



Terra

Empowering hydroponics farmers with ML & ISE-driven early-warning software

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The Problem

Meet Mario!



What's the problem?

MORE
DATA



BETTER
RESULTS

Meet TERRA

What is it?

an *early-warning decision-support system* that helps forecast crop yield using precise nutrient concentration and macroclimate data

“You are using data to support humanity, to feed life.” - Prof. Suelia Rosa



Who is it for?

- Specialty crops
- Hydroponic methods
- Controlled Environment Agriculture

“Americans are overwhelmed with data volume and are overcorrecting. Rockwool farms needs a data-driven product.” - Prof. Abe Stroock

Big Farms



Send samples to the Netherlands



Data is sent to the farmer



We learn from Mario's unwieldy data, allowing him and other farmers to focus on the growing!

TERRA is for all!

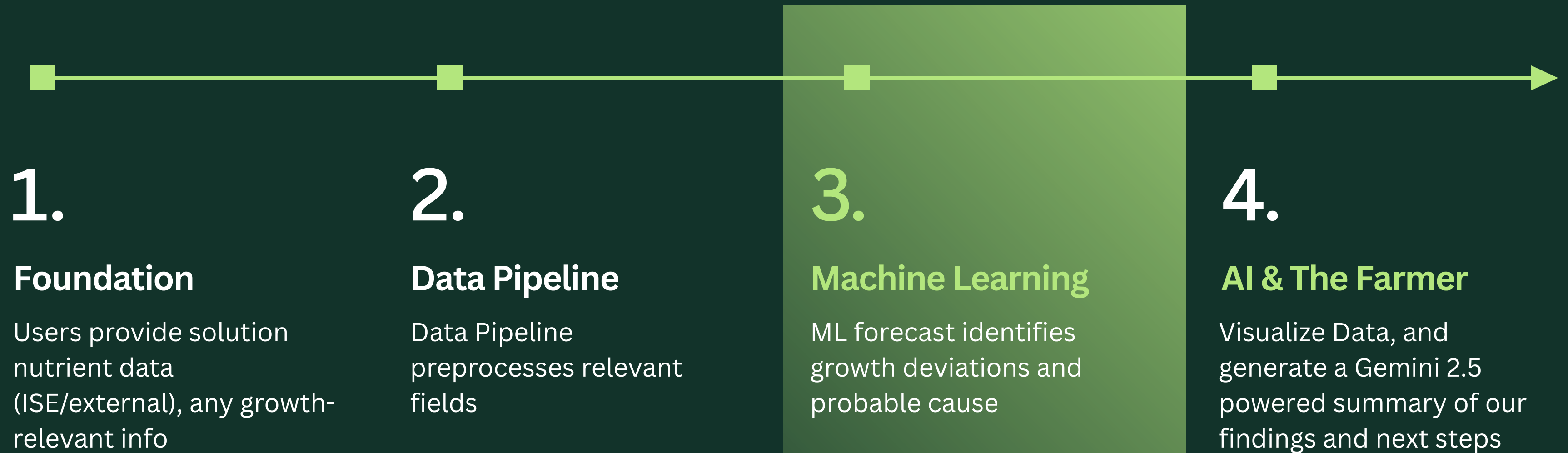
Small Farms



ISE sensors



Our Technology Pipeline



EXPLORER

AG_HACK

- > __pycache__
- .env
- .gitignore
- long_horizon_model.pkl
- new_test_data.csv
- sample_input.csv
- short_horizon_model.pkl
- streamlit_app.py
- test_data.csv
- yield_forecast.py

OUTLINE

```
streamlit_app.py > ...
1 import streamlit as st
2 import pandas as pd
3 import plotly.express as px
4 import google.generativeai as genai
5 import os
6 from dotenv import load_dotenv
7
8 # bring in ML system
9 from yield_forecast import load_system, make_reading
10
11 load_dotenv()
12
13 # --- PAGE CONFIG ---
14 st.set_page_config(page_title="Terra | Early Warning System", layout="wide", page_icon="🌱")
15
16 # --- CUSTOM "FARM-TECH" STYLING ---
17 st.markdown("""
18     <style>
19     .main { background-color: #f9fbf9; }
20     .stButton>button { background-color: #4CAF50; color: white; border-radius: 20px; border: none; }
21     h1 { color: #2E7D32; font-family: 'Segoe UI', sans-serif; }
22     .metric-card { background-color: white; padding: 15px; border-radius: 10px; box-shadow: 2px 2px 5px rgba(0,0,0,0.05); }
23     </style>
24     """, unsafe_allow_html=True)
25
26 # --- GEMINI SETUP ---
27 api_key = os.getenv("API_KEY") # Ensure your .env has API_KEY=...
28 if api_key:
29     genai.configure(api_key=api_key)
30     model = genai.GenerativeModel('models/gemini-flash-latest')
31     st.info("🌱 Gemini API configured")
```

PROBLEMS 1 OUTPUT DEBUG CONSOLE TERMINAL PORTS

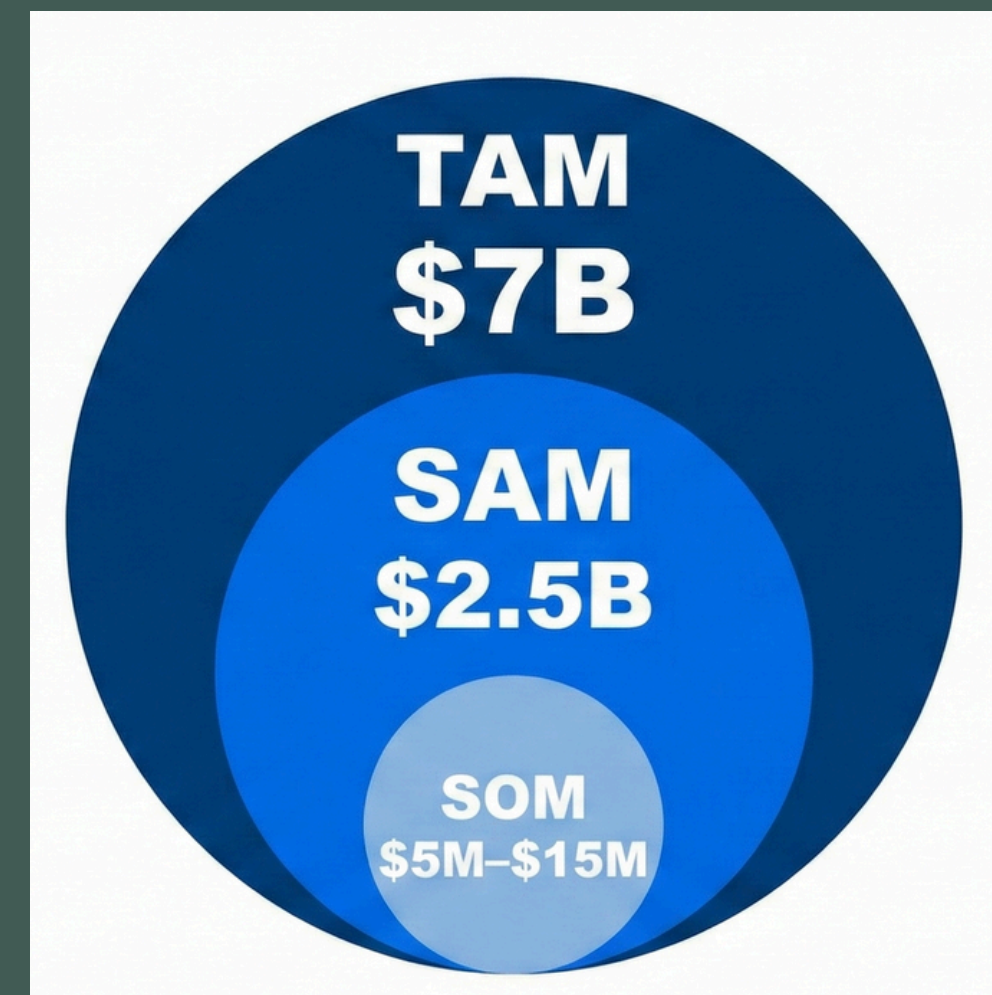
zsh + ~

(base) rishishah@Rishis-MacBook-Air Ag_Hack % streamlit run

Business Model

Subscription-based, scaling with data volume to incentivize smaller farms to use ISE

- One time fee for 'plug-in' with your hardware or data collection methods.



CAGR of Smart Agriculture = 17.3%
>> trad ag. CAGR

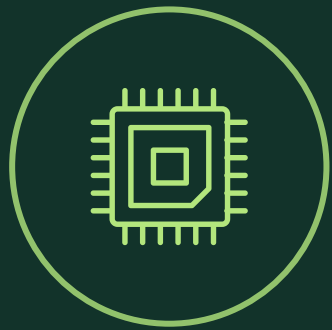
CAC offset by high LTV

- High-retention, due to integration with various future-forward collection methods and farm scales.

Competitor Analysis

Terra	Bluelab or Growee	Analog Approach
Pros • Highly scalable (SaaS) • Plug-n-play to multiple markets and scales • Tracks each ion, to perfect nutrient solution • Accessibility (educational) • Built on novel hydroponics Research Cons • Dependency on clean data and hardware • High onboarding friction (CAC)	Pros • Remote, cloud-based app for monitoring • Costly hardware dependency (2k+) Cons • Based on EC sensors, which measure dissolved salts instead of specific ions' concentrations (not useful for improving) • Lack of educational accessibility	Pros • Low starting capital • No tech dependency Cons • Lag time – cannot early diagnose issues or predict yield trajectory • High labor costs - manual inspection of leaves and other features • Lower yield consistency - removes benefits of precise nutrient knowledge • Extensive domain knowledge needed

What we **Learned**



About Digital Agriculture & ISE

- From limited background, to learning from novel research and Profs Abe, Suelia, and more!



About future of agriculture

- Hydroponics
- Food waste and scarcity issues.
- Agriculture 4.0 (AI & Robotics)



About the community that feeds the world

- Our future is made by you! We were inspired by Farmers, Techies, Professors, Fellow teams!



Terra

THANK YOU!

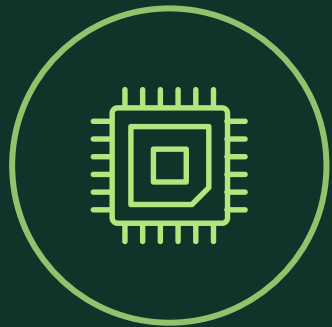
We hope you were as inspired as we were by you!
From Rishi, Mohit, Yoojung, and Sophia



Next Steps



Limitations & Challenges we **overcame**



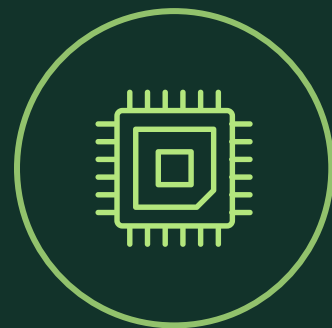
Data Availability

- Hard to find ISE sensor data. We contacted a dozen PhDs/Professors to find more.



Identifying relevant factors

- Which fields are relevant? Are we forecasting or classifying?



Data Quality & Drift

- ISE sensors are finicky, so baseline readings shift over time without recalibration.

