

SDGs for Innovations at HBCUs

Kiruba Krishnaswamy (She/Her/Hers)

**Assistant Professor (Sustainable Food Systems
Engineering)**

Department of Biomedical, Biological &
Chemical Engineering

Division of Food, Nutrition and Exercise
Sciences (Joint Appointment)

University of Missouri, Columbia

Aug 26th, 2021



Poll 1

• **Have you heard of Sustainable Development Goals (SDG's) before this event?**

Yes

No

Poll 2

• **Please identify the sector that best describes your current position**

- Student
- Faculty
- Industry
- Academia
- Government/regulatory
- Private Sector
- NGO
- Civil Society
- Other

Poll 3

• **Please indicate how long you have been working /training in your selected field**

- 1-2 years
- < 5 years
- 5-15 years
- 15-25 years
- 25+ years

Contents

- **My Journey**
- How HBCUs can engage/lead innovations to address food and nutrition security?
- **Research Motivation:** FEAST program
- **Teaching:** Zero Hunger Challenge (15-week challenge)
- Two case study: Food innovations & Entrepreneurial success
- Transdisciplinary teams addressing societal challenges
- **Broader Impacts:** SDG creative workshop
- Global connections (India- Canada- Kenya - US)
- **Summary**

An aerial photograph of a winding asphalt road through rolling green hills. The sun is low in the sky, casting a warm, golden glow over the landscape. The hills are covered in lush green grass, and the road curves through the valleys. The overall scene is peaceful and scenic.

My Journey

Kiruba Krishnaswamy, 2021



Kiruba Krishnaswamy, 2021



Kiruba Krishnaswamy, 2021



Afghanistan

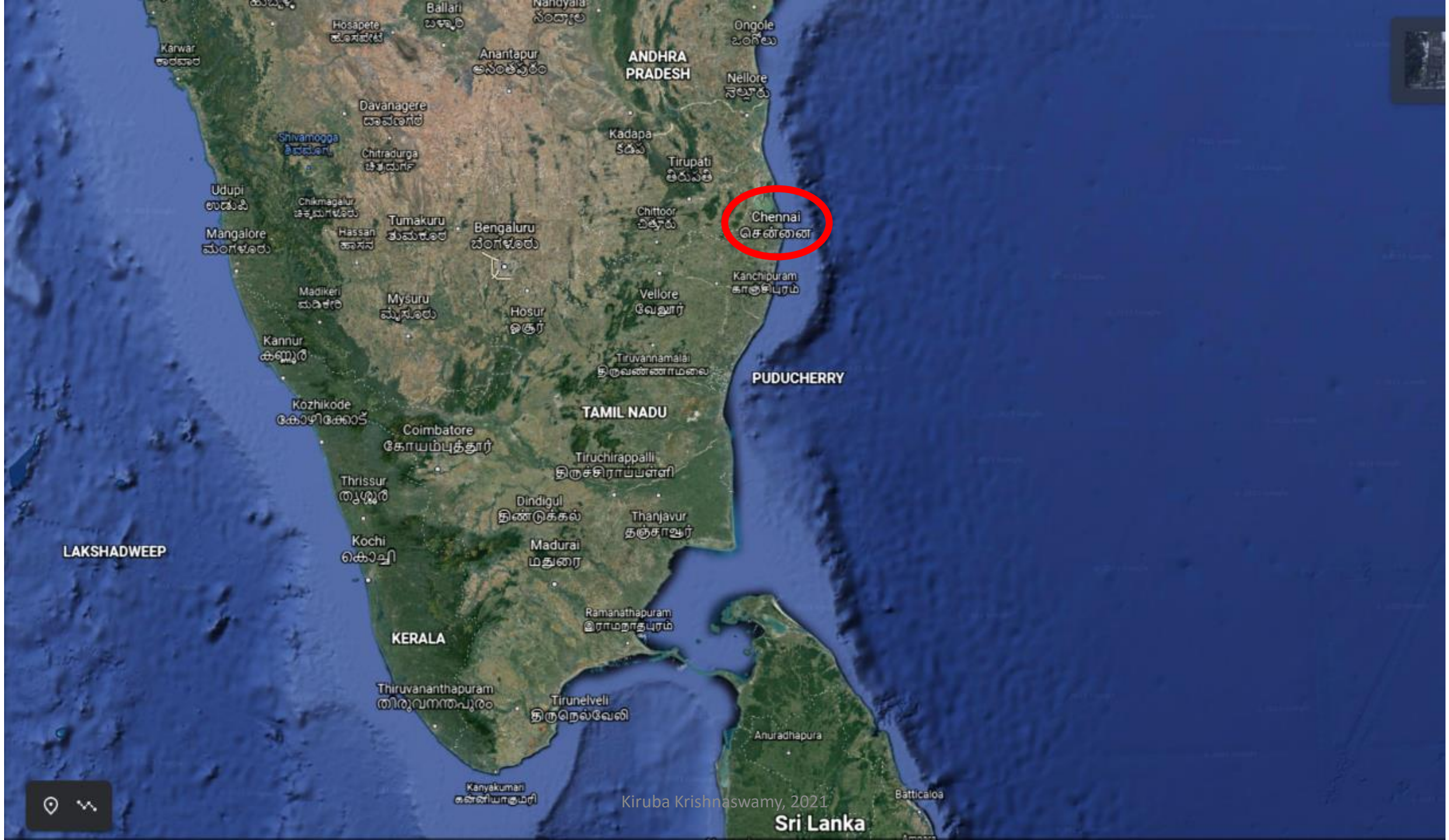
China

Pakistan

India

Bangladesh

Myanmar (Burma)



ANDHRA PRADESH

TAMIL NADU

KERALA

Chennai சென்னை

PUDUCHERRY

LAKSHADWEEP

Kiruba Krishnaswamy, 2021

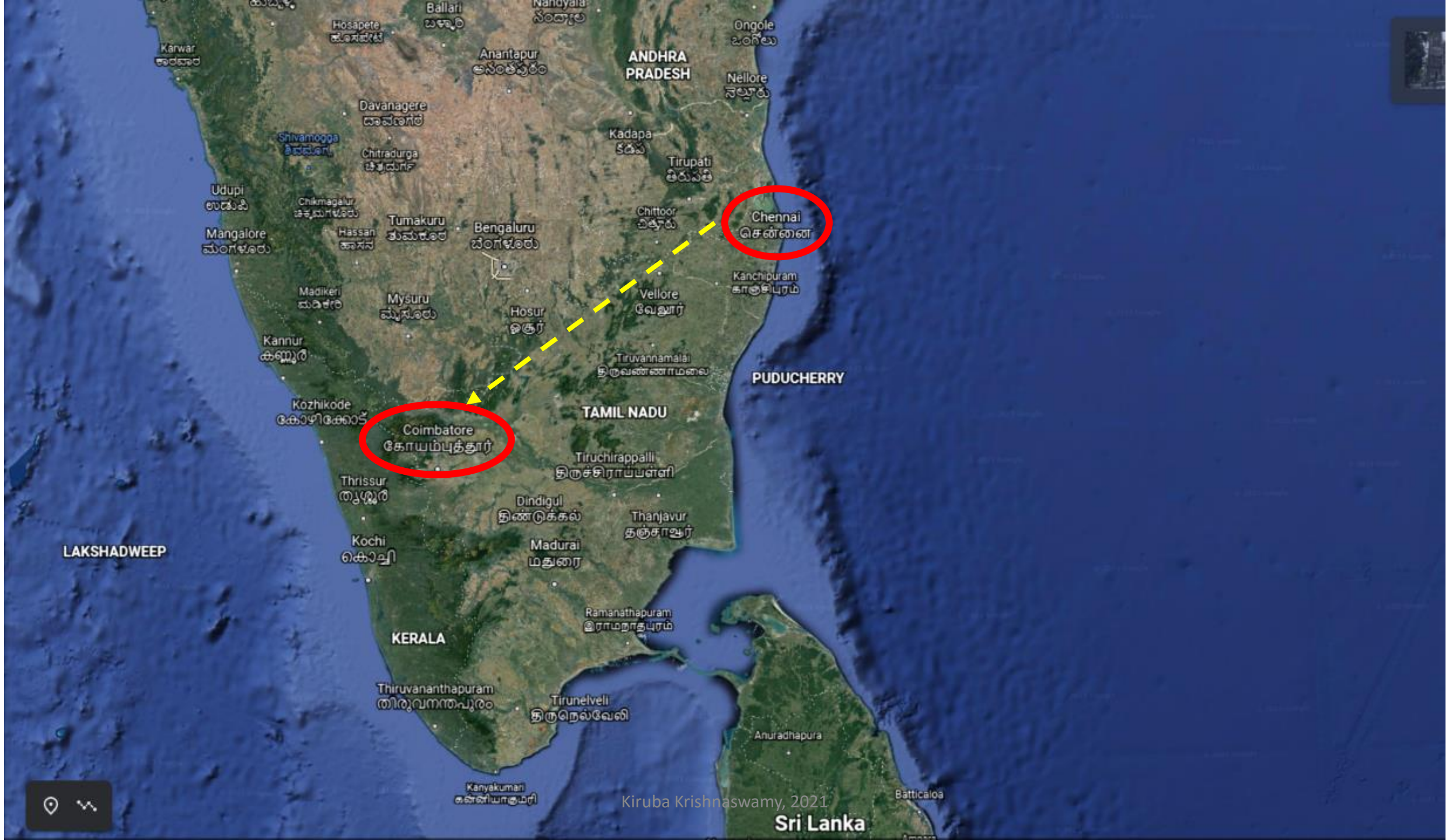
Sri Lanka



My Journey

Food brings joy!





ANDHRA PRADESH

Chennai சென்னை

Coimbatore கோயம்புத்தூர்

TAMIL NADU

PUDUCHERRY

KERALA

Kiruba Krishnaswamy, 2021

Sri Lanka





Tamil Nadu Agricultural University (TNAU)

Land Grant Institution

Established: 1906 (114 years old)



McGill
UNIVERSITY

Kiruba Krishnaswamy, 2021



Cornell University.

Value added processing: Fruit Juice



Mango Processing



TNAU

Kiruba Krishnaswamy, 2021





**9th All India Youth Festival, Udaipur, Rajasthan, India
Power of transdisciplinary student team from TNAU.**

Project:
Improving
Livelihood
Rural Women

Tomato
Processing
Training - SHG

Food and
Nutrition Security



TNAU

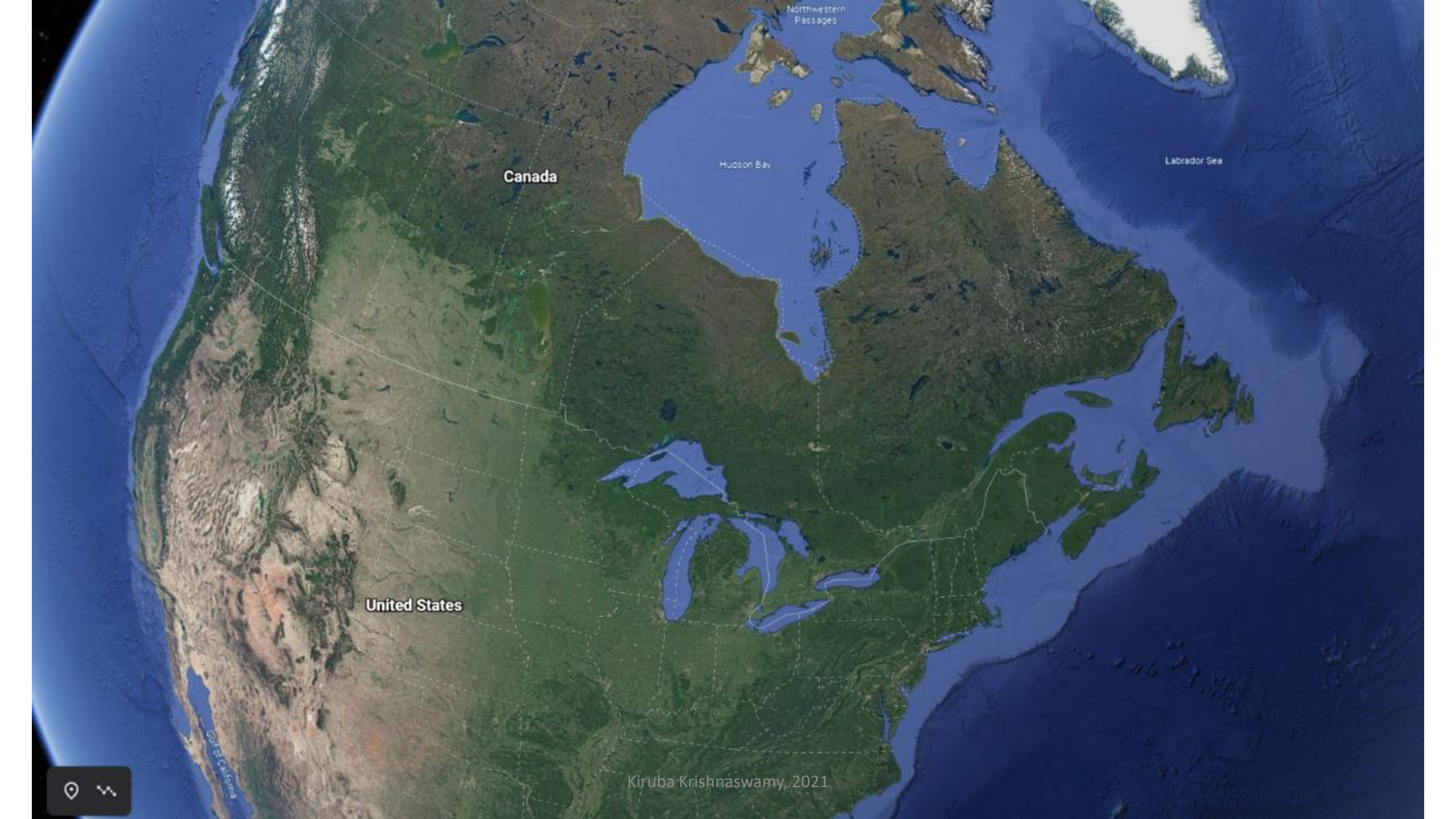


Kiruba Krishnaswamy, 2021





Kiruba Krishnaswamy, 2021



Canada

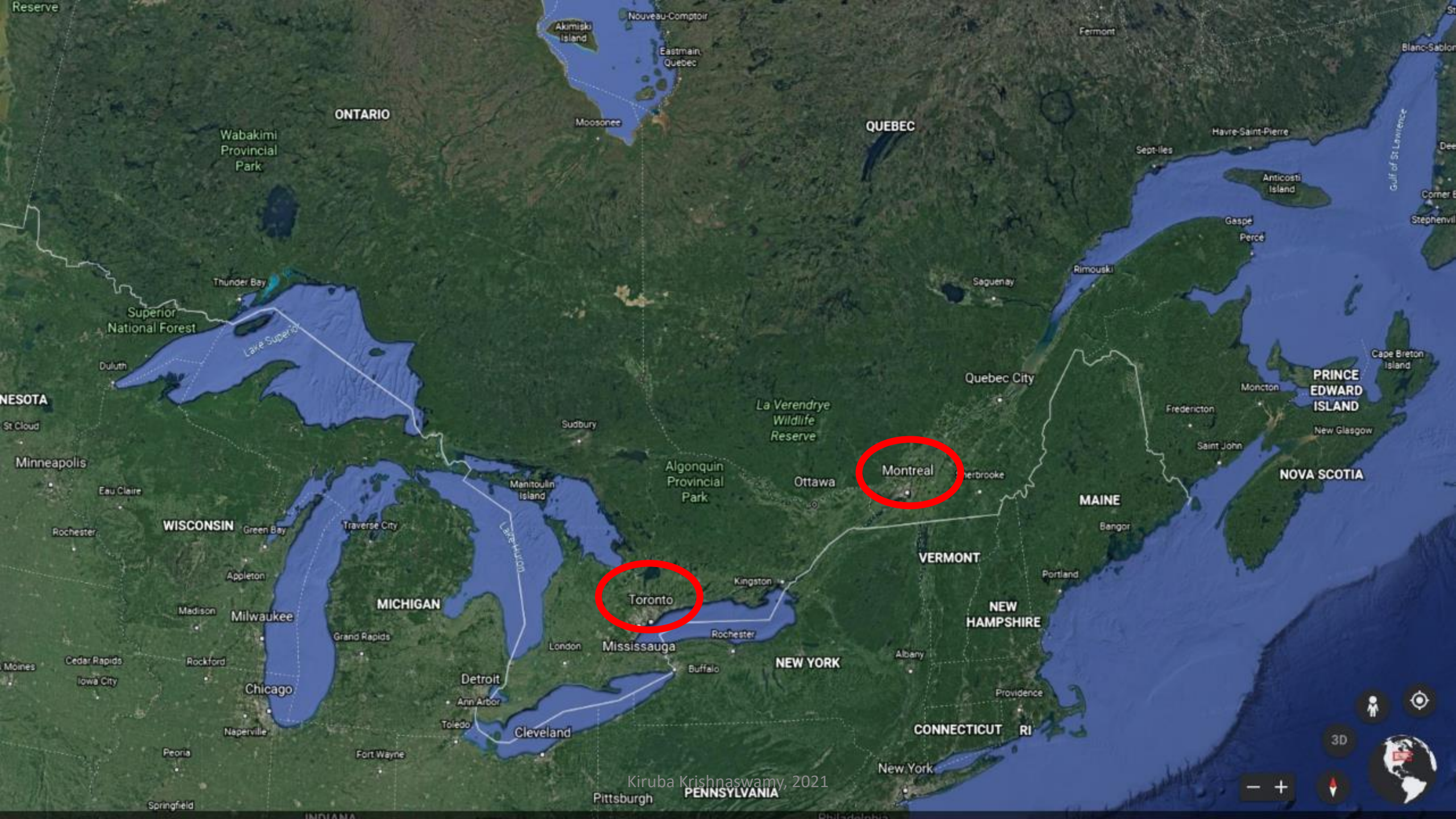
Hudson Bay

Labrador Sea

United States

Kiruba Krishnaswamy, 2021





ONTARIO

QUEBEC

Wabakimi
Provincial
Park

Moosonee

Eastmain,
Quebec

Fermont

Havre-Saint-Pierre

Sept-Îles

Anticosti
Island

Gaspé

Perce

Rimouski

Saguenay

Gulf of St. Lawrence

Corner B

Stephenville

Thunder Bay

Superior
National Forest

Duluth

Lake Superior

Sudbury

La Verendrye
Wildlife
Reserve

Quebec City

Moncton

PRINCE
EDWARD
ISLAND

Cape Breton
Island

New Glasgow

Fredericton

Saint John

NOVA SCOTIA

MINNESOTA

St. Cloud

Minneapolis

Eau Claire

WISCONSIN

Green Bay

Traverse City

Manitoulin
Island

Algonquin
Provincial
Park

Ottawa

Montreal

Sherrbrooke

MAINE

Bangor

Rochester

Appleton

Madison

Milwaukee

MICHIGAN

Grand Rapids

Kingston

Toronto

Rochester

NEW YORK

VERMONT

Portland

NEW
HAMPSHIRE

Moines

Cedar Rapids

Iowa City

Rockford

Chicago

Detroit

Ann Arbor

London

Mississauga

Buffalo

Albany

CONNECTICUT

RI

Providence

Peoria

Fort Wayne

Cleveland

New York

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Pittsburgh

PENNSYLVANIA

Philadelphia

3D

- +

Compass icon



Canadian Commonwealth Scholarship



McGill

**Master's
Dissertation
Thesis –
Research**



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Ph.D. Bioresource Engineering



McGill University, Montreal, Canada

Established: 1821 (199 years old)
(AAU Member)



Millennium Development Goals MDG (2000-2015)



Sustainable Development Goals SDG (2015-2030)



Postdoctoral Fellowship- Chemical Engineering

University of Toronto, Canada

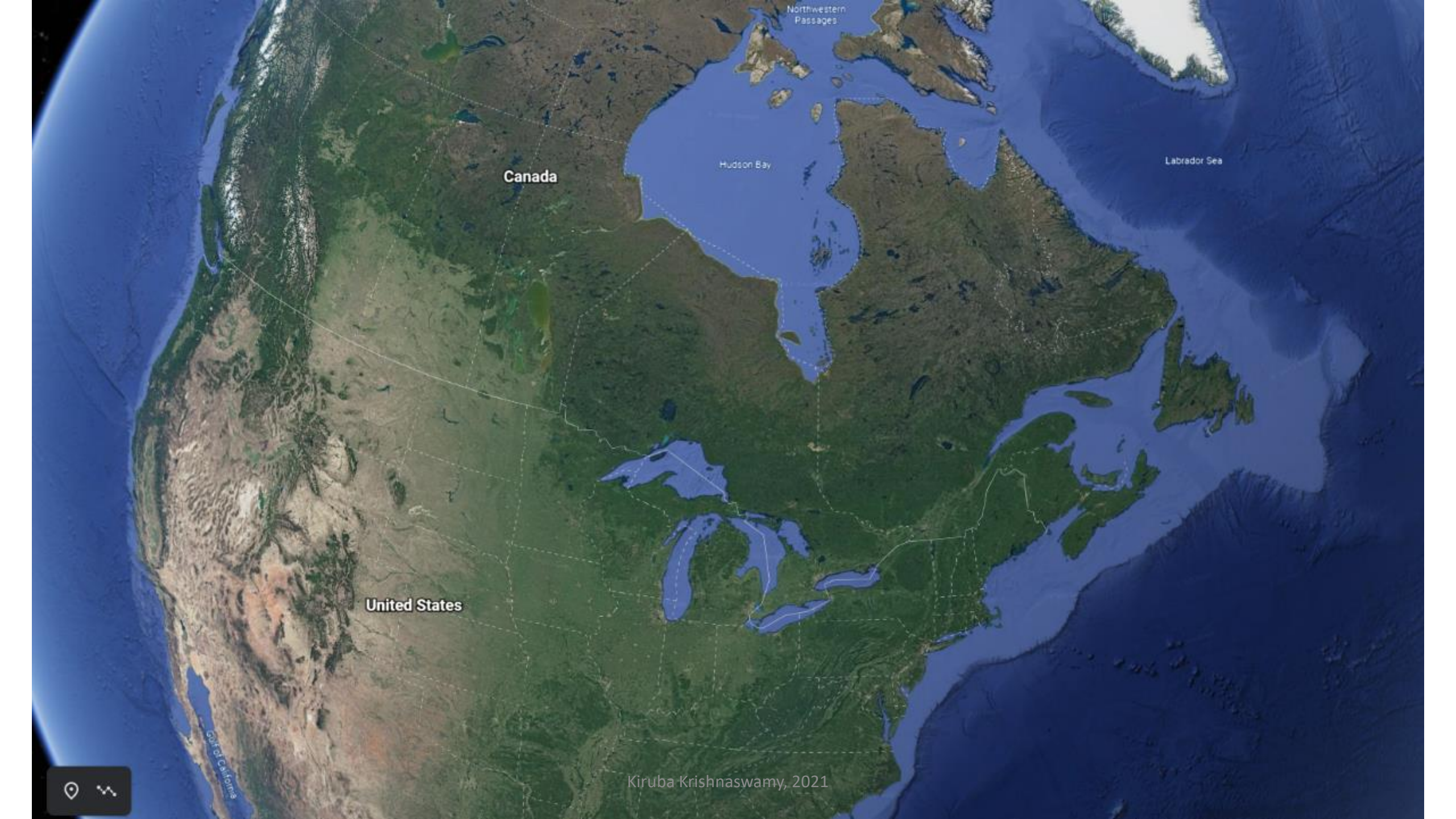
Established: 1827 (193 years old)
(AAU Member)



United Nations- Sustainable Development Goals (SDGs) Youth Leadership Training Session – Toronto



Sept
2016



Canada

Hudson Bay

Labrador Sea

United States

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University of Missouri - Columbia

Established: 1839
(181 years old)

AAU Member +
Land Grant Institution

2018

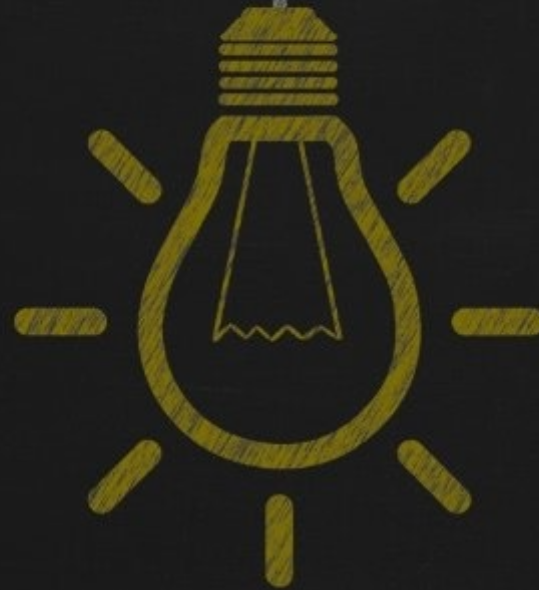




How HBCUs can engage & lead innovations to address food and nutrition security?



Research Motivation




Can we achieve a
Zero Hunger World,
where every child has access
to safe, nutritious food?



1950 – 2.5 B
2000 – 6.0 B
2010 – 6.8 B
2020 – 7.5 B
2030 – 8.2 B
2050 – 9.3 B

How do we
feed 9 billion
people
sustainably
with
healthy
foods ?



Start of the 21st century



Climate crisis Natural calamities



Golden E Dairy near West Bend has been forced to dump 25,000 gallons of milk a day as the coronavirus pandemic slams the fragile dairy industry. *Golden E Dairy Farm*



Sources: WFP 2015

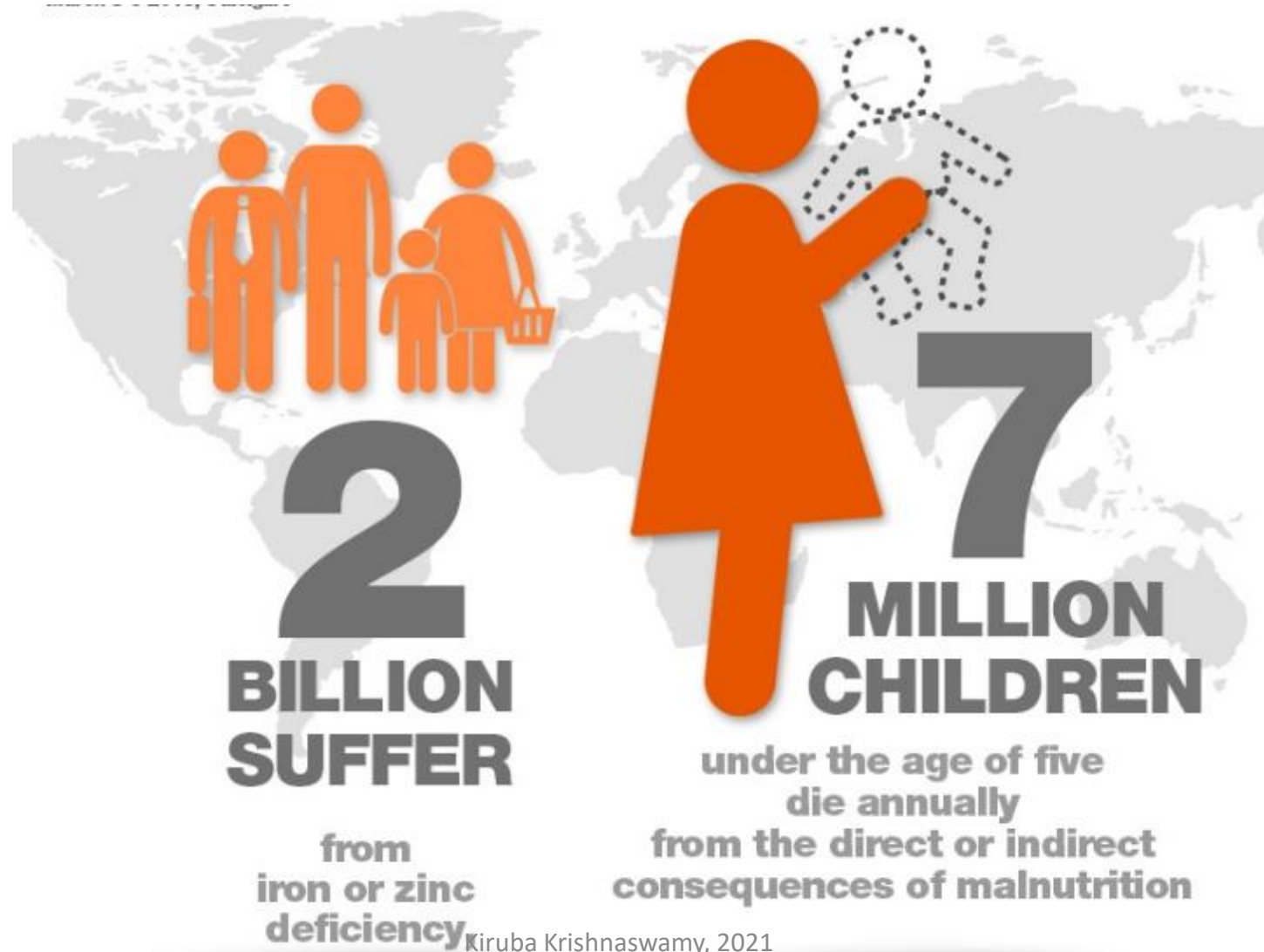
COVID-19 has exposed the social disparities in the world

Chronic hunger



Sources: FAO 2018

Hidden Hunger – (Vitamin & Mineral Deficiency)



PI: Krishnaswamy FEAST Program **VISION**

1.3 billion tonnes

Food loss/waste
= Raw material

Native fruits, vegetables, ancient grains



Food loss/waste Impacts

- Environmental challenges
- Increases green house gas emissions
- Accelerates climate crisis
- Underutilized fruits, vegetables, grains- nutritional food loss
- Biodiversity loss over time



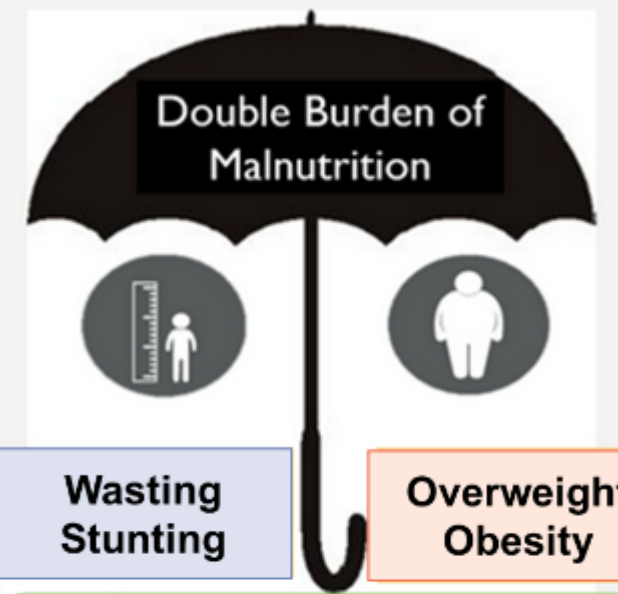
Zero-Waste
Food Processing

+

Micronutrients
Fortified Foods

Kiruba Krishnaswamy, 2021

**2 billion people
Hidden Hunger**



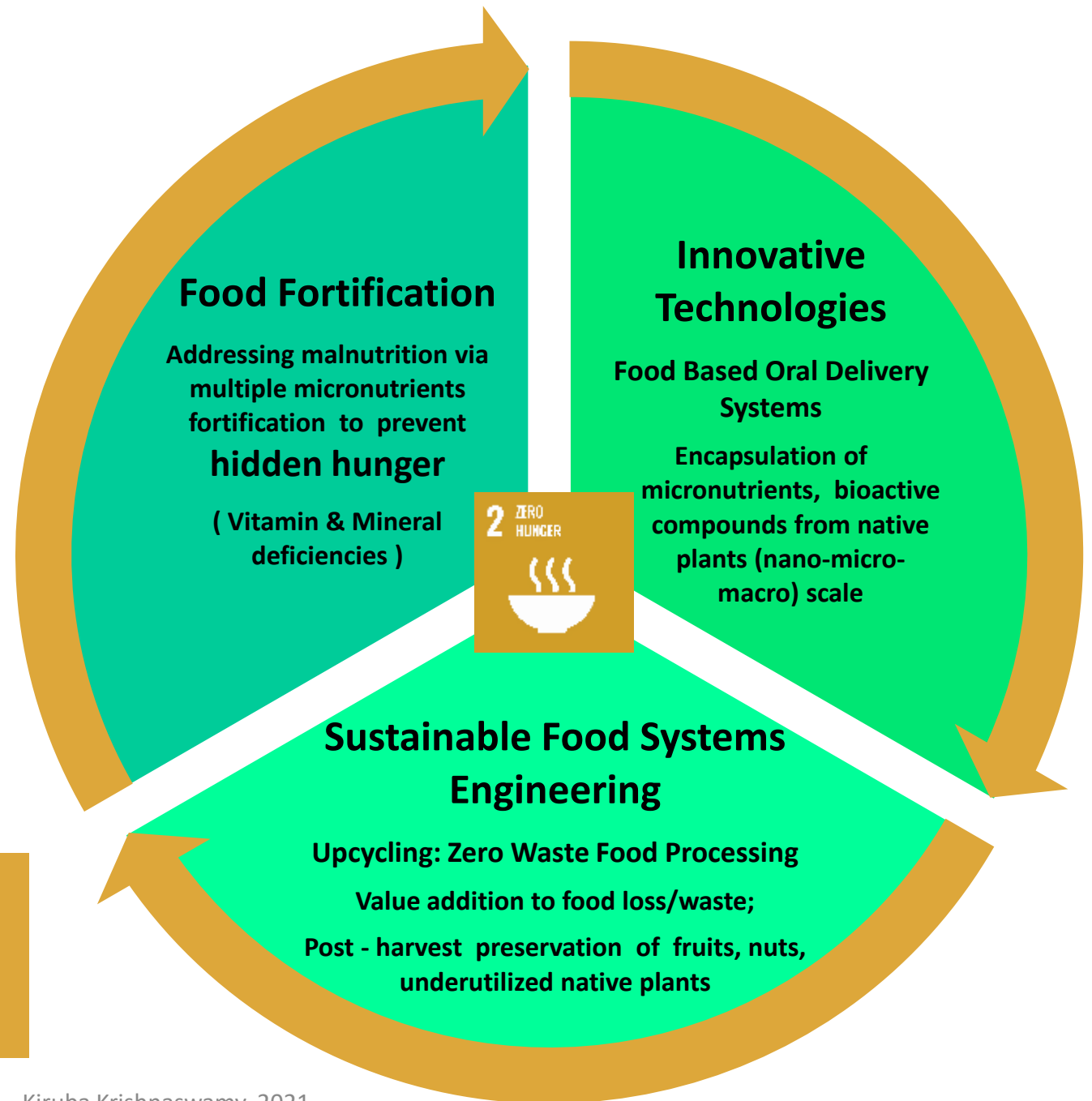
Micronutrient deficiency
(Lack of vitamins & minerals)
Hidden Hunger

Image Source: FEAST Lab

Food Engineering And Sustainable Technologies



Interested Population Groups:
Women & Children
Rural, Urban & Tribal Communities



SUSTAINABLE DEVELOPMENT GOALS

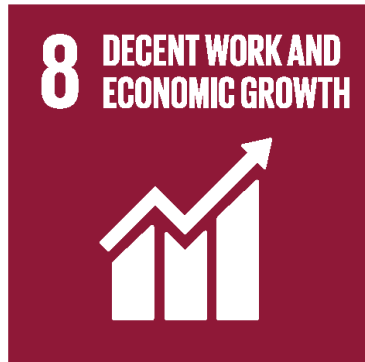
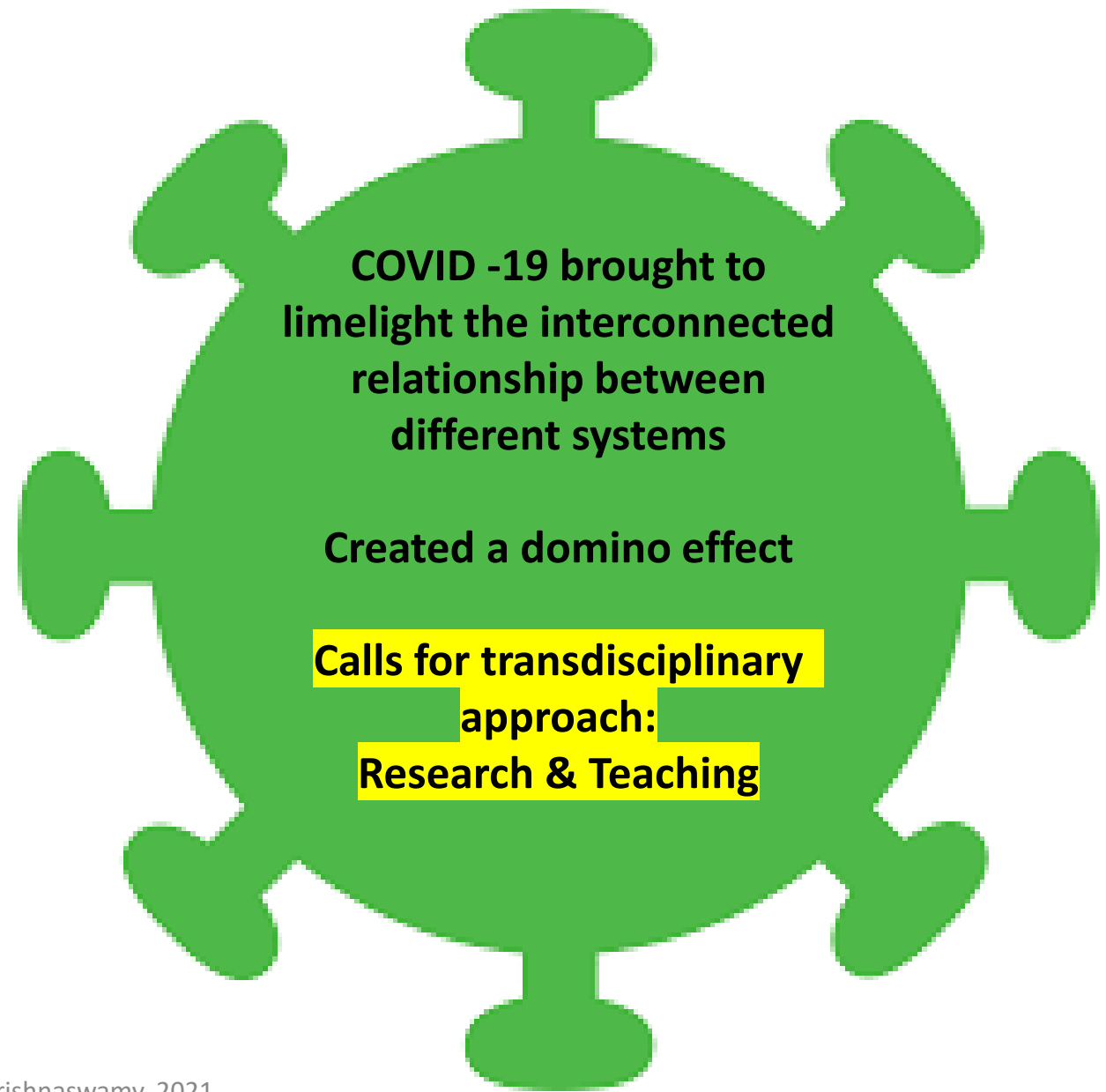


FIGURE 5: COVID-19 AFFECTING ALL SDGs



Teaching





FOOD

PROCESS ENGINEERING

BIOL_EN (4160 & 7160)
CH_ENG (4160 & 7160)
F_S (4160 & 7160)

Spring 2021

Course Purpose

- To **provide you a comprehensive** overview of Food Process Engineering (FPE)
- Food Process Engineering is a **transdisciplinary** field that connects science, engineering and technology.
- This course introduces the **underlying engineering principles** of different processing unit operations in the food industry.
- You **will be provided with an opportunity to re-design a food process/product** to support sustainable food systems.

Instructor:

[Kiruba Krishnaswamy, PhD](#)

Office Address: 244 Agricultural Engineering Building, University of Missouri
krishnaswamyk@umsystem.edu

Time and Location: Online;
Central Standard Time (CT)

Office Hours: Mondays 3.00 pm and by appointment

Credit Hours: 3



FALL
Semester



Course Purpose:

- Nurtures transdisciplinary thinking regarding feeding the world sustainably (~9 billion people by 2050)
- Convergence towards food and nutrition security – supporting Sustainable Development Goals (SDGs)
- Partnerships (SDG 2 & SDG 17) connecting peer mentorship to mimic professional life
- Empowering students to become global leaders

Instructor:

Dr. Kiruba Krishnaswamy
krishnaswamyk@umsystem.edu
Office: 244 Agricultural Engineering Building

ZERO HUNGER CHALLENGE





ZERO HUNGER CHALLENGE

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Zero Hunger Challenge

- ✓ New Course – online
- ✓ Transdisciplinary teams
- ✓ Food and nutrition security
- ✓ UN Sustainable Development Goals (SDG 2 & 17)

Open to all students

- Interested in food sustainability
- Grand challenges

Thank you – DEATON INSTITUTE

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The poster features the SDG logo with 'GOAL 2 ZERO HUNGER' and a bowl icon. Below is a yellow box with 'FALL Semester' and a world map made of grains. A list of course purposes follows, including transdisciplinary thinking and food security. The instructor's name and contact info are provided. On the right, a vertical strip shows icons for water, planting, food waste, a bowl, and a person with a checklist.

SDG GOAL 2 ZERO HUNGER

FALL Semester

Course Purpose:

- Nurtures transdisciplinary thinking regarding feeding the world sustainably (~9 billion people by 2050)
- Convergence towards food and nutrition security – supporting Sustainable Development Goals (SDGs)
- Partnerships (SDG 2 & SDG 17) connecting peer mentorship to mimic professional life
- Empowering students to become global leaders

Instructor:
Dr. Kiruba Krishnaswamy
krishnaswamyk@umsystem.edu
Office: 244 Agricultural Engineering Building

THE BRADY & ANNE DEATON INSTITUTE

DEATON INSTITUTE'S INTERDISCIPLINARY PROGRAMS IN MANUFACTURING SECURITY AND ENERGY INNOVATION

ZERO HUNGER CHALLENGE

Water cycle icon, Planting icon, Food waste icon, Bowl icon, Person with checklist icon



UMSYSTEM **LOGIN**

Use this log in with your UMSystem credentials

UMSystem log in



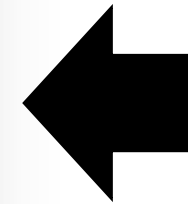
GUEST **LOGIN**

Coming soon Log in with guest access.

Guest log in

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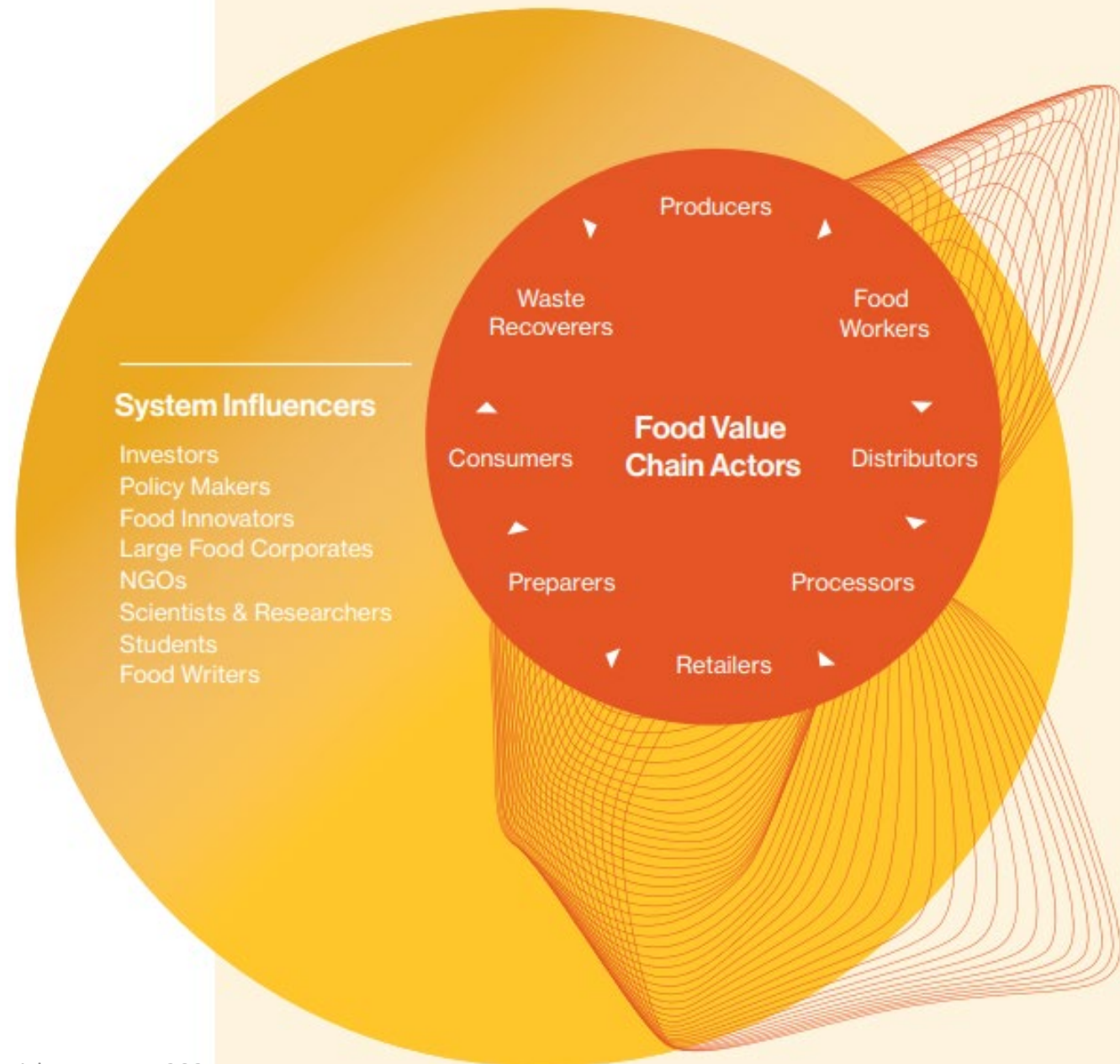
Students from
HBCUs,
community
colleges,
other
institutions



Food Systems

We're all stakeholders in our food systems.

Because we all eat!



Poll 5

- **Who are the key stakeholders in the food system? (can select multiple options)**
 - Farmers / producers
 - Food workers
 - Distributers/ transportation
 - Food processors
 - Retailers
 - Consumers
 - Everybody- Because we all eat

Student Teams from Diverse Disciplines

Arts & Science

Agriculture

Business

Engineering

Food Science

Humanities

Journalism

Law

Medicine

Natural Resources

Public Health

Public Policy

Technology

Every possible sector- we all eat!



Outcomes

- ✓ Building a positive visions
- ✓ For the future – healthy people & the planet
- ✓ Co-create solutions with communities
- ✓ Connecting people to “Imagine a Zero Hunger World”

Featured | News

Zeroing In On World Hunger

A pair of Mizzou teams place third in global competition.

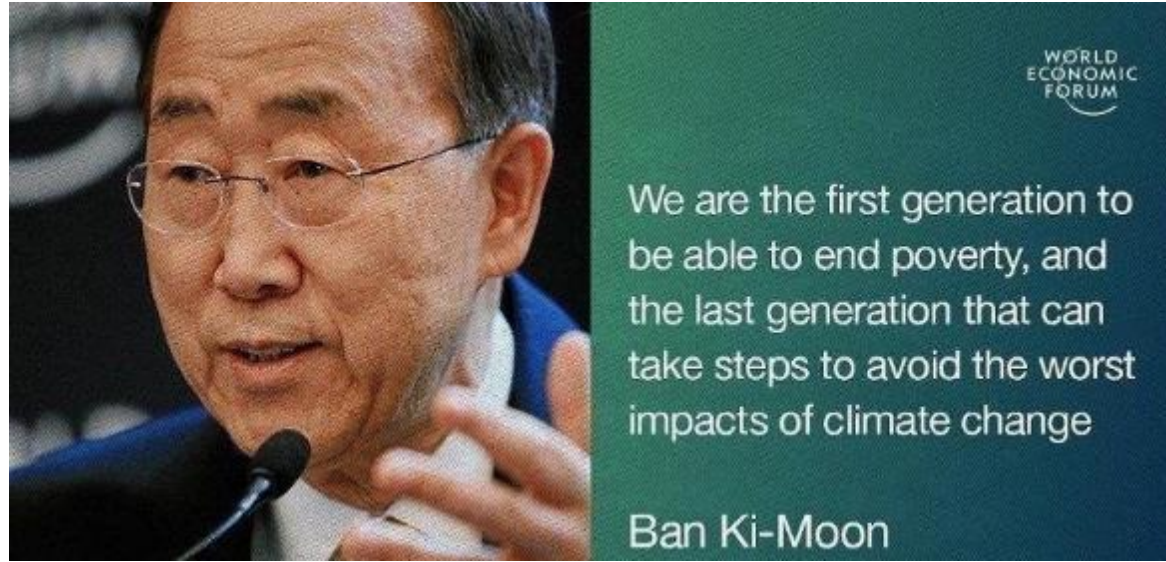
By Ashley Dorf

Published on Nov. 12, 2020

Updated on Nov. 16, 2020



Professor Kiruba Krishnaswamy meets via Zoom with students in the Zero Hunger Challenge class Nov. 10, 2020.



Welcome
HBCU
Students

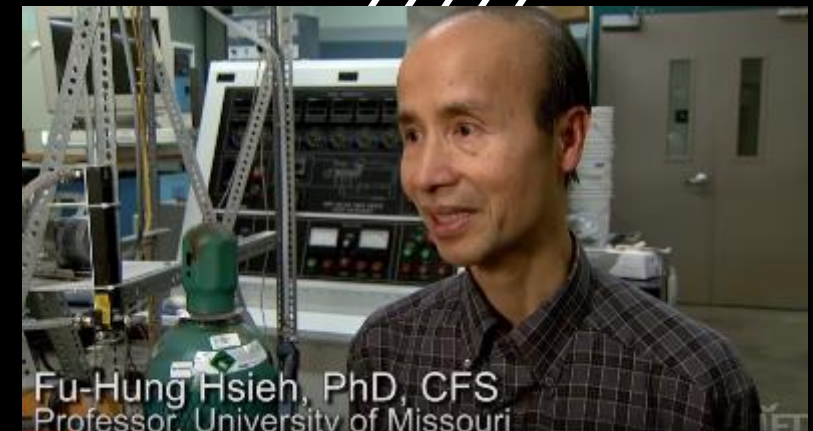


Food Innovations & Entrepreneurial success

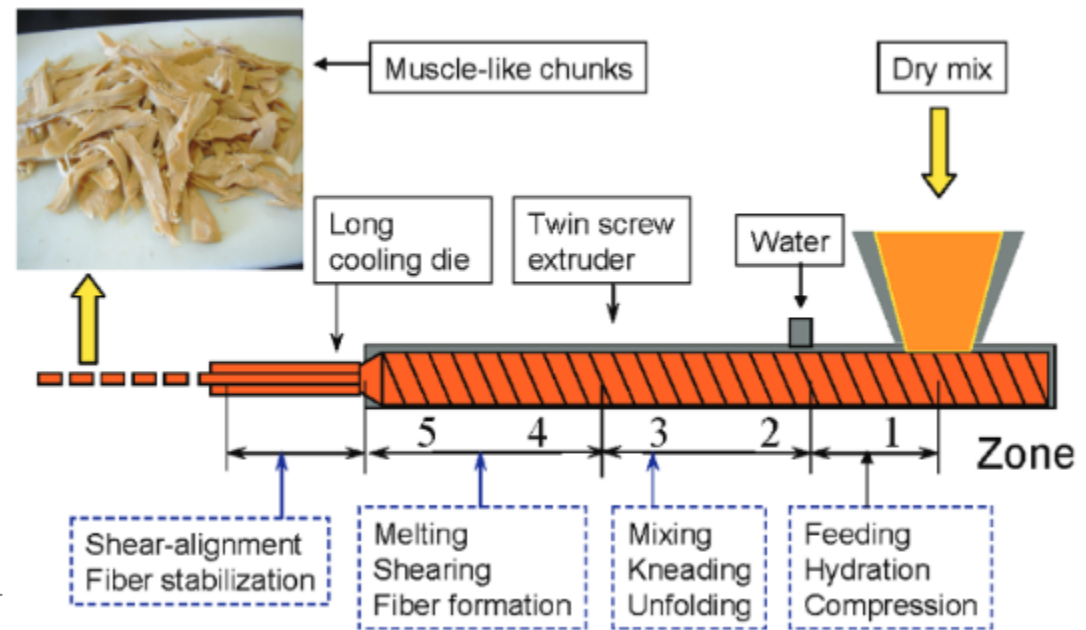


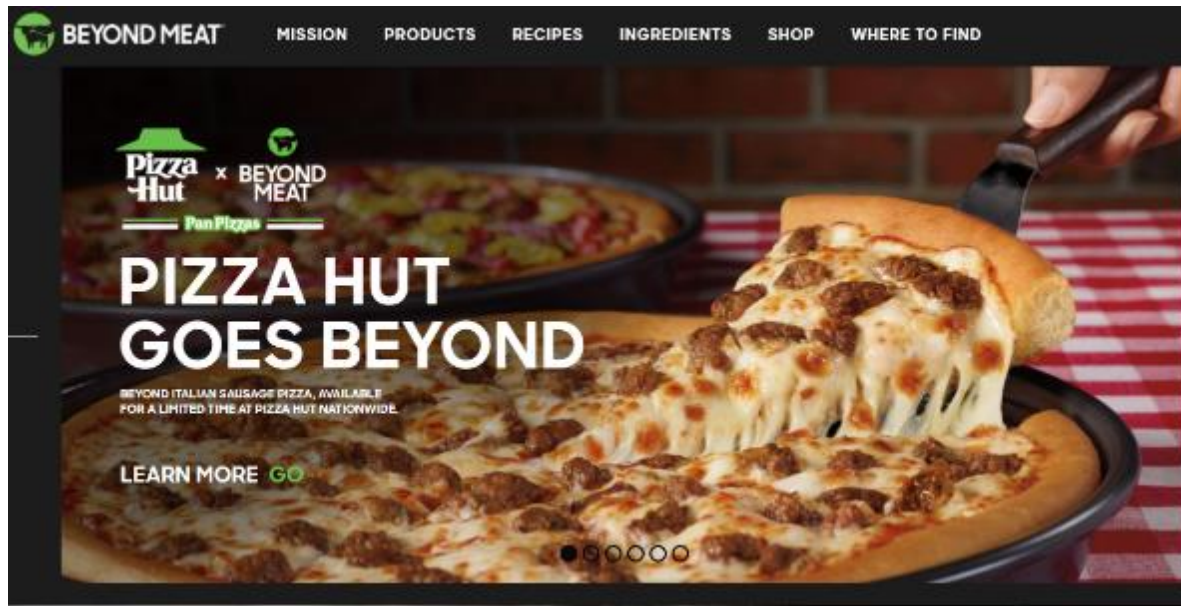
Case Study 1: Beyond Meat

Food Engineering Innovations



Innovation

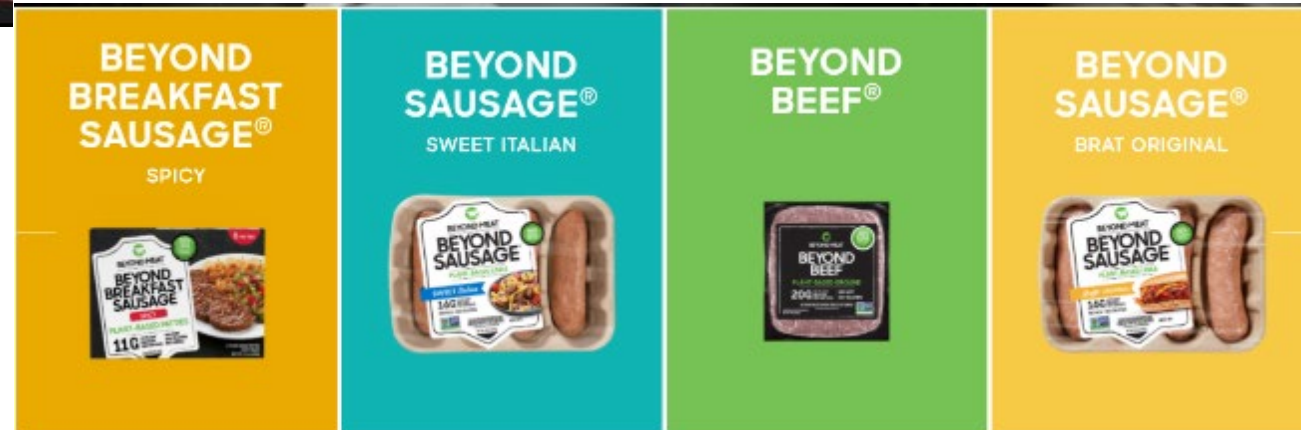




University of Missouri Food Engineering Research Lab to Global Markets

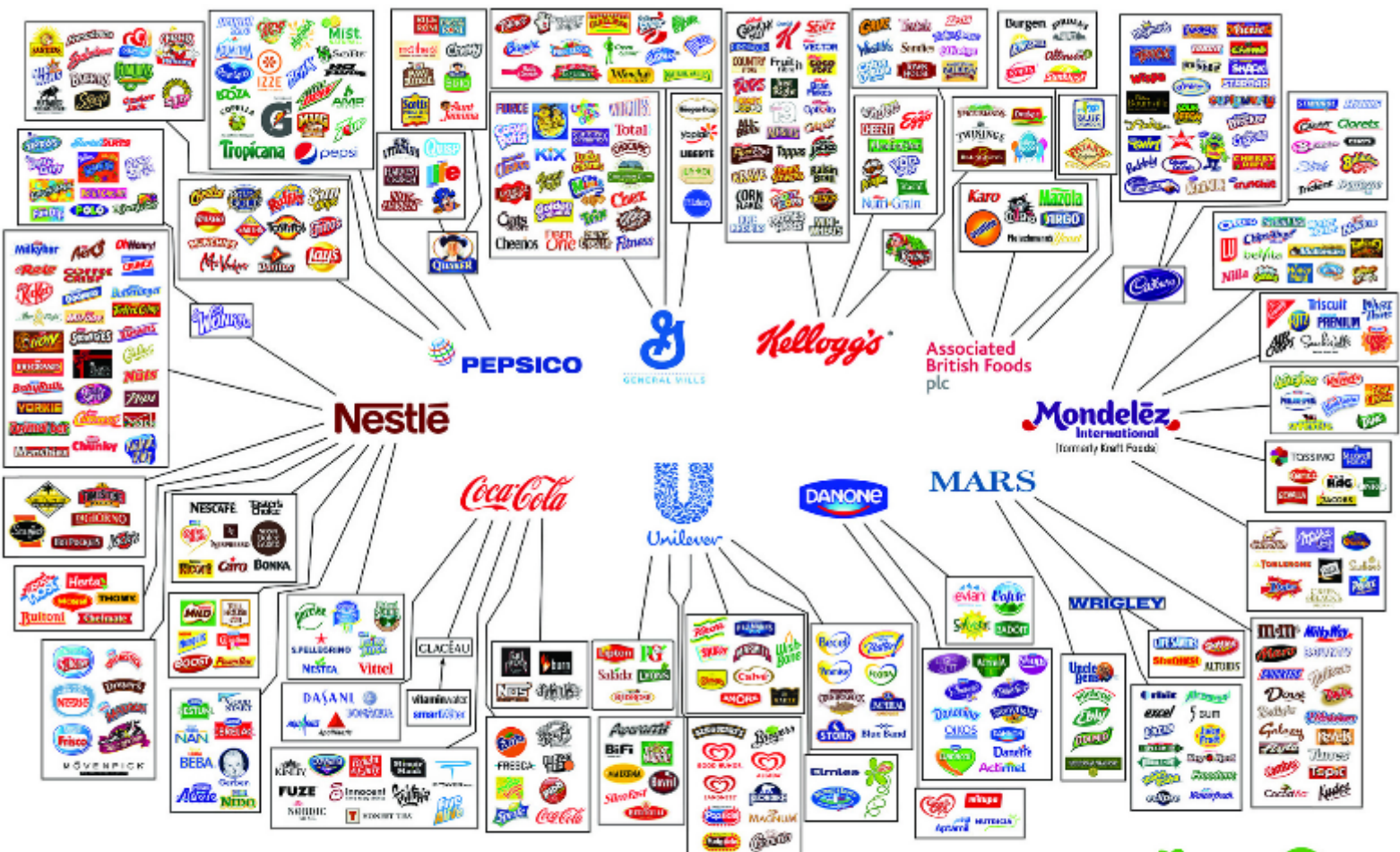
WHY MAKE MEAT FROM PLANTS?

- IMPROVE HUMAN HEALTH 
- POSITIVELY IMPACT CLIMATE CHANGE 
- ADDRESS GLOBAL RESOURCE CONSTRAINTS 
- IMPROVE ANIMAL WELFARE 



WHERE TO FIND BEYOND MEAT®

**NOW IN OVER 112,000 GROCERY STORES,
RESTAURANTS, HOTELS, UNIVERSITIES AND BEYOND...**

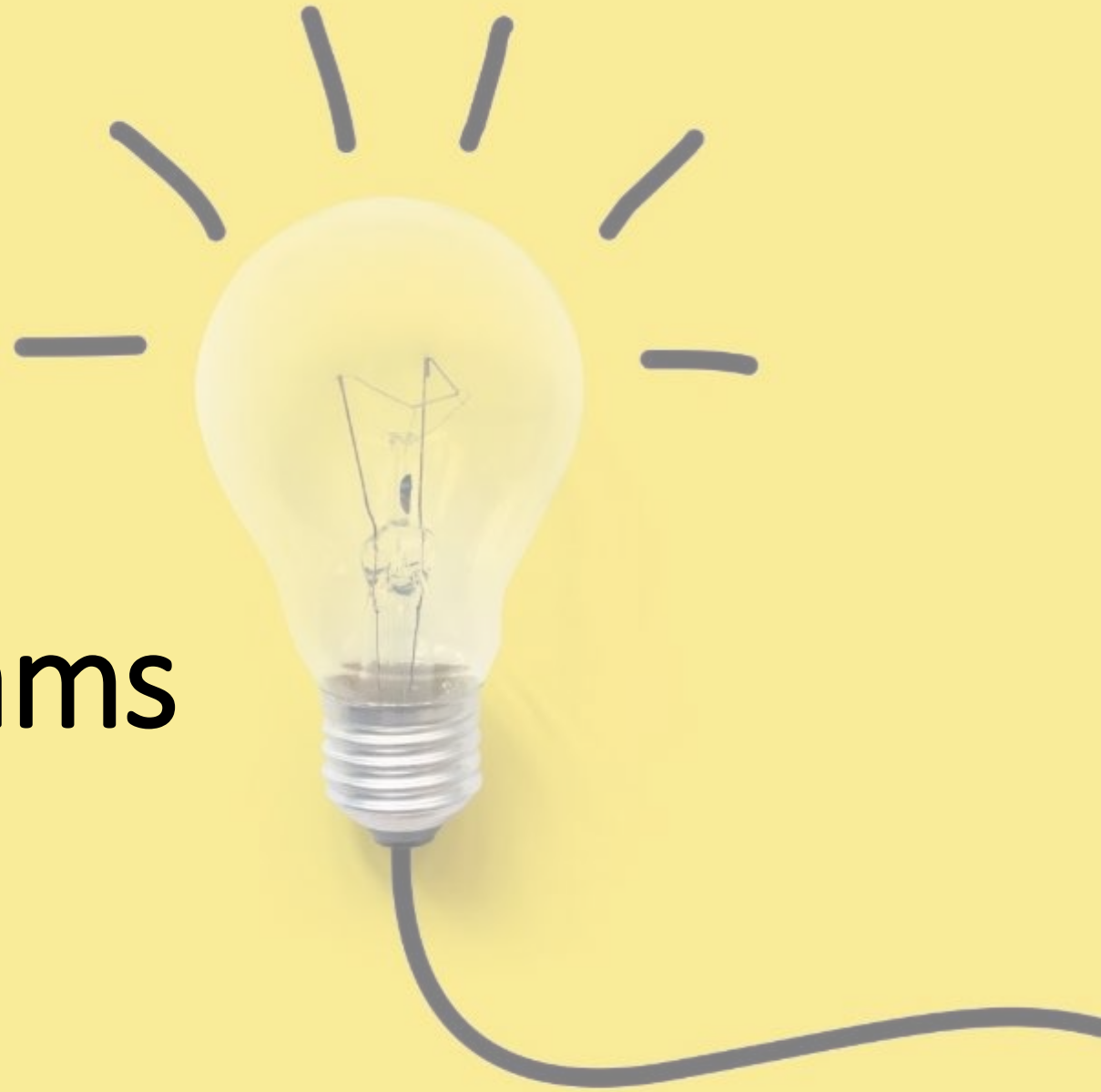


New Start-Ups

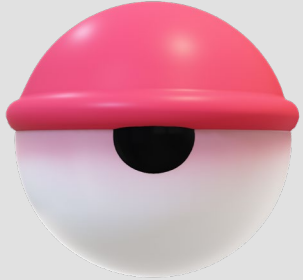





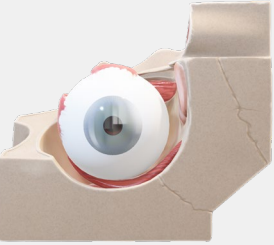
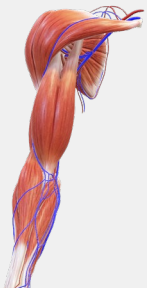

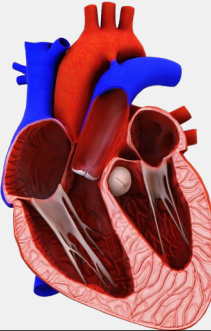


Open Opportunities for Innovation



Transdisciplinary teams addressing societal challenges



Vitamin Deficiency Disorders

Vitamin A	Vitamin B1 to B12	Vitamin C	Vitamin D	Vitamin E	Vitamin K
					
Night blindness	Anemia	Scurvy	Rickets & fragile bone	Muscle weakness	Non-clotting of blood
					
Dry eyes	Beriberi	Swelling of gums	Heart diseases	Fertility disorders	Cystic fibrosis

Poll 6

Fact: Babies born in the United States with anemia varies with race. (CDC, 2010; Ojodu et al., 2014)

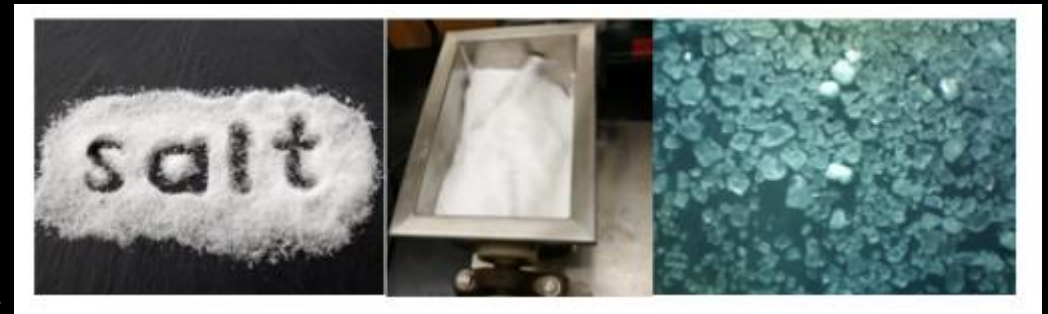
- 3 cases per 1,000 white births
- 2 cases per 1,000 Asian/Native Hawaiian/Pacific Islander births
- 6 cases per 1,000 Hispanic births

Select the number of cases for black babies:

- 13 cases per 1,000 black births
- 73 cases per 1,000 black births
- 43 cases per 1,000 black births

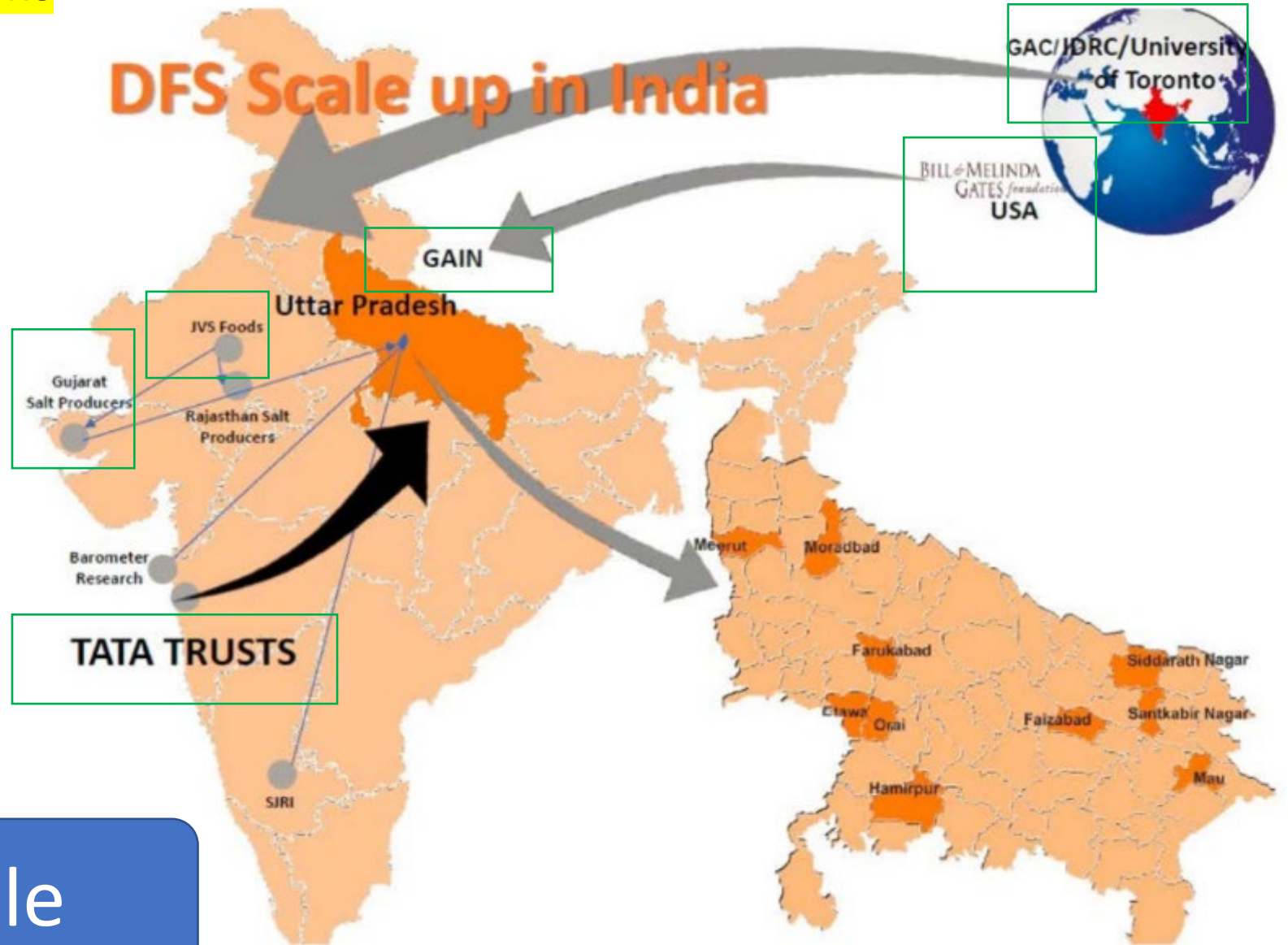
Case Study 2:
Double Fortified
Salt (DFS) fortified
with Iron & Iodine

Iron deficiency
anemia in women
& children



Success of Transdisciplinary Teams

University Researchers
Food Industries
Global NGO's
Local NGO's
Community Development
Groups
Govt. of UP
Govt. of India
Govt. of Canada



24 Million People



Food Process Engineering Innovation Double Fortified Salt (DFS)

60 Million lives

Poll 7

- **Who do you expect to drive the implementation/ support for SDGs?
(can select multiple options)**

- Government
- Private sector,
- Research institutions,
- Non-Governmental Organizations (NGOs)
- Media
- Civil Society
- Partnerships for the Goals



Broader Impacts: SDG creative workshop

World Food Day film screening – “Because we all EAT” (since 2018 @ MU)



Chocolate Processing Workshops



Unit operations
Time, temperature,
1°C change in temp – product quality
Cocoa Bean – chocolate – sustainability

Chocolate created by middle school children (with and without fat bloom) 2019

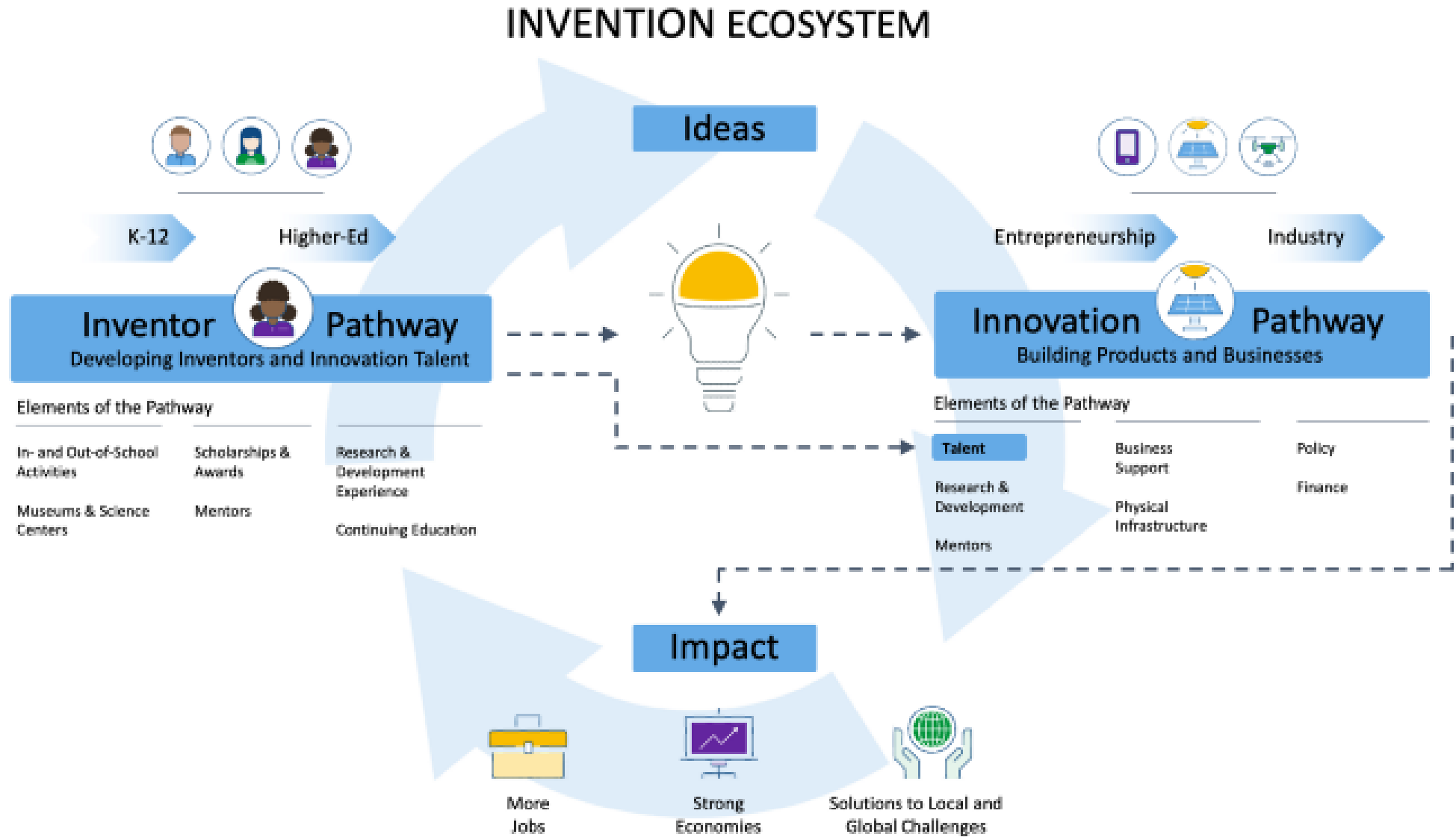
Increasing youth engagement in UN Sustainable Development Goals (creativity workshop) 2018,2019



Kiruba Krishnaswamy, 2021



If We Want to Build Back Better,
We Need a New Focus on Invention and Innovation



Zero Hunger Challenge COLLECTIONS

- Video/Animation
- Song
- Virtual Dance
- Mime
- Poem
- TED Talk Style Presentation
- Business Pitch
- Painting
- Infographic
- Robotics/Tech Solutions To AI
- Cultural Mural Ideas
- Digital Storytelling
- Others- Any creative platform that is newly conceived (imagination has no limits!)

Submissions open to all
“Imagine a Zero Hunger World”

Contact:
Dr. Kiruba Krishnaswamy
krishnaswamyk@umsystem.edu

NUTRITION AND THE SDGs

CENTRAL TO THE 2030 AGENDA

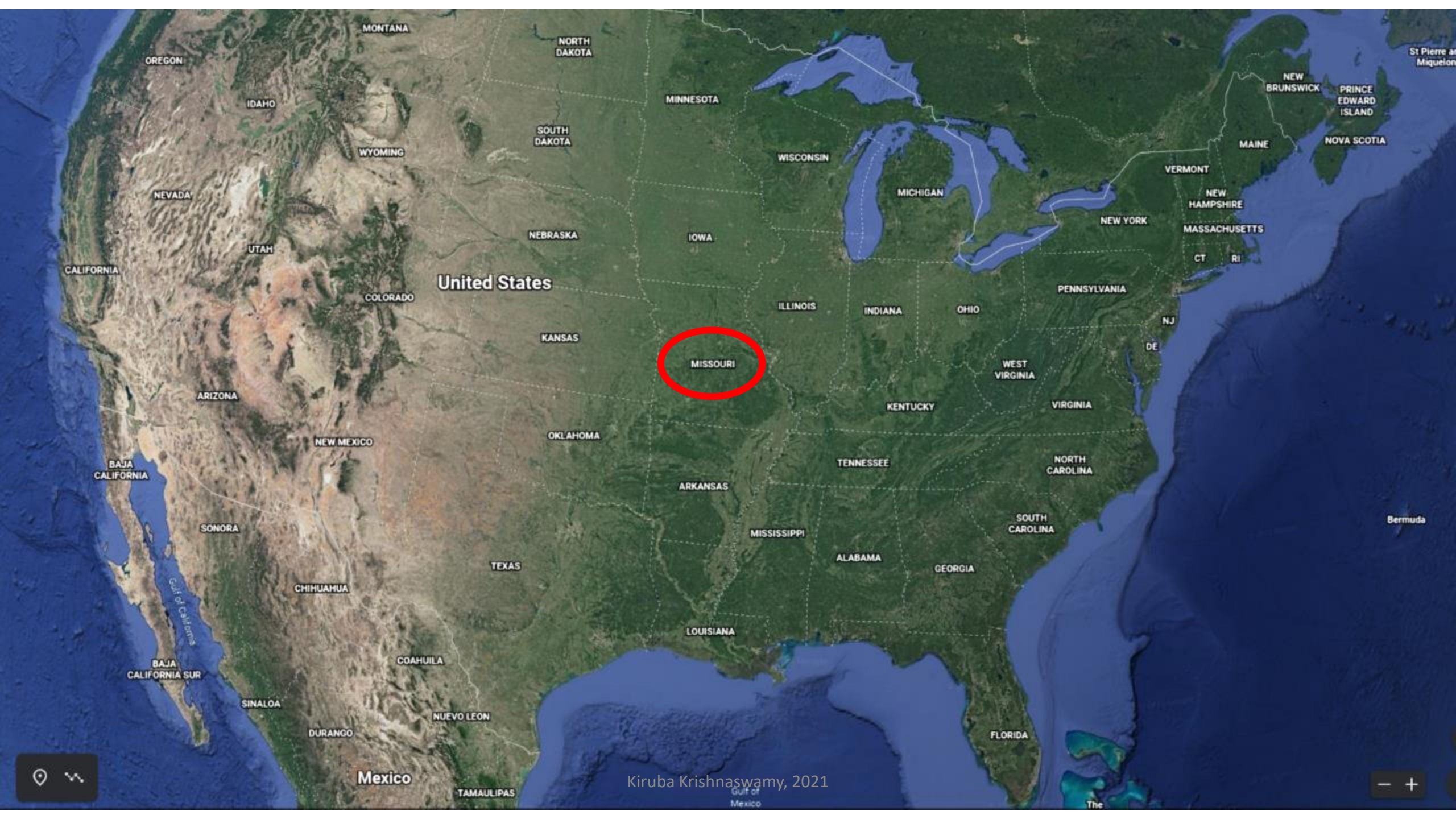


UNITED NATIONS DECADE OF
ACTION ON NUTRITION



2016-2025

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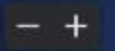
United States



MISSOURI

Mexico

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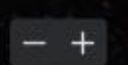


Food Connects Us

Kiruba Krishnaswamy at Osage
Nation, Oklahoma, USA



Kiruba Krishnaswamy, 2021





Food Connects Us

Kiruba Krishnaswamy
interacting with Maasai
Community. Nairobi, Kenya

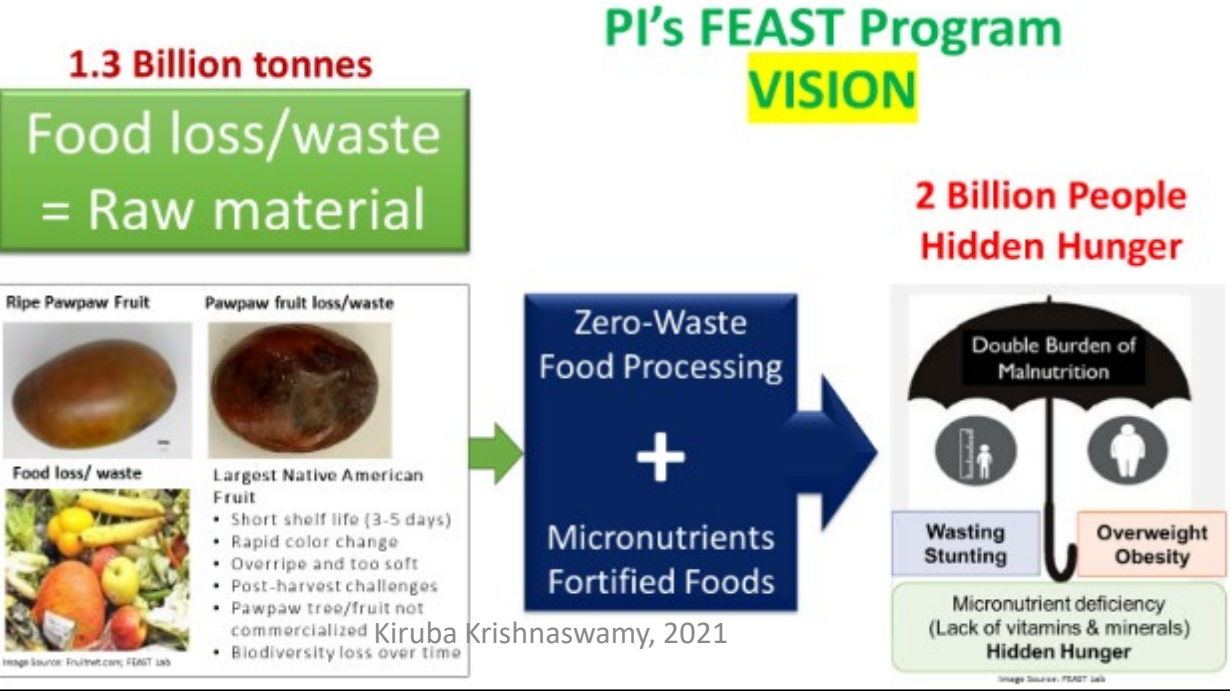


Integrate

Breaking the vicious cycle of **Hidden Hunger & Preventing Food loss/waste**



Inspire



Innovate

Poll 8

If we want to build back better addressing societal challenges, we need a new focus on innovations with SDG. (Pick your top three to catalyze change)

- Youth engagement
- Innovative curriculum/Breaking silos
- Entrepreneurial ecosystem
- Transdisciplinary teams
- Funding
- All the above

Take home message:

Post-COVID era:
to build resilient food systems

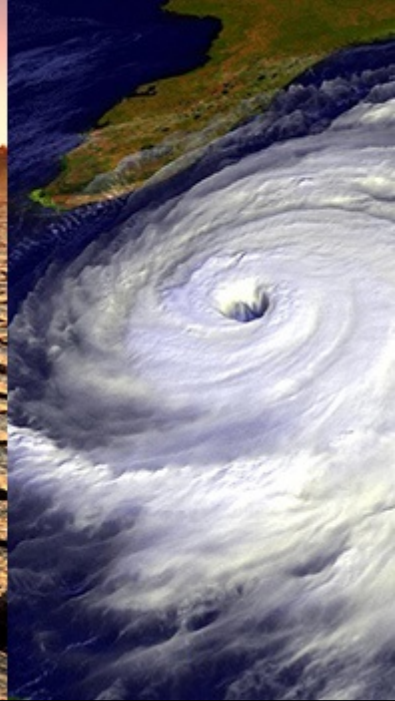
Act locally!

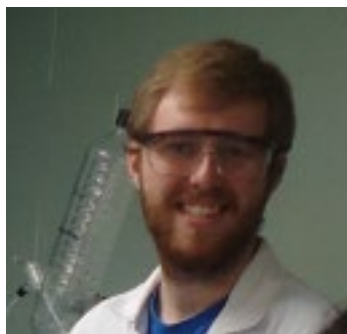
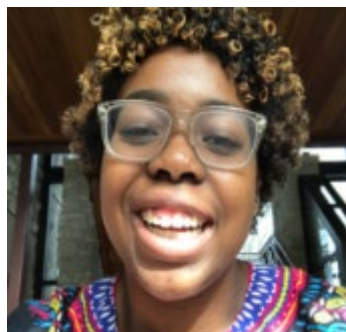
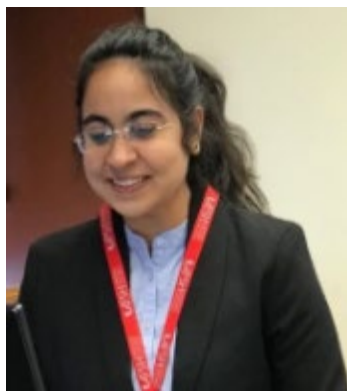
Think globally!

Partnerships:

Key to success in the 21st
century!

We need Diversity, We need
HBCUs!






FEAST TEAM



Resources:

- Food and Agricultural Organization: <http://www.fao.org/home/en/>
- International Fund for Agricultural Development: <https://www.ifad.org/>
- UNICEF- Nutrition: <https://www.unicef.org/nutrition/>
- United Nations Academic Impact: <https://academicimpact.un.org/archive/events>
- VentureWell: <https://venturewell.org/>
- United Nations: <https://www.un.org/sustainabledevelopment/>
- World Food Prize: <https://www.worldfoodprize.org/>
- World Food Program: <http://www1.wfp.org/>
- The Lemelson Foundation: <https://www.lemelson.org/>
- Worldwide University Network: <https://wun.ac.uk/knowledge-partnerships.html>
- Zero Hunger Challenge: <https://www.un.org/zerohunger/>



Would like to **Thank** all mentors
& amazing people,
who inspired & motivated me to
continue this journey:
Towards a Zero Hunger World!



Our Home!

