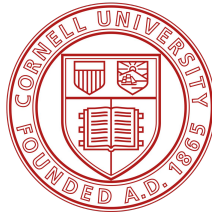




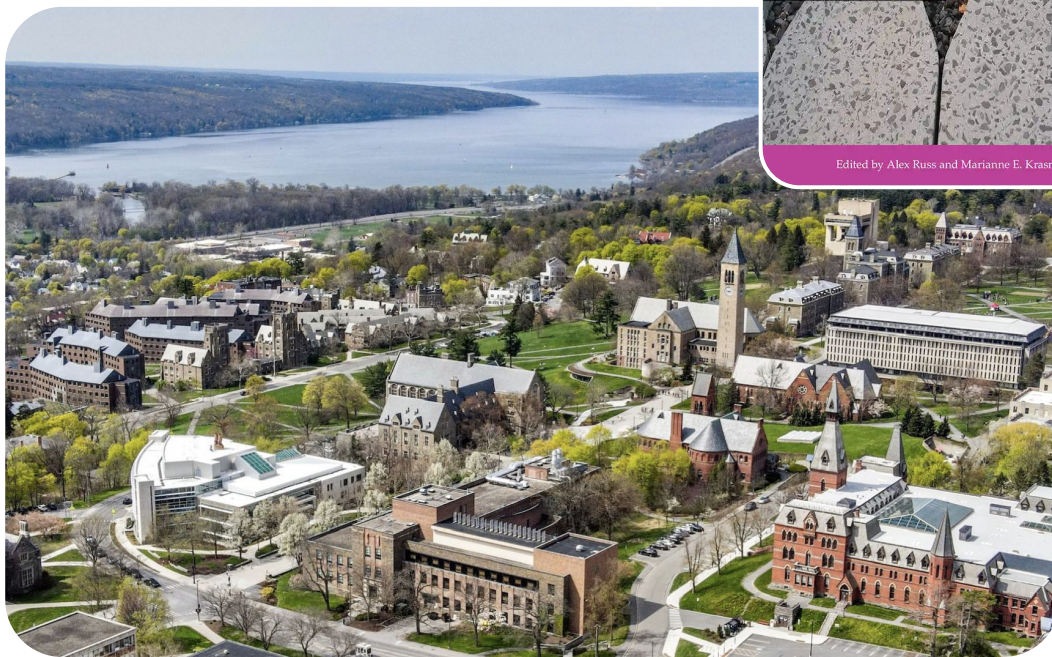
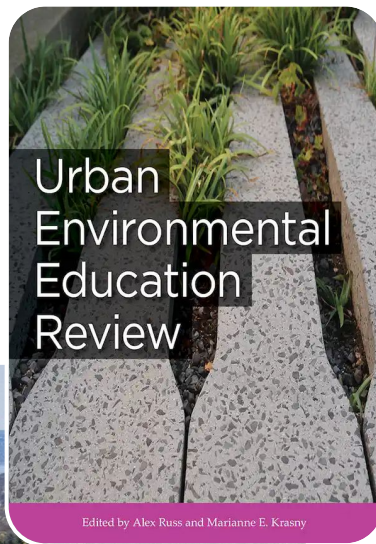
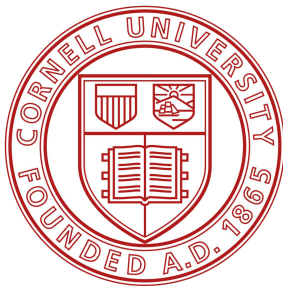
12th WEEC
CONNECTING PEOPLE
CREATING TOMORROW
29 JAN - 02 FEB, 2024 | ABU DHABI

Integrating sustainability science into school curricula: New York Sun Works case study

Alex Kudryavtsev, Cornell University
Manuela Zamora, NY Sun Works
Megan Nordgren, NY Sun Works



Cornell University Civic Ecology Lab



Research question

What are the **outcomes** of
hydroponic-based
**sustainability science
education**?

```
graph LR; A[What are the outcomes of hydroponic-based sustainability science education?] --> B[How does NYSW influence specific desired outcomes?]
```

How does NYSW
influence specific
desired outcomes?

ABOUT NY SUN WORKS



NY Sun Works, a non-profit organization that builds **hydroponic farm classrooms** in NYC K-12 public schools for the teaching of:

- Science
- Sustainability
- Climate Education
- Nutrition

We envision a generation of **environmental innovators**, empowered to create solutions to global climate challenges.

www.nysunworks.org

14 YEARS EDUCATING STUDENTS ABOUT SCIENCE THROUGH URBAN AGRICULTURE



www.nysunworks.org

HYDROPONIC CLASSROOMS



www.nysunworks.org

HYDROPONIC CLASSROOMS



www.nysunworks.org

**FOREMOST COMPREHENSIVE
CLIMATE EDUCATION PROGRAM**

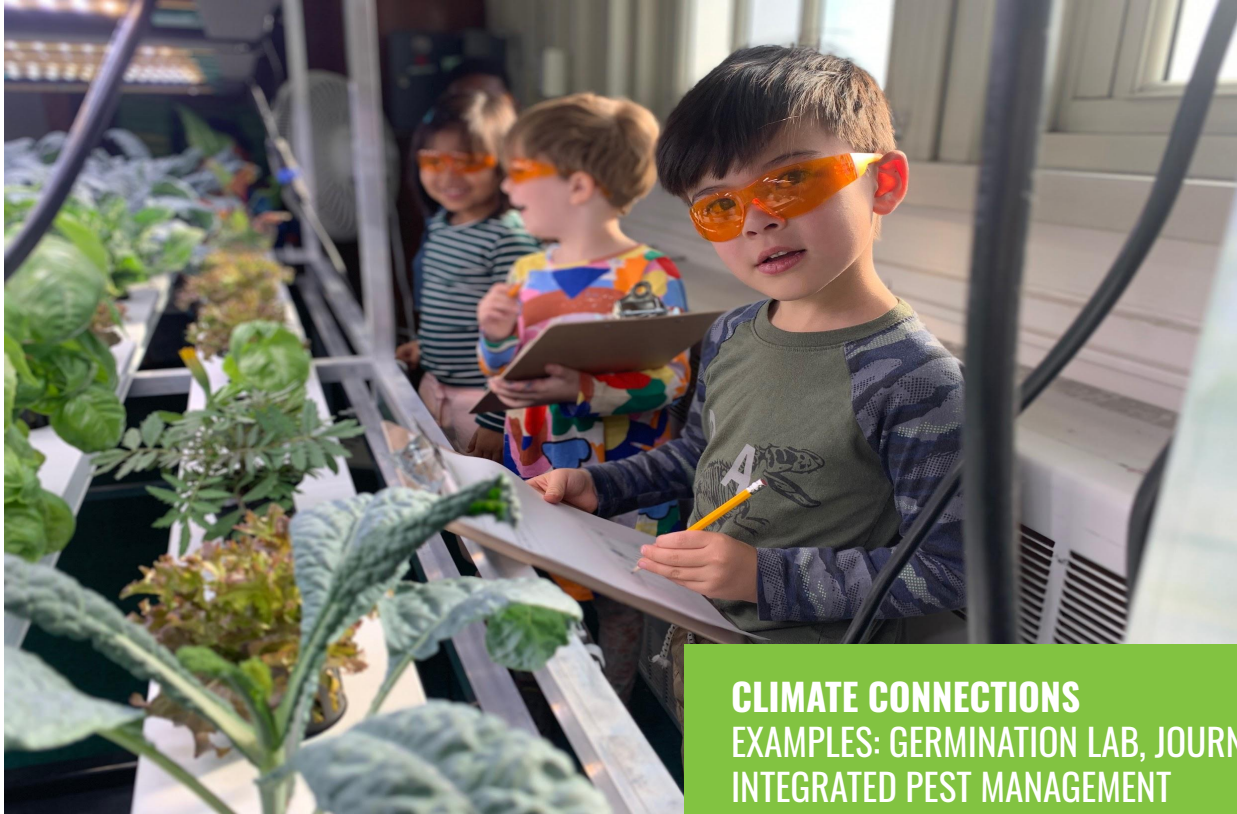
**REACHING 120,000
STUDENTS ANNUALLY**

300+ PARTNER SCHOOLS



www.nysunworks.org

EDUCATION AT NYSW



Standards based Curriculum and Pedagogy

- Inquiry-based
- Collaborative
- Hands-on, experiential learning
- Data analysis
- Multimedia resources
- Differentiation
- Assessment

CLIMATE CONNECTIONS

EXAMPLES: GERMINATION LAB, JOURNEY OF PRODUCE, EUTROPHICATION, INTEGRATED PEST MANAGEMENT

LEARNING CENTER



www.nysunworks.org

CONNECT TO WHAT TEACHERS ARE ALREADY DOING

	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE		
KINDERGARTEN	AMPLIFY UNIT 1: NEEDS OF PLANTS AND ANIMALS			AMPLIFY UNIT 2: PUSHES AND PULLS			AMPLIFY UNIT 3: SUNLIGHT AND WEATHER					
	PLANT NEEDS & PERSONAL PLANTERS GHC Connect: Plant and Animal Needs (Lessons 1-2) SE: Upcycling (Lessons 1-2)			WATER MOVEMENT GHC Connect: Water Movement (Lessons 1-2)								
GRADE 1	AMPLIFY UNIT 1: ANIMAL AND PLANT DEFENSES			AMPLIFY UNIT 2: LIGHT AND SOUND								
	PLANT ADAPTATIONS & IPM GHC Connect: Plant Adaptations (Lessons 1-4)			AGENTS FOR CHANGE SE: Planting Promises (Lesson 1)								
GRADE 2	AMPLIFY UNIT 1: PLANT AND ANIMAL RELATIONSHIPS			AMPLIFY UNIT 2: PROPERTIES OF MATERIALS								
	PLANT, ANIMAL, & INSECT RELATIONSHIPS GHC Connect: Plant and Animal Connections (Lessons 1-3)			WATER PROPERTIES GHC Connect: Water in the GHC (Lessons 1-3)								
KINDERGARTEN	NYC S&S: WEATHER STUDY (YEAR LONG)											
	WEATHER INSIDE AND OUT: GHC Connect: Weather Research (Lessons 1-3)											
	NYC S&S: SOLIDS AND LIQUIDS (9 WKS)			NYC S&S: PUSH ME, PULL ME (9 WKS)			NYC S&S: OUR ENVIRONMENT (9 WKS)			NYC S&S: OUR WEATHER (9 WKS)		
	RECYCLING OPTIONS SE: Recycling in the GHC (Lessons 1-3)			WATER MOVEMENT GHC Connect: Water Movement (Lessons 1-2)			PLANTS NEEDS & PERSONAL PLANTERS GHC Connect: Plant and Animal Needs (Lessons 1-2) SE: Upcycling (Lessons 1-2)					
GRADE 1	NYC S&S: EXPLORING LIGHT AND SOLAR PATTERNS (2 WKS)			NYC S&S: LIGHT, SOUND, AND WAVES (2 WKS)			NYC S&S: STRUCTURES AND BEHAVIORS IN LIVING THINGS (2 WKS)					
	SEASONAL LIGHT VARIATION GHC Connect: Light in the GHC (Lessons 1-3)			AGENTS FOR CHANGE SE: Planting Promises (Lesson 1)			PLANT ADAPTATIONS & IPM GHC Connect: Plant Adaptation (Lessons 1-4) SE: Bug Battles in the GHC (Lessons 1-4)					
GRADE 2	NYC S&S: PROPERTIES AND PATTERNS OF WATER (2 WKS)			NYC S&S: THE CHANGES TO LAND OVER TIME (2 WKS)			NYC S&S: PLANT AND ANIMAL INTERACTIONS (2 WKS)					
	WATER PROPERTIES GHC Connect: Water in the GHC (Lessons 1-3)			THE GREENHOUSE CLASSROOM SE: GHC and What Might Be Next (Lessons 1-3)			PLANT, ANIMAL, & INSECT RELATIONSHIPS GHC Connect: Plant and Animal Connections (Lessons 1-3) SE: Bee Parts, Pollination, and Possibilities (Lessons 1-3)					

Curriculum complements both NGSS (green) and Amplify Science (orange)



Nutrient film technique is a hydroponic technique where in a very shallow stream of water containing all the dissolved nutrients required for plant growth is recirculated past the bare roots of plants in a water-tight gully, also known as channels.

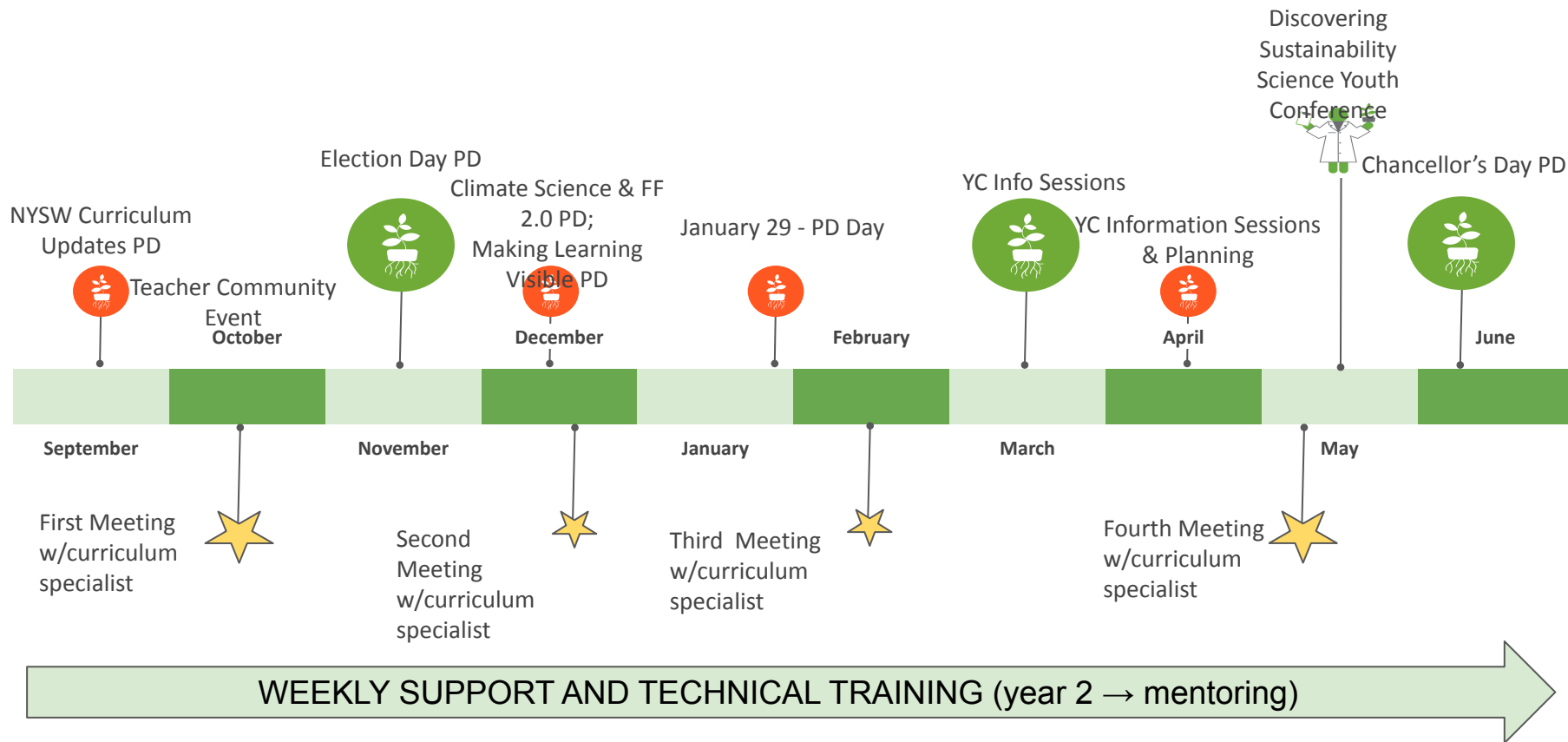
96% OF STUDENTS ARE WILLING TO EAT FRESH FOOD HARVESTED IN HYDROPONIC CLASSROOMS

SUSTAINED TEACHER SUPPORT



www.nysunworks.org

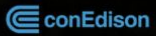
Supporting Teachers: Curriculum Support & Professional Learning



DISCOVERING SUSTAINABILITY SCIENCE YOUTH CONFERENCE

12th Annual **NYSUNWORKS** YOUTH CONFERENCE Discovering Sustainability Science

#nysunworks



CVC



An annual celebration of science where students from around NYC showcase the research and investigations they've conducted in their hydroponic classrooms.

Joining students are scientists, innovators, and experts in the sustainability and STEM fields, who share real-world applications of what students learn in the classroom.

**RESEARCH PRESENTED BY
OUR FARMER SCIENTISTS**

ANNUAL YOUTH CONFERENCE



Students have the opportunity to present their research and sustainability projects in front of 1,000 of their NYC public school peers at the annual NY Sun Works Youth Conference.

www.nysunworks.org

IMPACTS



- Access to Quality Science Education
- Advanced Project-Based Climate Education
- Access to New Technologies
- Training for the Expanding Urban Agricultural Workforce
- Greater Nutritional Knowledge
- Fresh Vegetables to Food Insecure Areas

MEETING THE MOMENT: CLIMATE EDUCATION



**AT NY SUN WORKS WE
ARE HELPING TO BUILD A
GENERATION OF ENVIRONMENTAL
INNOVATORS, EMPOWERED TO
CREATE SOLUTIONS TO GLOBAL
RESOURCE CHALLENGES.**

www.nysunworks.org



facebook.com/nysunworks



twitter.com/nysunworks



[@Nysunworks](https://www.instagram.com/nysunworks)



info@nysunworks.org

www.nysunworks.org

Research methods:

- Interviews
- Observations



<https://youtu.be/ymkioZ92ino>



Intended outcomes of NY Sun Works

Intended outcomes of NY Sun Works

Students

Primary outcomes:

- Sustainability literacy
 - Climate change literacy
 - Science literacy
-
- Problem solving skills
 - Urban agriculture skills
 - Civic engagement
 - Leadership skills
 - Gender equity in science
 - Social-emotional learning

Intended outcomes of NY Sun Works

Students

Primary outcomes:

- Sustainability literacy
- Climate change literacy
- Science literacy
- Problem solving skills
- Urban agriculture skills
- Civic engagement
- Leadership skills
- Gender equity in science
- Social-emotional learning

Schools

- Sustainability topics in different subjects
- Making sustainability education a priority
- Teacher competence in sustainability topics
- Consuming fresh produce in the classroom & at home
- Developing a school's green infrastructure

Intended outcomes of NY Sun Works

Students

Primary outcomes:

- Sustainability literacy
- Climate change literacy
- Science literacy
- Problem solving skills
- Urban agriculture skills
- Civic engagement
- Leadership skills
- Gender equity in science
- Social-emotional learning

Schools

- Sustainability topics in different subjects
- Making sustainability education a priority
- Teacher competence in sustainability topics
- Consuming fresh produce in the classroom & at home
- Developing a school's green infrastructure

Communities

- Donation of vegetables to communities
- Growing culturally important food
- Parent and family engagement in sustainability education
- School-nonprofit partnerships

Intended outcomes of NY Sun Works

Students

Primary outcomes:

- Sustainability literacy
- Climate change literacy
- Science literacy
- Problem solving skills
- Urban agriculture skills
- Civic engagement
- Leadership skills
- Gender equity in science
- Social-emotional learning

Schools

- Sustainability topics in different subjects
- Making sustainability education a priority
- Teacher competence in sustainability topics
- Consuming fresh produce in the classroom & at home
- Developing a school's green infrastructure

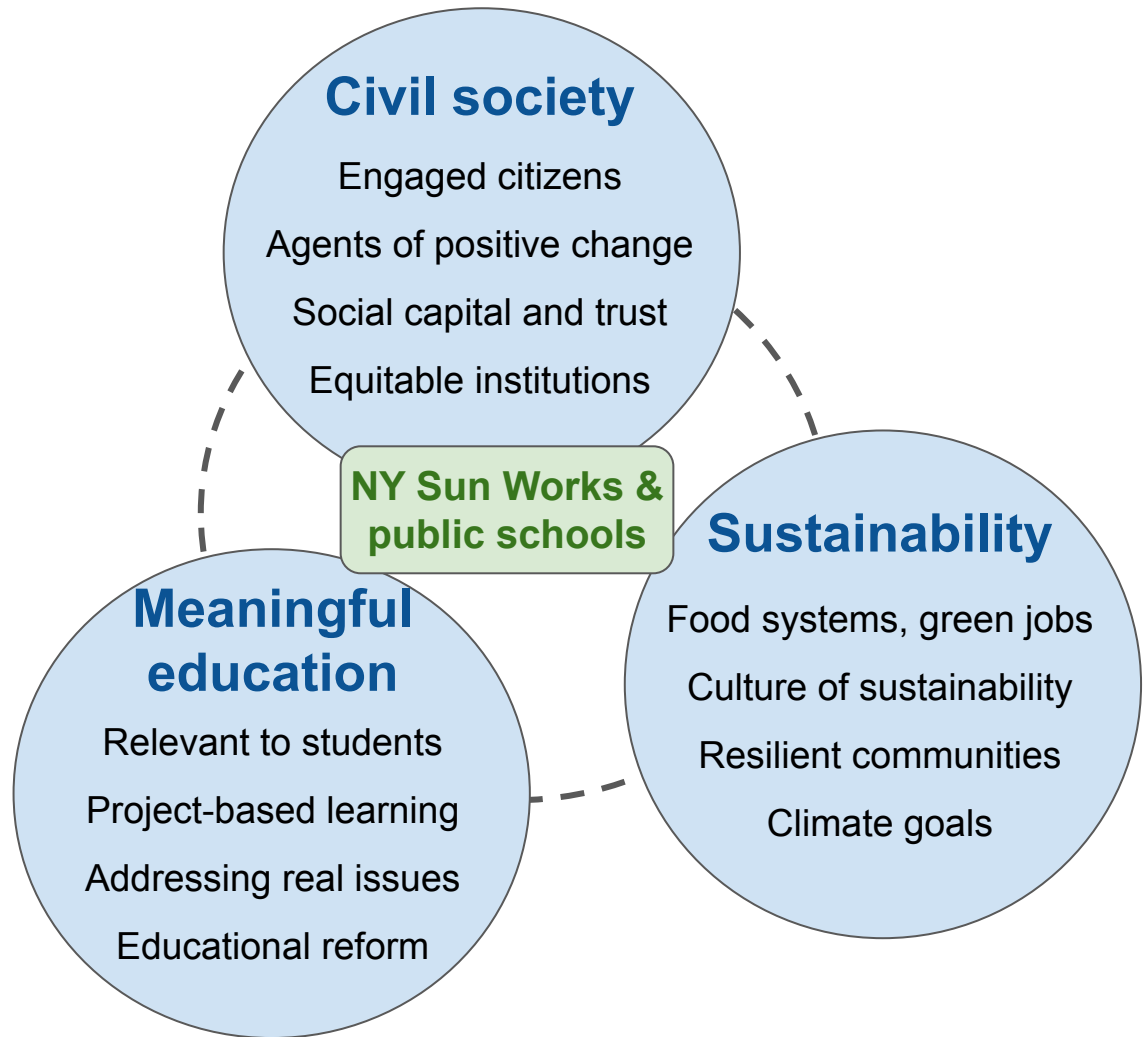
Communities

- Donation of vegetables to communities
- Growing culturally important food
- Parent and family engagement in sustainability education
- School-nonprofit partnerships

City

- Sustainable urban agriculture systems
- Reduced ecological footprint on natural ecosystems
- Equitable access to healthy food
- Engaged citizens and participatory environmental governance

Cross-cutting themes



Contact us



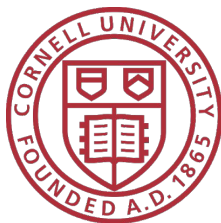
Manuela Zamora

mzamora@nysunworks.org

Megan Nordgrén

megan@nysunworks.org

<http://nysunworks.org>



Alex Kudryavtsev

ak383@cornell.edu

<http://civicecology.org>

Thank you!