Sustainability Webinar Series:

Urban Sustainability

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National Academies of Sciences, Engineering, and Medicine

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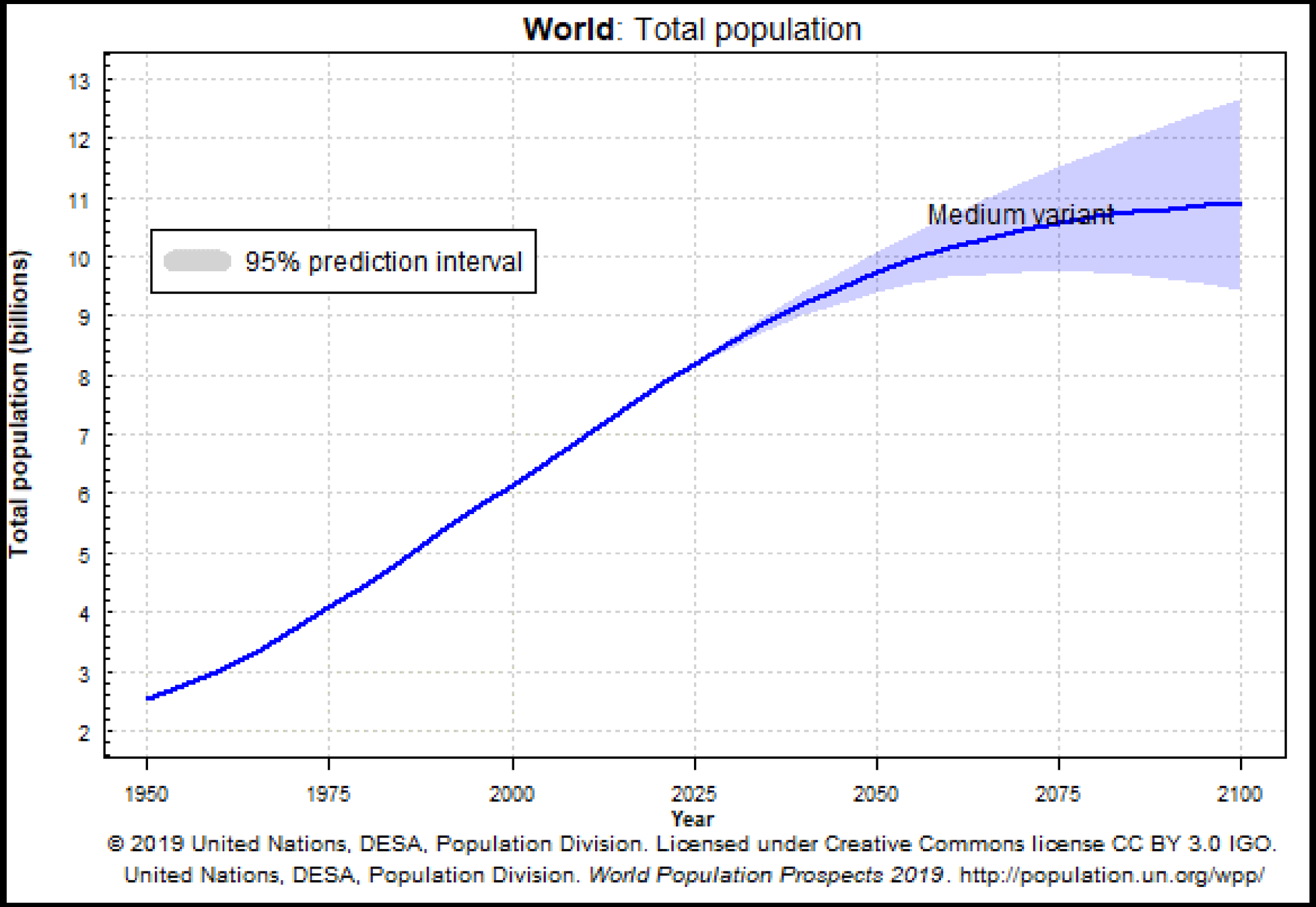
Deputy Under Secretary for Research, Education, and Economics

USDA Science
"Cultivating Scientific Innovation"

UNITED STATES DEPARTMENT OF AGRICULTURE

RESEARCH, EDUCATION, AND ECONOMICS

USDA


World: Total population
Total population (billions)
13
12
11
10
9
8
7
6
5
4
3
2
95% prediction interval
Medium variant
1950
1975
2000
2025
2050
2075
2100
Year
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United Nations, DESA, Population Division. World Population Prospects 2019. http://population.un.org/wpp/

In 20 years, over 80% of us will live in urban areas.

Source: United Nations

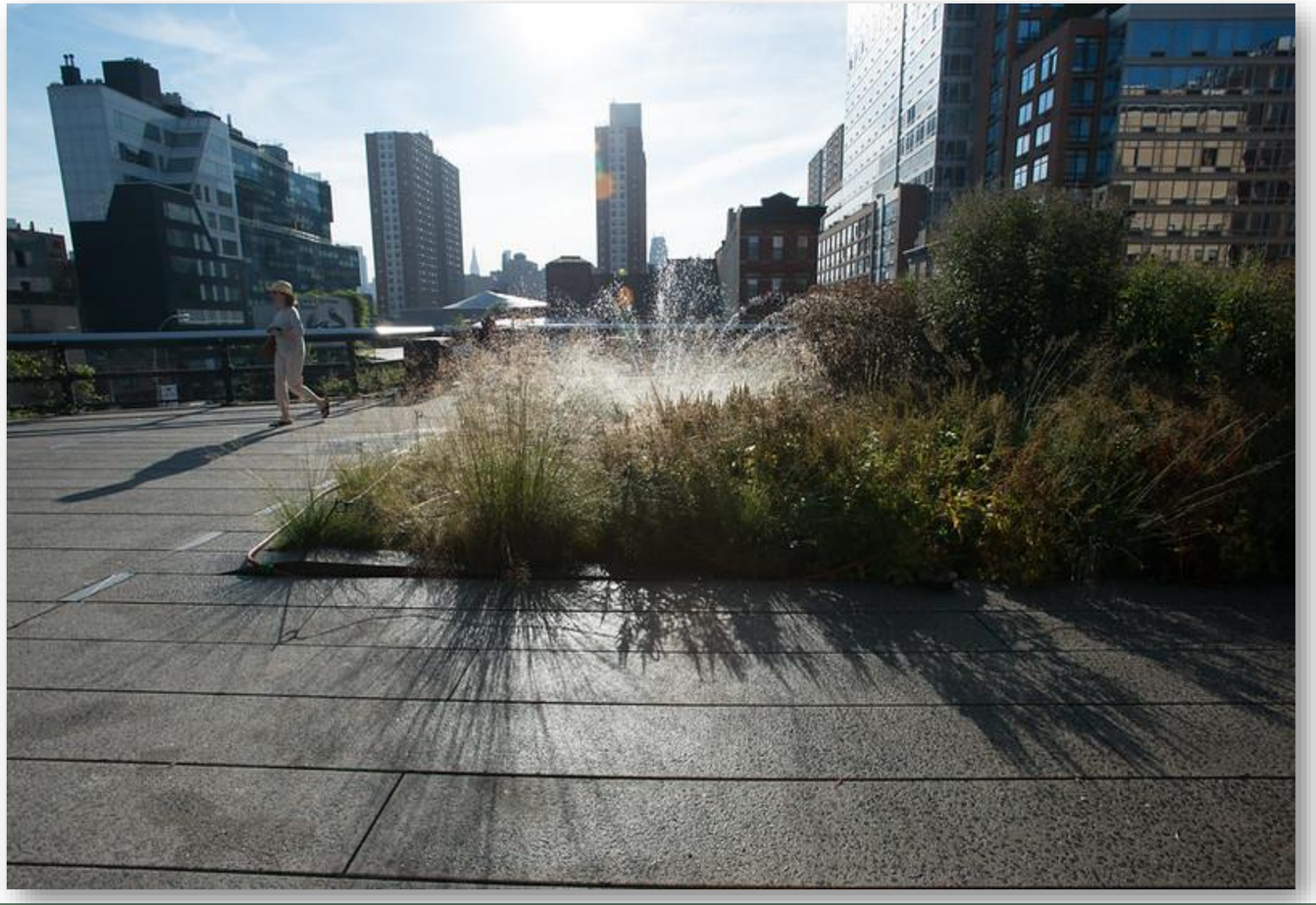
Source: American Farmland Trust

THE URBAN AGRICULTURE BOOM

Urban agriculture is on the rise.

The 2018 Farm Bill authorized:

- Competitive grants program to support farmers
- Competitive grants to support research, education, and extension activities
- The establishment of an Office of Urban Agriculture and Innovative Production to encourage and promote urban, indoor, and other emerging agricultural practices:
  - Community gardens and farms
  - Rooftop farms, outdoor vertical production, and green walls
  - Indoor farms, greenhouses, and high-tech vertical technology farms
  - Hydroponic, aeroponic, and aquaponic farm facilities



USDA AGRICULTURE INNOVATION AGENDA

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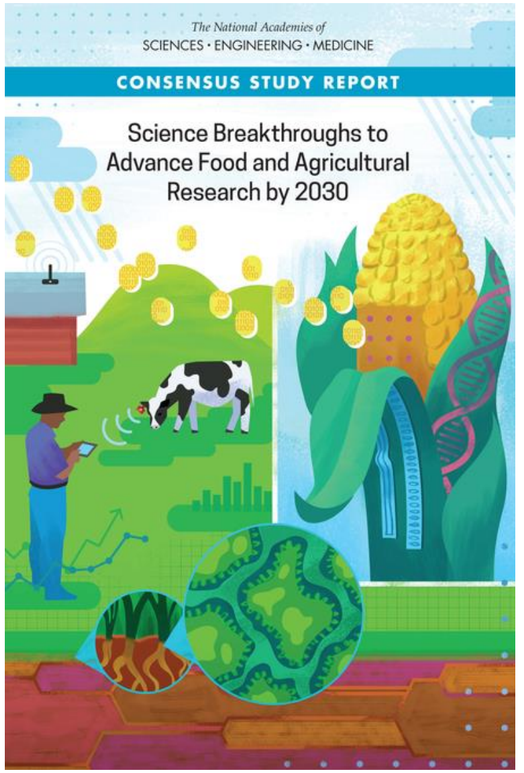
Increase ag production by 40%

Decrease environmental footprint of U.S. ag by 50%



SPECTRUM OF URBAN AGRICULTURE

Battery Park

Brooklyn Grange

Harlem Grown

Sky Vegetables

Aerofarms

Technology Gradient

Low-Tech → High-Tech

Community Soil-Based	Commercial Rooftop Engineered-Soil	Community Hybrid	Rooftop Hydroponic Greenhouse	Commercial Vertical Aeroponic

USDA URBAN AGRICULTURE EFFORTS

USDA Urban and Community Agriculture Working Group

Urban agriculture pilot study using big data (National Agriculture Statistics Service)

Reports on regional and local food system economics (Economic Research Service)

Research on urban agriculture, controlled environment agriculture, and aquaponics (Agricultural Research Service and National Institute of Food and Agriculture)

USDA RESEARCH, EDUCATION, AND ECONOMICS

AGRICULTURE RESEARCH SERVICE (ARS) URBAN AGRICULTURE RESEARCH

ARS researchers are developing dwarf or columnar trees for urban settings and small spaces, successfully breeding:

- Pear trees
- Peach trees
- Plum trees

GENETICALLY ENGINEERED PLUMS EXPRESSING FLOWERING LOCUS T 1 (FT1)

FT (Florigen) is a mobile signal that induces flower formation.

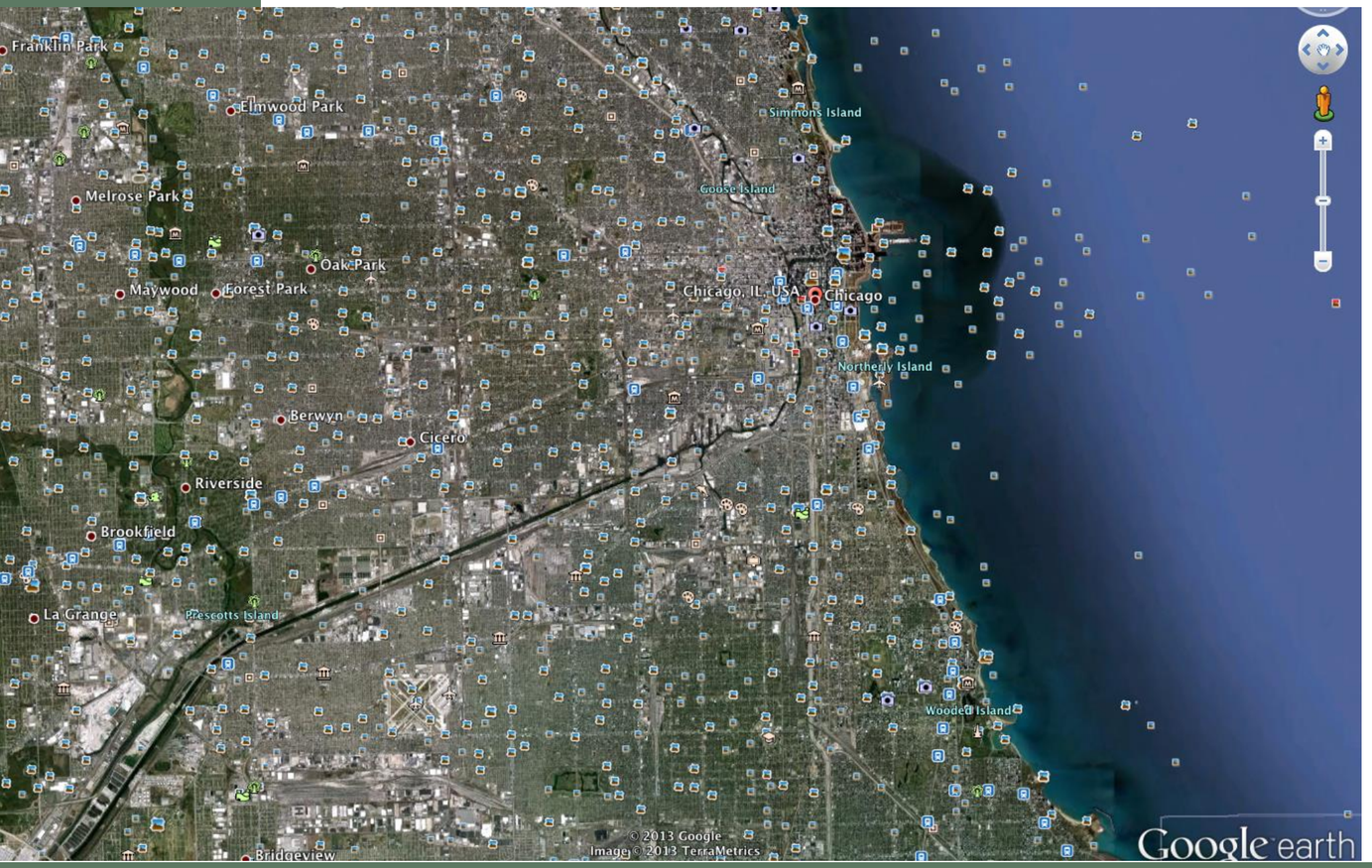
- Small tree size
- No juvenility period
- Continual flowering
- No dormancy required
- Set fruit year-round
- Flowering controlled by temperature

Modern biotechnology strategies can be used to engineer crops better suited for specialized growing environments such as vertical and urban settings.

Orchard grown plums

FT plums

NATIONAL INSTITUTE OF AGRICULTURE (NIFA)-FUNDED URBAN AGRICULTURE RESEARCH EXAMPLE



In collaboration with Google, NIFA-funded researchers assessed the value of urban agriculture and the benefits it provides on a global scale.

USDA

Arizona State University

Google Earth

CONTROLLED ENVIRONMENT AGRICULTURE (CEA)

NIFA

Food Safety and Quality and Production Sustainability Research

- Looking at product quality and increasing shelf-life of leafy greens through light and water management practices pre-harvest
- Developing an efficient ratooning process for leafy greens grown in CEA

ARS

Food Safety and Quality and Nutrition Research

- Breeding scion and rootstock of tomato varieties suitable for greenhouse production and vertical farming under artificial light with better quality and disease resistance
- Evaluating LED lighting sources to promote indoor tomato growing and fruit production
- Manipulating hydroponic nutrient solutions to enhance tomato productivity and fish production
- Developing an effective integrated management system for pests, diseases, and pollinator health
- Improving food quality, safety, and nutrition of tomatoes through postharvest handling

AQUAPONICS AND HYDROPONICS RESEARCH EXAMPLE

Central State University, Ohio State University research conducted with NIFA investments

Innovative approaches to urban food production through preservation of one major ecosystem service - water quality:

- to optimize water quality to enhance clean water supply for fish growth and desired nutrient availability for plant growth in local food production
- to conserve water in urban agriculture to reduce environmental footprint and solve water scarcity
- to evaluate the performance of the chosen urban farming method in achieving sustainability and conduct an economic analysis to determine feasibility of the proposed methods

USDA SCIENCE BLUEPRINT

- Sustainable Agricultural Intensification
- Agricultural Climate Adaptation
- Food and Nutrition Translation
- Value Added Innovation
- Agricultural Science Policy Leadership

THANK YOU
&
STAY CONNECTED!

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