Overview:

Chemical use has become vital to industrial scale agriculture in both the United States and the world as a whole. The use of chemicals has also lead to several unintended consequences, however, and the repercussions are affecting both the people and the environment of the surrounding agricultural communities.

There are currently two main factors that play a role in chemical use: regulation, and social positioning.

Regulation: Organizations such as the USDA and EPA create national legislation for pesticide use. At the state level, the California Department of Pesticide Regulation handles all pesticide permits and applications. They strictly monitor the amount and frequency of pesticide use on California crops and use permits to track pesticide use trends.

Social Positioning: Anti-pesticide advocate groups frequently protest and lobby against pesticide use because of its adverse effects on humans. These organizations are concerned with the well-being of agricultural workers and the communities that surround agricultural land. They are a huge factor on creating new pesticide legislation.

Recommendation:

Create an all inclusive hardware/software suite that utilizes the ideology of “Integrated Pest Management” practices.

Data Collection: Develop methods of data collection for pest protection. These include life cycle trackers for pests in order to accumulate data on the mating and breeding cycles of common pests and pest traps with wireless cameras so that farmers can actively check on infestation levels in any given section of their field.

Analysis: Integrated software will be able to analyse and recommend action to farmers. Farmers can proactively spray pesticides at a time that will result in the most impact. By understanding where the outbreak is coming from, farmers can coordinate sprays only on the problem areas, both reducing the amount of pesticides used and maximizing the effect of the spray.

Automation: Automated devices will provide actionable solutions that are both safe and efficient. Automated drones will be able to carry out tasks delegated by farmers at any time, from anywhere. Drones will be far better suited to handle the dispensing of toxic pesticides and chemicals. These drones could target specific problem areas to maximize efficiency, while also spraying at night in order to give enough time for the chemicals to settle before workers take to the field in the morning. In time, with enough sensors and data analysis, drones could work completely autonomously, allowing farmers to focus solely on the big picture.
**Overview:**

From the federal government, down to state, county, and city compliance requirements, regulations managing water usage not only crosses into the territory or individual consumers, be that residents, businesses, farmers, landowners, and the like, but also the utility industry, as well. And under the focused lens of agricultural producers and providers, this has significant weighted meaning for agricultural water providers, which then directly impacts farmers.

Given that water is both a vital resource for consumption across several tiers, whether a region or crop-type is concerned with water mitigation or water quality protection is an important distinction.

**Recommendation:**

Develop integrated systems that allow for remote monitoring and control of key, low-process productions that help address regulatory compliance issues.

**Analysis:**

Integrated software will be able to analyse and recommend action to farmers. Farmers can proactively water their crops at a time and in a specific area that will result in the most impact. They can also monitor chemical use to prevent or mitigate leaching and runoff. By understanding where the issue is coming from, farmers can coordinate action only on the problem areas, both reducing the amount of water used and maximizing the life of the water supply. This data and analysis can then be used to inform mandatory agricultural water management plans.

**Automation and Remote Control:** Automated and remote controlled devices will provide actionable solutions that are both safe and efficient. Automated and remote controlled drones and robots will be able to carry out tasks delegated by farmers at any time, from anywhere. Drones and land robots can be used to provide aerial and ground imaging to better infer canopy cover, and indicator of crop vigor, as well as individual crop size and growth history. These drones could target specific problem areas to maximize efficiency. In time, with enough sensors and data analysis, drones and robots could work completely autonomously, allowing farmers to focus on larger more involved issues, rather than everyday, automated processes, such as irrigation, weed removal, and beyond.

**Data Collection:**

Develop methods of data collection for both water consumption and water/soil quality. This requires monitoring soil and plant conditions in order to accumulate data on humidity/moisture levels, temperature, nutrient levels, and growth history over the life-cycle of the crop.
Overview:

Energy has always been critical to successful agricultural production. Without an effective source of energy the vast majority of food can not be successfully grown.

Modern technological advancements have led to increased crop yields, yet they have come at the cost of increased fossil fuel usage, with the vast majority agricultural machinery running on gas/diesel engines and the energy used to maintain and house the harvested product mostly come from hydroelectric, coal or nuclear power sources.

Financially it is difficult for farmers to keep up with the growing costs of fossil fuel usage and the rising demands of government regulation.

In order to address the needs of the environment and the farming communities, a two part process is needed.

Firstly, the efficiency of current energy inputs (e.g. machinery, monitoring systems, irrigation systems and transportation) needs to be greatly improved.

Finally, there needs to be a shift to alternative sources of energy, but only when it does not disrupt the farmer’s business.

Recommendation:

Create a host of hardware/software products that increase the energy efficiency of current energy inputs.

Data Collection: Develop methods of monitoring energy usage. The software/hardware solutions need collect information on all active products. Parameters need to be set in place for what is needed for successful crop production.

Analysis: Based on the information gathered, the software will analyze the energy data from the various products in comparison with local forecast data and the parameters needed for the current stage of production. Based on the analysis, the farmers will be given status reports and recommendations for action. Such as the need for maintenance of under performing machinery or preventative measures to counteract the changing environment.

Automation: Based upon the decisions of the farmers, the software will make changes to the set parameters. Some actions could be set by the farmers as emergency settings to generally counteract the changing situation.