A promise to fight world hunger

With the global population swelling to nine billion people by 2050, the world will have to double its agricultural output or face the risk of mass starvation. To tackle this critical problem, Purdue University’s world-renowned College of Agriculture has partnered with HPE and Aruba to launch a new digital ag program that combines Internet of Things (IoT) and high performance compute technologies to gather, transmit, and analyze field and campus lab data. The ultimate goal: more effective ways to sustainably grow nutritious, healthy, and abundant food for a hungry planet.
Sustainable agriculture: a global imperative

With world population expected to hit 9b people by 2050, the race is on to boost food production

To feed the growing world population, we need to double food production in the next 30 years.

But achieving that goal is a complicated undertaking. Simply doing more tomorrow of what we’re doing today is not a sustainable option.

One factor is the availability of arable farmland and pasture. Only 24% of the world’s ice-free land areas could feasibly be used for agriculture—and we’re using much of that space for other purposes. We’re running out of room—and putting additional land under cultivation will become increasingly expensive over time.

There’s also the impact of agriculture on the environment. As we cultivate more land, we sacrifice more of the Earth’s shrinking wild spaces. This potentially degrades the planet’s biodiversity and environmental resilience.

Another issue is water. Today, about 70% of the world’s fresh water supplies are used for agriculture. By 2050, growing demands for food production is expected to increase fresh water needs by another 15%.

Agriculture today is heavily dependent on fossil fuels: they’re used to power farm machinery, to manufacture fertilizers and pesticides, to process food, and to distribute it to consumers. Strategies to increase agricultural output must therefore consider the consequences of conventional fuel usage on the climate.

In addition, as the world’s supply of fossil fuels dwindles, agricultural costs will rise, which will drive up the cost of food. And eventually, non-sustainable energy sources will be depleted entirely. The world needs to be ready to feed itself when that happens.
Breaking new ground in agricultural research and innovation

Food supply, food safety, and sustainability are central to the college’s mission

Founded in 1869, the Purdue University College of Agriculture, one of the university’s 10 major academic divisions, is a world leader in the science of agricultural, food, and natural resources. The college prepares students for careers in these fields and advances research in food production, food safety, and sustainability. Through the Purdue Extension and engagement programs, the college also helps the people of its home state of Indiana and beyond improve their lives and livelihoods.
Empowered acres

To drive breakthroughs in research, the college must prepare and equip its people

How much irrigation is enough? What seeds grow best in a particular soil? How do fluctuations in sunlight impact plants’ health?

Researchers at Purdue’s College of Agriculture use the scientific method to answer those kinds of critical questions. They identify promising lines of inquiry, create and test hypotheses, and validate and publish research results.

Today, many of the richest areas of study require researchers to peer into the molecular workings of plant biology—right to the level of plant and pest genomics. Researchers must also be able to measure and analyze extremely subtle changes in plant health, growth, yield and decline.

One of the College’s top priorities, therefore, is to equip its researchers with state-of-the-art tools and facilities. These include labs for growing plants under highly controlled conditions, and a 1,408-acre field research station called ACRE (Agronomy Center for Research and Education) where researchers can study husbandry and harvesting techniques as well as the plants themselves. To ensure its researchers can generate the data they need to perform their studies, the College must also implement the right scientific equipment, from the simplest sensors to sophisticated machines such as genomic sequencing, chemical assay, and hyperspectral imaging systems. And it must implement the right IT to ensure researchers can drive maximum value from the data they generate.

“Brilliant minds come up through our programs. Our job is to empower them.”

- Patrick Smoker, Department Head/Director, College of Agriculture Information Technology, Purdue University
To nurture innovation, you need the right IT

Researchers need timely access to data—and the power to use it.

The Purdue College of Agriculture’s ACRE field research facility is equipped with sensors to detect information such as soil moisture, nitrogen, and oxygen levels. At one time, researchers were using thumb drives and cell phones to manually share field data. Someone—typically a student—had to be physically located in the field to transmit that data. Often, these students endured long stretches of boring downtime between data events. The College was running eight computers in its field research trailer to validate sensor data as it came in. The performance of these systems was not optimal. It took several hours per day of compute time to process the data. Because of these restraints, researchers lacked the real-time visibility into field data they needed to respond quickly to events occurring at the ACRE facility.

For the labs on the College’s campus, the critical IT issue is data volumes. The labs’ phenomics research correlates observational data with other information, such as the results of plant tissue assays. It is critical that the servers powering the labs’ Hadoop cluster be powerful enough to support the researchers’ analytics.

“We needed a way to manage our field research more efficiently and more effectively.”

- Dr. Richard Grant, Professor of Agronomy, Purdue College of Agriculture
Breaking new ground in data-driven ag research

Automated data capture in the field paired with powerful compute resources

To more effectively manage its field research, the Purdue College of Agriculture equipped its ACRE research station with an Aruba wireless network. This network enabled Purdue, HPE, and Aruba to develop cutting edge AgTech innovations, such as solar-powered mobile Wi-Fi hotspots for recording field data and next-generation adaptive wireless equipment for farm-scale wireless connectivity. The College also replaced its eight field research computers with a single on-site HPE Edgeline IoT System. This ruggedized system now runs the algorithms College researchers use to validate captured data before it is transmitted to the campus data centers.

Back on campus, the College runs its Hadoop data cluster on a high performance compute platform that leverages HPE Apollo 4000 systems. Because these systems, which were configured and implemented by HPE Pointnext, are purpose-built to serve big data storage-centric workloads, they provide the campus labs with the capacity to ingest its continually-growing body of research data without compromising applications performance.

“The HPE and Aruba solutions help us reduce the time it takes to translate scientific research into technologies that will enhance food security and improve lives around the world.”

- Patrick Smoker, Department Head/Director, College of Agriculture Information Technology, Purdue University
Harvesting the fruits of intelligent agriculture

Empowered with the right tools, Purdue researchers pursue new ways to feed a hungry planet.

Purdue College of Agriculture researchers can now manage their ACRE facility more effectively. If problems arise—for example, hungry rodents start damaging crops—research staff can intervene in time to protect their work.

Breakthrough scientific research flourishes in an environment of curiosity and creativity. Today, data uploaded from the ACRE facility allows researchers to more quickly pursue tantalizing “what if” questions based on current conditions in the field. Consider, for example, the interrelationships between day length, cloud cover, plant size, and soil moisture content. Researchers can track data on all of these variables in real time, and quickly set up and run experiments to test the impact of different irrigation schedules on plant growth and health.

By supporting effective, on-site validation of captured data, College researchers maximize their confidence in their field measurements, which supports better research outcomes. For example, some percentage of the nitrogen fertilizer that farmers apply to their fields escapes into the atmosphere. If researchers can pinpoint this phenomenon with enough precision, they can potentially help farmers reduce their fertilizer usage and costs—but clean, validated data is critical to pursuing this line of inquiry.

Within the College’s campus labs, its high performance compute platform equips researchers to interact with data more effectively. This helps to unlock both curiosity and creativity, and ensures the College can retain all of the data it generates over time.

1.4k-acre Field research station—now connected

>1 Pbyte Data generated by campus lab equipment

Insights To feed a hungry world

“By combining Purdue’s breadth of knowledge and experience with the right technology, we’re better equipped to address interconnected issues like feeding the world, sustainability, and protecting the environment. We can integrate and weave pieces of these issues into a whole.”

- Dr. Richard Grant, Professor of Agronomy, Purdue College of Agriculture

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