Pest-AI-cides

Weed wHackers

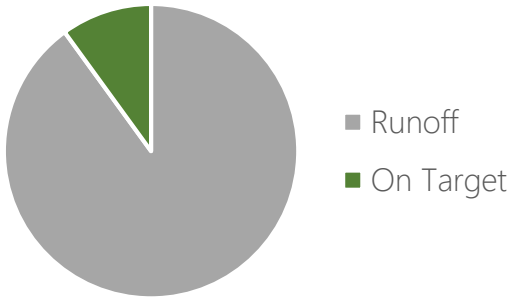
May 12th, 2019

The Problem

Sources: United Nations, Pimentel et al.

The Process of Aerial Pesticide Application

Pesticides are sprayed by plane ("crop-dusters") on a large scale



The majority of pesticides miss and are runoff into streams and forests

"Hazardous pesticides are in excessive use, inflicting damage on human health and ecosystems."

- United Nations, 2017

Both the environment and humans suffer consequences

The inefficiencies of large-scale aerial pesticide application leads to runoff, poisoning drinking and food supplies and harming the wildlife in our environment

The Solution

Minimize off-target pesticide with **unmanned aerial vehicles (drones)** by adjusting application patterns and volume by leveraging machine learning algorithms **trained on wind, weather, and terrain data.**

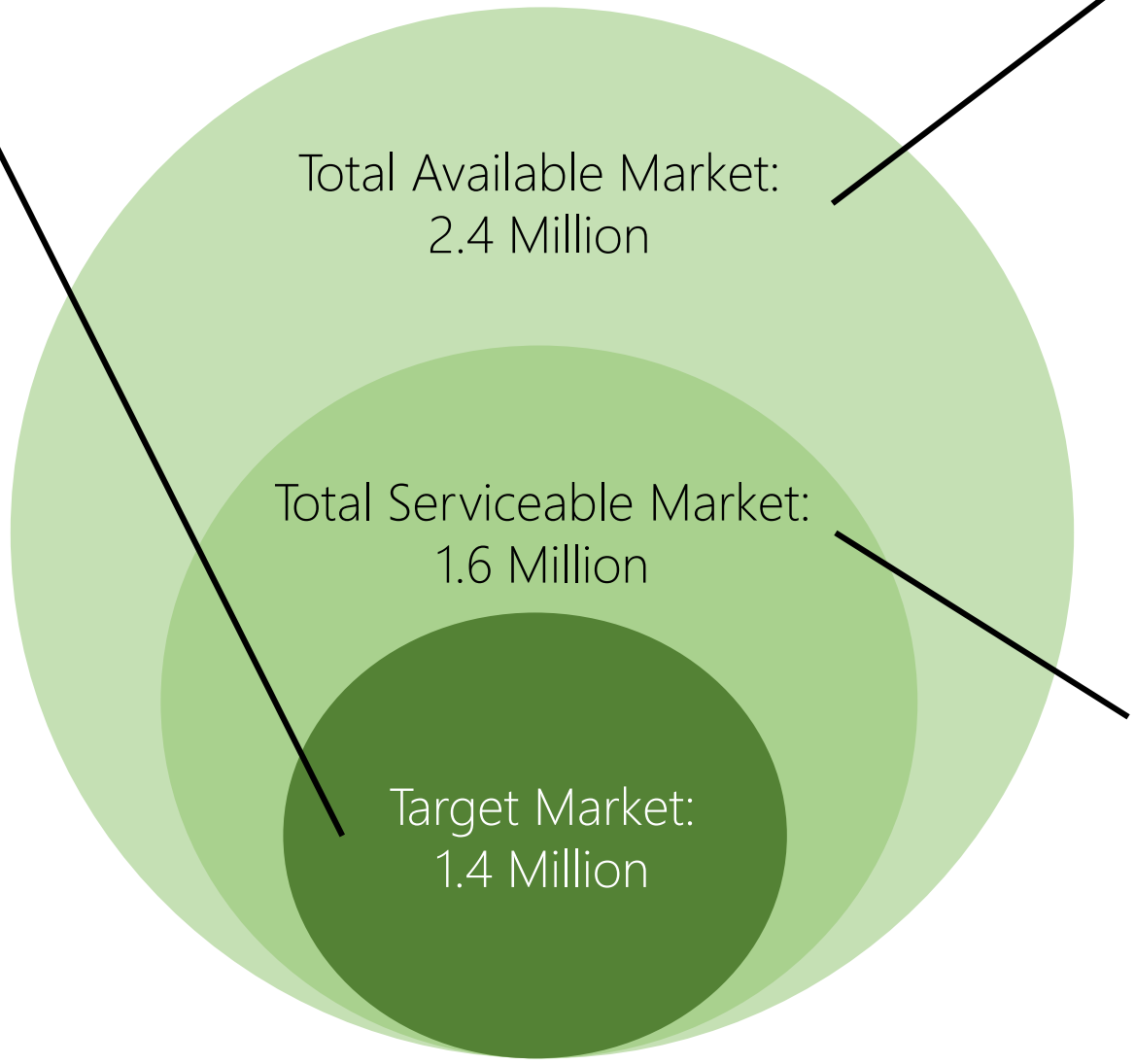
Method of Runoff	Method of Reduction
Aerial Drift (50%) Pesticides are carried by the wind into nearby streams and forests	Modify flight path, nozzle direction and spray rate using insights from wind speed and direction.
Soil Leaching (30%) Water soluble pesticides are carried into streams through permeable soils	Optimize application density by estimating flow vector fields through proximity to streams, terrain, and natural soil composition.
Rain Runoff (20%) Pesticides are carried into streams through rainfall	Determine pesticide application schedule through forecasting of weather and pest population data.

The Target

Sources: USA Gov, CAN Gov.

Target Market

- Farmers with more than 250 acres in farm space
- Larger farms currently spray more pesticide less efficiently
- Larger farms will see larger economic benefits that will eclipse switching costs
- Requires aerial applications to sustain large-scale



Total Market

- Farmers in the USA and Canada
- Growing usage of technology to aid in crop efficiency
- Second largest consumer of pesticides in the world
- Driven by economic factors

Serviceable Market

- Farmers that use Aerial Applications
- Ground applications are already somewhat efficient

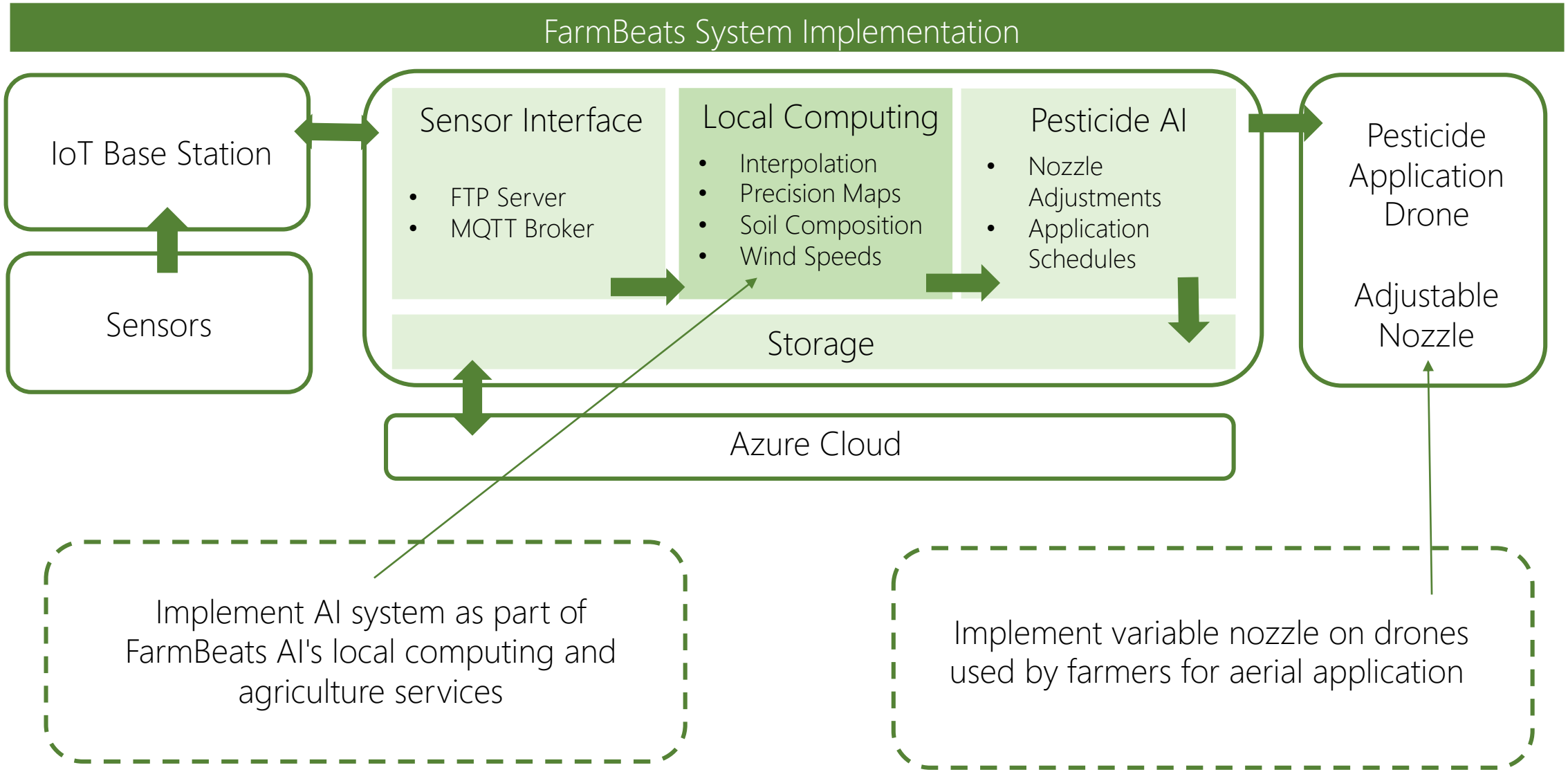
The Architecture

Sources: Microsoft

Microsoft FarmBeats AI	Azure and other Microsoft Tools
Take advantage of FarmBeats-implemented IoT sensors to drive data collection of wind speed, weather data, and soil composition	**Azure FarmBeats Drones + AI** to inexpensively create precision maps by interpolating data from various sensors
Ensures connectivity despite remote area through white space connectivity	**Azure-trained models** to represent spray patterns, volumes of pesticides, and possible routes of runoff from collected data
Gain real-time insights on pesticides used, estimates on runoff, and variable schedule for pesticide applications	**Azure Weather API** to predict weather patterns and insect/weed cycles to ensure an efficient application schedule is created

Implementation

Sources: Microsoft



Timeline

Input Costs

- Cost of drone production
- Cost of nozzle production
- Cloud costs
- Patent

To-Market

- Economies of scale
- Fully integrate with FarmBeats system

Objectives

- Target 10% of the target market
- Period of 5 to 7 years

Future Goals

- Extend to developing countries with growing demands for agriculture and as a result large quantities of pesticides
- See noticeable improvement in biodiversity in North America
- Have convincing results to repeal EU aerial application ban

Prototyping

- Extension on current FarmBeats AI
- 4 farms in period of 12 months
- Select farms in different areas

Objectives

- 1 year observation period
- Reasonable economic benefit
- 5-10% pesticide reduction
- Tune AI Model

Immediate Goals

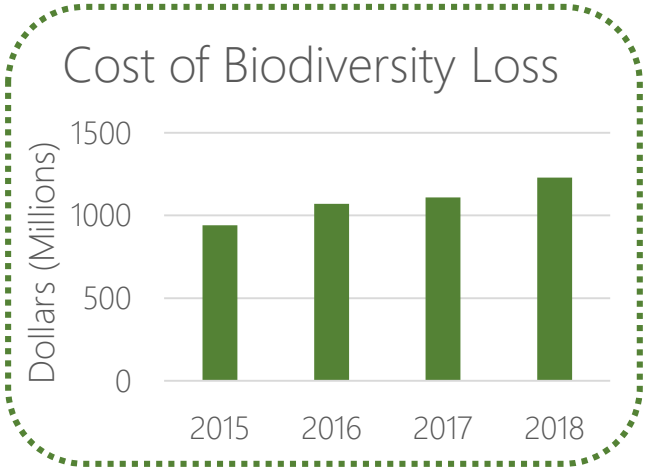
- Deploy to farms with measurably less pesticide drift
- Extend reach across farms in North America
- See noticeable increase in farm productivity/quality
- Observe decrease in North American pesticide spending
- Observe consistent synergy between pesticide system and FarmBeats AI
- Gain additional data to further tune Pesticides AI

Benefits

Sources: Pimentel et al., Cornell University, Beyond Pesticides, Sparling et al.

Environmental Benefits

Reduce cost of loss of biodiversity by **$100 million**



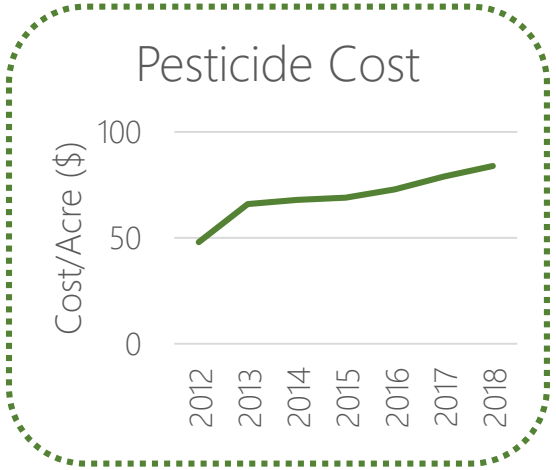
Bees
Loss of pollination valued at $200 million per year

Birds
Loss of natural predators valued at $520 million per year

Fish
Loss of sustainable food conservatively estimated at $56 million per year

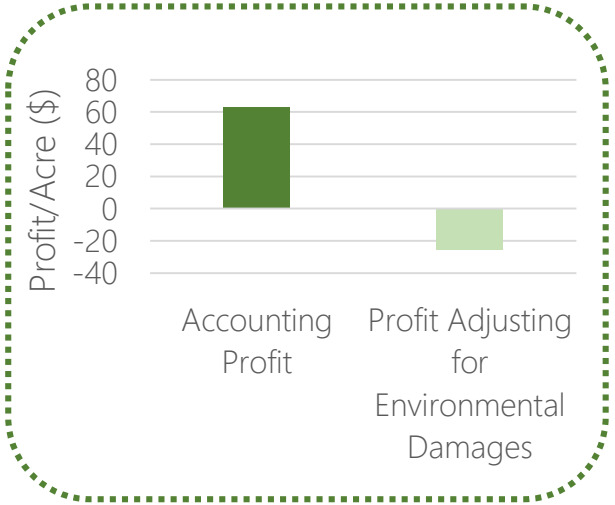
Contribute to the **recovery** of various at-risk species that contribute to sustainability

Economic Benefits



Reduction of pesticide use will save American farmers **$880 million** a year

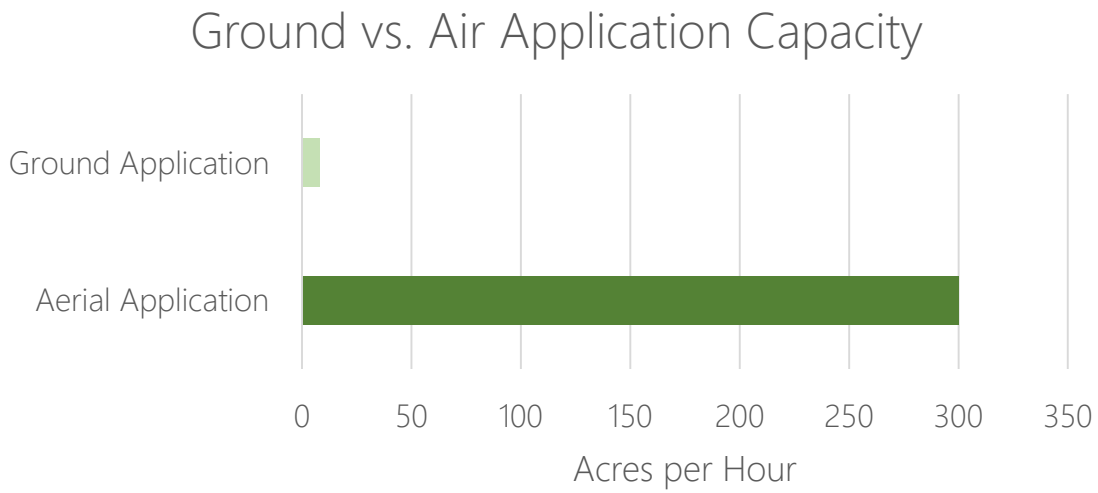
Reduce cost of environmental degradation by **$30/acre**, allowing for sustainable use of agricultural land



Benefits

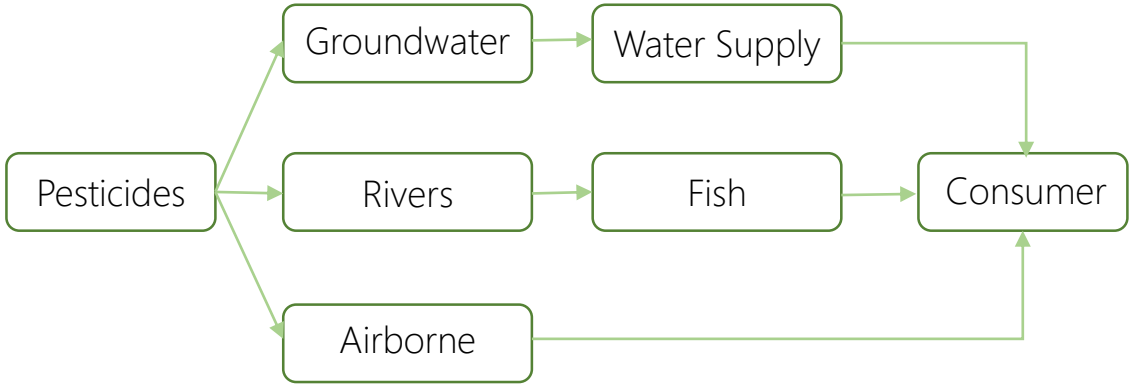
Sources: Pimentel et al., USA Gov.

Scale Benefits



- Continued aerial applications are more energy and fuel efficient
- Aerial applications are several times faster and can tend to more crops
- No yield loss from physical damages of ground applications

Health Benefits



- Reducing pesticide runoff means reduction in multiple methods of exposures
- **Nearly $200 million USD** spent per annum from pesticide-related hospitalizations, not including pesticide-induced cancers
- Links between pesticides and chronic impacts, including cancer, asthma, diabetes, and cognitive impairment

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