Headquartered in Beautiful Fraser Valley

Operations in BC & Alberta

Company Background

- Canadian company headquartered in Abbotsford, British Columbia
- i-Open delivering solutions to government and Energy sectors since 2002, and moved into AgTech in 2017
- Professional team has a solid track record with strong understanding and experience in custom mapping & enterprise scale applications
- Experts in optimizing business processes and resources to ensure efficiencies and cost reductions
- Two Industrial Strength Geospatial Platforms

iOPEN Technologies™
Delivering Real & Sustainable Technology Solutions for a Better Planet!

Global Companies Trust The i-Open Group

Application Suite

CORELine™ PLANWORX™
CommandPost ERP INCIDENT MANAGER
agrilyze™ BIDWORX™
Powered by PlanworX

i-OPEN GROUP

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206-3670 Townline Road
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Team:

Jonathon McIntyre: CTO, i-Open Technologies
Ron Armstrong: Technical Architect
Gabriel Murray: Data Scientist
Peng Wang: Data Scientist

Stay Competitive, Stay Compliant

Agrilyze is A division of the i-Open Group of Companies

Delivering Real and Sustainable Benefits To The Planet

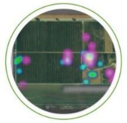
Precision Agriculture for Modern Farming

Artificial Intelligence

Weather & Sensors

Remotely Sensed Imagery

Mapping



Thermal Imagery & Security

GPS

Sensors & Devices

Weather Station

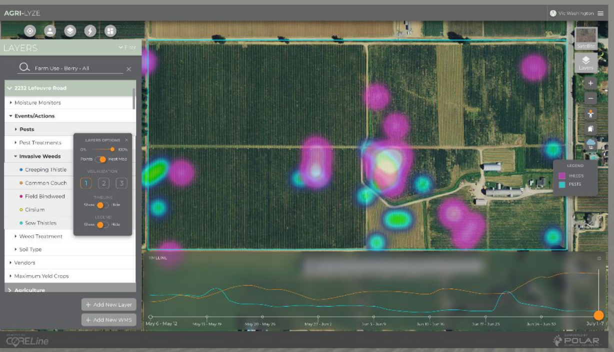
Soil Moisture Sensors

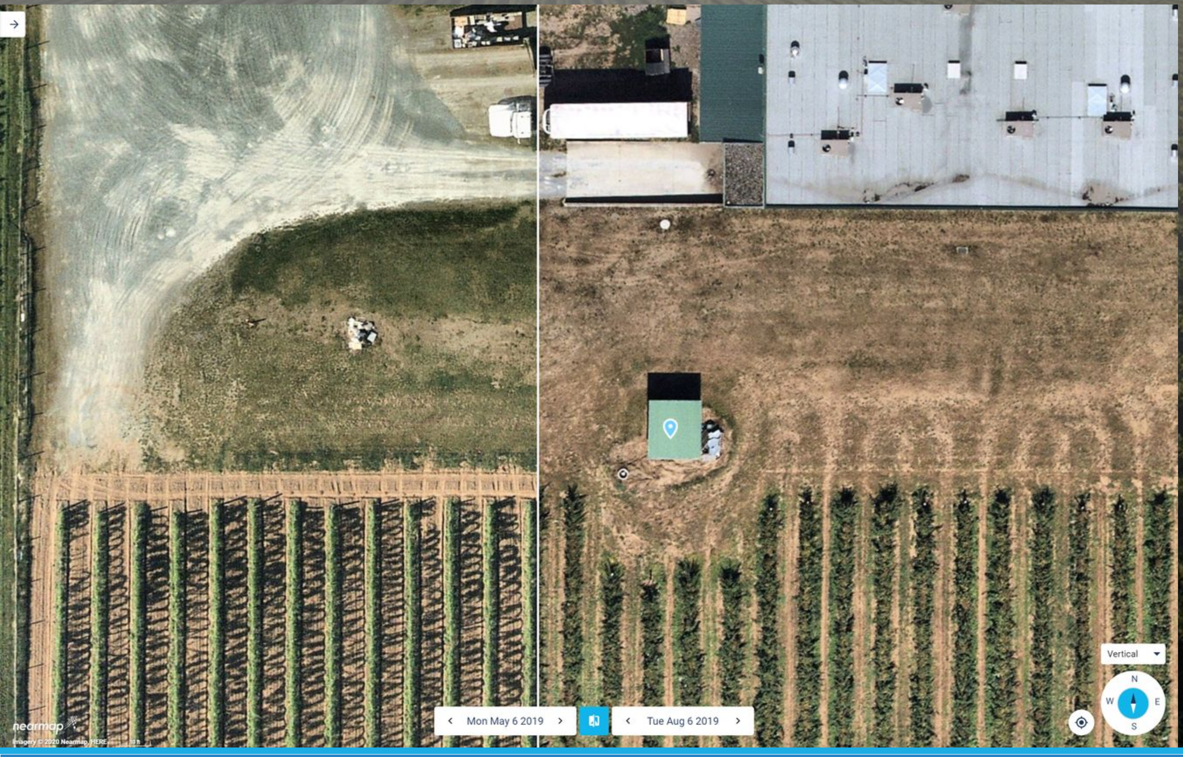
Nitrogen Monitoring

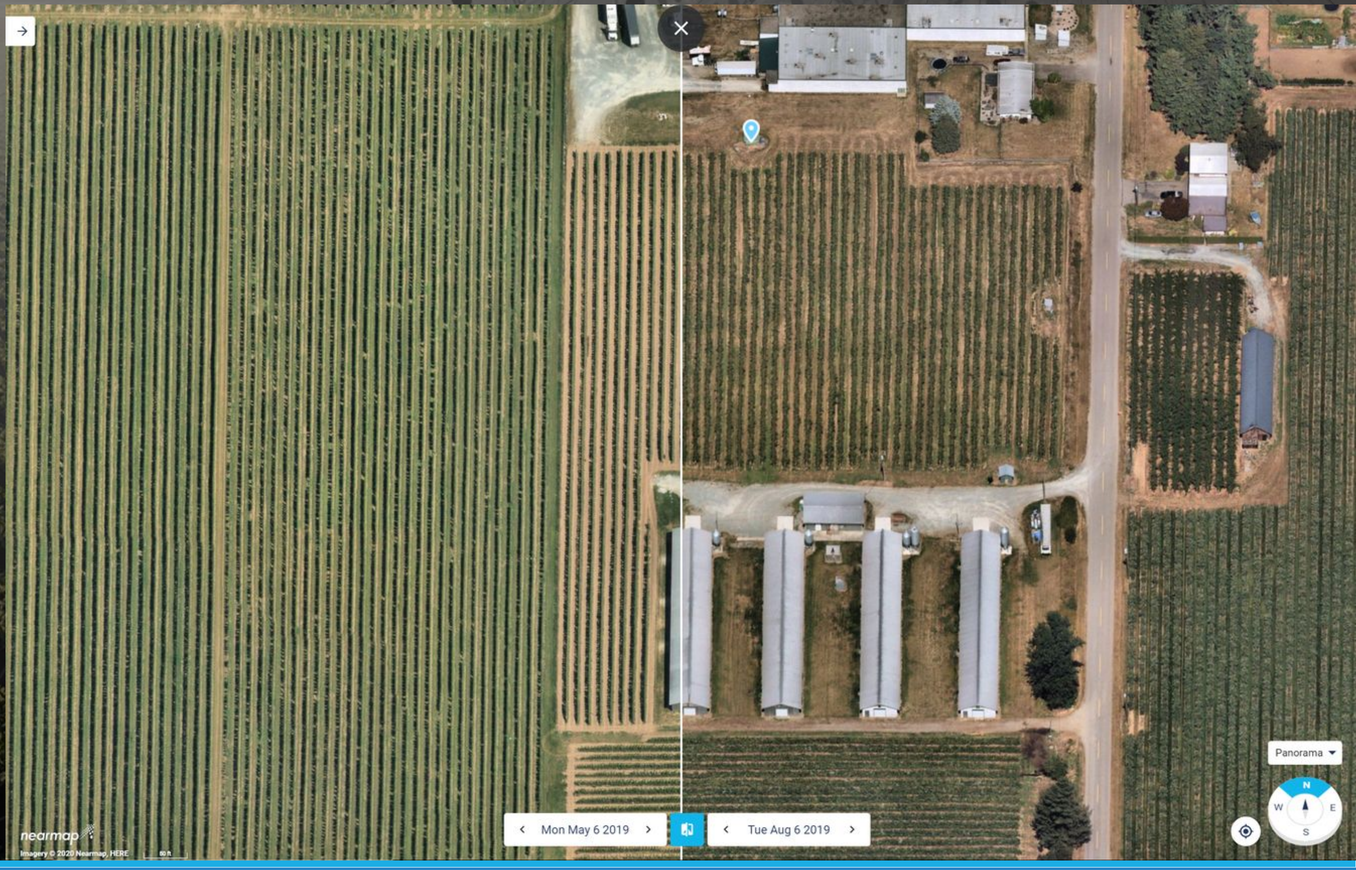
Plant Growth Sensors

Transpiration Sap Flow Sensors

Utilize Aerial Imagery







Compliance & Traceability

Financial & CRM

Documents & Legislation

Mobile

Agriculture KPI's

PRODUCTIVITY

- Increase in production
- Estimated production potential
- Fertilizers per output
- Chemicals per output
- Work per output
- Water per output
- Yield per plant/acre

ADMINISTRATION

- Plantation age structure
- Plants per hectare
- Total plant number
- Field utilization rate
- People efficiency
- Mechanization utilization

FINANCE

- Return to shareholders
- Profitability
- Cash flow
- Investments evaluation
- Fixed vs variable costs

INVENTORY

- Average usage period (fertilizers, pesticides, fuel)
- Average sales period
- Monthly stock usage
- Waste percentage
- Low inventory items

Bottom Line:
Do more with Less

Digitization – moving forward

A Farmer's Benefit - Going from Paper to a Web-Based Application

PAIN POINTS

- **Sticking with paper document storage can become a serious problem.** You are putting important information at risk. The longer you have been in business, the more documentation you have and more space is needed to store it.
- **This requires added financial costs and can become a problem if you need to change your storage plan.** There is also the risk of your records getting into the wrong hands. Sensitive information may be exposed.
- **Finding documents can also become complicated, and let's not forget to mention the threat of natural disaster.** All in all, you need a better way to house records improving maintenance, traceability and ease of monitoring private and sensitive documents.

HOW WE CAN HELP

- **Save your documents and data on a secure, web-based application.**
- **Secure your farm data with credentials** – a user-specific password and username are needed to login to Agrilyze.
- **Farm data is secured through data anonymization and data aggregation.** No one will be able to attribute or trace your farm data back to you, keeping your business safe.
- **Keep your data secure and private;** only you can access your farm data, and you can set access rights and permissions to the person who should have access to specific data or documents.
- **Audit and obtain digital signatures easily and accessibly.** We provide you with a reliable backup of your data and documents.

DATA ANALYTICS

- **Overlay data sources and compare data over time for better productivity and efficiency of resource utilization.**
- **Leverage your data into other tools, such as AI analysis, to further research/productivity and reduce error-prone manual calculations.**
- **Capture data once and use it in multiple ways, associating it directly with information from the field (photos/sensors).**

BENEFITS TO FARMERS AND THE ENVIRONMENT:

- Become more productive
- Spend less time filing, organizing and searching for paper documents or notebooks
- Improve efficiency
- Avoid repetitive and high volume tasks
- Export to various formats such as Word, PDF and Excel
- Send documents as attachments from your computer, tablet or mobile phone
- Become more sustainable - share documents online instead of printing and using paper and non-renewable printer ink and toner

Farm smarter. Start today.

Decrease time

Fill out repetitive documents faster; populate from multiple places

Export to Reports

Leverage templates for spreadsheets, documents, pdf

Add related info

Attach scanned documents, images

Share to others

Multiple people can collaborate

ABBOTSFORD FOOD ASSET MAPPING

Researchers

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University of the Fraser Valley

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Archway Community Services

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Fraser Health Authority

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Fraser Health Authority

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Chief Technology Officer
i-Open Technologies Group

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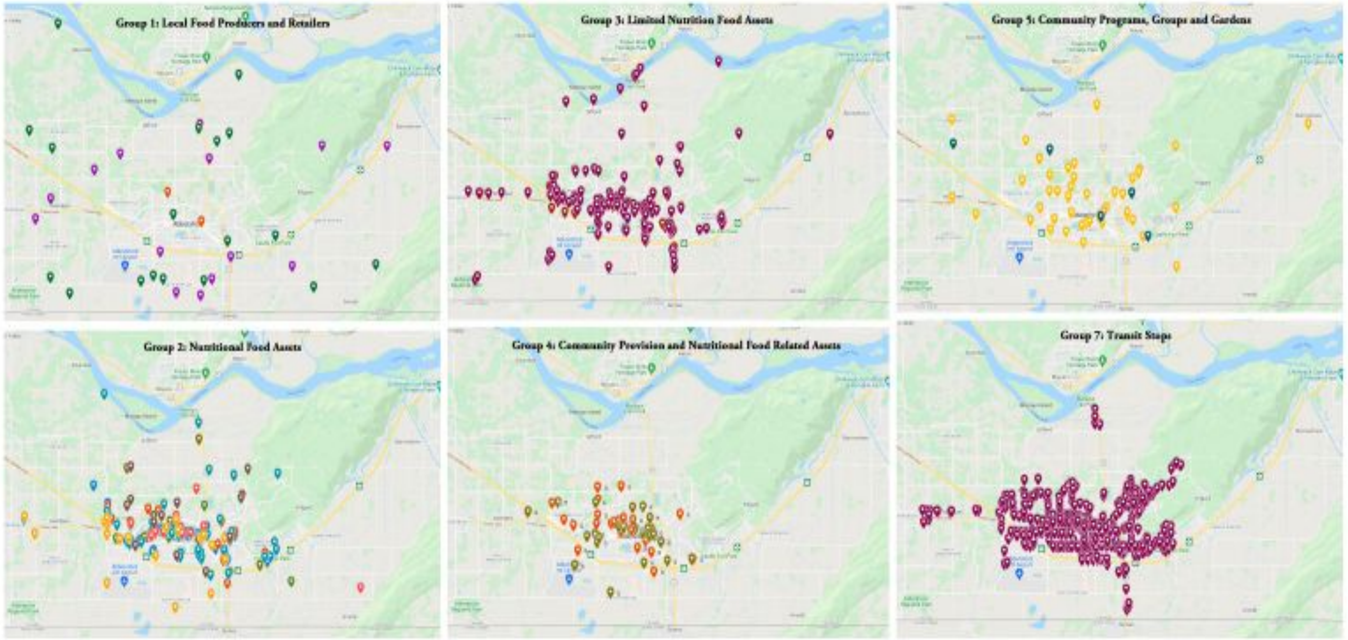
GIS Data Analysts
i-Open Technologies Group

Acknowledgements

Val Crooks and the
"Mapping the COVID-19 pandemic's secondary health impacts"
research team, Simon Fraser University



BACKGROUND

This project explores the use of food asset mapping for addressing food insecurity and improving food justice in Abbotsford. The goal of food justice efforts is "to ensure that the benefits and risks of where what and how food is grown, produced, transported, distributed, accessed, and eaten are shared fairly. Food justice represents a transformation of the current food system, including but not limited to eliminating disparities and inequities." (Gottlieb and Joshi, 2010)

Food justice efforts aim to address food insecurity issues, which present significant sustainability issues to individuals and societies. Food insecurity exerts substantial health impacts on affected individuals and a burden on the health care system. Food insecurity often stems from poverty, and thus, it reflects the social and economic inequities and disparities experienced in communities.

A number of factors are involved in food security such as consumer autonomy, community relationships, food access and availability, and availability. Efforts toward food security and justice include those that build understanding and increase awareness around the relationships that exist between an individual's overall health and access to different food assets and services.

UNIVERSITY OF THE FRASER VALLEY

PROGRAMS ADMISSIONS SERVICES RESEARCH NEWS EVENTS ABOUT UFV COVID-19 SAFETY

FOOD AND AGRICULTURE INSTITUTE

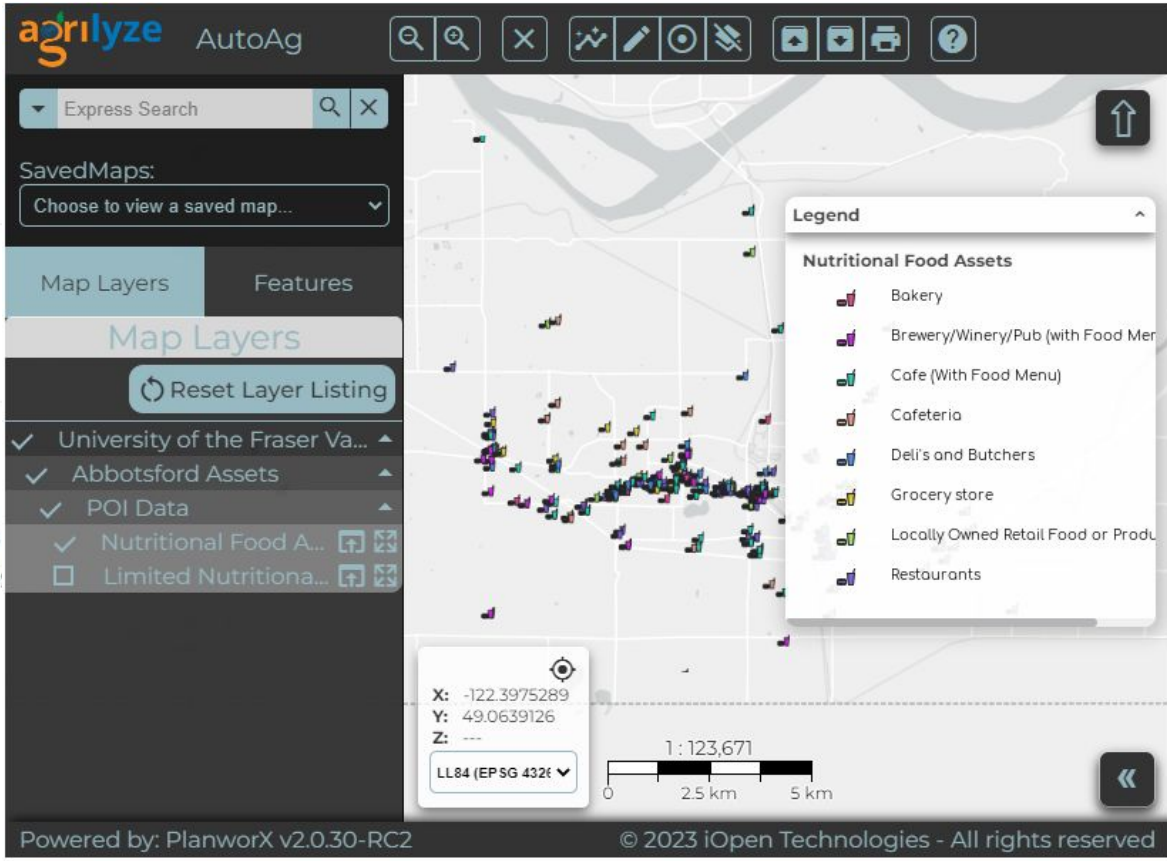
UFV / FOOD AND AGRICULTURE INSTITUTE / THE RESEARCH / INDOOR AGRICULTURE / VERTICAL FARMING

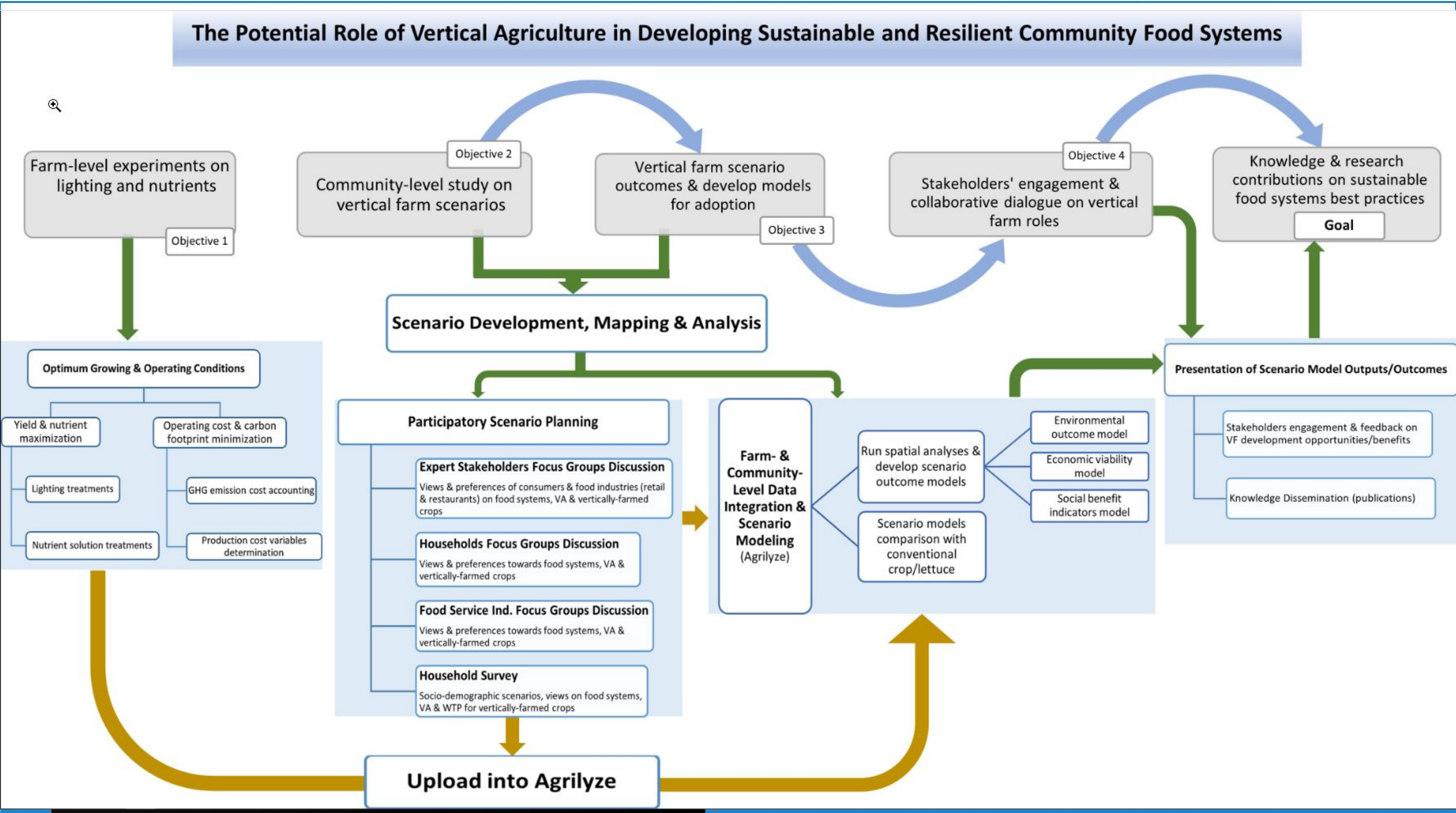
Vertical Farming

The Potential Role of Vertical Agriculture in Sustainable and Resilient Community Food Systems

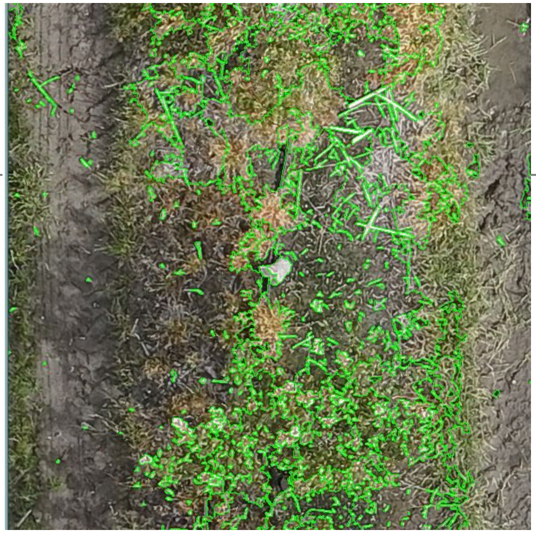
Project Description

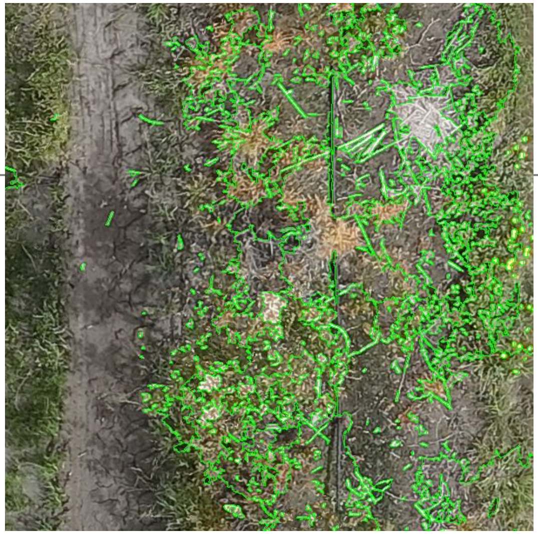
This project is being conducted in collaboration with QuantoTech Solutions Ltd. and i-Open Technologies Inc. The research is driven by pressing needs for finding innovative ways of addressing food system vulnerabilitie and increasing resilience in the face of climate change and economic shocks, issues that relate to and are compounded by the farm succession and food supply/distribution challenges associated with conventional agriculture. A potential approach for addressing these growing challenges is to explore options for widespread implementation of urban agriculture by adopting vertical farming and controlled-environment agriculture methods. Such farming methods could possibly provide an avenue for sustainable food production, distribution, and access, where technology-driven (but also inclusive and resilient) food production systems can be developed in ways that align with environmental, economic, and food security objectives.



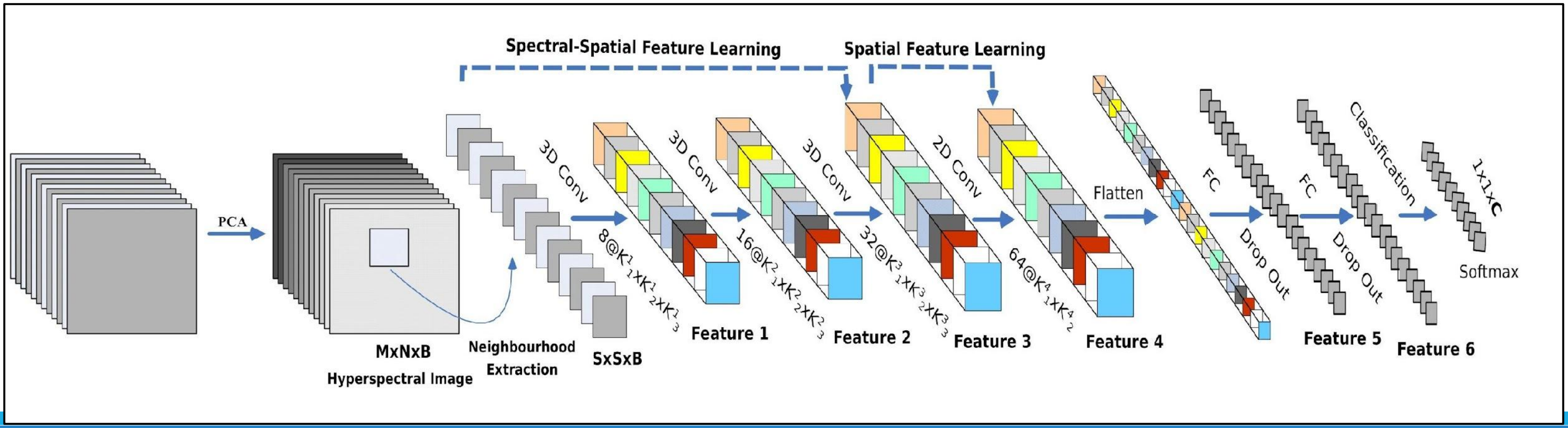


The Potential Role of Vertical Agriculture in Developing Sustainable and Resilient Community Food Systems
Farm-level experiments on lighting and nutrients
Objective 1
Objective 2
Community-level study on vertical farm scenarios
Vertical farm scenario outcomes & develop models for adoption
Objective 3
Objective 4
Stakeholders' engagement & collaborative dialogue on vertical farm roles
Knowledge & research contributions on sustainable food systems best practices
Goal
Scenario Development, Mapping & Analysis
Optimum Growing & Operating Conditions
Yield & nutrient maximization
Operating cost & carbon footprint minimization
Lighting treatments
GHG emission cost accounting
Nutrient solution treatments
Production cost variables determination
Participatory Scenario Planning
Expert Stakeholders Focus Groups Discussion
Views & preferences of consumers & food industries (retail & restaurants) on food systems, VA & vertically-farmed crops
Households Focus Groups Discussion
Views & preferences towards food systems, VA & vertically-farmed crops
Food Service Ind. Focus Groups Discussion
Views & preferences towards food systems, VA & vertically-farmed crops
Household Survey
Socio-demographic scenarios, views on food systems, VA & WTP for vertically-farmed crops
Farm- & Community-Level Data Integration & Scenario Modeling (Agrilyze)
Run spatial analyses & develop scenario outcome models
Scenario models comparison with conventional crop/lettuce
Environmental outcome model
Economic viability model
Social benefit indicators model
Presentation of Scenario Model Outputs/Outcomes
Stakeholders engagement & feedback on VF development opportunities/benefits
Knowledge Dissemination (publications)
Upload into Agrilyze

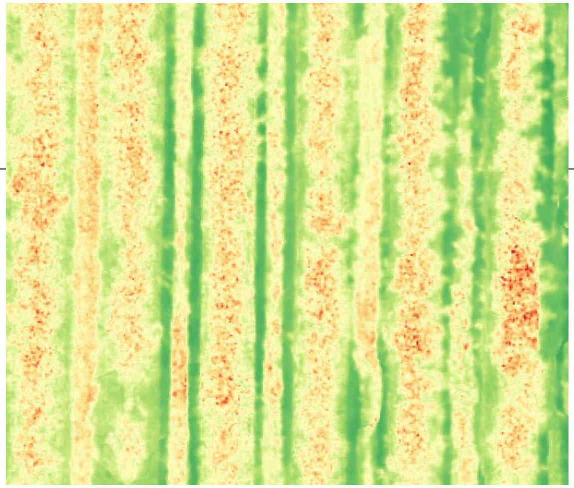




1) Delineate boundaries of healthy and infected bushes
2) Differentiate them on the images

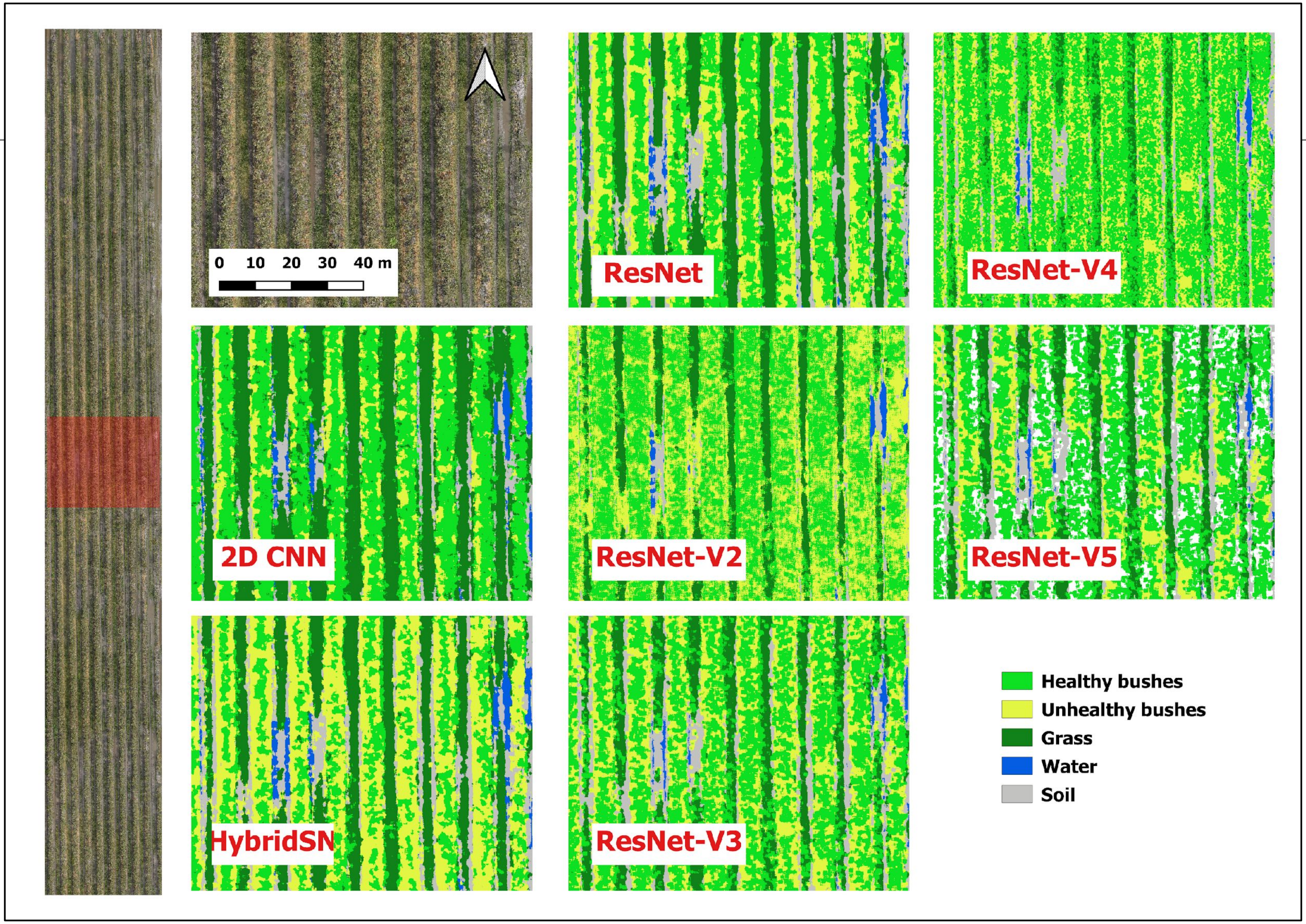


Machine Learning and Deep Learning Models

1) Plan Flight with Dronelink (Low cost flight planning/automation for Drones)
2) Upload images, process with OpenDroneMap (build Mosaic, leverage existing visualization tools, analyze with industry standard tools
3) Load mosaics on top of farm data, use to correlate with field findings

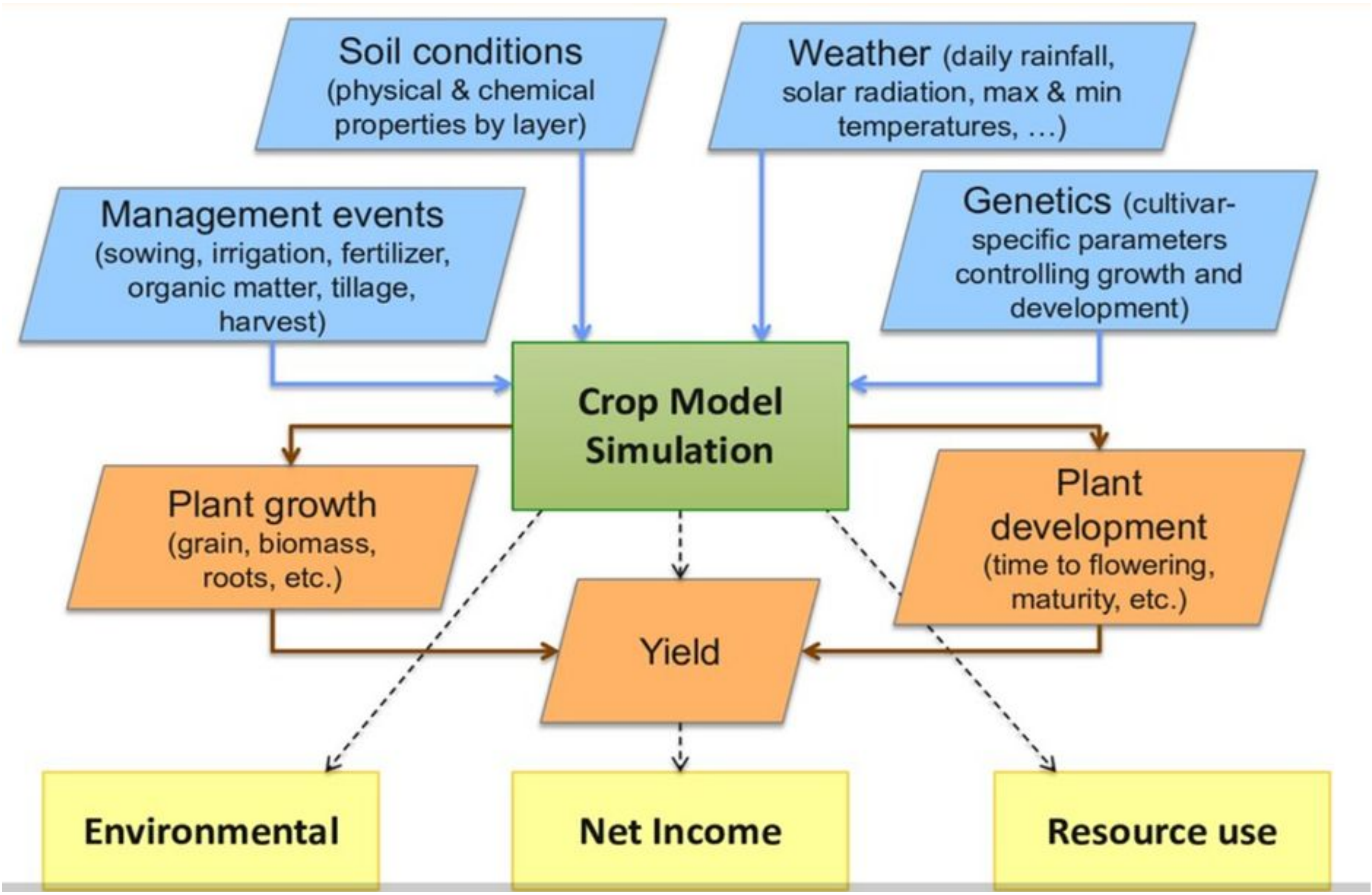
Use a variety of drones, share data with various groups



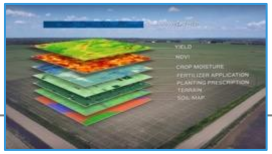
Mapping Results from Different Models

ICASA Data Exchange

International Consortium for Agricultural Systems Applications (ICASA) has developed an internet-based system, the ICASA Data Exchange (IDE), that provides a convenient forum for documenting, archiving, and exchanging cropping system experiment and/or weather data sets. Users of the IDE can enter metadata that describe their data sets, upload their data set files, edit their entries, search for data using specific criteria, browse metadata of data sets in the system, and download data sets from the system.



Interactive Operations Planning Platform

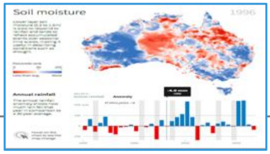


- Monitor crop health
- Save costs
- Digitize decisions

High value specialty crops

- Reduce input costs
- Reduce GHG emissions
- Optimize growing season

Broadacre row crops



- Monitor climate variables
- Deploy micro farms
- Reduce food miles

Controlled environment agriculture

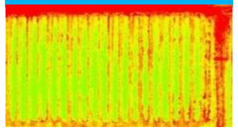
Digital Twin of the Farm

- Crop Characterization
- Field Model Characterization
- Soil Characterization
- Equipment Characterization
- Pod Characterization

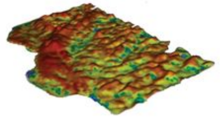
Data Commons Infrastructure: Automated Data Processing and Aggregation Engine

- Stress Indices
- Water Runoff and Soil Loss
- Soil Carbon and Nutrient Modeling
- Year-over-Year Field Operations
- Location Analysis

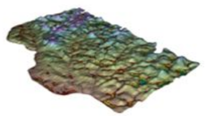
Drone Imagery



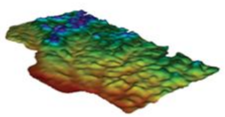
Weather



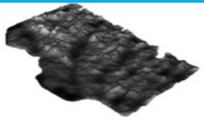
Terrain



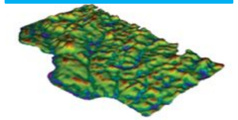
Hyperspectral



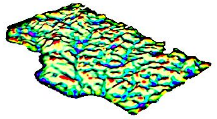
Soil Sampling



Agronomic Data



Spatial Data



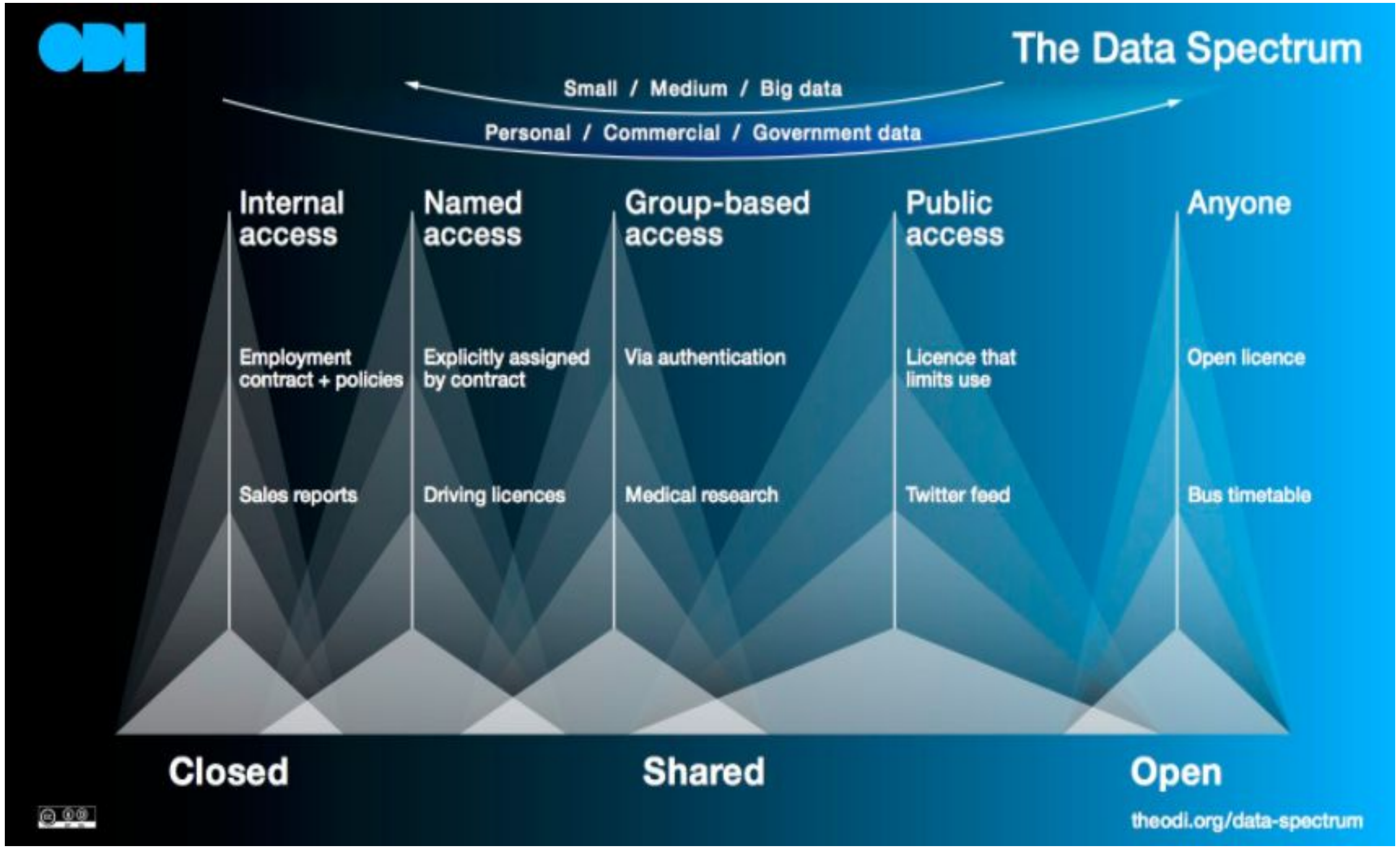
Population

Agri Data Standards

Data Spectrum For Data Sharing

DEVELOPED BY OPEN DATA INSTITUTE (ODI)

SHOW RELATIONSHIP OF DATA SENSITIVITY AND OPENNESS



The Data Spectrum – The ODI." https://theodi.org/about-the-odi/the-data-spectrum/

Guiding Frameworks for Data Sharing

- Five star open data deployment scheme
- Designed by Sir Tim Berners-Lee in 2006

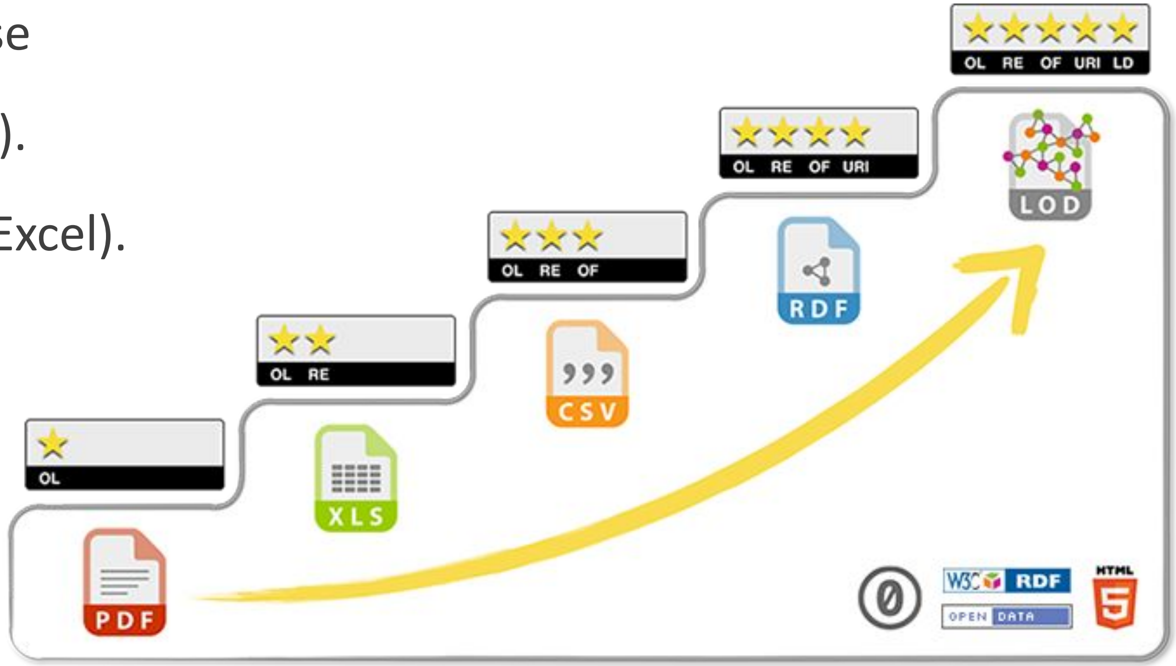
☆ Data available on the web under open license

☆☆ Structured data (i.e., not a scanned image).

☆☆☆ Non proprietary format (i.e, CSV, not Excel).

☆☆☆☆ Using URIs to identify things

☆☆☆☆☆ Linking to other open data



Guiding Frameworks for Data Sharing

- FAIR principles
- Developed by a group of representatives from academia, industry, publishers, funding agencies in 2014. Formally published in the journal Scientific Data in 2016.
- Focus on clear access rights rather than technical requirements

Wilkinson, M. D., M. Dumontier, et al. (2016) The FAIR Guiding Principles for scientific data management and stewardship. Scientific Data 3. https://www.nature.com/articles/sdata201618.

Image credit: National Library of Medicine https://www.nlm.nih.gov/oet/ed/cde/tutorial/02-300.html

Guiding Frameworks for Data Sharing

- W3C Data on the Web Best Practices (DWBP)
- Provides 35 detailed technical best practices for publishing and consuming data on the Web
- DWBP benefits:
  a. Each represents improvement in the way how datasets are available on the Web

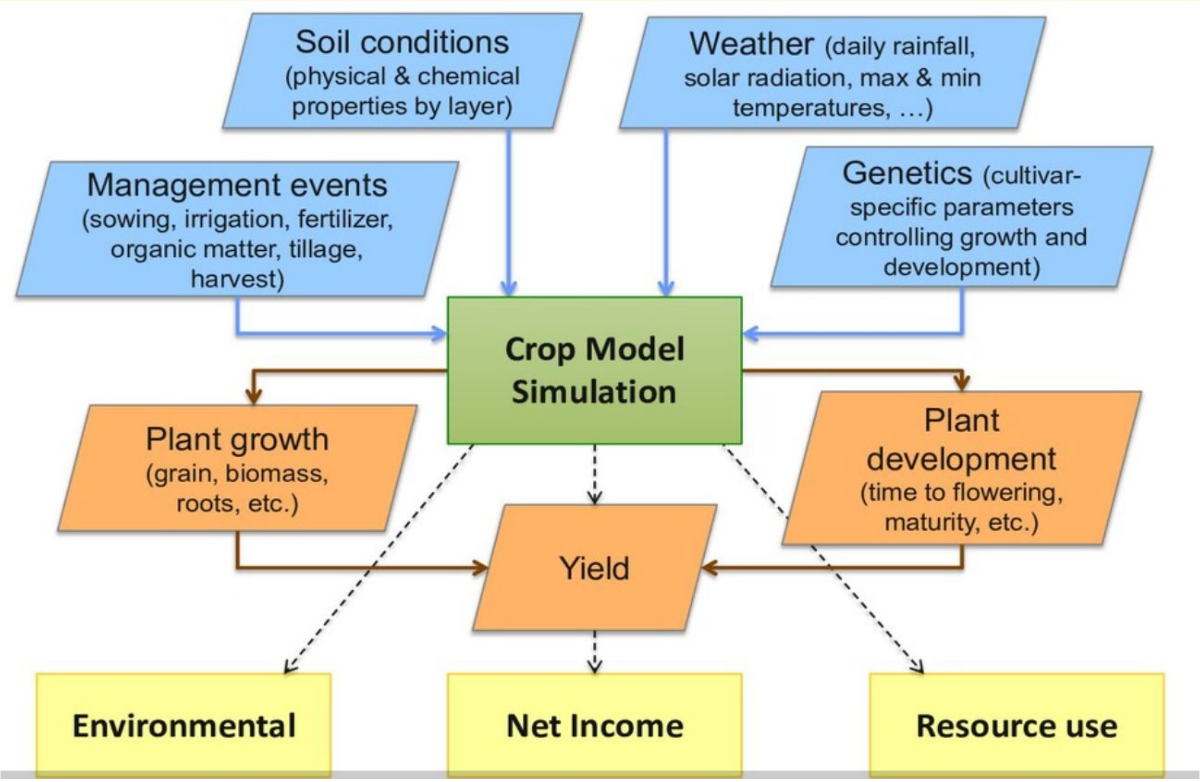
Best Practice 1: Provide metadata
Best Practice 2: Provide descriptive metadata
Best Practice 3: Provide structural metadata
Best Practice 4: Provide data license information
Best Practice 5: Provide data provenance information
Best Practice 6: Provide data quality information
Best Practice 7: Provide a version indicator
Best Practice 8: Provide version history
Best Practice 9: Use persistent URIs as identifiers of datasets
Best Practice 10: Use persistent URIs as identifiers within datasets
Best Practice 11: Assign URIs to dataset versions and series
Best Practice 12: Use machine-readable standardized data formats
Best Practice 13: Use locale-neutral data representations
Best Practice 14: Provide data in multiple formats
Best Practice 15: Reuse vocabularies, preferably standardized ones
Best Practice 16: Choose the right formalization level
Best Practice 17: Provide bulk download
Best Practice 18: Provide Subsets for Large Datasets
Best Practice 19: Use content negotiation for serving data available in multiple formats
Best Practice 20: Provide real-time access
Best Practice 21: Provide data up to date
Best Practice 22: Provide an explanation for data that is not available
Best Practice 23: Make data available through an API
Best Practice 24: Use Web Standards as the foundation of APIs
Best Practice 25: Provide complete documentation for your API
Best Practice 26: Avoid Breaking Changes to Your API
Best Practice 27: Preserve identifiers
Best Practice 28: Assess dataset coverage
Best Practice 29: Gather feedback from data consumers
Best Practice 30: Make feedback available
Best Practice 31: Enrich data by generating new data
Best Practice 32: Provide Complementary Presentations
Best Practice 33: Provide Feedback to the Original Publisher
Best Practice 34: Follow Licensing Terms
Best Practice 35: Cite the Original Publication

Data on the Web Best Practices https://www.w3.org/TR/dwbp/
Image credit https://www.dublincore.org/webinars/2017/data_on_the_web_best_practices_challenges_and_benefits/slides.pdf

ICASA - Schema For Farm Management Data

- Created by researchers from universities of Georgia, Florida, Hawaii, Guelph and Michigan State University in collaboration with the International Fertilizer Development Center

- Provides crop growth simulation



ICASA System Model

Soils_data | Weather_data | Measured_data | Explanatory_notes | Metadata_codes | Crop_codes | Manag

8	WINTERU	7	WINTERU	46		Winter soil evaporation, upper limit for stage 1
21	SLDR	4	SLDR	14		Drainage rate as fraction per day
19	SLRO	4	SLRO	15		Runoff curve no. (Soil Conservation Service)
18	SSCOL		SSCOL	16		Surface soil color, moist, using Munsell hue
22	FLST	4	FLST	17		Surface stones (cover)
21	SLNF	4	SLNF	18		Mineralization factor (0 to 1 scale)
23	SMHB	4	SMHB	19		pH in buffer determination method
23	SMKE	4	SMKE	20		Potassium determination method
24	SMPX	4	SMPX	21		Phosphorus determination method
12	SLTX	4	SLTX	43		Soil texture
24	SLDN	4	SLDN	44		Soil denitrification factor
23	SLPF	4	SLPF	45		Soil fertility effect on photosynthesis (0 to 1 scale
4	CONA	4	CONA	45		Apsim Cona soil evaporation
12	DIFFUSCONST	11	DIFFUSCONST	46		APSIM Evaporative diffusion constant
12	DIFFUSSLOPE	11	DIFFUSSLOPE	47		APSIM Evaporative diffusion slope
7	SID	3	SID	0	1	Unique soil identifier linking to SOIL_PROFILES
15	SOIL_ID	7	SOIL_ID	1	1	Soil profile identifier
12	SOIL_FILE_ID	12	SOIL_FILE_ID	2	1	Soil profile file name
20	SLLT	4	SLLT	3	1	Soil layer top depth
21	SLLB	4	SLLB	4	1	Soil layer base depth
14	SLMH	4	SLMH	5		Master horizon
24	SLCOM	5	SLCOM	6		Soil color of moist soil using Munsell hue
18	SLCLY	5	SLCLY	11		Soil texture, clay (<0.002 mm), weight percent of earth
13	SLACC	5	SLACC	11		Biologically active soil organic carbon by layer, expressed as g[C]/100g[soil]
19	SLINC	5	SLINC	11		Intermediate soil organic carbon by layer, expres g[C]/100g[soil]
13	SLSC	4	SLSC	11		Stable organic carbon by layer, expressed as g[C]/100g[soil]
12	SLIC	4	SLIC	11		Inert organic carbon by layer, expressed as g[C]/100g[soil]
22	SLFAC	5	SLFAC	11		Biologically active soil organic carbon by layer, fr of total organic C

ICASA - Schema For Farm Management Data

Metadata

ent	Qualifier Element Refinement(s)	Encoding Schemes/Controlled Li
title	(DCTERMS) alternative	-
creator	(AGS) creatorPersonal	-
	(AGS) creatorCorporate	
	(AGS) creatorConference	
publisher	(AGS) publisherName	-
	(AGS) publisherPlace	
date	(DCTERMS) dateIssued	(DCTERMS) W3CDTF
subject	(AGS) subjectClassification	(AGS) ASC (AGS) CABC (DCTERMS) DDC (DCTERMS) LCC (DCTERMS) UDC
	(AGS) subjectThesaurus	(AGS) AGROVOC (AGS) CABT (AGS) ASFAT (AGS) NALT (DCTERMS) MeSH (DCTERMS) LCSH
description	(AGS) descriptionNotes	-
	(AGS) descriptionEdition	
	(DCTERMS) abstract	
identifier		(DCTERMS) URI (AGS) ISBN (AGS) RN (AGS) JN (AGS) PN (AGS) IPC (AGS) DOI
ype	-	(DCTERMS) DCMIType
format	(DCTERMS) extent	-
	(DCTERMS) medium	(DCTERMS) IMT
language	-	(DCTERMS) ISO639-2 (AGS) ISO639-1
relation	(DCTERMS) is Version Of (DCTERMS) has Version (DCTERMS) is Replaced By	(DCTERMS) URI (AGS) ISBN (AGS) RN

- Data about data
- Makes data easier to search, use and manage
- AGRIS AP (The International System for Agricultural Science and Technology Application Profile) defines a metadata standard
- Developed by Food and Agriculture Organization (FAO) in 2005 and draws elements from well-known metadata standards

"Elements in AGRIS AP" https://www.fao.org/3/ae909e/ae909e05.htm

Ethical Use Frameworks

ESG PARAMETERS

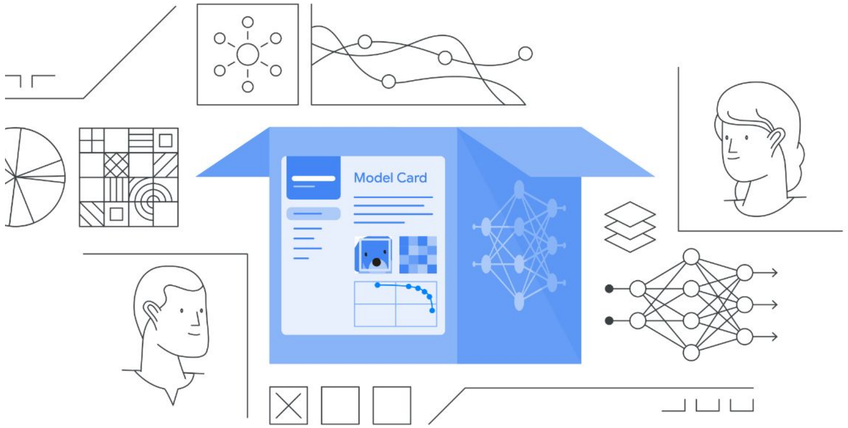
Ethical Use Frameworks

Our goals in creating an ethical use framework are

- to offer assurances to farmers and other clients that we will use their data **responsibly, appropriately, and securely**, and
- to create a set of internal guidelines for ourselves that will **inform and guide all of our data-related work**.

Informed by:

- Existing and proposed legislation (e.g. Canada's Digital Charter).
- Existing ethical use frameworks from the US, UK, Australia, New Zealand, and the EU.
- Agricultural data codes of conduct (e.g. GODAN, EU).



Key Ethical Use Principles

- **Accountability**
  - e.g. regular compliance review; person in charge of compliance with these principles
- **Transparency**
  - e.g. interpretable models; metadata such as datasheets for datasets and model cards for ML models
- **Privacy**
  - e.g. data anonymization; avoiding harmful disclosures; secure storage and distribution

Key Ethical Use Principles, Continued

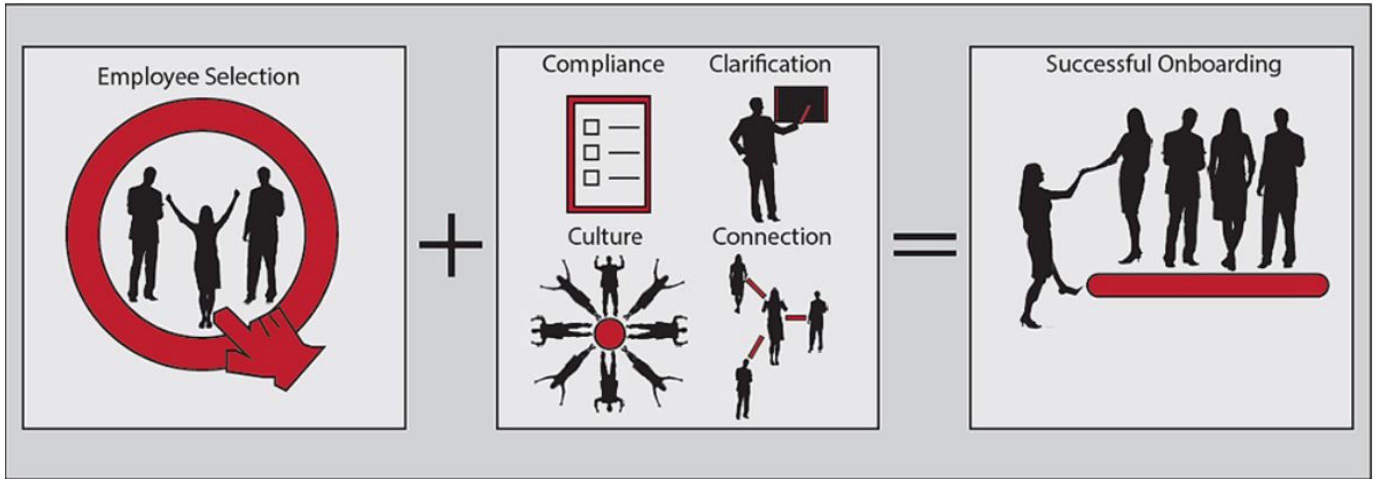
- **Compliance**
  - e.g. adherence to regulations on data collection, usage, and privacy; Canada's Digital Charter
- **Accuracy and Timeliness**
  - e.g. tracking model accuracy over time; updating predictive models; using models that are auditable (at least internally)

Implementing Ethical Use Frameworks

Assign **a person to be responsible** for data ethics.

Publish and disseminate data ethics principles.

Make them part of the **job application and onboarding** process.



Provide **ongoing training** in ethical data use.

Notify farmers about how their data is being collected, stored, and transmitted.

Implementing Ethical Use Frameworks, Continued

GODAN

Agricultural Data Code of Conduct Toolkit

Codes of conduct are a recent construct, setting much-needed guidelines and common standards on the transparent governance of farm data, over which there is currently very little official legislation. Launched 20 May, 2020, this NEWLY CREATED online toolkit provides the conceptual basis for general, scalable guidelines for everyone dealing with the production, ownership, sharing and use of data in agriculture.

Provide	Provide farmers with simple and understandable contracts regarding data use.
Maintain	Maintain clear written agreements around data removal/destruction.
Monitor	Continuously monitor the quality, accuracy, and security of the data;
Assign	Assign attribution for data ownership.
Implement and publish	Implement and publish pre-defined procedures for dealing with a data breach.

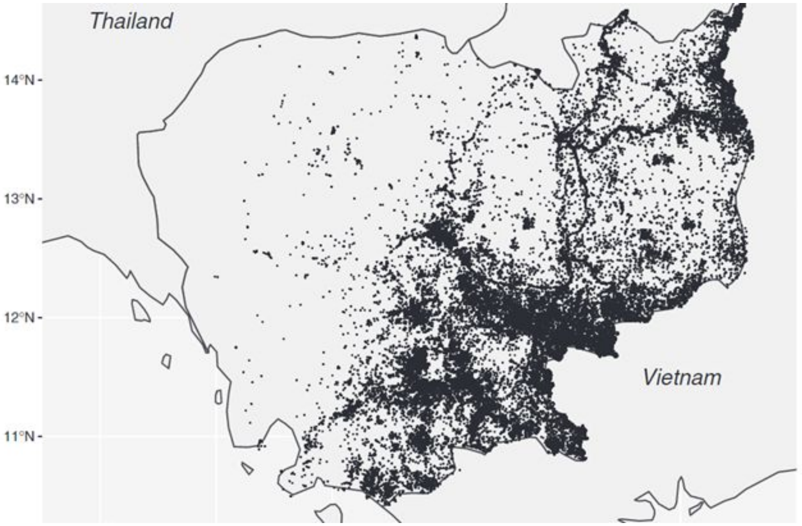
ESG Parameters

Environmental:

- Climate change / C02
- Deforestation
- Regenerative agriculture
- Water usage and quality
- Soil type and quality
- Pests and Pesticide use
- Sustainable farming

Social:

- Child labour
- Impact of war on farmland
- Animal welfare
- Food traceability for consumers
- World hunger / food scarcity / cost of food
- Land reserves / city zoning / land claims
- Demographic changes

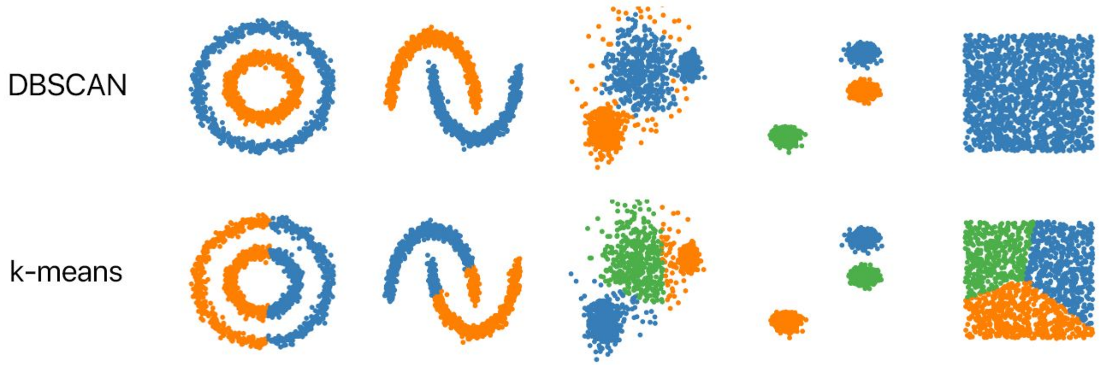


ESG Parameters

Governance:

- Rights of temporary farm workers
- Corporatization of agriculture / consolidation of ownership / demise of small farms
- Financials / tax burden
- Insurance claims
- Government support / relief
- Farm ownership continuation
- Farm ownership structure and investment/investors
- Technology (availability, and application)
- Reporting tools
- Safety and oversight

Data Anonymization



GOALS

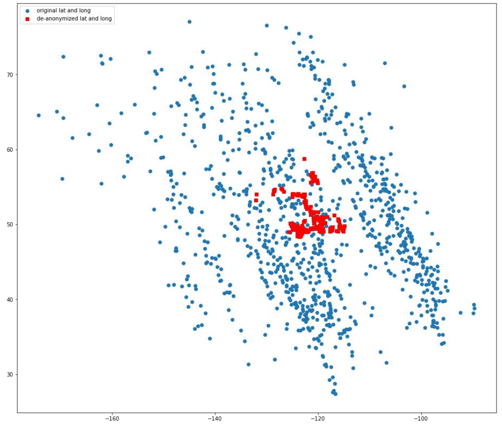
1. To anonymize geospatial data so that it cannot be de-anonymized
2. To develop a predictive model using the anonymized data and achieve 90% accuracy of using the original data

Approaches:

- Clustering-based (e.g. k-means, DBSCAN)
- Dimensionality reduction (e.g. PCA, self-organizing maps)

Data Anonymization Results

- Anonymization methods validated on three geospatial datasets.
- Both clustering and PCA-based approaches exceed desired 90% accuracy threshold when comparing with original (un-anonymized) data.
- Both are very difficult to de-anonymize
  - e.g. adversary builds predictive model to try to predict original location
- The implemented methods are complementary
  - Clustering is interpretable in the original feature space.
  - PCA is a more radical transformation of the data.



	Adjusted R2
Original Features	**0.45**
PCA Features	**0.41**

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Thank You

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