Overview

Lawrence Berkeley National Laboratory
Precision Urban Agriculture Initiative

Lawrence Berkeley National Lab

One of the world's most respected centers of advanced research

Funded by the US Department of Energy to conduct cutting edge research & development on important issues affecting the US and the world

An $800 million dollar budget

3,000 world-class scientists and engineers

13 Nobel Prize Laureates

What is Precision Urban Agriculture

Targeted Use of Resources

- Sharply limiting use of water, nutrients, and space
- No pesticides, herbicides or insecticides

Environmental Controls

- Precise controls of lighting, temperature, humidity, CO_2 and other environmental factors

Efficiencies in the Production to Consumer Chain

- Reduce waste in transportation and marketing
- On demand harvest
- Year-round growing
- Efficient integration with urban scale users

Breakthrough technologies for sustainable, cost-effective, locally grown, fresh food for urban families

What if we could grow healthy vegetables in our urban centers, in a way that conserves water, minimizes the use of pesticide and fertilizer, is cost-competitive with conventional agriculture, and provides affordable, accessible, nutritious food for low-income urban communities?

A new generation of agronomic technologies is emerging, which can transform food production by dramatically reducing the use of water, land, fertilizer, pesticides and herbicides. However, a number of fundamental technical hurdles and research questions remain, before such innovations can achieve the needed scale and cost-effectiveness.

Lawrence Berkeley National Lab (LBNL) is launching the Precision Urban Agriculture initiative, which will:

- Develop new technologies to overcome the most critical barriers faced by emerging food production systems, using the scientific capacity of US national labs with expertise in microbiology, material sciences, advanced lighting, energy efficiency, soil and earth sciences, and the biological processes underlying plant growth.
- Partner with innovative growers who are already pushing the technological edge, learning from their experience and testing new technologies in the context of on-the-ground application.
- Work closely with urban political and community leaders who are invested in creating the policy framework and local partnerships to support urban agriculture in their cities.

Our ultimate goal is to catalyze large-scale, cost-effective production of fresh vegetables in urban settings, in a way that directly reduces the environmental foot print, increases access to nutritious food for low-income urban communities, and improves the overall quality of life in America's cities.

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Background

Lawrence Berkeley National Laboratory Precision Urban Agriculture Initiative

Conventional agriculture does not work, for the environment or for the urban poor

The Institute for Globally Transformative Technologies at LBNL

In 2012 LBNL established LIGTT. LIGTT's mission is to discover, develop and deploy the next generation of technological breakthroughs to combat global poverty.

To achieve its mission, LIGTT works with research institutions, international and government agencies, companies, and nonprofits around the world.

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Food production in America, as we know it, poses two significant problems: it has a fundamentally unsustainable environmental footprint and, in low-income urban areas, the absence of affordable fresh food has caused a major health crisis among America's poorest communities. Nationally 37% of our water withdrawals are for agriculture. In a state like California, agriculture accounts for 80% of water used. We use over 1 billion pounds of pesticide and 60 million tons of fertilizer each year. The cost we pay is not just in dollars, but in compromised and polluted streams, water scarcity, eroded topsoil, and several other documented forms of damage to the environment, our food supply, and our health. In addition, the economics of food production and distribution has led to the troubling nationwide phenomenon of urban food deserts—areas where fresh healthy food is simply unavailable to low-income Americans.

New scientific technologies—combining soilless growing with precise control of lighting, nutrients and other inputs based on crop-specific requirements—are creating a revolution in agriculture, growing plants with as little as 3% of the water used in conventional farming, 10-40% of the fertilizer, a fraction of the space, and no pesticides. A small number of innovative growers are already employing these techniques across the United States; however, they are largely small scale or not yet cost-competitive with conventional agriculture. Moving this field from innovation to scale will require technological solutions such as: an understanding of how to manage complex interdependent biological systems, a deeper understanding of the optimal nutrient and lighting requirements for specific crops; enhanced sensors for highly precise environmental monitoring; controllers to precisely moderate nutrient and water flow, temperature and humidity; advanced energy-efficient lighting systems with precise wavelength and intensity modulation; beneficial micro-organisms to enhance plant resilience, flavor profile and nutrient value; new materials that can enhance insulation or light flow, or reduce clogging. It will also require shifts in the urban and agricultural policy landscape that help to create an adaptive environment for these new agricultural efforts.

Initiative Description

Lawrence Berkeley National Laboratory Precision Urban Agriculture Initiative

A powerful new partnership—teaming the scientific capacity of a national laboratory with agricultural innovators and committed urban partners

The Lawrence Berkeley National Laboratory is launching an ambitious initiative in which three mutually supportive bodies of work will help build the scientific and real world knowledge base to make cost-effective, environmentally sustainable urban food production a reality.

Track 1: Understanding the potential and limitations of current innovations

Our goal in this phase of the work is to understand how existing precision agricultural efforts perform in comparison to conventional agriculture. Three specific studies will form the heart of this phase:

- A life cycle analysis which will compare inputs and costs across existing precision agricultural efforts and compare to conventional agriculture
- A plant growth analysis which looks at plant bio-mass nutrient and micro-nutrient profiles for plants in soilless, conventional and organic growing environments
- A key informant study that will explore with innovators and experts where technological innovations can impact cost and scalability.

Track 2: Creating breakthrough technologies to support precision agriculture

Building off capacities of the lab and its partners around advanced lighting, energy efficiency, climate control, sensor and micro-controller technology, plant biology, and microbiome-plant interaction we will look to identify turnkey solutions that can reduce costs, enhance productivity, or contribute to scalability. In partnership with innovative growers we will test technological enhancements within the context of growing systems already being used in urban settings across the country enabling real-world testing of innovation within the context of everyday application.

Track 3: Partnering with cities to demonstrate impact at scale

As the technology innovations prove themselves to be effective in actual production systems, we will work closely with political and community leaders in three cities to identify mechanisms through which they sustain, scale, and achieve meaningful impact to low income urban communities. These mechanisms include working with the municipality to identify and make available sites that can meet multiple urban goals such as redevelopment, beautification and livability; structured relationships with institutional consumers such as schools or hospitals; articulation and integration into other urban initiatives such as job training or development, or anti-obesity initiatives. Finally we will partner with business incubators and use economic modeling to ensure long-term financial viability of the developing urban agriculture systems.

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