



Research Brief

# The GREEN Tool

Garden Resources, Education, and Environment Nexus

*For Well-Integrated  
School Gardens*



August 2016



## **Laurie M. Tisch Center for Food, Education & Policy Program in Nutrition Teachers College, Columbia University**

The Center cultivates research about connections between a just, sustainable food system and healthy eating and translates it into recommendations and resources for educators, policy makers, and community advocates. The Center focuses on schools as critical levers for learning and social change.

### **The GREEN Tool Development**

The GREEN (Garden Resources, Education, and Environment Nexus) Tool was developed as part of the doctoral dissertation of Kate Gardner Burt, PhD, RD, with Pamela Koch, EdD, RD, Claire Uno, MLIS, and Isobel R. Contento, PhD. Dr. Burt's research was conducted with funding from the Tisch Food Center Doctoral Fellowship supported by the Laurie M. Tisch Illumination Fund.

Many thanks to the 21 schools and other organizations that contributed to the research that led to the development of the GREEN Tool.

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# Overview

This research brief describes the background study that led to the conception of the GREEN (Garden Resources, Education, and Environment Nexus) Tool and highlights how it can be used to strengthen school gardens. The purpose of the study was to examine which components make up a well-integrated garden in New York City schools and to determine how those components work together. This study resulted in the GREEN Tool, comprised of a Map illustrating how and when to operationalize the 19 components needed to establish, integrate, and sustain a school garden, and a Scorecard with questions on a 3-point scale to assess progress on the 19 components. Used together the Map and Scorecard can help school garden leaders develop and sustain a garden that is well-integrated into the school. This brief focuses on the background study and the GREEN Tool Map, and includes policy recommendations based on research findings. A forthcoming brief will address the Scorecard and how to use it.

## Why School Gardens

School gardens have many benefits. They provide engaging, hands-on, experiential learning. From increasing physical activity to fostering healthy eating, gardens can be good for students' health (Bell & Dymont, 2006; Wells, Myers, & Henderson, 2014; Lineberger & Zajicek, 2000; Morris & Zidenberg-Cherr, 2002). They can be academically beneficial as well (Williams & Dixon, 2013). Some research has shown that students in schools with active school garden programs have better grades, improved attitudes toward school, and increased attendance (Lieberman & Hoody, 1998). For these and many other reasons, school administrators, educators, parents, policymakers, and funders are interested in expanding the school garden movement.

### Benefits of School Gardens

*Research points to school gardens' many benefits including:*

- Improved food and nutrition knowledge (*Parmer, Salisbury-Glennon, Shannon, and Struempfer, 2009*)
- Improved attitude toward, preference for, and willingness to try fruits and vegetables (*Morris & Zidenberg-Cherr, 2002; Morris, Neustadter & Zidenberg-Cherr, 2001; Ratcliffe, Merrigan, Rogers, and Goldberg, 2009*)
- Increased fruit and vegetable consumption (*Christian, Evans, Nykjaer, Hancock, & Cade, 2014*)
- Improved attitude toward school (Lieberman & Hoody, 1998)
- Improved attitude toward the environment and studying science (*Waliczek & Zajicek, 1999; Skelley & Bradley, 2007*)
- Improved academic achievement in all subjects, particularly science (*Klemmer, Waliczek, & Zajicek, 2005*)
- Increased physical activity (*Bell & Dymont, 2006; Wells, Myers, & Henderson, 2014*)
- Improved inter- and intrapersonal skills, such as collaboration, self-esteem, pride (*Thorpe & Townsend, 2001; Robinson & Zajicek, 2005*)

# School Gardens are Growing

This is a key time for the school garden movement in New York City. Since the 2010 launch of Grow to Learn—a citywide school gardens initiative in partnership with the nonprofit GrowNYC, the NYC Department of Parks and Recreation’s Green Thumb program, and the NYC Department of Education’s Office of School Food—over 500 New York City schools have registered school gardens. Many of these have received Grow to Learn mini-grants and other resources and professional development to support their garden program.

## School Gardens Take Root

In order to sustain gardens over time it is critical that they are deeply integrated within the school community. Yet this process can be difficult. Initial enthusiasm around starting a school garden can be challenged by changes in school or garden leadership, conflicting priorities, and the effort required to maintain a productive garden space. Educators have significant demands on their time. Clearly defined strategies and tools are needed to support success for the people who invest considerable time, effort, and funding into these gardens, and the children who benefit from them.

The GREEN Tool study found that in NYC, well integrated school gardens:

- Are connected to the curriculum across academic subjects such as science, social studies, writing and math,
- Inspire healthy and environmentally conscious values as a core part of the school,
- Have a plan for who will maintain the garden,
- Are at or near a school and primarily used as a learning environment to create meaningful experiences for students,
- Are a valued part of the school community, and
- Are sustained over time.

### Many Shapes and Sizes

Well-integrated gardens in NYC come in many shapes and sizes. They can be raised beds, containers and hydroponics on rooftops, greenhouses, or in classrooms. The places where school gardening occurs are unique to the particular circumstances, desires, and budgets of individual schools. Some begin with only a few containers and expand and integrate the garden over several years while others begin in a large space from the start. The location of the garden in, around, or on top of the school often determines how, when, or by whom it can be used. The edible plants grown in the gardens vary, but most schools tend to grow at least one type of leafy green, herb, and/or tomato.

# Conception of the GREEN Tool

## *Overview*

The GREEN Tool was developed as part of a larger study to understand well-integrated gardens in New York City. The purpose of the study was to examine which components make up a well-integrated garden and to determine how those components work together to build toward a well-integrated garden. Prior published research identified 18 components of successful school gardens.

## *Methods*

Grow to Learn helped to identify 54 potential well-integrated school gardens and we contacted these schools to determine their interest in participating. Due to city implementation of new teacher assessments, teachers and school gardeners at some schools felt too overburdened to participate; they often reported that the garden suffered too. At each stage of data collection, we excluded school gardens that did not meet criteria for being well-integrated.

The final sample was 21 elementary and middle schools from three boroughs, Manhattan (n=10), Brooklyn (n=8), and the Bronx (n=3). Using the percentage of students who qualify for free and reduced price lunch (F/R) as a proxy for socioeconomic status, the sample mean was 70% F/R which is close to the mean for all NYC schools (72% F/R). Thirteen of the 21 schools were elementary schools, five schools served students in grades K-8, and the remaining three were middle schools. The key garden contacts were most frequently teachers (n=14), and the remainder consisted of four garden educators (not affiliated with or employed by the school), two parents, and one sustainability coordinator.

We collected both quantitative and qualitative data from participating schools over the 2013-2014 school year through multiple measures including:

- Survey with key garden contact,
- Interviews with key garden contact(s),
- Observations of students in school gardens,
- Digital images of physical spaces,
- Concept mapping with key garden contact(s),
- Additional documents, such as garden lessons and garden diagrams.

## *Results*

The results found four key domains of a well-integrated garden and a general sequence for how schools move through the components that make up these domains. The GREEN Tool Map is a visual representation of this sequence of how schools move through the 19 components. The degree of garden integration with the larger school community varies greatly and is an area that many school gardeners continue to struggle with.

## *Conclusion*

Even though the 21 schools in this study had many different types of gardens, they shared common ways for how they moved through the components needed for a well-integrated garden. This process was synthesized into the GREEN Tool. Using the GREEN Tool may help school gardens become more well-integrated.

*“It’s really good to bear in mind that a garden is a 12-month thing and a school is a ten month thing. And at certain times of year, a garden is a seven day a week thing. And, again, the school is not...Try to think through your whole year of your garden and really go over all of that with the administration in a very open way and ready to be flexible.”*

– RER, PS/MS 282

## Digging in With the GREEN Tool

Although there are many resources that help schools start gardens, to date, there are no resources to help schools effectively integrate and sustain their school gardens over the long term. The GREEN Tool is specifically designed to help schools have a well-integrated garden. The GREEN Tool is comprised of a Map illustrating how and when to operationalize the 19 components needed to establish, integrate, and sustain a school garden, and a Scorecard with questions on a 3-point scale to assess progress on the 19 components. Used together the Map and Scorecard can help school garden leaders have success over the long term.

The GREEN Tool resulted from an in-depth study of 21 school gardens in New York City (see Conception of the GREEN Tool box, page 6). The GREEN Tool is practical and evidence-based. It is also flexible, to accommodate the infinite variety of school gardens (see Many Shapes and Sizes box, page 5). While the primary use of the GREEN Tool is for individual school gardens, other stakeholders can also use it. Garden support organizations such as Grow to Learn, funders, researchers, policymakers, and others can use it to help to understand, strengthen, and expand the school garden movement.

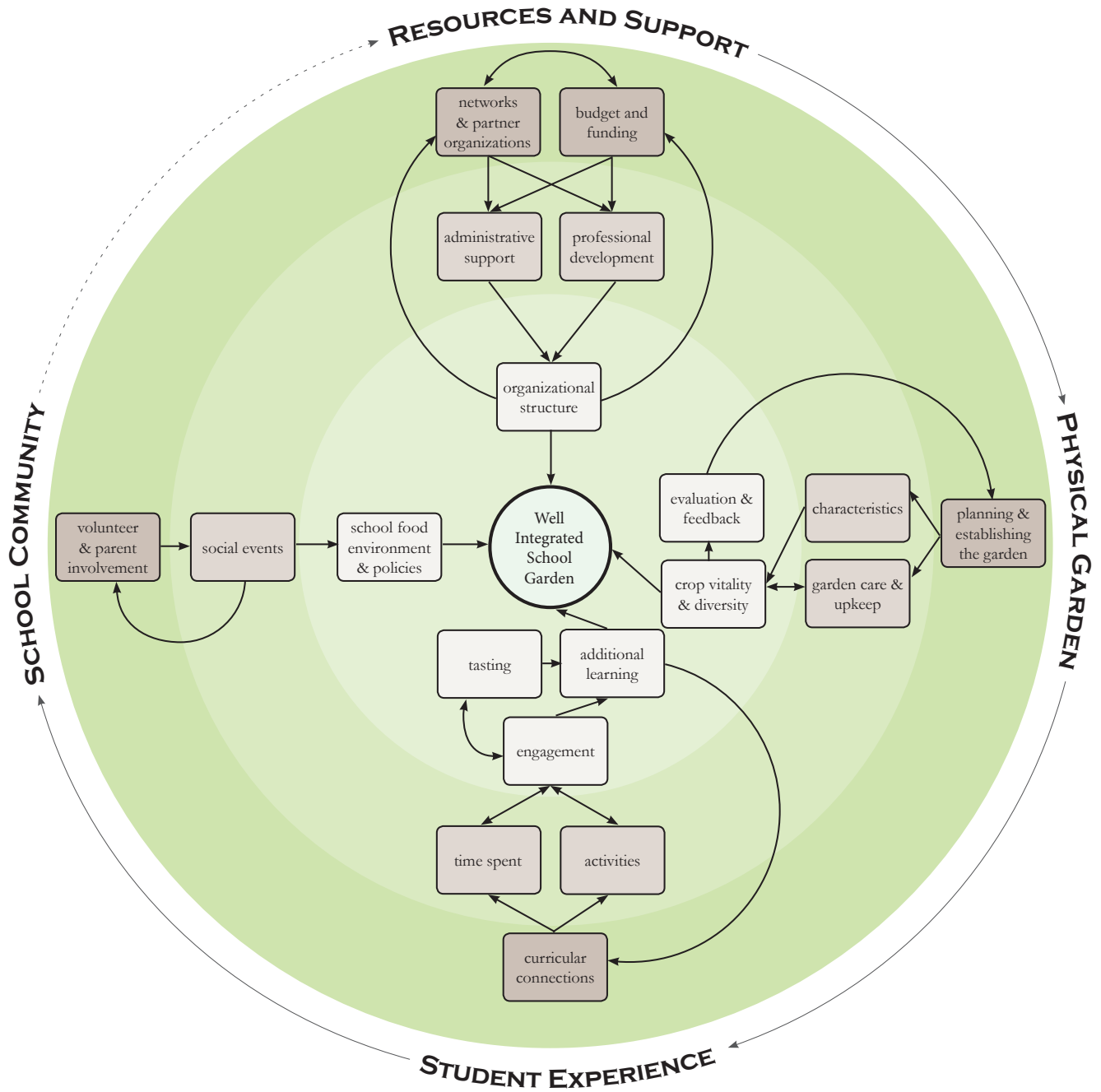
This research brief focuses on the development and use of the GREEN Tool Map. A forthcoming brief will address the Scorecard and how to use it.



### Curricular Connections

School gardeners find many creative ways to connect the garden to core and non-core subjects. Gardens can be an effective platform to teach all core subjects (math, science, and English/language arts) and all well-integrated gardens connect with at least one core subject. Teachers who have experience gardening tend to be aware of more connections to required topics than teachers inexperienced with gardening; however, inexperienced teachers tend to do more problem solving and learn with students by trial and error. In addition, teachers' and garden educators' varied personal and professional interests foster connections to the curriculum beyond mandated standards. School gardeners in NYC are also using gardens to teach history, agriculture/growing food, art, computer technology, environment and climate change, foreign languages, health, home economics, nutrition, community service, physical education, and theatre arts.

# The GREEN Tool Map





# How to Read the GREEN Tool Map

The terms around the outside of the rings are the GREEN Tool **domains**, illustrating the sequence of how gardens become integrated (beginning with Resources and Support and working around clockwise). The 19 brown-shaded boxes are the **components** of the GREEN Tool, with the arrows showing how the components flow toward a well-integrated garden.

The **rings** illustrate stages of integration. The outer ring is the Minimally-integrated stage. School gardens most often address the components in this stage first. The middle ring is the Moderately-integrated stage. This stage includes the components schools address as they become better integrated. The innermost ring is the Well-integrated stage and helps ensure that the garden is institutionalized within the school. To sustain their gardens, schools will move around the Map multiple times over the years, re-evaluating goals and taking steps toward refining the space, developing more curricular connections, and engaging more of the school community.

Of note, all school gardeners in the study that led to developing the GREEN Tool Map began with the acquisition of resources and support. Thus, Resources and Support is the point of entry into the Map.

*“Start it any way you can. Just start with something, start with an earth box. Find a sunny spot even if you have to take it out there on wheels, roll it out, roll it back in. Start small build enthusiasm and don’t give up.”* – SK, PS 84

## The GREEN Tool Domains

**Resources and Support Domain** – Adequate resources and support are the foundation for establishing a school gardening program. “Budget and funding” is the most important component and different types of gardens have vastly different financial needs. Many school gardeners described how their current operating budget was significantly lower than their start-up costs.

**Physical Garden Domain** – There is a lot of variation in the physical spaces of school gardens, therefore many strategies are used to maintain them. Garden care is initially challenging but once there is a plan in place it becomes easier. Most commonly, school gardeners design gardens to suit their motivations and their perceived needs (e.g. science education or nutrition education).

**Student Experience Domain** – There are many opportunities and benefits to students who participate in a school garden program. What students can derive from gardening varies depending on the physical space, the goals for the garden, the educator’s experience and level of interest, the strength of curricular connections, and the time available for using the garden. Linking the garden to the curriculum happens in many ways. The garden is connected to many core and non-core subjects and used to teach a wide range of topics (See Curricular Connections box, page 7).

**School Community Domain** – Successful integration of a school garden is, in part, realized when the school community as a whole is invested in the values of the garden. Involving parents, administrators, teachers, and the school food service staff can help expand the garden’s reach while social events may provide opportunities for students to freely engage with the garden.

# The GREEN Tool Component Definitions

		The GREEN Tool Domains			
		Resources and Support	Physical Garden	Student Experience	School Community
Stages of School Garden Integration	Minimally-integrated	<p><b>Budget and Funding:</b> The monetary requirement and financial estimate necessary to support a gardening program</p> <p><b>Networks &amp; Partner Organizations:</b> The interconnectedness of a school with other supporting organizations or individuals in the field of school gardens</p>	<p><b>Planning &amp; establishing the space:</b> The deliberate action(s) taken to develop and implement a strategy to maximize the garden's potential to meet the school's goals and needs for the space</p>	<p><b>Connection with curriculum:</b> The relationship, relevance, and fit of the garden with state mandated learning objectives, aims, and goals for students in a particular grade or class</p>	<p><b>Volunteer &amp; parent involvement:</b> Non-staff members of the school, neighborhood, or community become involved with the school's gardening program</p>
	Moderately-integrated	<p><b>Administrative Support:</b> Mental, practical, or other encouragement and help needed from key leaders within a school required for teachers, parents, or others to implement an ongoing gardening program</p> <p><b>Professional Development:</b> Guided learning and training provided to educators in order to improve their knowledge, skills, and comfort using school gardens as an educational tool</p>	<p><b>Garden care &amp; upkeep:</b> The physical support provided to the garden to ensure that plants, animals, or habitats in the garden have the adequate care and resources necessary for growth</p> <p><b>Characteristics:</b> The attributes of a particular garden that facilitate or promote its use space</p>	<p><b>Time spent in the garden:</b> The duration and frequency of structured educational time that students spend in the garden</p> <p><b>Activities:</b> Action taken by students in the garden</p>	<p><b>Social events:</b> Time allotted for recreational activities in or related to the garden</p>
	Well-integrated	<p><b>Organizational Structure:</b> The decision making person(s) that determines how a school's gardening program is implemented</p>	<p><b>Crop vitality &amp; diversity:</b> The robustness and variance of plant species in a particular garden</p> <p><b>Evaluation and feedback:</b> The acquisition of information relating to the effectiveness and/or efficacy of one or more aspects of a garden or gardening program</p>	<p><b>Engagement:</b> The cognitive, emotional, and behavioral involvement of students in the learning process and participation in tasks related to the garden</p> <p><b>Tasting:</b> The specific activity of trying edible plants</p> <p><b>Learning opportunities:</b> Learning facilitated by the garden that is unrelated to mandated curriculum or learning standards</p>	<p><b>Food environment:</b> The school's culture and standards for foods allowed within the school, offered to and/or consumed by students</p>

# Moving through the GREEN Tool

There can be a steep learning curve to establishing a school garden. Depending on who champions the garden, schools vary in how they address each domain. Initially, a school garden requires a lot of time devoted to acquiring more horticultural knowledge, researching academic standards, lesson writing, developing partnerships, and establishing financial investment. Teachers need to learn to teach new lessons, or familiar lessons in a new way, and sometimes face new classroom management issues.

In the beginning there is a focus on the physical space. Over time costs decrease, the garden matures, and garden educators (teachers, parents, or otherwise) become more comfortable with the lessons they teach. The focus shifts from the physical space to gaining support for and full integration of the garden into other classrooms and/or for additional uses.

As school gardeners' focus shifts from securing resources and support to establishing the physical garden to enhancing the student experience and finally to connecting with the school community, the garden becomes better integrated or woven into the fabric of the school. It becomes a valued space that inspires pride in the members of the school and, in some cases, the surrounding community. To sustain gardens over time, schools may continually move through the Map, addressing new components as the school and garden evolve.

## Conclusion

The GREEN Tool Map is the first framework to illustrate how and when to operationalize the 19 components needed to establish, integrate, and sustain a school garden. The key contacts from the study's 21 schools identified the importance of all 19 components and these components were evident in their gardens.

*“Raising chickens in [my] classroom ended up being one of the coolest things I’ve done as a teacher, just in a sense that having live animals in your classroom engages kids in, like, a really amazing way. And chickens very much demand care and attention and patience and I think it gave kids a really incredible chance to learn how to be patient in a way that’s hard to teach. It’s hard to tell someone to do, but when you work with live animals like chickens, um, it’s very, it’s very important. So we raised six chickens.”* – MH, CSS

Schools need support for each component. There is no single or “correct” school gardening model, rather, components can be combined and operationalized in different ways on an ongoing basis to create and sustain a well-integrated school garden.

As evidenced by this research, school gardens vary greatly and have unique needs and challenges. The GREEN Tool Map gives school personnel, administrators, parents, and other school community members an evidence-based, customizable means of establishing and setting goals. The Map can serve as a guide to sustain the garden over time, as it captures a “big picture” view of the necessary components for a well-integrated garden. As teachers and administrators involved in the garden end their tenure with a school, a customized GREEN Tool Map can act as a way to orient new garden leaders with the status of their gardening program, enable garden committees to work more closely together, and delegate priorities to improve efficiency and decrease redundancy of garden activities within a school. Lastly, the GREEN Tool Map and Scorecard make it easy for school personnel to identify where capacity is strong and where help is needed, and marshal resources accordingly.

# Next Steps & Recommendations

Using the GREEN Tool Map, garden support organizations, advocates, educators, and policymakers, can identify strategies, policies, and programs to ensure that school gardens in NYC are well-integrated. The GREEN Tool Map's identified domains and components give all stakeholders supporting school gardens a common language and set of strategies to make decisions around. In spring 2016 Grow to Learn is piloting the GREEN Tool Map and Scorecard in several schools to help refine the support it offers.

NYC government provides some support for school gardens. In addition to the city's collaboration on Grow to Learn, the Department of Education's Garden to Café Program connects school gardens to their cafeterias with the goal of increasing students' knowledge of healthy food, farming, and the local food system. However, these two programs have limited capacity to support the growing number of school gardens in NYC.

The following are recommendations that could further support NYC school gardens, identified through the research that led to the development of the GREEN Tool:

## **1. Strengthen Grow to Learn's (GTL) capacity.**

GTL is perceived by NYC garden leaders to be the primary resource for school garden support. Their programs and services address many of the GREEN Tool Map's domains and components, especially in the outer rings of the Map. Schools can apply for GTL mini-grants to establish or expand gardens. GTL also provides technical and professional development to school gardeners, offers workshops and networking opportunities, and connects school gardens with free supplies. Despite the great success that GTL has had with limited funding, they have primarily focused their efforts on helping schools establish gardens. With more capacity, along with using the GREEN Tool, GTL would be better equipped to assist schools to integrate and sustain gardens.

## **2. Connect gardening to the NYC Core Curriculum:**

As addressed in the Map's Student Experience Domain, engaging and meaningful curricular connections are foundational to a well-integrated garden, to advance student learning and to warrant teachers' and administrators' time and attention. Teachers using gardens, particularly those with little horticultural knowledge or understanding of gardening, would like to have DOE-approved lessons and/or full garden-based curricula clearly linking the garden to educational objectives. While GTL has compiled many curricular resources on their website, they do not have direct connections to the New York City Scope and Sequence. A curriculum expert should collect, evaluate, and disseminate the many lessons teachers have already developed and create or adapt others for all grades and subjects.

## **3. Identify and support borough-based coordinating organizations:**

Supportive networks and partners are identified in the Map's Resources and Support Domain as fundamental supports on the path to a well-integrated garden. In addition to GTL, organizations that partner with and support school gardens are spread throughout all five boroughs. However, teachers and other garden leaders often have difficulty finding and taking advantage of these opportunities because they are perceived as too hard to access. NYC could fund a coordinator at one organization in each borough (e.g. botanical garden, nonprofit such as Edible Schoolyard NYC, etc.) who could match school gardens with local resources, as well as help coordinate and network among nearby schools. These borough coordinators could also promote gardens to schools that do not already have them. Staff based at these organizations should be linked to GTL so there is a feedback loop between place-based information and GTL's role as a citywide hub of school garden support.



## Case Studies



# Well-integrated School Garden Case Study 1: PS 29

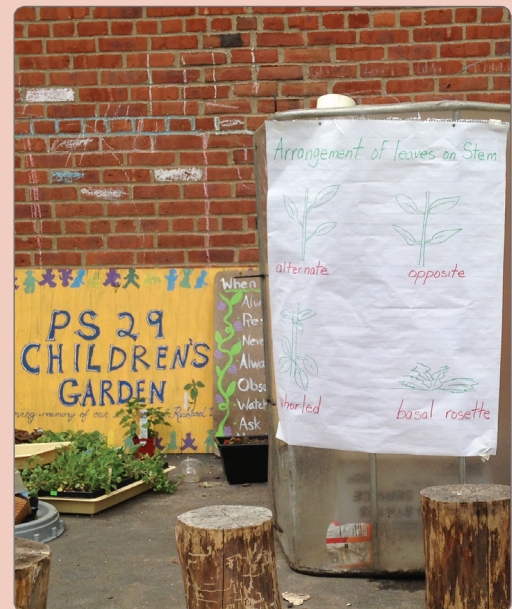
PS 29, in Carroll Gardens, Brooklyn is home to an outdoor raised bed and container garden.

## How it was established

*A science teacher's convergence of ideas:*

1. The science teacher wanted to grow edibles at school (to date, she had only grown flowers).
2. She also noticed that students were not making as many life connections to plant units as they could be using a garden as a learning tool.
3. The administrators and teachers were interested in orienting themselves more closely, as a whole and within the curriculum, to sustainability.
4. Parents were interested in a more relevant nutrition unit.

Teachers, parents, custodians, school food chefs, and the principal had a strategic meeting about how to make food and farming more resonant within the school and the community. Money was raised through a Grow To Learn mini-grant and networking with other partner organizations. Families, teachers, administrators, and local community groups donated time to install raised beds.



# Well-integrated School Garden Case Study 1: PS 29 (continued)

## Steps toward integration within the four GREEN Tool domains

The PS 29 garden committee has taken several important steps to integrating the vegetable garden in the school, including:

### School Community

Expanding the garden to include enrichment and cooking and re-envisioning school lunch:

1. Teachers make connections to the garden outside of science classes. Grades K-2 participate in cooking and students in grades 3-5 can participate in the garden as part of a required enrichment activity.
2. The school lunch has been reoriented toward more healthy, fresh foods, through SchoolFood's Alternative Menu as well as supplements of garden produce.

### Resources and Support

Gathering additional funding and support:

1. The original garden committee delegated tasks and developed methods to recruit new parents into the garden committee.
2. Parents undertook additional grant writing and teachers developed curricular connections across educational units.

### Physical Garden

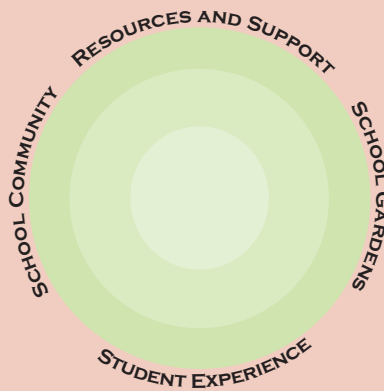
Altering the physical characteristics of the garden:

1. The garden was enclosed with a fence, which made it a separate space from the playground, increasing the opportunities to use it as an outdoor classroom with fewer interruptions.
2. The school added additional features, like tree stumps for students to sit and/or have writing surfaces to complete assignments in the garden.

### Student Experience

Enriching students' experiences:

1. The garden is incorporated into all science classes at all grade levels.
2. All students have access to the garden before, during, and after school through clubs. This creates multiple opportunities for students to get involved in gardening.



# Well-integrated School Garden Case Study 2: PS 333

PS 333 on the upper west side of Manhattan is home to a rooftop, greenhouse, aquaponic hydrofarm classroom.

## How it was established

Parents' desire for more inquiry-based, explorative, experimental science learning:

1. Two parents spearheaded the initiative and founded New York Sunworks, an organization dedicated building environmental science labs, using hydroponic and aquaponic systems, adapted for schools.
2. The goal was to teach sustainability and science through hands-on urban farming that connected students' daily lives.
3. The principal became very involved with the parents spearheading the project to raise funds, find space, and work with the Department of Education's School Construction Authority to build out the school's rooftop.

The result was a 1,500 square foot dual use greenhouse and science classroom on the roof of PS 333. The greenhouse consists of hydroponics, aquaponics, rainwater collection, composting, and a traditional classroom area with tables and chairs for students to work.



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# Well-integrated School Garden Case Study 2: PS 333 (continued)

## Steps toward integration within the four GREEN Tool domains

The partnership with New York Sunworks resulted in a physical space conducive to year-round garden-based learning for students. PS 333 has taken several important steps to integrating the hydrofarm into the school, including:

### School Community

Expanding involvement of students and parents:

1. The school has developed many clubs and activities around the garden. One example is the CCC, or Caring for the Community Club. Students gather produce and prepare salad for the whole school and/or harvest and deliver produce to a local nursing home, only a few blocks away.
2. Though more parent involvement is needed, the hydrofarm teacher maintains Facebook and Instagram accounts in order for parents to stay updated with the current hydrofarm news and events.

### Resources and Support

Providing support:

1. The principal became less involved so that teachers could become more involved. Professional development for teachers became a regular, ongoing activity, to help translate lessons students learn in the science classroom to other topics.
2. The need for a complete organizational structure was made obsolete by raising enough funds to hire a full-time teacher dedicated to the hydrofarm.

### Physical Garden

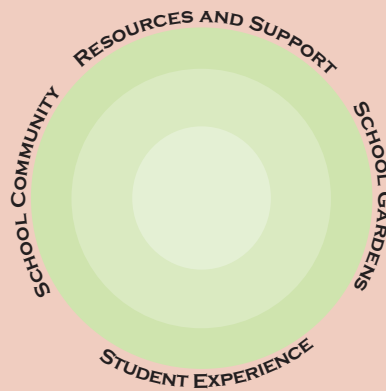
Focusing on crops and experimentation:

1. Few alterations were made to the physical space once it was established, given the expertise that went into development. Focus shifted to components "deeper" in the Map, like crop diversity and yield.
2. A lot of garden care and upkeep was needed immediately to maintain the hydroponic and aquaponic systems. The school enlisted the help of parents and New York Sunworks volunteers alike.

### Student Experience

Enriching students' experiences:

1. The hydrofarm lessons are full science units, covering mandated standards, that link to larger issues, such as climate change and sustainability. Older students create year-long culminating projects.
2. Tasting in the classroom and the lunchroom are a primary experience in the hydrofarm. The hydrofarm teacher works closely with the school's chef for students to taste fruit, vegetables, and salads regularly.



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