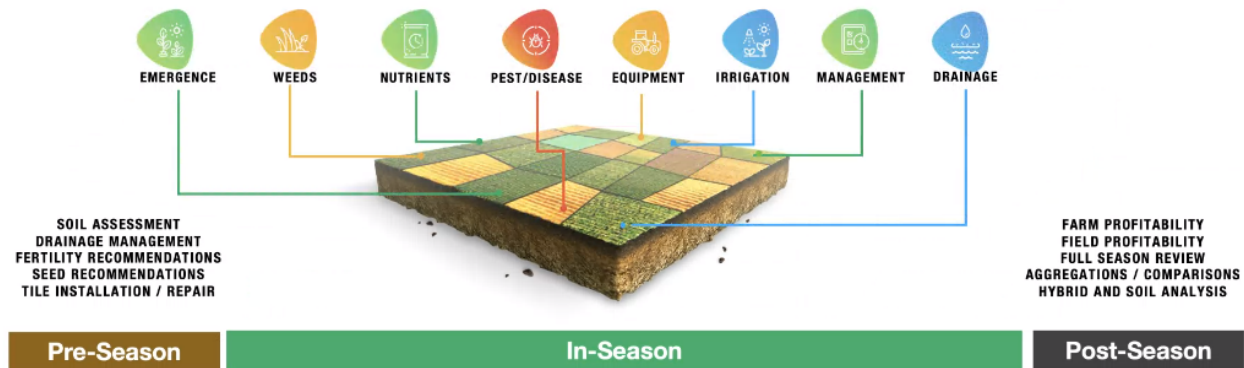
THE FUTURE OF CROP INTELLIGENCE

AGMRI's actionable insights already have proven themselves capable of saving farmers time and money and improving their yield potential across thousands of participating fields and millions of acres. However, we at Intelinair have much more in active development. While we fully intend to continue to expand our current focus on Agronomic Insights, this is only one of three pillars of the AGMRI platform. The next two are Sustainability and Aggregated Intelligence, and will each provide a number of exciting new features in the coming years. The current state of the AGMRI platform provides the groundwork for an expansive network of unified agricultural insights that cover every aspect of agriculture.

Expanded Actionable Insights: As we continue to collect more and more data on crop growth and harvest rates, we believe AGMRI will soon be able to provide farmers with accurate yield forecasting in the early-to-mid season, allowing them to effectively plan storage and transport. Additionally, while AGMRI currently primarily serves corn and soybeans farmers, we have plans to expand to a number of new crops. The artificial intelligence is already trained to detect crop rows, so any row-based crops can be easily integrated into our current machine learning models. We also intend to expand to fruit and tree crops with new algorithms to process their unique growing needs. Finally, we are looking into partnerships with government agencies to provide insights to support forestry and grassland development and cultivation, expanding the benefit from just farmers to the entire plant-care world.

AUTOMATED CROP INTELLIGENCE

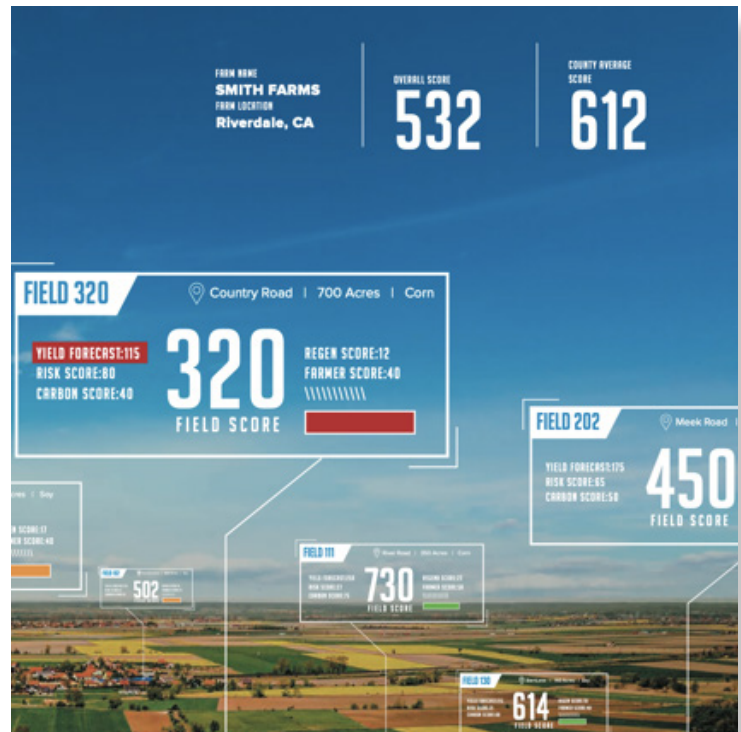
ANY FIELD – ANY CROP – ANYWHERE





Sustainability: As climate change casts its long shadow over the world, more and more farmers are moving towards sustainable and carbon-regenerative agricultural practices. Governments incentivize these practices, offering grants for farmers beginning sustainable programs and money for carbon credits. However, one of the primary issues facing farmers attempting to switch to regenerative practices is providing proof that they are successfully sequestering carbon to receive payouts. At Intelinair we believe that regenerative agriculture is an important part of the future of farming, and intend to support it with AGMRI's powerful insights. We have plans for integrating carbon sensing analytics into the Digital Twin, allowing farmers to easily and accurately track their carbon sequestration. This will allow us to collaborate with carbon credit vendors, streamlining the process of certifying farmers' credits and getting them to market.

Aggregated Intelligence: AGMRI Enterprise already provides insights at scale, but our aggregated intelligence goals aim higher. Leveraging the tremendous weight of geolocated data AGMRI processes across numerous fields on a regular basis, we believe that the platform has the potential to provide even wider reaching predictive analytics on the macro state of agriculture. One of the ways we intend to implement this is through regional yield forecasting. Unlike the personal yield forecasting discussed previously, this upscaled version would use AGMRI's anonymous grid collected data on crop health, emergence, along with weather data to make accurate predictions across entire regions rather than individual fields. Third-party agricultural entities, such as insurance, storage, and transport companies must prepare adequate resources to manage operations during the season. Maintaining too few resources can lead to bottlenecks, while too many causes unnecessary overhead costs. Successful region-wide yield forecasting provides additional information for planning and management purposes.



CONCLUSION

The AGMRI platform is the premier crop intelligence platform on the market, providing actionable insights powered by artificial intelligence that cannot be found anywhere else. AGMRI supports farmers and ag retailers of all sizes across the entire growing season to maximize their operational efficiency, contribute to reduced overhead costs, save time, and increase yield potential. To learn more about how you can use the AGMRI platform on your own fields, or partner with us to support farmers, visit agmri.com, or call 1-833-692-4674.



intelinair