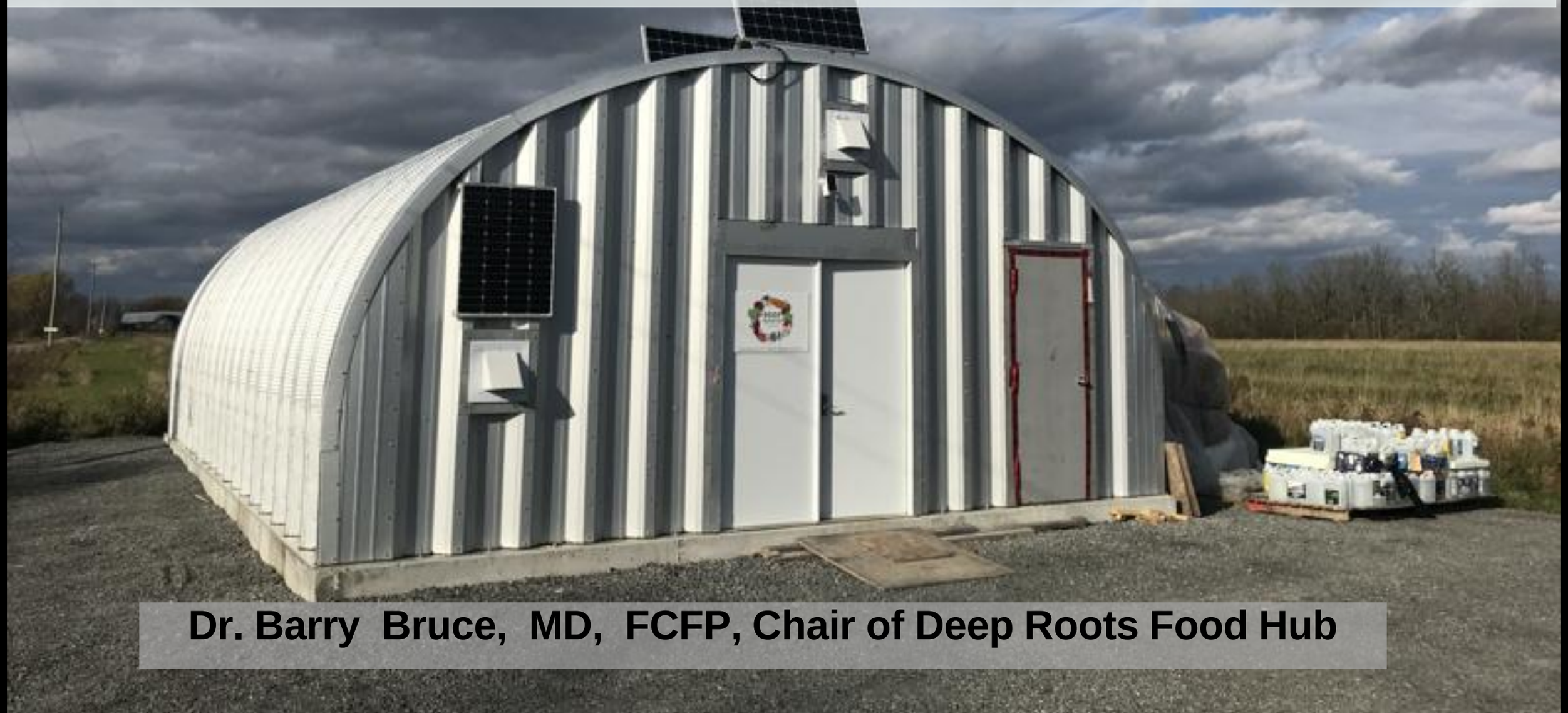
Deep Roots Food Hub

An Off-Grid Root Cellar
and
How A Root Cellar Could Support Human and Planetary Health

Presentation to CACOR

Nov. 25, 2020



Dr. Barry Bruce, MD, FCFP, Chair of Deep Roots Food Hub

Deep Roots Food Hub's Root Cellar!

* **Brief history of DRFH: a <u>volunteer,</u> "not-for-profit", organization focused on season-extending support of local producers *vs* *JIT* imported produce**

* **Counter local "food desert", transportation costs, & CO2 emissions**

* **Root Cellar, on NCC property, *a*n "innovation" project**

* **Root Cellar to benefit CSA's and/or community food distribution groups**

* **Funding sources: $125,000 from Ottawa Community Foundation**
  * **$48,500 from from Ontario's Greenbelt Fund**
  * **$25,000 from the City of Ottawa**

DRFH’s Timeline

2015: Aims:

* Establish a community root cellar that will enable area farmers to store their produce longer,

* Create a West Carleton Food Centre for local farmers to drop off produce for redistribution thus expanding the market share of local food through the Good Food Box (GFB) and local retailers

2016. Healthy Food Workshop Series

2016 Dec – won a $125,000 New Leaf competition – to deal with the “Food Desert” in West Carleton and to build a root cellar.

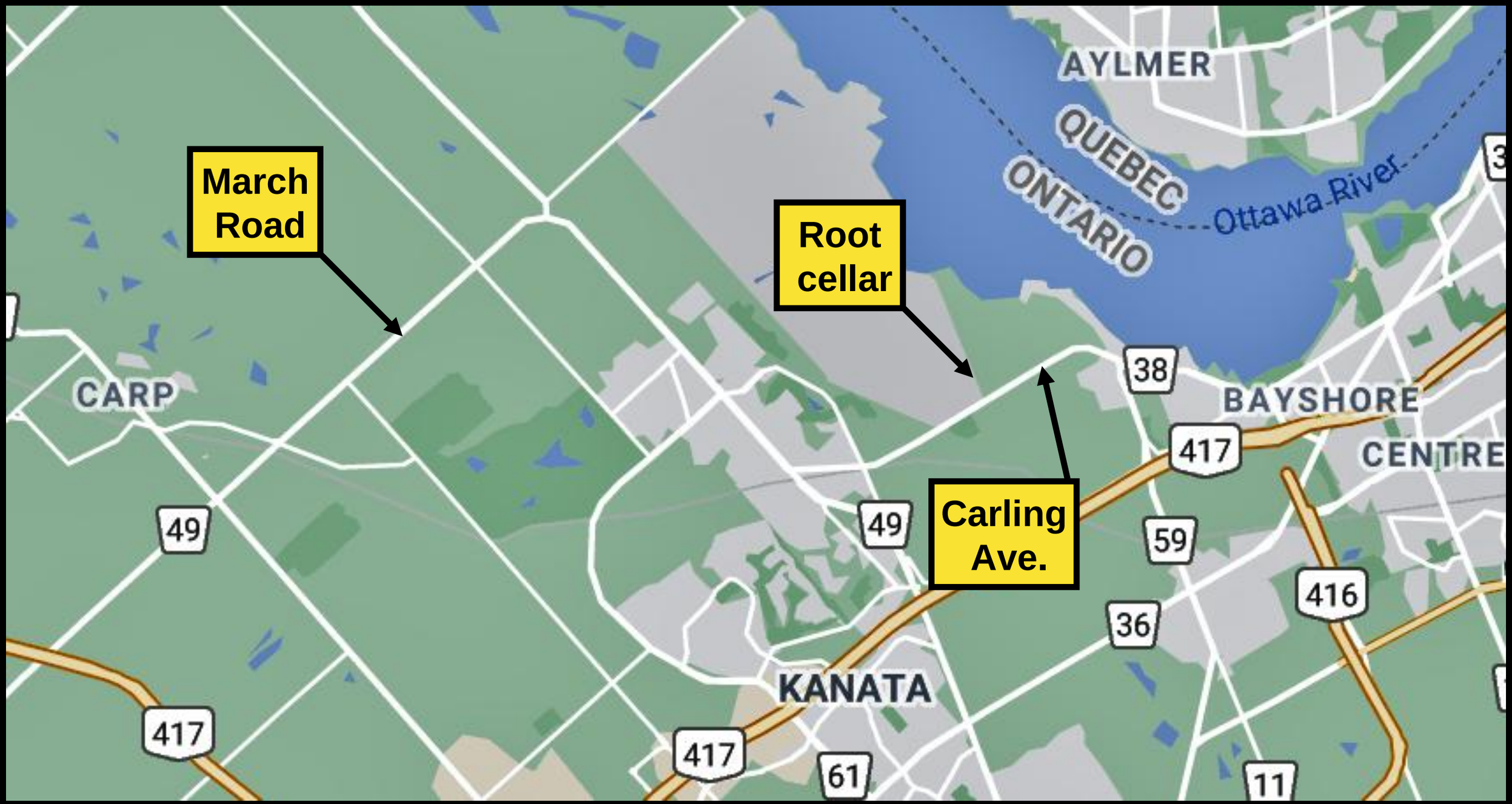
2017 September. NCC Land becomes site of Root Cellar (also site of BeetBox Cooperative Farm)

2018 December. Root Cellar kit delivered . Construction, by volunteers, during winter months!

2019 -2020 – 3000 hours and $115,000 later, the first test crop successfully survives the winter

2020 – ongoing volunteer fit-ups, IceCube successfully tested (November), about 5000 lbs of produce placed in the produce chamber. Unprecedented warm spell…….

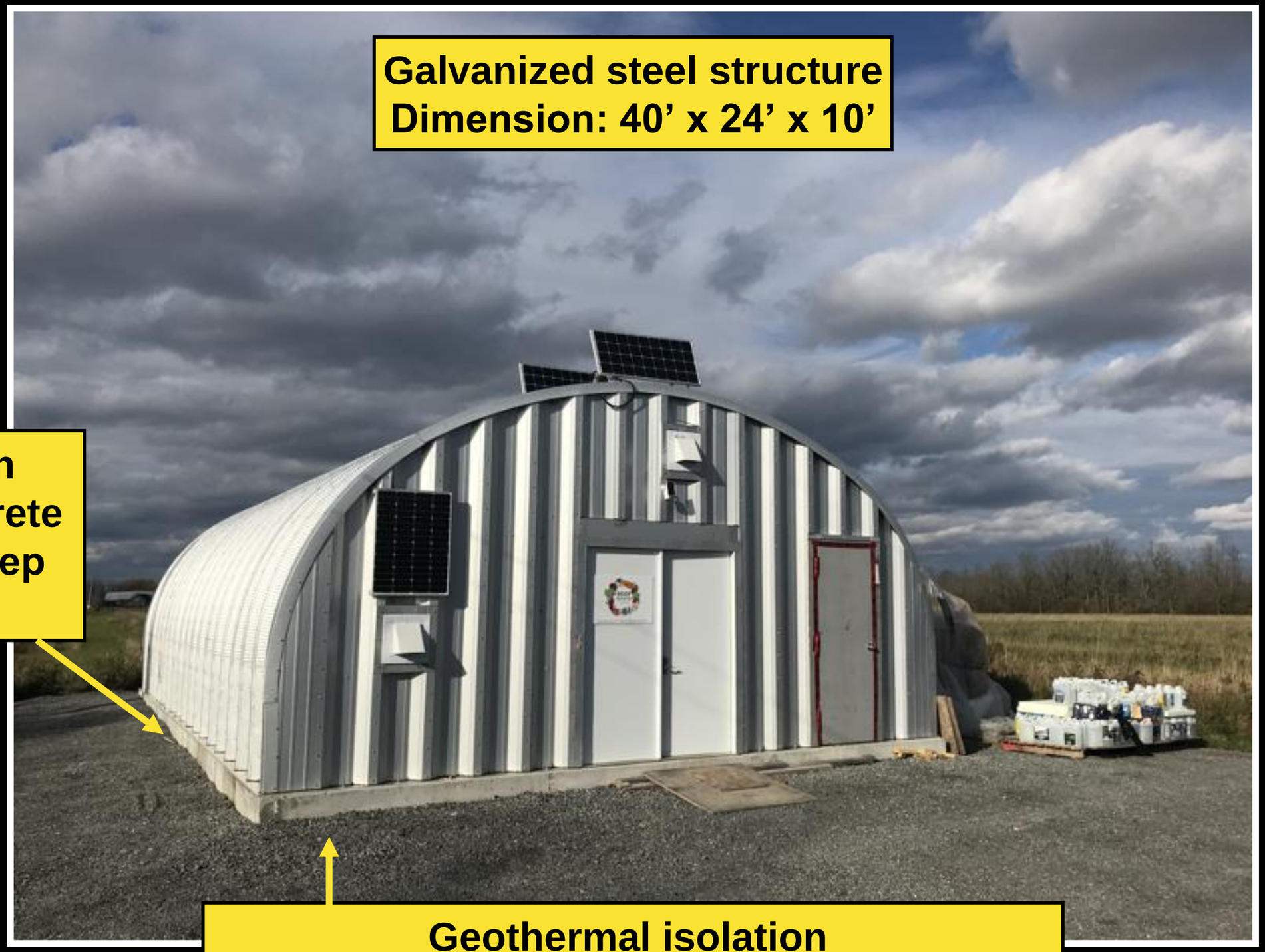
Root Cellar Location



Volunteers Braving the Cold

- 14 C Dec 11 2018
2018/12/11

Root Cellar Exterior

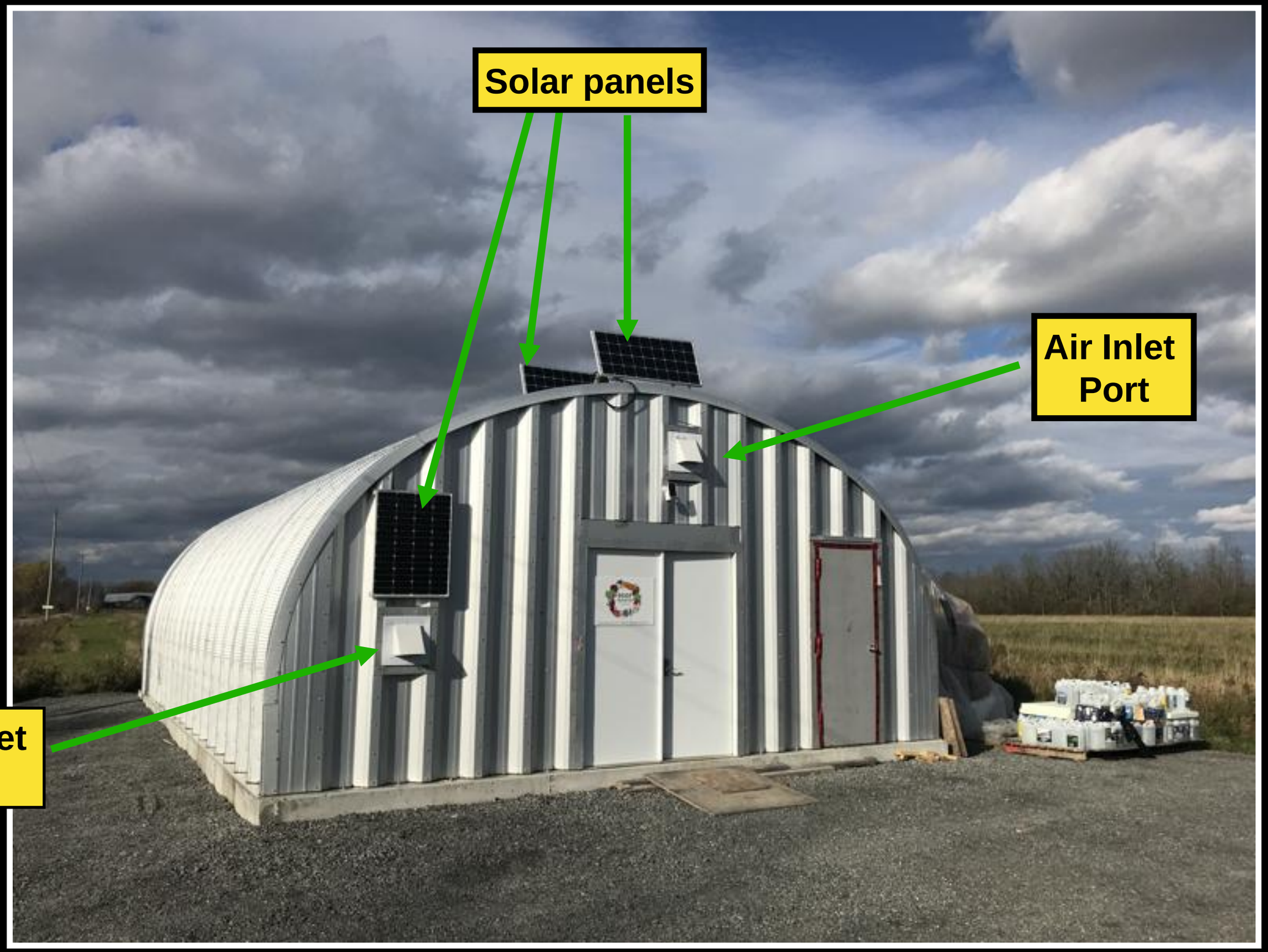


Galvanized steel structure
Dimension: 40’ x 24’ x 10’

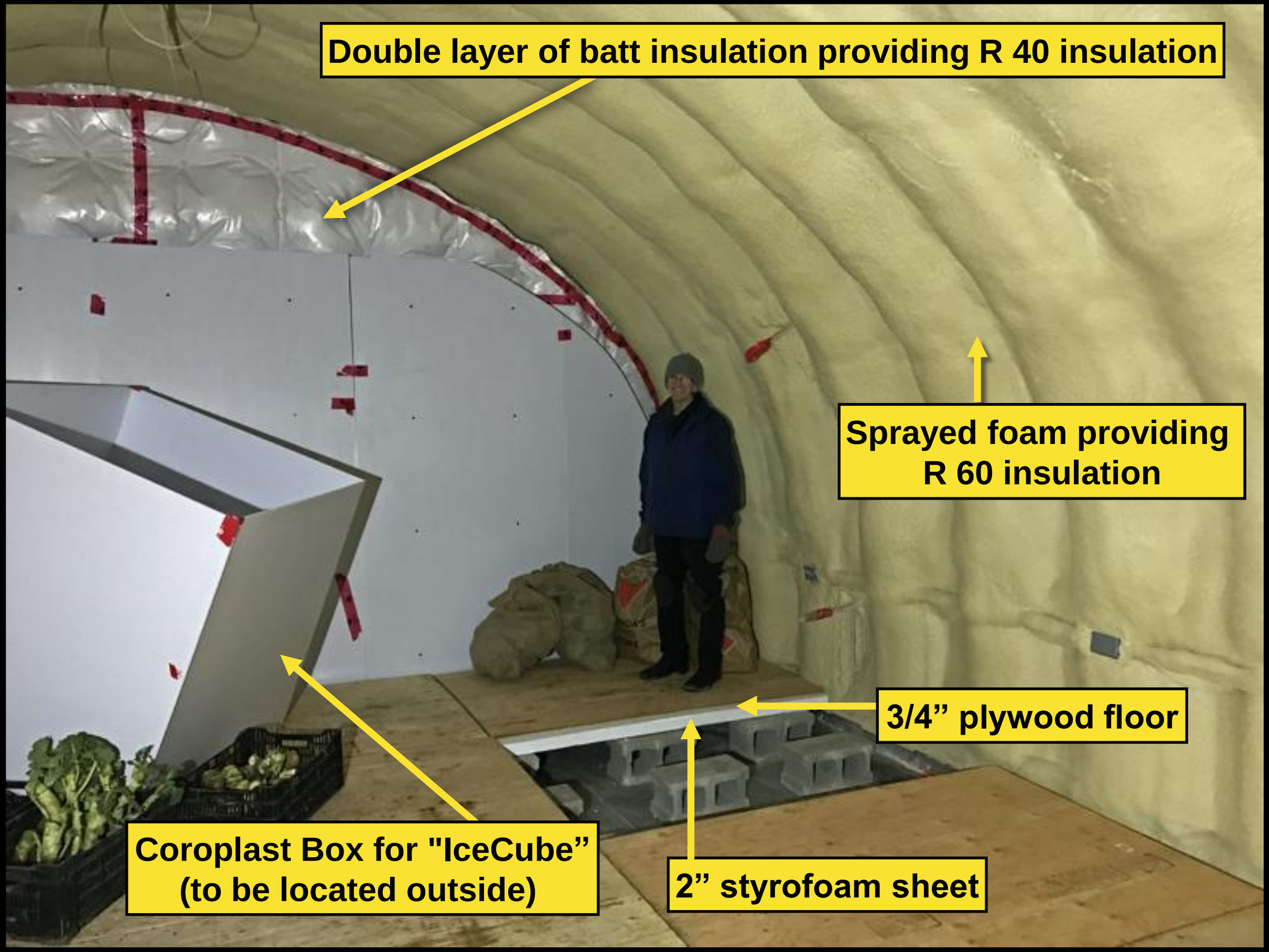
Foundation
poured concrete
10” x 18” deep
(in clay)

Geothermal isolation
2” high density foam,
covered with 12” of Granular “A” gravel,
extends 5‘ from poured concrete foundation

Root Cellar Exterior



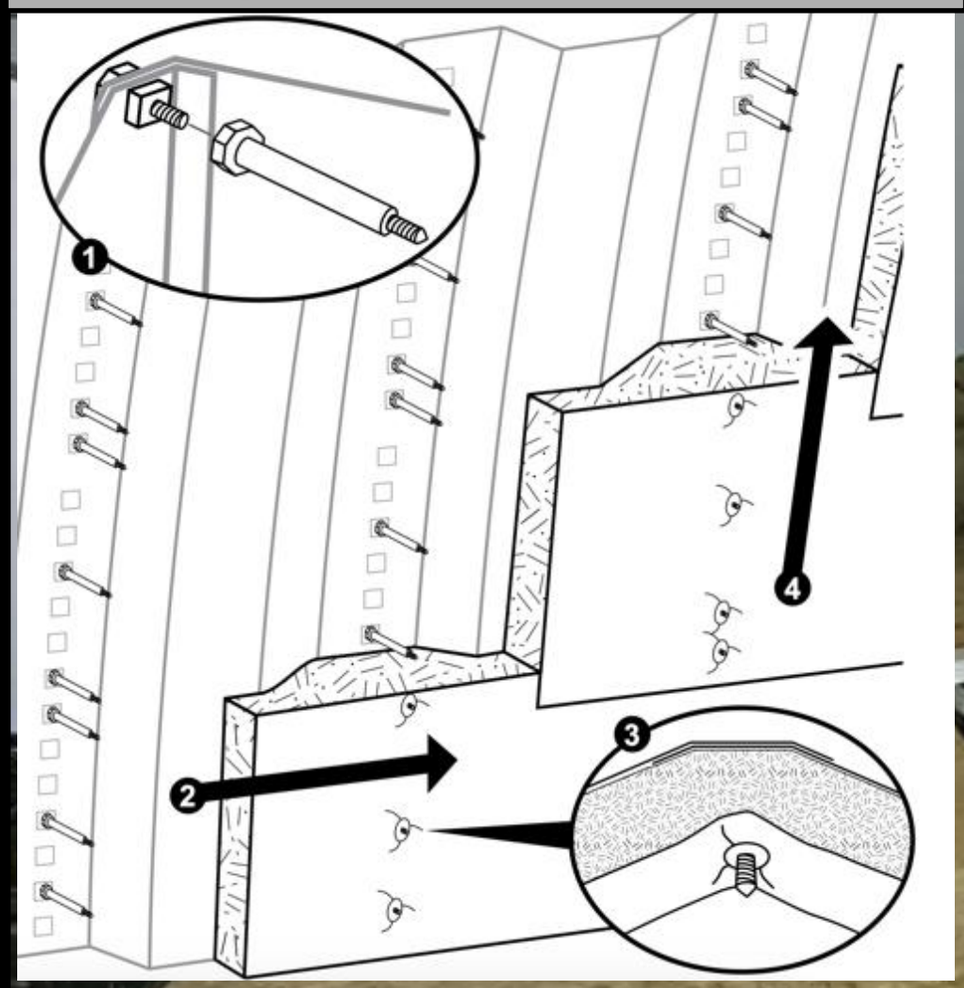
Root Cellar Storage Chamber



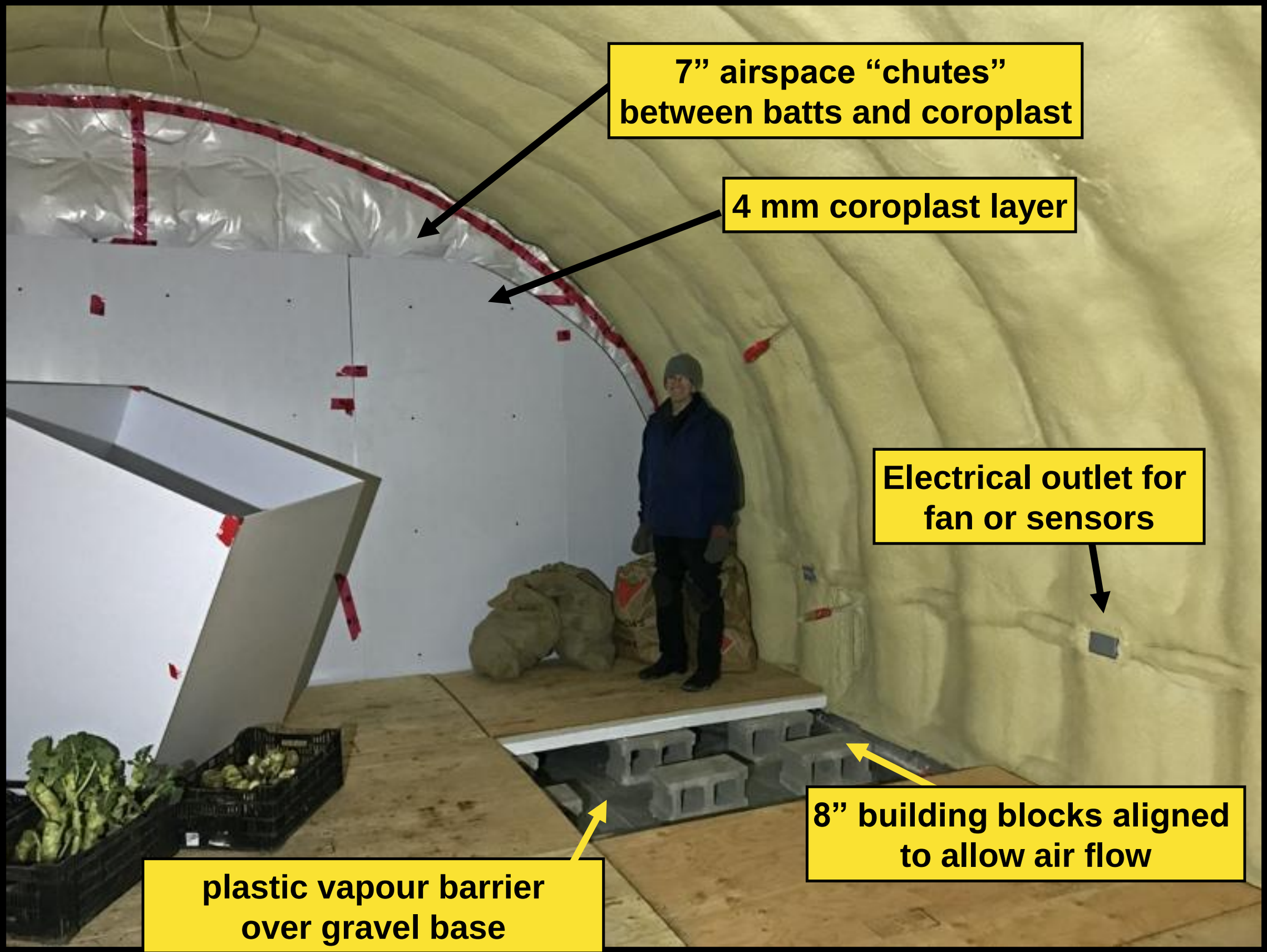
Root Cellar Storage Chamber

Double layer of batt insulation providing R 40 insulation

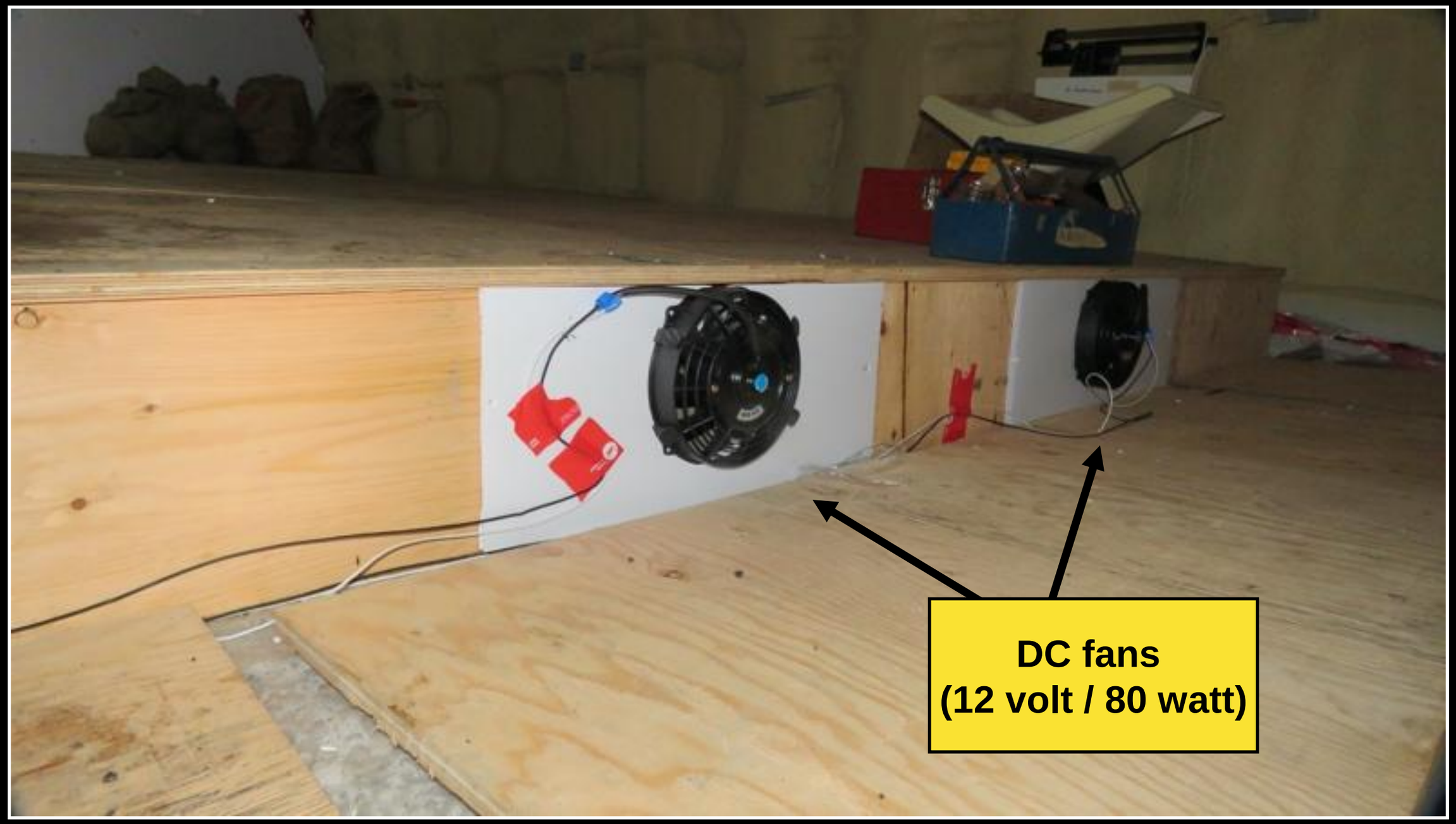
Plastic pins hold insulation bats



Root Cellar Storage Chamber

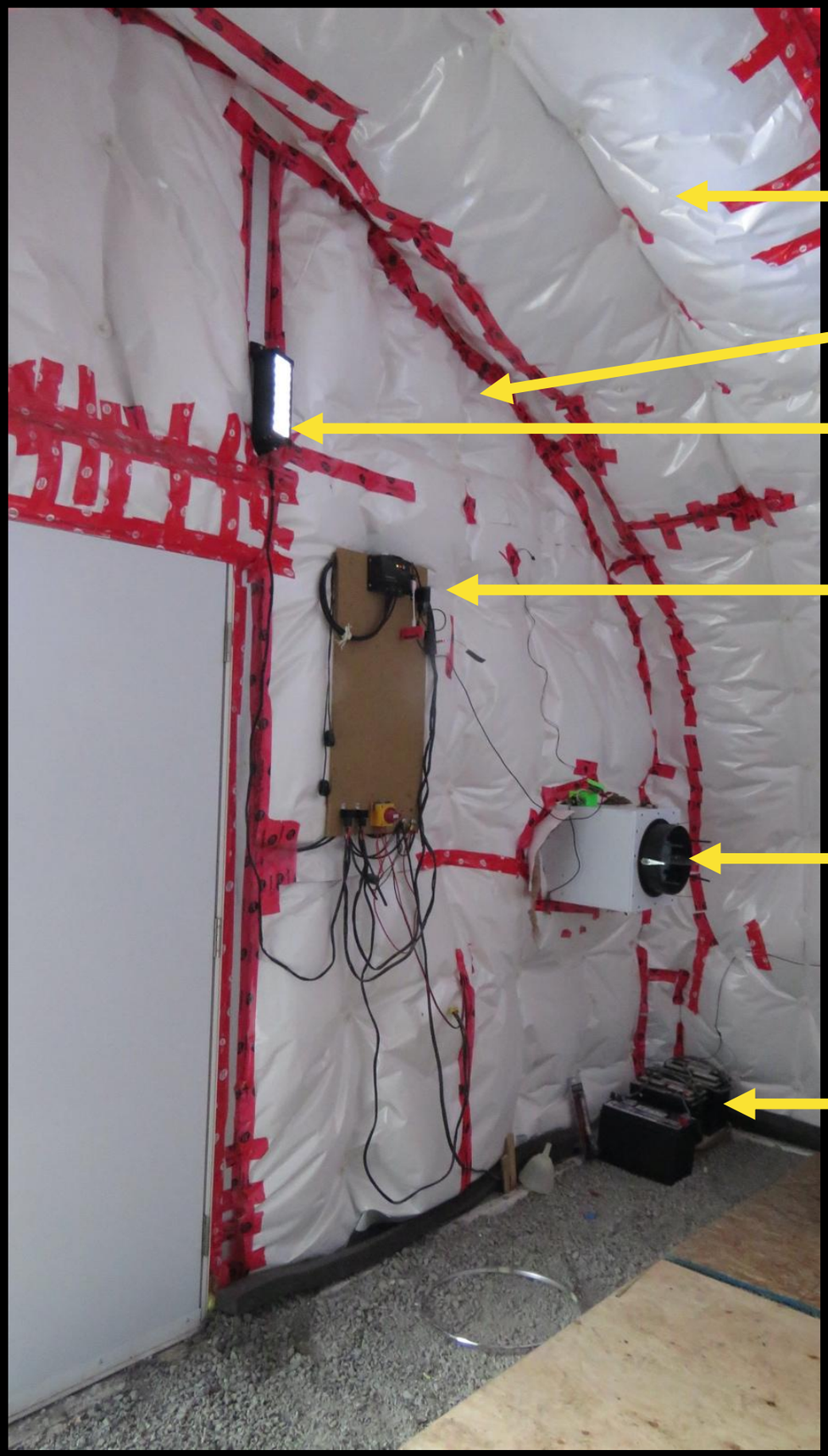


Root Cellar: Storage Chamber Floor fans



Fans activated when geothermal heat is needed to maintain storage chamber temperature if temperature drops below a target threshold of +2 C.

Root Cellar: Antechamber



R 20 Insulation batts

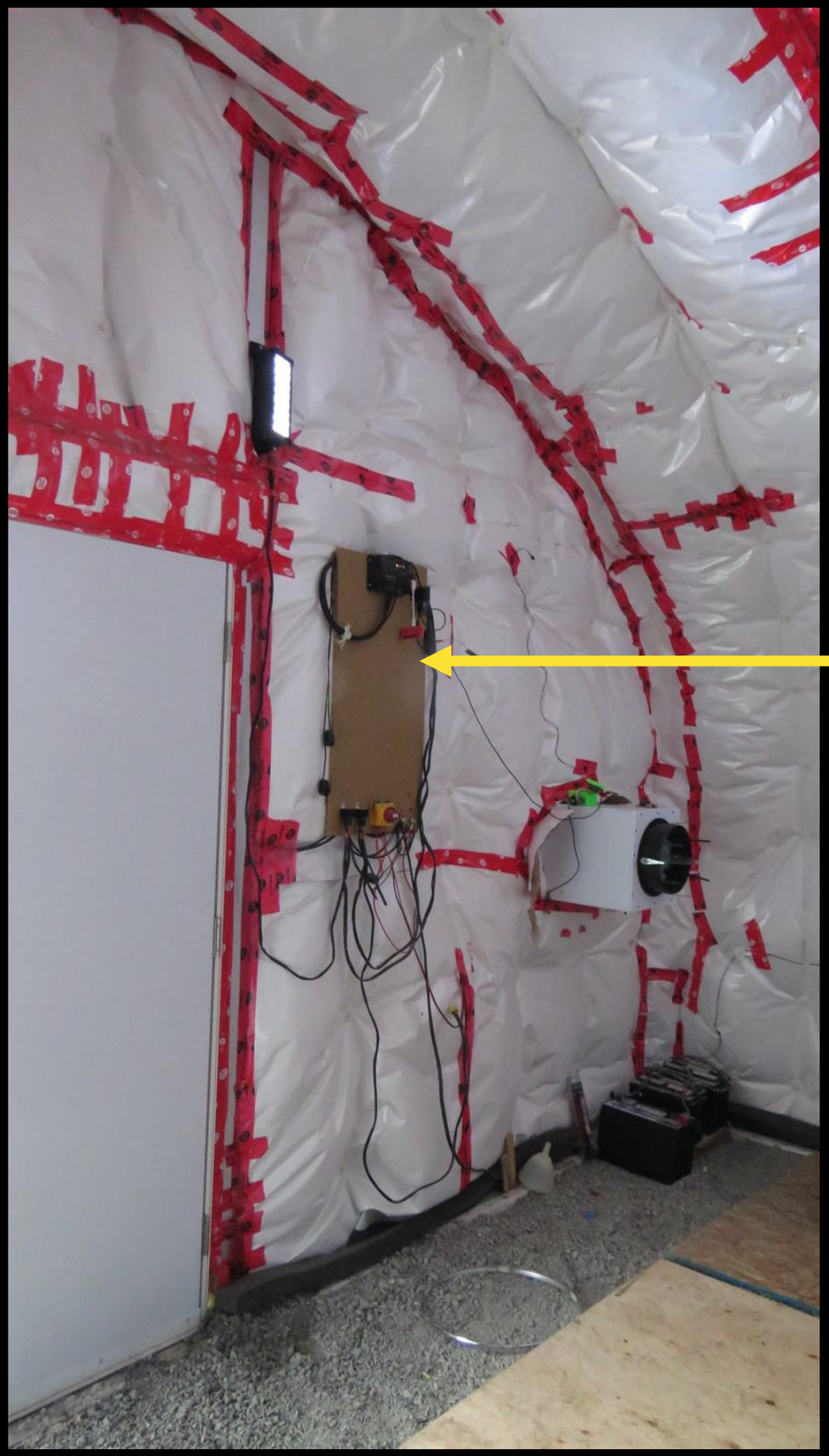
LED light fixture

Battery charge controller/monitor

Exhaust port to remove
warm air from storage chamber

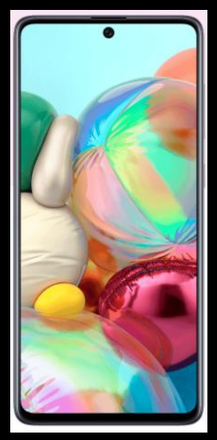
storage batteries powered by
roof-mounted solar panels

Root Cellar: Entrance Chamber



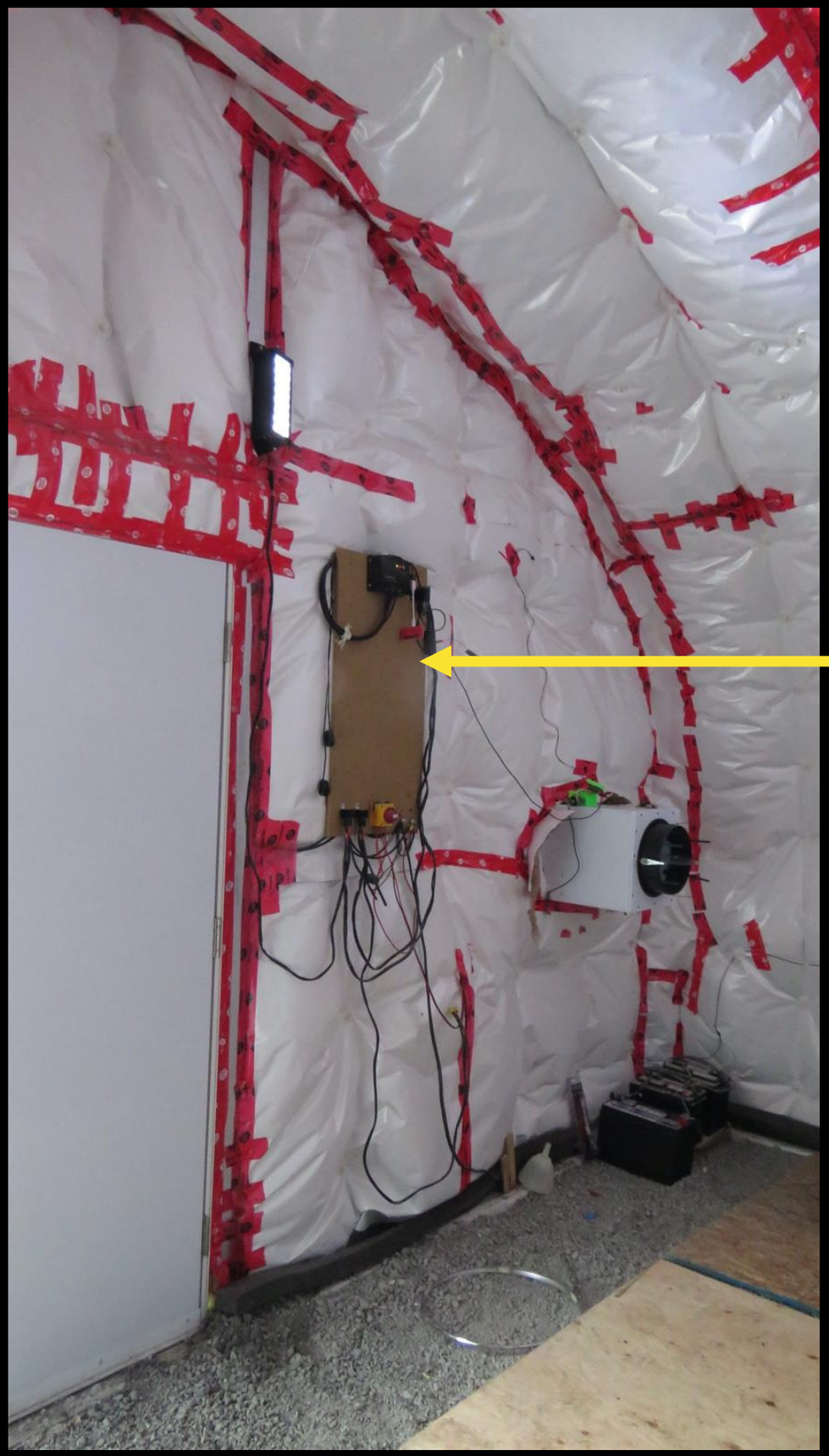
One of our volunteers has expertise in computer electronics .

- humidity and temperature monitors
- Raspberry pi (microcomputer) to connect Wifi to Cellular
  - (Other microcontrollers connect to the Raspberry pi over wifi and are used for monitoring temperature, humidity, battery levels and fan controls.)
- Raspberry Pi is monitored and controlled on a mobile phone



Root Cellar: Entrance Chamber

Environmental Control Details

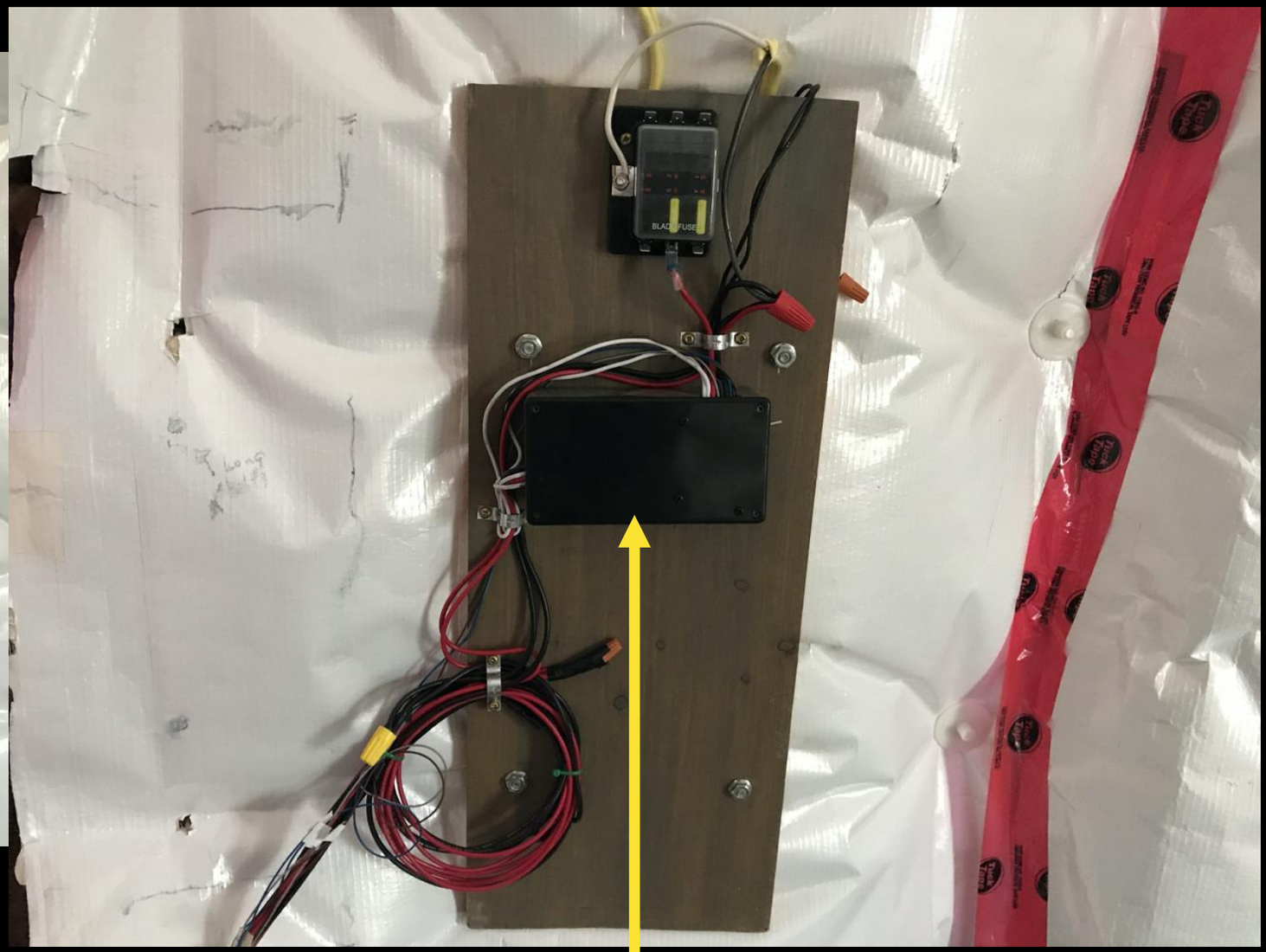


There is another software component, written in python, used to query for current temperature in the zones, calculate averages, and compare against external conditions.

This leads to automated decisions on whether air should come in from outside (cooling), or should circulate air from under the floor (heating), circulate air within ice cube (cooling in spring), or simply turn on circulation fan (air flow to reduce chance of mold growth and to balance temperatures in main chamber).

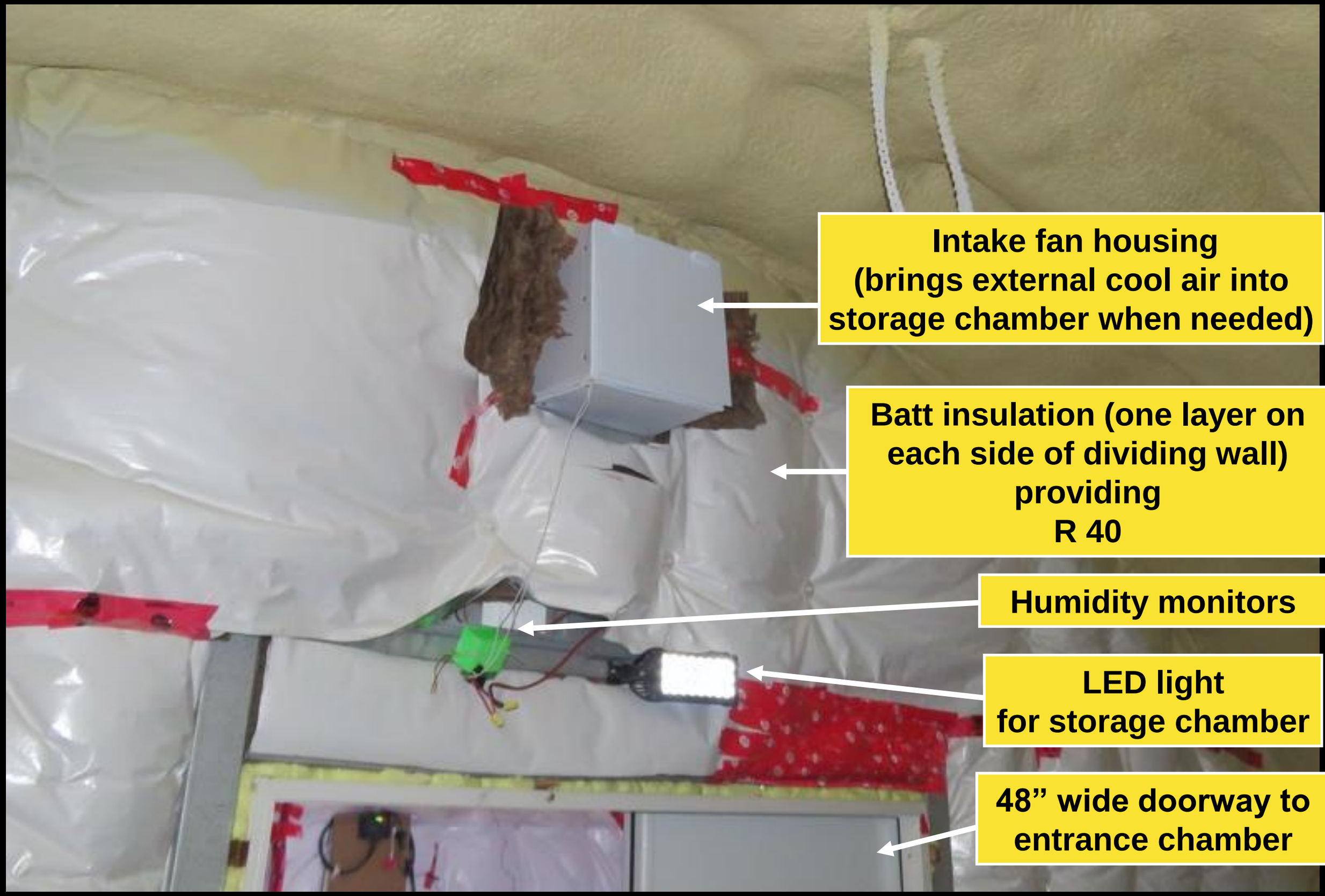
Root Cellar: Entrance Chamber

Cold air inlet
from Ice Box

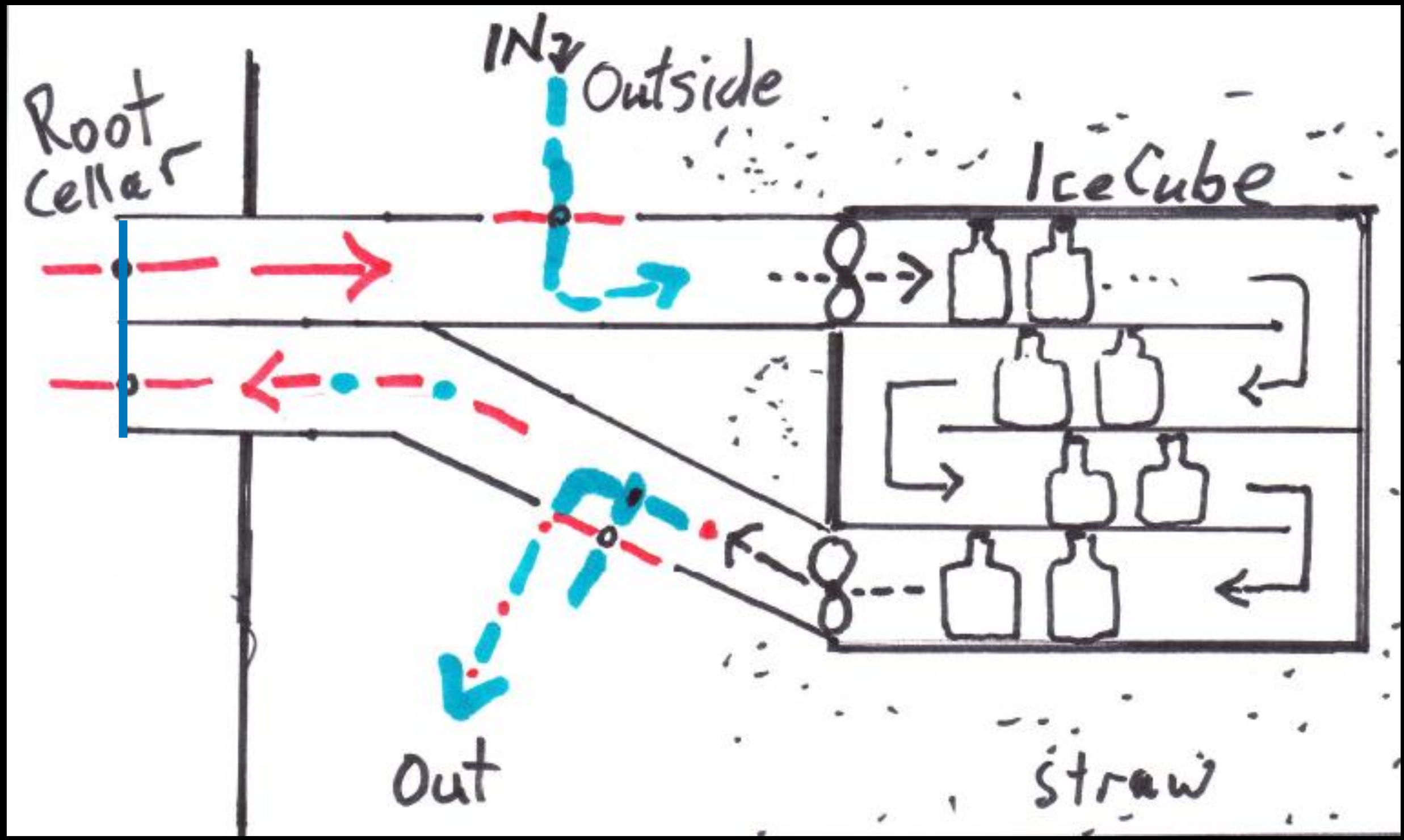


Cold air inlet
Air movement
regulator

Root Cellar : Storage Chamber Antechamber Wall

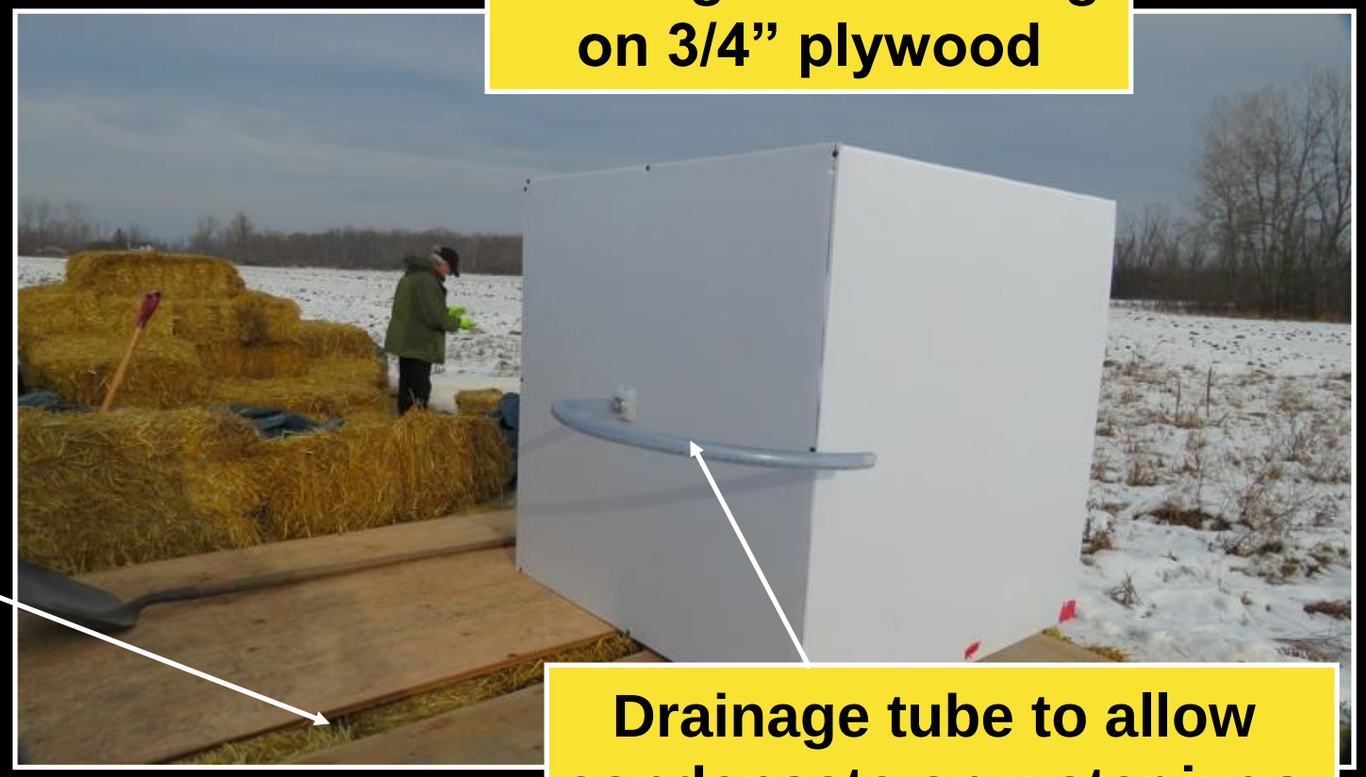


Root Cellar : Straw Bale Ice Chamber



Root Cellar : Straw Bale Ice Chamber

Drainage box resting on 3/4” plywood



Drainage portal location

Drainage tube to allow condensate on water jugs to seep into ground

10 mm Coroplast drainage box (before turning upright and surround by straw bales).

Drainage tube enters 3” drainage pipe set 12” into gravel & clay base

Ice Cube : (Straw Bale Insulated)

Cooling Chamber

Four layers of 4 litre bottles sit on plywood floors. Plywood snug to sides with 4 “ gap at one end.

**Layers staggered
(with 4” openings at alternate ends)**

**Duct channel
(contains two ducts)**

Fan pushes warm air to IceCube (visible)

Root Cellar : Straw Bale Ice Chamber

Root Cellar : Storage items Nov. 19, 2020

Center isle

Center isle and right side

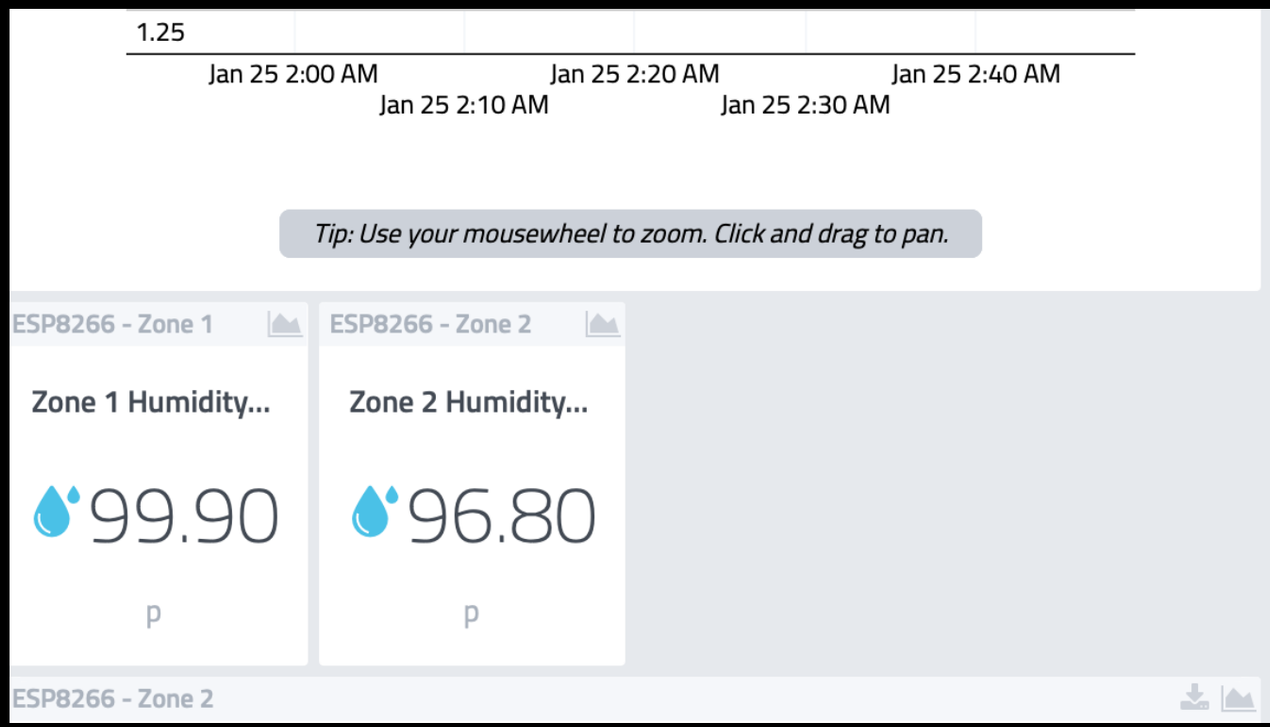
Left Side

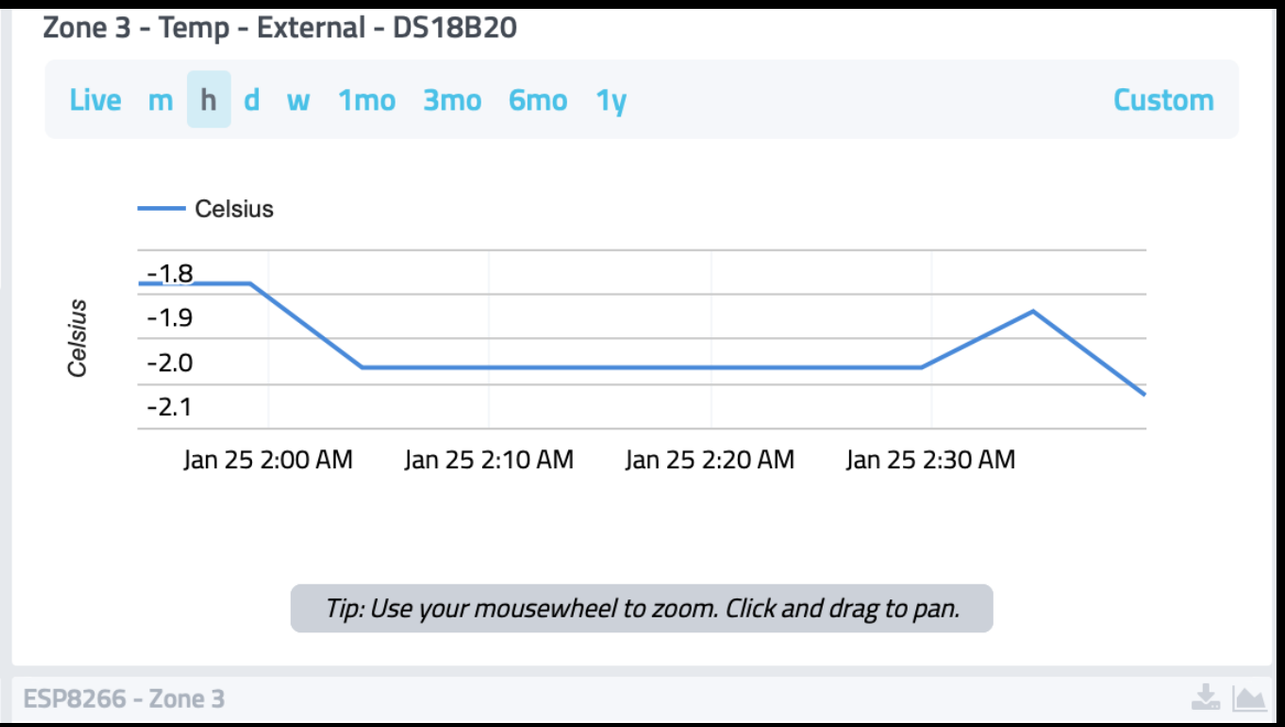
Thanks to Big Steel Box
for a donation of this 20’ storage container

Storage shed
for Gasoline and Generator

Temperature & Humidity Monitoring

(Cayenne Internet of Things (IoT) dashboards for remote monitoring.
Future release to use Google Firebase for dashboards.)



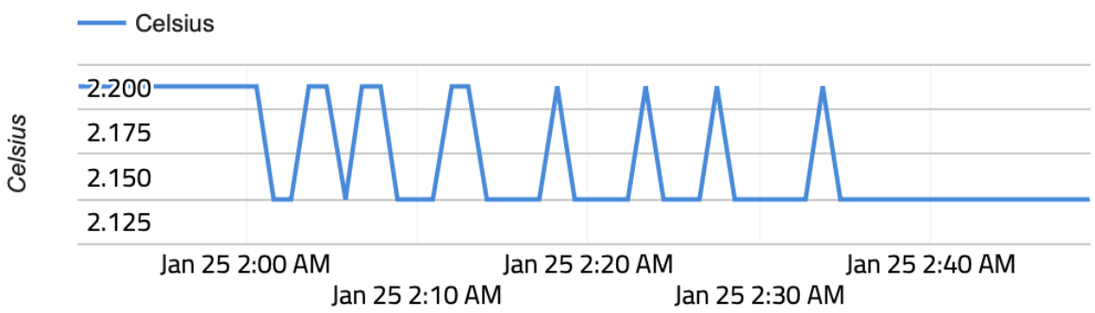


Temperature & Humidity Monitoring

(Cayenne Internet of Things (IoT) dashboards for remote monitoring.
Future release to use Google Firebase for dashboards.)

Zone 2 - Temp DS18B20 - 2 - MainChamber at floor

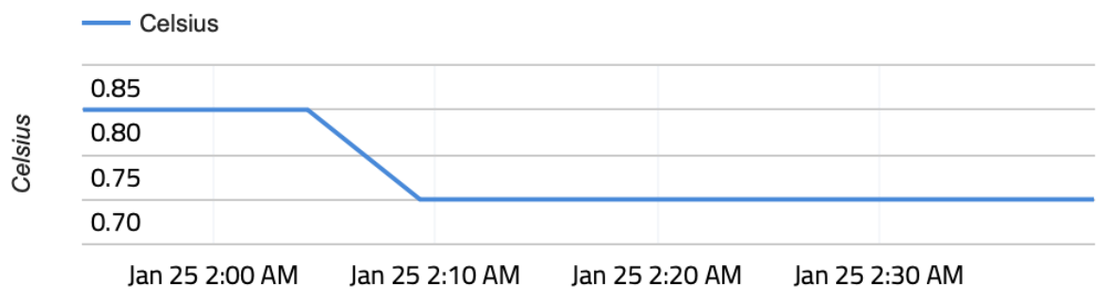
Live m h d w 1mo 3mo 6mo 1y Custom



Tip: Use your mousewheel to zoom. Click and drag to pan.

Zone 3 - Temp - DHT22 - AntiChamber

Live m h d w 1mo 3mo 6mo 1y Custom

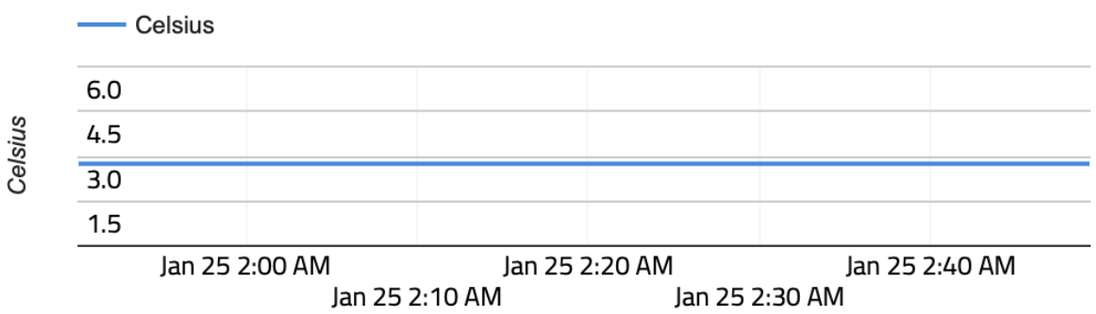


Tip: Use your mousewheel to zoom. Click and drag to pan.

ESP8266 - Zone 2

Zone 2 - Temp - DS18B20 -1 - MainChamber - Under Floor

Live m h d w 1mo 3mo 6mo 1y Custom



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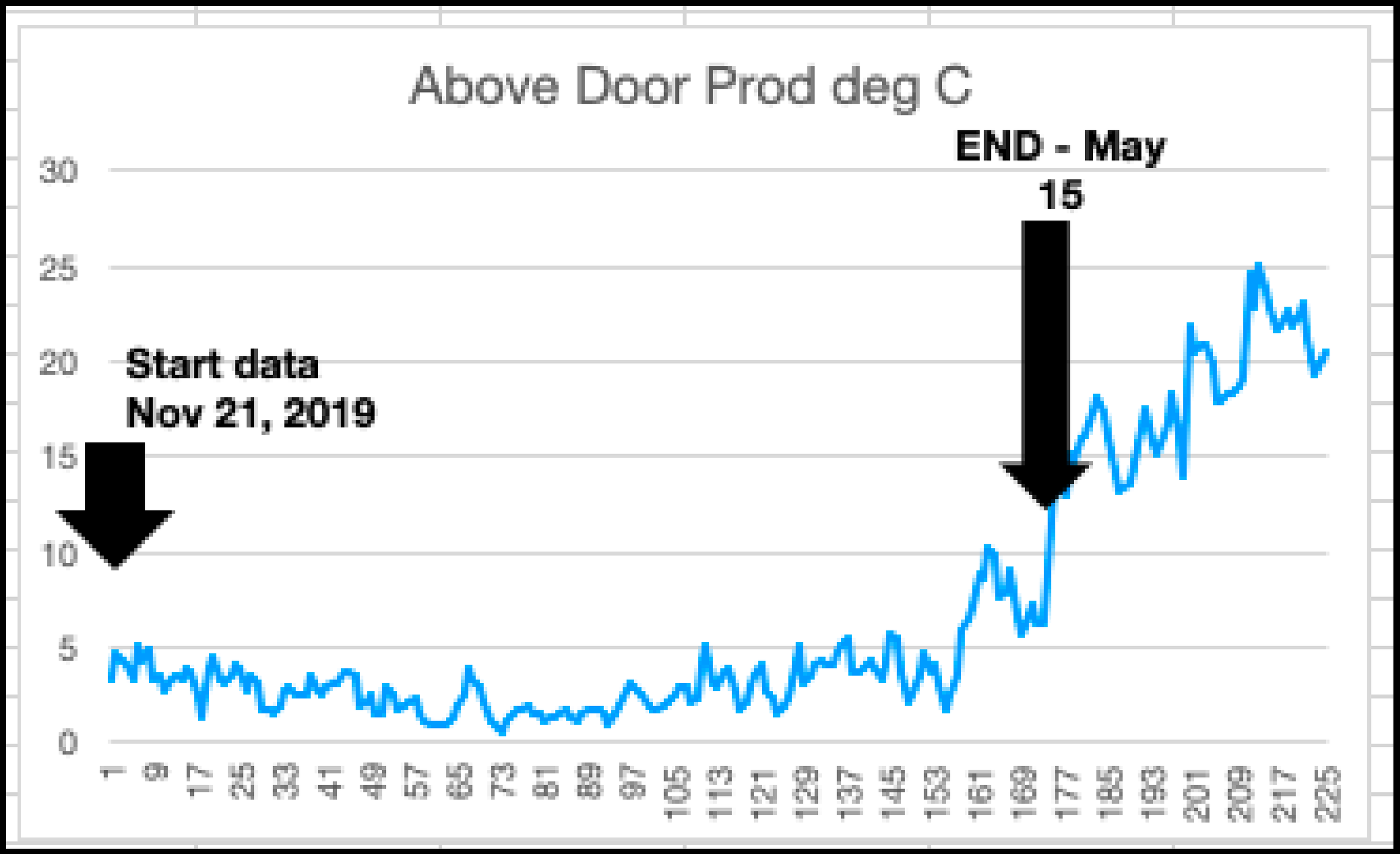
Above Door Prod deg C
END - May 15
Start data Nov 21, 2019
30
25
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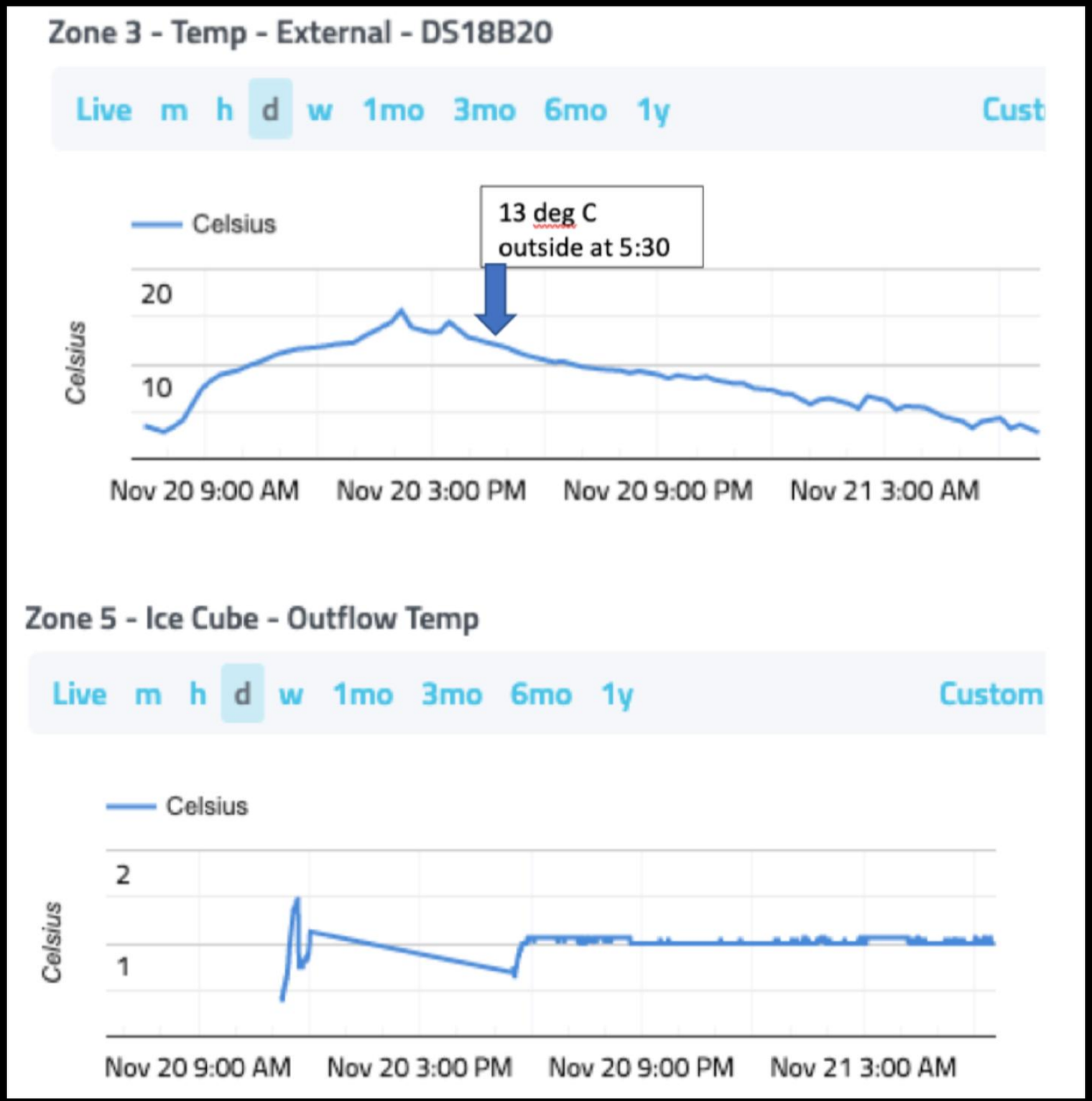
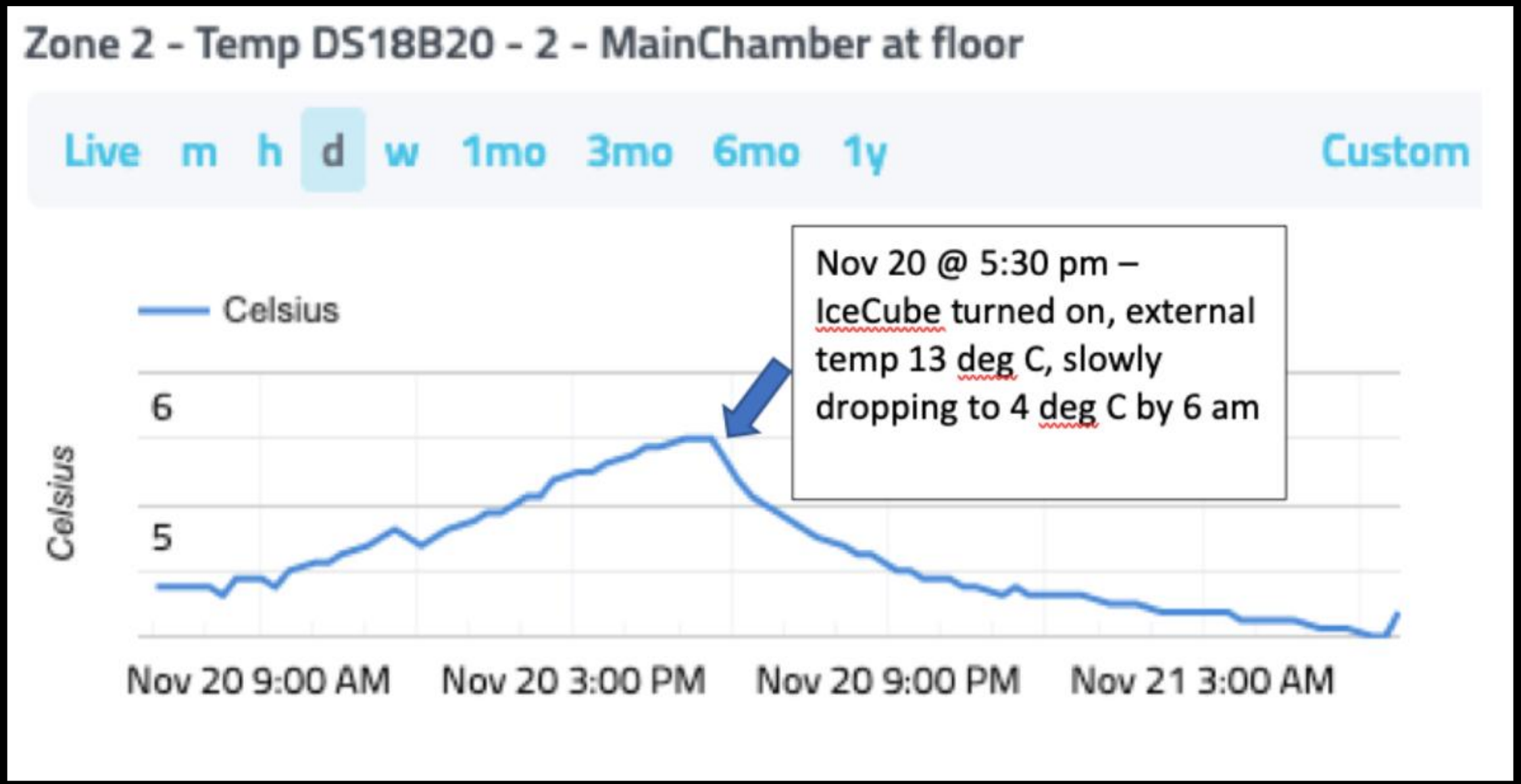
IceCube Testing

Nov. 20, 2020



IceCube Testing

Nov. 20, 2020



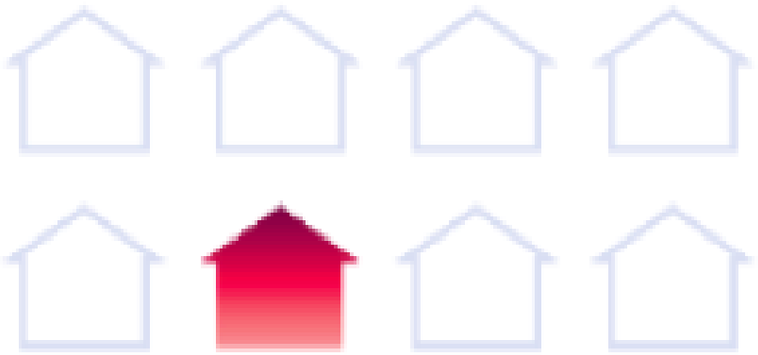
Current Challenges!!

- **Minimal Humidity Control**
- **Power**
- **Season Start**
- **Long Warm Spells**
- **Summer**
- **Produce storage methods**
- **Business and Marketing Plan**
- **$$$**

Questions?
So what??
What does it mean?
What would it look like scaled up?
What could it mean scaled up?
If not a root cellar, what?

Household Food Insecurity in Canada

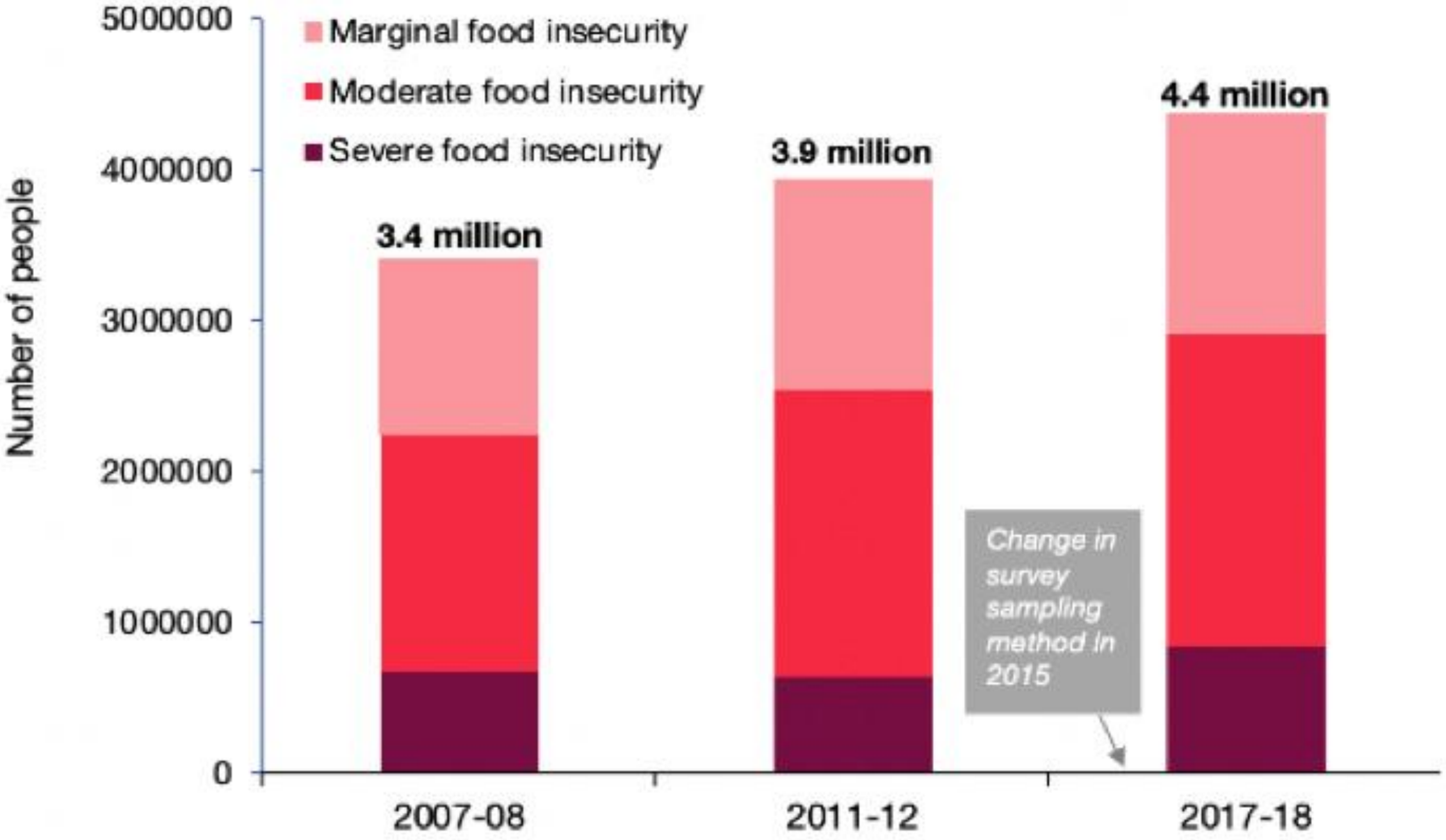
Household food insecurity is the inadequate or insecure access to food due to financial constraints. It is a serious problem in Canada that negatively impacts physical, mental, and social health, and costs our healthcare system considerably.



In 2017-18, 1 in 8 households in Canada was food insecure, amounting to 4.4 million people, including more than 1.2 million children living in food-insecure households.[1]

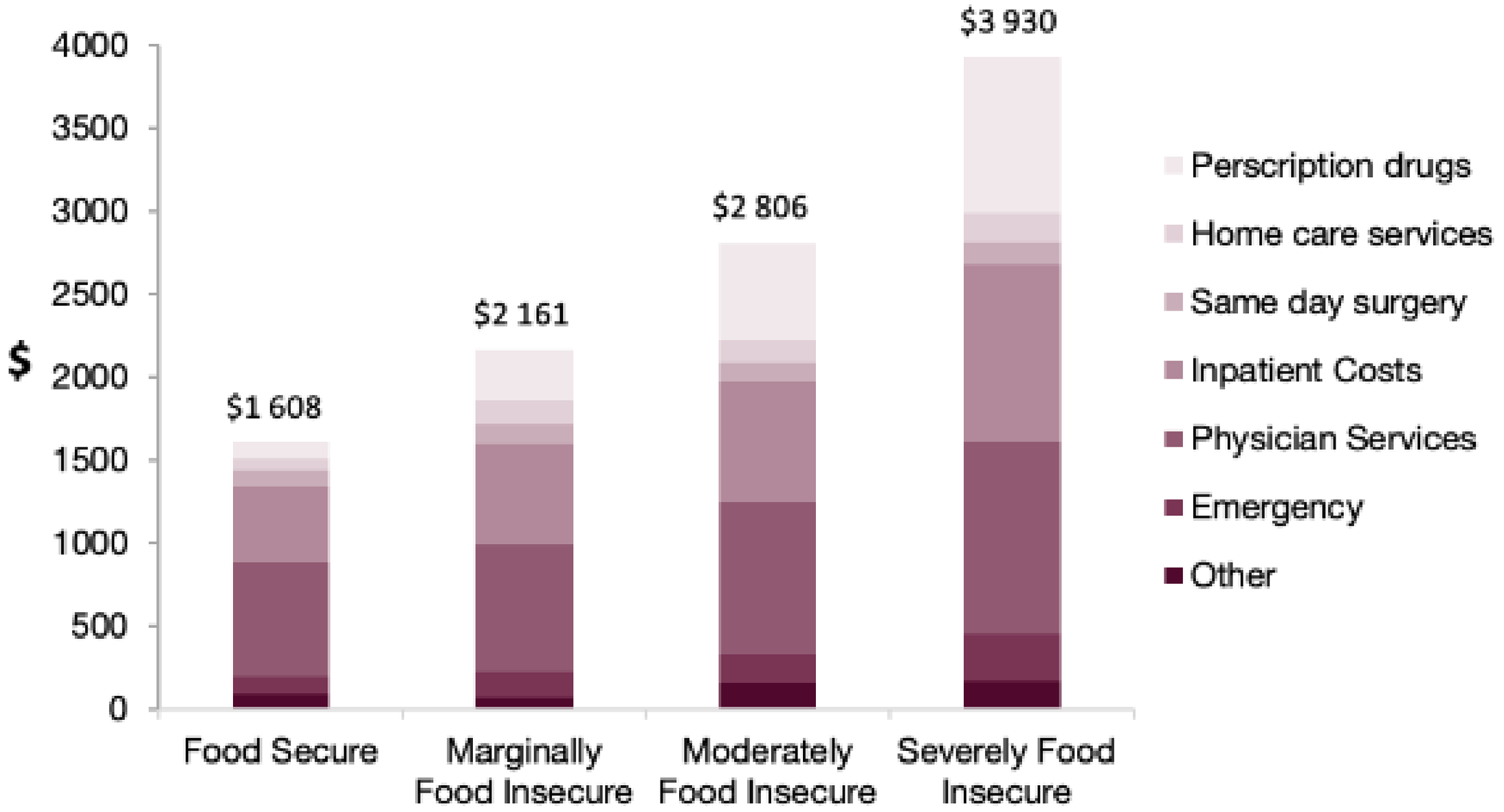
https://proof.utoronto.ca/food-insecurity/

Number of People Living in Food-insecure Households in Canada 2007-2018



Data Source: Statistics Canada, Canadian Community Health Survey (CCHS) 2007-08, 2011-12, 2017-18

Average health care costs incurred over 12 months by Ontario adults (18-64 years of age), by household food insecurity status



Data Source: Statistics Canada, Canadian Community Health Survey (CCHS) 2005, 2007-08, 2009-10

(Adapted from Tarasuk, Cheng, de Oliveira, Dachner, Gundersen & Kurdyak, 2015)[27]

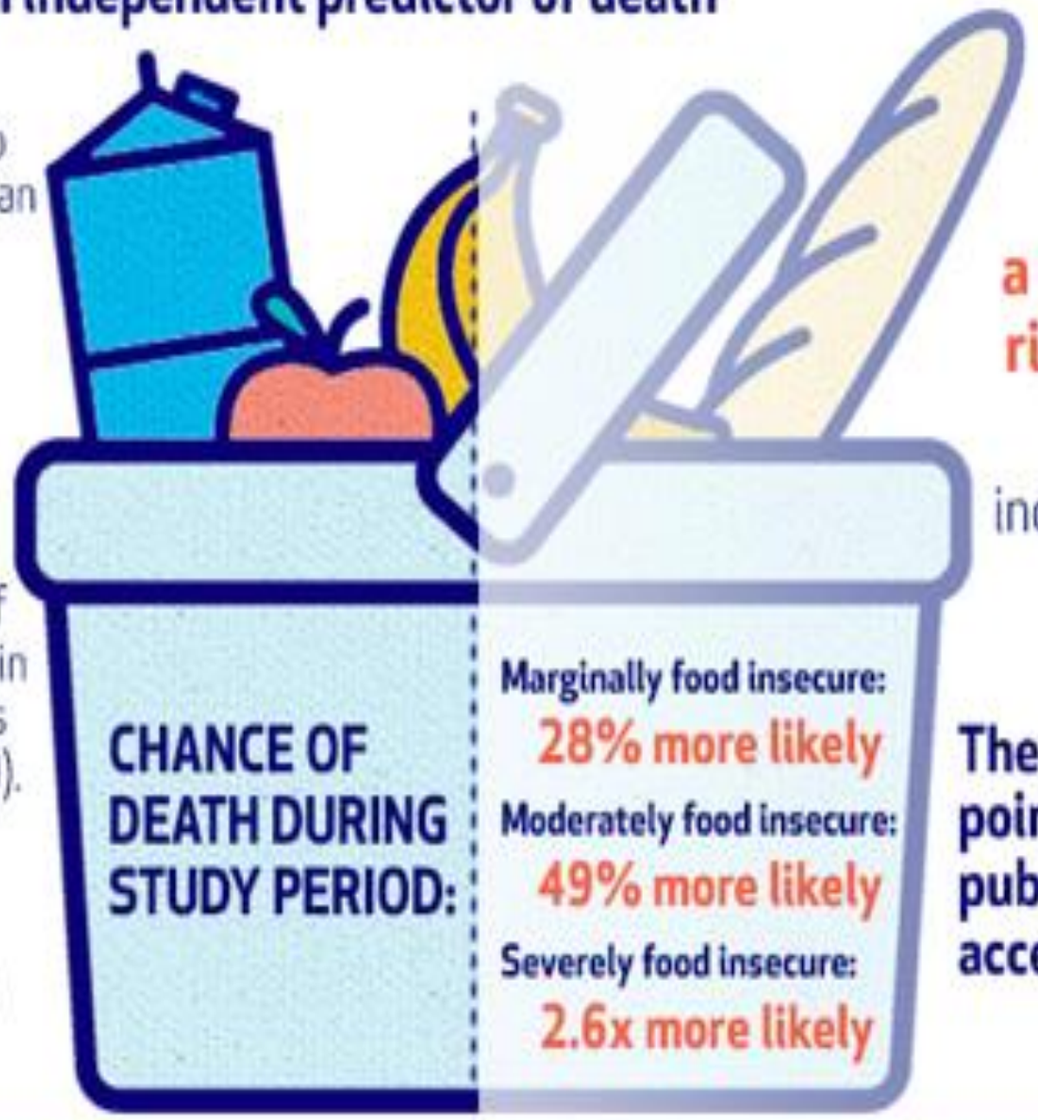
Ontarians who lack secure access to food are more likely to die prematurely

First population-wide study to look at food insecurity and mortality shows that unreliable access to food is an independent predictor of death

The study looked at linked health records for more than 90,000 Ontario adults who had completed the Canadian Community Health Survey, which includes questions about household food security.

The researchers accounted for other factors such as sex, age, education, housing, and family status, and then analyzed the independent influence of food security on the risk of dying within the study period (extending four years beyond the survey years 2005 - 2010).

Household food insecurity refers to uncertain, insufficient, or inadequate food supply at home, generally due to low income.



The study found that **a person's risk of death rises with their level of food insecurity,** independent of other health and social factors.

The authors say these findings point to the ongoing need for public policies that increase access to food for all people.

Gundersen C. et al. *PLoS ONE*. 2018.

Institute for Clinical Evaluative Sciences
ices.on.ca

PROOF
FOOD INSECURITY POLICY RESEARCH

UNIVERSITY OF TORONTO

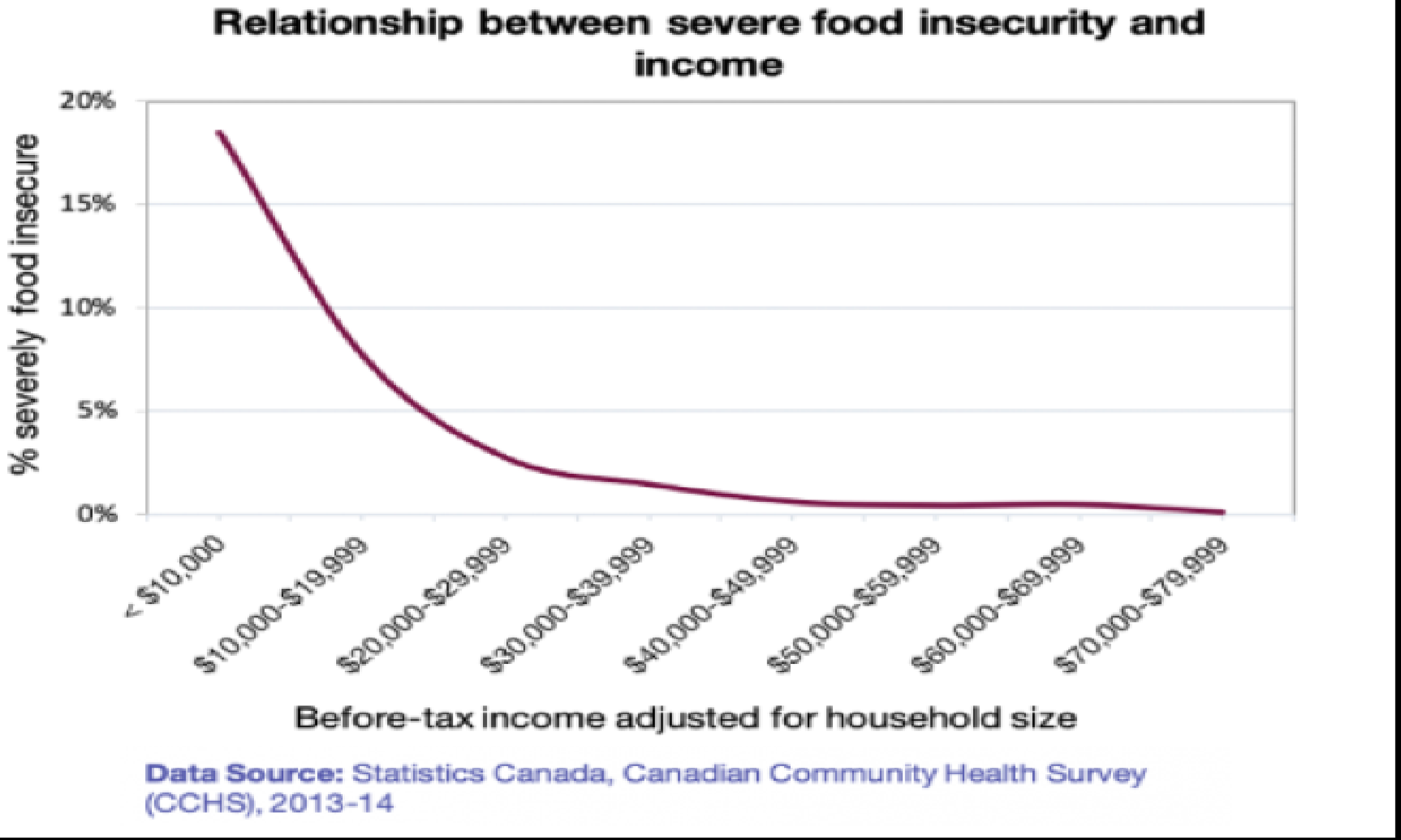
camh
mental health is health

Food insecurity is not a problem of food skills or shopping behaviours.

Self-rated cooking ability by household food insecurity status

Data Source: Statistics Canada, Canadian Community Health Survey (CCHS) Rapid Response – Food Skills, 2013

(Huisken, Orr & Tarasuk, 2016)



Food insecurity reflects a household's broader material circumstances, taking into account income, assets like property, and other resources a household could draw upon.

** Gigatons CO2 Equivalent Reduced / Sequestered (2020–2050)*

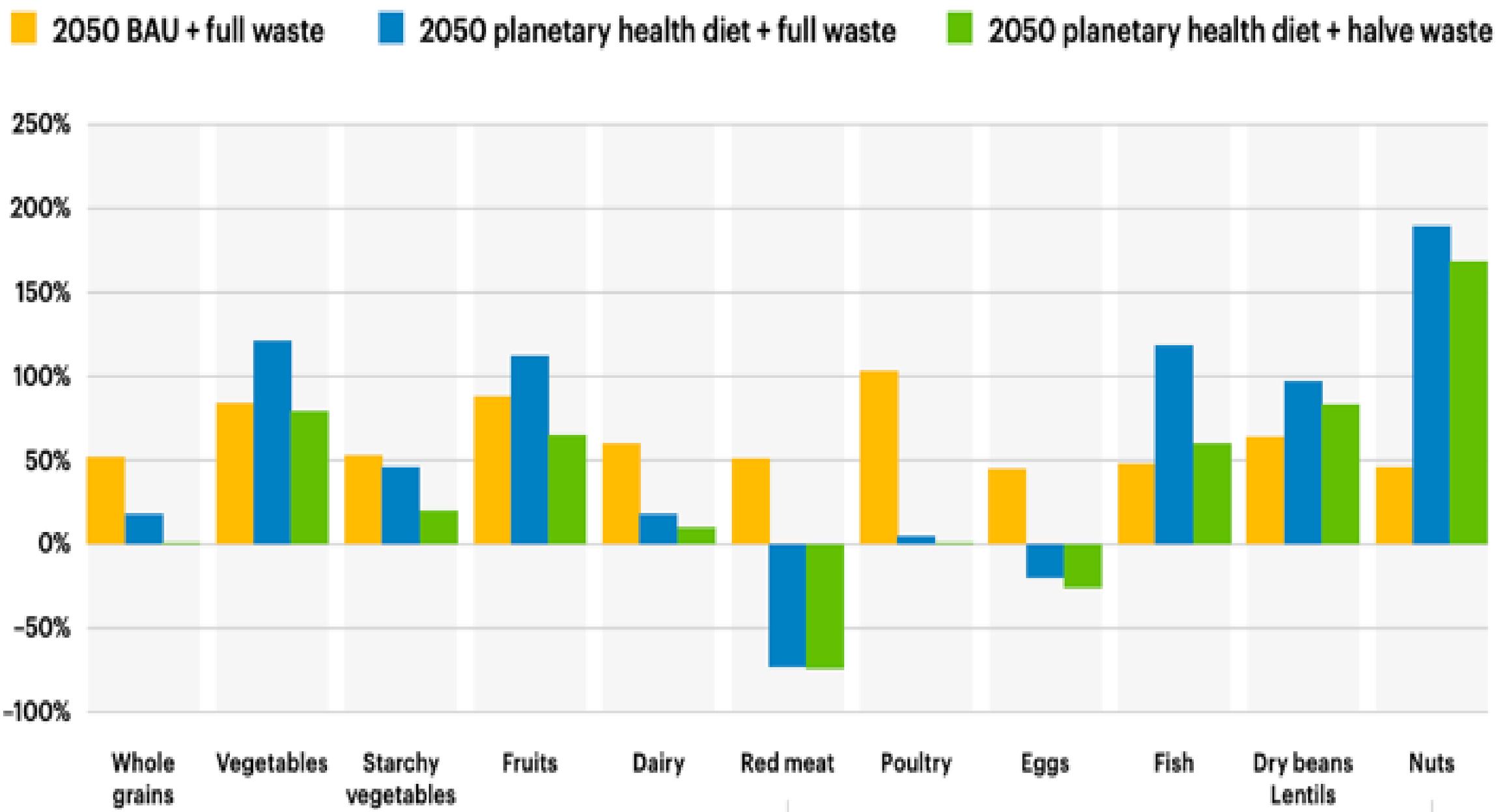
SOLUTION	SECTOR(S)	SCENARIO 1 *	SCENARIO 2 *
Reduced Food Waste	Food, Agriculture, and Land Use / Land Sinks	87.45	94.56
Health and Education	Health and Education	85.42	85.42
Plant-Rich Diets	Food, Agriculture, and Land Use / Land Sinks	65.01	91.72
Refrigerant Management	Industry / Buildings	57.75	57.75
Tropical Forest Restoration	Land Sinks	54.45	85.14
Onshore Wind Turbines	Electricity	47.21	147.72
Alternative Refrigerants	Industry / Buildings	43.53	50.53

From Drawdown – Gigatons of CO2 Equivalent Reduced/Sequestered
Top 7 Contributors https://drawdown.org/

Solutions Impacted by Off-Grid Root Cellar
(Arrows are mine)

There's an "Inextricable Link Between Human Health and Environmental Sustainability"

From "Eat Lancet"



Strategy 1

Seek international and national commitment to shift toward healthy diets

<<“……Agriculture is one of the worst offenders of the climate system. In all respects, organic agriculture is the best form of agriculture. Modern agriculture is a huge emitter of greenhouse gases and other suspect chemicals. Ironically, changing agricultural practices is another “must do” for survival…… A post-agricultural world is defined as one without enough food to feed all of the people…… The most effective, definitively effective, immediately effective, readily doable action that everybody in the world can do is Go Vegan. In theory, we can all do that. If we do that, emissions drop immediately.”

…….Counterpunch excerpts

https://www.counterpunch.org/2020/11/20/expert-ipcc-reviewer-speaks-out/

“This is the way the world ends This is the way the world ends This is the way the world ends Not with a bang but a whimper” … The Hollow Men TS Elliot 1929 –

***reading the whole poem in the light of what’s happening to us now, gives it new meaning*.**

Thanks to our partners !

OTTAWA COMMUNITY FOUNDATION

invested for good

GREEN BELT

Possibility grows here.

fresh healthy affordable

www.ottawagoodfoodbox.ca

Ottawa

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