

GREEN HORIZONS

CAREERS IN THE ENVIRONMENT AND NATURAL RESOURCES

Design of the Green Horizons Careers booklet was supported by a special grant from The F. A. Bartlett Tree Expert Company.



The Green Horizons Careers booklet was sponsored in part by the NYS Department of Environmental Conservation.



Green Horizons is a collaborative educational project, sustained by the following:



For more information: visit www.MagnoliaTreeEarthCenter.com or www.eeac-nyc.org

Table of Contents

Careers & Resources

Green Horizons is an annual collaborative event for middle school students, held each October at a site in one of the 5 boroughs of New York City. Students, teachers and counselors who attend learn about a wide variety of natural resource and environmental careers in a “hands-on” way, working closely with professionals who volunteer their time to share their expertise and enjoyment.

The **Green Horizons Careers** booklet provides guidance beyond the actual event and will assist young people interested in the careers that are presented. It will be useful in choosing high schools, curriculum subjects, internships, and, eventually, post-high school education or training.

Many thanks to the following institutions that have provided free or low-cost venues for the **Green Horizons** events over the past 20 years: Brooklyn Botanic Garden, Central Park Conservancy, New York Botanical Garden, Queens Botanical Garden, Snug Harbor/SI Botanical Garden and Van Cortlandt Park of the NYC Department of Parks & Recreation.

Green Horizons is made possible by the support of hundreds of volunteers each year and by the generous financial and in-kind sponsorship of Con Edison of New York, The F. A. Bartlett Tree Expert Company, Davey Tree Expert Company and Davey Resource Group.



Editor/Researcher: Nancy A. Wolf, *JLN WOLF, Inc.*
 Designer: Leslie Kameny, *Kameny Design*
 Photos: Brooklyn Botanic Garden, Con Edison, NYS Department of Environmental Conservation

Advisory Committee:

Susan Gooberman, *Environmental Education Consultant*
 Mary Kramarchyk, *NYS Department of Environmental Conservation*
 David McMaster, *The F.A. Bartlett Tree Expert Company*
 Gregory Owens, *NYS Department of Environmental Conservation*
 Mala Ruzi, *Berta A. Dreyfus IS 49, Staten Island*

PAGE 3
 Exploring careers in the environment and natural resources
Letter to Students

PAGE 4
 Defining Terms
What is an Urban Environment?

PAGE 6
 Urban Farming
Agriculture

PAGE 7
 Protecting Water Quality
Aquatic Ecology and Environmental Engineering

PAGE 8
 Planting and Caring for Urban Trees
Arboriculture

PAGE 10
 Arbor Rx: CSI for Healthy Trees
Arboricultural Research

PAGE 11
 Monitoring Air Quality
Atmospheric Science

PAGE 12
 Exploring Geology and the Earth's History
Earth Science

PAGE 13
 Finding and Researching Insects
Entomology

PAGE 14
 Building “Green” Structures
Environmental Architecture

PAGE 15
 Teaching about the Environment
Environmental Education

PAGE 17
 Designing with Flowers
Floriculture

PAGE 18
 Gardening in Botanical Gardens, Parks and the Community
Horticulture

PAGE 19
 Designing a Plan for the Land
Landscape Architecture

PAGE 20
 Water All Around!
Marine Careers

PAGE 22
 Weather Forecasting and Climate Change Research
Meteorology and Atmospheric Science

PAGE 23
 Help for Birds and Other Animals
Ornithology, Zoology and Wildlife Management

PAGE 24
 Studying and Improving Soil
Soil Science Research

PAGE 25
 Solar Energy for the Environment and Economy
Solar Energy Production

PAGE 26
 Working in the Forest of the Urban Environment
Urban Forestry

PAGE 28
 Helpful Resources
Public High Schools to Consider

PAGE 29
 Helpful Resources
Colleges and Universities

PAGE 30
 Helpful Resources
Governmental Agencies

PAGE 31
 Helpful Resources
Non-profit Organizations



Dear Students:

Q. Do you like being **outdoors**? Do you enjoy **science** and **math**? How about **geography** and **mapping** and **natural history**? Have you participated in **tree-planting** at school or at home or perhaps helped to create a **flower** or **vegetable garden**? Are you curious about **plants** or **animals**?

A. If the answer is **“yes”** to any or all of these questions, you may be interested in a career in the environment and natural resources. This booklet can be your guide.

We all live in an urban environment that is an exciting place to explore and discover. The careers described in the booklet focus on caring for our environment. Working in one of these jobs will allow you to help create more healthful surroundings and provide a better life for yourself and others. Though each one is described separately, many of the careers overlap; those working in the environmental field often work closely together.

Some of the careers described in the booklet are learned “on-the-job” right out of high school. Others require a professional certificate that can be earned in a year or two. Many of them, such as scientific research, require at least two or four years of college or even graduate school. As you learn more about careers that interest you, one important question will be: how much education do I need to prepare for this job?

In the booklet, there are also lists of high schools and colleges or universities you may want to consider attending. All of them offer courses that can be important and interesting to you. There are also lists of organizations and governmental agencies that provide up-to-date information. As you grow older, you may be able to find internships or summer jobs through the contacts we have provided.

Best of all, the jobs described in the booklet are here in this country. They will not be “out-sourced” or go away. They exist for the present and the future.

What is an Urban Environment?

You may want to think about making one of the careers described in the booklet a part of your future. But, first, you need to know what makes up the special urban environment we are all part of:

Backyards

The closest bit of nature may be the one right next to the front or back of your own house or apartment building. Investigate these spaces for trees, shrubbery, flowers and urban wildlife, such as birds and squirrels.

Parks

Parks are a big part of the urban environment and they provide us with many trees and flowers, lakes and ponds, and places to play. New York City has famous large parks, such as Central and Prospect, but also many smaller parks in neighborhoods across all boroughs.



Closed landfills

New York City used to dump its garbage and trash into large dumps at the city's edges. Often, these landfills destroyed wetlands that should have been protected. All our landfills are now closed and they are being turned into huge parks and grasslands that help re-create some of the plants and habitats that once were there.

Natural Woodlands

The city also has many areas where trees and other plants have grown on their own. Some of them are remains of the landscape that was here before so many buildings, streets and sidewalks were built. New trees and shrubs are now being planted in our woodlands to create a healthier forest.



Creeks and rivers

The city has underground creeks that become visible as they empty into surrounding waters. Our one real river is Bronx River, an important food resource and habitat for wildlife all along its path.

The Atlantic Ocean, with hundreds of bays, tidal lands and inlets.

We have miles of shoreline, including many beaches that form our marine environment which supports thousands of special plants and animals that thrive in salty water.

Street trees

Thousands of trees are planted along our streets. They beautify our neighborhoods and provide cooling shade in summertime. Birds and small mammals such as squirrels obtain food from them. As the trees take in carbon dioxide and put out oxygen from their leaves, they help purify the air we breathe. Street trees are planted by city agencies, by neighborhood groups or by individuals who just love trees and want to see more of them.

Botanical gardens, community gardens, and even cemeteries

These valuable areas provide a combination of lawns, trees, shrubs, flowers and vegetables that create special environmental spaces.

Swamps, marshes and stream banks

These crucial wetlands provide very important habitats for birds and other creatures. They are critical for control of water running off the land and for protection from floods. In addition, special low areas called curbside rain gardens are now being built along streets and in parking lots to capture rainwater before it runs off into the sewers. Rain gardens can help provide water for street and park trees.

Ambient Air

Last but not least is the ambient air around us, which we take for granted but which is essential for life.

Agriculture

Many parts of New York City used to be covered in farms and the produce was sold in local markets. But, gradually, the city's land was sold to become part of business, industrial and housing developments and most farms disappeared. Today, there are farm museums in Queens and Staten Island that allow us to learn about the ways successful farms were run in the "old days". Modern farming can also be learned at John Bowne High School in Queens, which has special courses, including the raising of small animals.

Over the past few years, **Farmers** have reappeared in New York and a new career in Urban Farming has begun to succeed. Many **Farmers** got their start by actively growing crops in community gardens and decided to find enough open land to grow many more. They are growing food for their own families, but often sell extra produce at their garden sites or donate to neighborhood organizations that help distribute food to the community.

One successful urban farm is at Snug Harbor Cultural Center and Staten Island Botanical Garden; vegetables from this garden are marketed to small restaurants and at a weekly farm stand. Left-over produce is donated to Project Hospitality, an organization that helps the needy. Other botanical gardens also

urban farmer

Many urban farmers got their start by actively growing crops in community gardens and decided to find enough open land to grow many more.

have demonstration gardens staffed by **Farmers** or **Horticulturists**.

Some **Farmers** have even found space to garden on rooftops. Using specially prepared sites that can take the heavy load of soil and water, they have created businesses that support owners and employees and help provide food for various restaurants and markets



Another new farming technique is bringing back fruit trees to the city in **urban orchards**. Re-creating stands of fruit trees like cherry and apple that used to be part of many neighborhoods has given an additional way to succeed as a **Farmer** and offer fresh food to city dwellers.

The city's Green Markets have helped the "locavore" effort become larger, year by year, with over 200 **Farmers** from the city and nearby areas selling their products.



learn more online

SEARCH: Urban Agriculture, Farming, Urban Orchards, Agronomy

Aquatic Ecology and Environmental Engineering

Water Quality Scientists and **Environmental Engineers** have crucial jobs in providing and protecting water for our urban environment. Abundant supplies of clean, potable water are a "must"; humans and animals cannot live without water. Plants cannot grow and survive without water. As cities and their surrounding areas grew over the past 200 years, the demand for water increased. This demand is still growing today.



Supplies of clean water for large cities like New York are overseen by **Water Quality Scientists** who find and monitor water sources, either underground or by capturing water from springs, creeks, lakes and rivers. These sources are brought together to provide drinking, bathing and cleaning water for homes. They must also provide essential water for business and industry and for general public use. They are critical for control of fires.

The water supplies must continually be tested to make sure that they are safe from pollutants, so that illness is prevented. Both



learn more online

SEARCH: Water Quality Testing, Water Supply Systems, Aquatic Science, Environmental Engineering

water quality scientist

Supplies of clean water for large cities like New York City are overseen by water quality scientists who find and monitor water sources.

state and federal governments have created laws and rules for clean water that must be followed. Regular samples of water are taken and studied in labs to determine the cleanliness of the water at any point.

Once good water supplies have been identified, **Environmental Engineers** plan and construct the system that brings the clean and monitored water to the users. In the early days of New York City, people relied on underground wells that were soon over-used. The water became polluted and was not safe. Today, like many other cities, we are able to obtain water through a huge system of reservoirs, aqueducts and pipelines that bring supplies to the millions of users, both at home and on the job.

Environmental Engineers work constantly on the system that already exists so that proper maintenance is in place. In addition, they plan and construct new parts, such as additional pipelines or treatment plants.

Although most professionals who are in charge of providing clean water work for governmental agencies, there are also jobs for **Water Quality Scientists** and **Environmental Engineers** in private industry. Non-profit organizations that help the public oversee clean water systems also employ these professionals.

Arboriculture

Arborists have special training in the science, planting and care of urban trees. Many of them have studied at colleges or universities, but there are also “learning by doing” certifications from botanical gardens, for example. Companies like Bartlett Tree and Davey Tree accept applicants with high school diplomas and provide “on the job” training.

Most **Arborists** work “in the field”, meaning in parks or playgrounds or on city streets. They often advise homeowners who want to plant trees in their yards. They work with **Landscape Architects** and construction companies that need trees to be planted around new or renovated buildings. They work closely with **Urban Foresters** on many projects.

Some **Arborists** work for governmental agencies like the city Parks Department or the state Conservation Department. Many work in botanical gardens, such as those in Brooklyn, Queens, the Bronx and Staten Island. Managers at special parks, such as Central and Prospect, also employ **Arborists**. Non-profit organizations and private companies, employ Arborists, as well.

Once the species of trees for planting have been chosen, **Arborist, Urban Foresters** and **Landscape Architects** often travel to plant nurseries to select the best and healthiest trees for their

arborist

Most arborists work “in the field”, meaning in parks or playgrounds or on city streets.

jobs. They are then the “hands-on” people who actually help plant trees into selected sites. They know how large the tree pits should be, how wide and deep to make the hole for planting, and how deeply to plant the tree. Then they make sure the trees’ roots are properly covered and a mulch of wood chips or other organic material is applied. Many times, they add stakes to the trees to help them stand upright during the first one or two years of growth.

After the trees are planted, **Arborists** and **Urban Foresters** keep tending them. They water them regularly, especially during the first two years, and keep track of any droughts that may reduce rainwater needed for ongoing growth. During droughts, they often help to organize public campaigns for citizens to help water street trees.

From time to time, **Arborists** also prune the trees as they grow. They need to take off dead or dying limbs, eliminate branches that interfere with each other and create more open space for light and air. They know that proper pruning helps trees to grow better and stronger and provide benefits for many years.



learn more online

SEARCH: Arboriculture, Urban Forestry

Arboricultural Research

Trees are an important part of our urban environment, but they don't always have an easy time surviving and thriving in the midst of so many buildings, with acres of concrete and miles of asphalt pavement. Polluted city air makes it difficult for some of them to grow well. Sometimes they aren't watered enough during droughts or they may receive too much water in a rainy season. But urban trees have proven to be hardy. Despite it all, we are able to enjoy a city with millions of beautiful trees in parks and playgrounds and along the streets. New York City has recently sponsored a successful Million Trees Initiative, in which more than a million new trees have been planted over the past few years. More will continue to be planted every year.

Much of the success of urban trees comes from the work of **Arboricultural Researchers**. They are highly trained scientists who work for universities and in government agencies or for leading tree care companies. Their information has helped **Urban Foresters** and **Arborists** learn to plant the right trees in the right sites and with the right tools and techniques. They learn better care of trees once they are planted, including proper pruning. They are taught to recognize trees that are diseased or possibly dying so they can remedy the situation or perhaps remove the trees

arboricultural researcher

Much of the success of urban trees comes from the work of arboricultural researchers who are highly trained scientists.

before they fall and hurt someone or cause property damage.

Arboricultural Researchers create test sites in their outdoor labs and study the roots, trunks and branches to improve the structures of trees and identify those specimens that show best growth. They experiment with different planting techniques and test how specific trees survive extremes, such as cold and heat. They experiment with differing kinds of soils and measure how much water various tree species may need to thrive. The results are written for publication in printed materials and on the internet for practical use by those working in the field.

Arboricultural Researchers are also relied upon for information about insects and diseases that harm trees by preventing good growth or perhaps causing their death. In addition to their own studies, they are often asked to diagnose these conditions through soil and tissue samples sent to their labs. This information is valuable to all those working in urban forestry, arboriculture, horticulture and forestry, in printed materials, online or by workshop presentations.

Atmospheric Science

Air Quality Scientists are professionals who measure and monitor the air and help us determine its safety. The ambient air surrounding us is vital since we know that clean air is necessary for our life and health. But certain types of pollutants have created problems – many of them invisible by normal sight – and we know that breathing them for a long period of time can be unhealthy. Because air quality is so important, the federal and state governments have special laws and rules to help decide whether air in particular places is safe or not.



Air Quality Scientists are continuing to develop methods to identify pollution and to measure its effects on the health of humans, birds and other animals. They use many instruments to capture the information for study in their labs. They are guided by the air quality rules and it is their responsibility to share their research and findings so that decisions can be determined if air in a certain place is safe for people to breathe.

air quality scientist

They work often in labs, but also in the outdoors, taking samples that will be analyzed and that form the basis for difficult decisions.

Air Quality Scientists work often in labs, but also in the outdoors, taking samples that will be analyzed and that form the basis for difficult decisions. For example, if a certain source is proven to create harmful pollutants, the government may rule that it be shut down or changed so that it helps clean up the air.

Even if air quality is found to be safe for a particular area, we know that it is affected by air from around the world. Wind and air currents are world-wide, so pollutants from a smoke stack thousands of miles away can affect our air here. **Air Quality Scientists** confer with others and share data as they help to make decisions. They often publish their findings in scientific journals and on the Internet so they can be compared with findings in other places. This work helps the government review and sometimes change laws and regulations for clean air. Nations are learning to work together on this important issue.



learn more online

SEARCH: Arboriculture, Arboricultural Research



learn more online

SEARCH: Measuring Air Quality, Atmospheric Science, Climate Science

Earth Science

Geologists study a special part of the environment – the rocks that lie under the surface of Planet Earth. This is a fascinating field that includes materials such as igneous, sedimentary and metamorphic rocks, as well as minerals and gemstones. Beautiful jewels that become rings and bracelets are found under the Earth. By studying rocks, **Geologists** can also learn about the history of Earth, providing important information on what life was like in ancient times. They often do their studies as employees of a university or a museum or major science center.

Some **Geologists** are an important part of the work of construction companies that plan and erect buildings, roads, railroads and bridges. Nothing can be put on top of the ground that cannot be supported by the land structures underneath. **Geologists** are often the ones who “go first” on major projects.

Geologists also play an important role in energy development by identifying the locations of fossil fuels (such as coal and natural gas) and geothermal (underground hot water) that can be accessed for use in heating and cooling buildings.

While some of the work that **Geologists** do is excavating or exploring caves, they are also able to study above the ground, on rocky cliffs or by just picking up stones wherever they are found and bringing

geologist

By studying rocks, geologists can also learn about the history of Earth, providing important information on what life was like in ancient times.

them back to labs for observation. The American Museum of Natural History has a large and important collection of rocks that have been studied for many years and are also in exhibits for anyone to see.



New York City is particularly interesting for **Geologists** because there are so many different types of rocks under the five boroughs. One reason that so many very high buildings can be erected in Manhattan is because of the hard rock known as schist that underlies so much of that borough. The whole city is at the end of the **terminal moraine** from the glacier that covered much of New York about 10,000 years ago. The terminal moraine is the expanse of boulders and rocky soil that was left behind as the glacier melted. You can see some of the huge boulders left from the glacier in the Brooklyn Botanic Garden and Van Cortlandt Park in the Bronx.

Entomology

Scientific research on all aspects of natural life leads to many jobs that establish careers lasting a lifetime. One focus of research is on insects, which are recognized as essential to life on Earth. **Entomologists** with many levels of education study all types of insects in their habitats; today's **Entomologists** study the past natural history and build on this with new experiments and knowledge.

As a vital part of the Earth's ecosystem, insects have one of the longest life histories on the planet. They inhabit sky, water and land and even combinations of all three. As life evolved, some insects became part of the life of plants; today, many plants depend on insects for their survival. Without insects to pollinate them, most plants, including the food crops that we eat, will not be able to reproduce. Other insects may not survive without food from particular plants. For instance, the Monarch butterfly depends on the food supply from certain milkweed plants.

Insects have also evolved with animals such as mammals. Not only do some insects provide animals with food, but they can also be vectors of disease that may be carried by those animals. Research by **Entomologists** especially helps to keep the urban environment safe, where so many people live closely together. Insects also play a major part in the life cycles

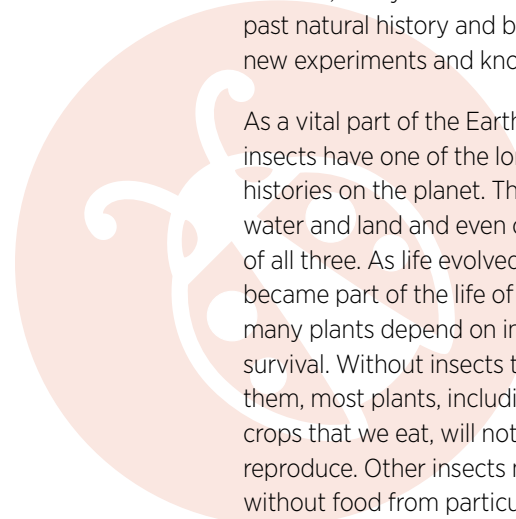
entomologist

Most work for various governmental agencies and their findings are shared world-wide, through cooperation among nations.

of animals, including helping to dispose of the remains of those who die. Insects such as termites also clean up waste wood and other materials that otherwise would cover the landscape. They are a critical part of biology and ecology and environmental management.

Research by **Entomologists** is highly connected to the field of medicine, as many serious diseases across the world are caused by the bites or stings of insects. Likewise, agriculture and forestry are highly dependent on scientific information about what insects may help or damage crops and trees. They need help in knowing whether certain insects are helpful or destructive and how to deal with them in an ecological way.

Most **Entomologists** work for various governmental agencies and their findings are shared world-wide, through cooperative arrangements among nations. Others are on the faculty of universities and colleges, which often have their own outdoor research properties. Valuable information and discoveries are shared in this network, as well. Trained **Entomologists** also work for corporations whose work requires the control or elimination of harmful insects.



learn more online

SEARCH: Geology, Coal, Natural Gas, Geothermal Energy

learn more online

SEARCH: Entomology, Insects

Environmental Architecture

A career in architecture requires a great deal of special training in design and in construction. With few exceptions, most new buildings require a licensed architect to create detailed plans and have them approved by a local governmental agency. In many cases, renovations or changes in older buildings also require these plans. Plans will include how large the building will be, how many rooms or other spaces will be created and what materials, such as steel, bricks or concrete, will hold it up and make it secure.

Environmental Architects are leading other architects and the building industry in the recognition that houses and other buildings can be built in harmony with ecology and the surrounding environment. Their work focuses on identifying special designs and building materials. They design construction plans that help new houses, apartment buildings and other structures save energy and result in healthier conditions for those who live or work in them.

Environmental Architects choose windows and doors that block out both cold and hot air and save indoor energy. They choose plumbing that limits water use. Solar panels often contribute to heating systems and save fuels or the use of electricity. Special lighting fixtures

environmental architect

They are leading architects and the building industry to understand that houses and buildings can be built in harmony with the environment.

are energy-efficient and often will automatically turn off when not in use. On the outside, they choose weather-resistant roof and wall materials that will hold up under sun and rain. They can design gutter systems that controls rain water to lead into an irrigation system for the surrounding landscape. They design “green roofs”, particularly for large buildings, where special plants capture water and keep the building cooler. Sometimes these “green roofs” can be used for growing food.

Buildings that are designed with environmental choices may cost more because of the special materials that are used. However, the energy savings over time often help to pay back the extra costs. For example, solar collectors can help owners pay less for electricity and even receive payments or credits for electricity that they provide to the electric company.

The work of **Environmental Architects** has been nationally recognized. The US Building Council has created certificates under a program called **Leadership in Energy and Environmental Design (LEED)**. Depending on a specific building plan, it can be designated as a Platinum or Gold LEED building and receive state or federal tax credits.

learn more online

SEARCH: Architecture, Environmental Architecture, Energy Conservation, Building Design

Environmental Education

Science has always been a part of education and teachers have taught it in many ways. **Environmental Educators** are teachers who are creating new ways of teaching that help students understand the connections to their real life and their surroundings. Teachers and students are part of teams that seek to observe and understand the natural life of their indoor and outdoor environment and how to make it better and sustain it.

Environmental Educators plan “hands-on” lessons, where students learn by their own discoveries, as well as from books and computer information. They have classroom terrariums or fish tanks for daily observation. They may measure weather and temperature by mounting thermometers or barometers at schoolroom windows. They actively save paper, plastic or metals for recycling and learn about the problems of waste disposal. They visit the school boiler room to learn about how the building is cooled or heated.

Many lessons in environmental education take place outdoors on field trips. Sometimes, students travel to parks or woodlands or beaches to study plants that grow there or animals that live on land or in the water. They are discovering the plants or animals as they live in their own environment or habitat. The students

learn more online

SEARCH: Environmental Education, Teaching about the Environment

environmental educator

They plan “hands-on” lessons, where students learn by their own discoveries, as well as from books and computer information.

make records of their observations to take back to the classroom.

Other field trips take place in the neighborhood, where students observe trees that are planted on the streets, or study and map the “built environment” of sidewalks, fences or walls that may be covered with plants or create homes for



insects or other tiny creatures. No matter how urban it may be, nature will be there in some way.

Many **Environmental Educators** teach in schools as regular teachers. Others, who have special training, teach at environmental centers in parks or summer camps. Many work for governmental agencies or for non-profit organizations. Environmental education has been recognized as an important part of the education of every student.



Designing with Flowers

Floriculture

Floriculturists may work as **Horticulturists** in botanical gardens or parks or museums. They are responsible for the design of exhibits that illustrate themes from nature or literature or the art world. In good weather, the exhibits may be outdoors and feature plants such as a rose collection or designs of shrubbery. Exhibits may also be designed for indoors, such as in a greenhouse, and these are especially popular at winter holiday time.

New York City's botanical gardens offer outstanding examples of the work of design through floriculture and horticulture. During the Thanksgiving/Christmas season, the New York Botanical Garden's Train Show in its greenhouse features model trains running through a "landscape" all made of plants. At the Staten Island Botanical Garden, designers from China have created a "Scholars' Garden" for meditation. The Queens Botanical Garden has a special wedding garden with chosen plants that relate to this celebration. At the Brooklyn Botanic Garden, there is a Shakespeare Garden featuring all the plants mentioned in his plays.

Many other **Floriculturists** are employed in retail nurseries, garden centers or small flower shops located in many neighborhoods. They work directly with

floriculturist

Many are responsible for the design of exhibits that illustrate themes from nature or literature or the art world.

customers who are purchasing flowers or other plants for their own homes or gardens. Most of the plants are in pots or large containers and all of these must be carefully tended as part of the job.

Floriculturists working in centers or shops often have special training in floral design, which can be learned on-the-job or by taking certificate lessons at botanical gardens. They prepare bouquets or wreaths that people need for special occasions, such as weddings, graduations or memorial services. Often, they are advising on purchases of flowers for customers to take home and arrange themselves. This career is one that offers many types of jobs for those with high school diplomas or with additional training.



learn more online

SEARCH: Horticulture, Floriculture, Nurseries and Garden Centers

Horticulture

Gardeners love working directly in the soil and creating spaces for beautiful flowers or other plants. Even in our urban environment, almost everyone can be a **Gardener**, even if it's only in a small backyard or courtyard or in containers on a fire escape.

Those who choose a career as a **Gardener** or **Horticulturist** often work for the Parks Department in parks across the city. Some work for the Housing Authority or for private developers, helping create gardens around the City's many large buildings. Many others work in botanical gardens in all five boroughs. Some work for private companies or for organizations that sponsor community gardens.

Horticulturists work on a year-round schedule that follows the seasons. In early spring, they remove mulch and other materials that have covered the planting area and begin turning the soil to make the beds ready for seeds or for plants that are moved from greenhouses or other indoor spaces. Some plants may have been "over-wintered" indoors in containers or **Horticulturists** may propagate new plants through cuttings and grafting. Under the soil may be bulbs or roots of flowers or vegetables that are ready to grow in the new season. The bulbs may have been planted a long time ago and will grow year after year or they may have been planted in the previous fall.

horticulturist

Horticulturists work on a year-round schedule that follows the seasons.

As plants grow, **Horticulturists** must tend to them regularly, especially by watering. Very few plants can thrive if they do not receive the right amount of water, either through good rainfall or by special "soaker" hoses or by hand. As **Horticulturists** know, some plants survive very well with little water, but many others need a great deal, even several times a week. They also prune the plants at specific times that help them grow better over time.



During the winter, Horticulturists focus on plants that grow indoors, in pots or planters or in specially prepared areas in greenhouses. Their work with **Floriculturists** through the winter helps to create special exhibits at holiday time, or provide ongoing green beauty when the outdoor landscape is in its dormancy,

Landscape Architecture

Landscape Architects combine art, mapping and knowledge about plants to create designs for new spaces in the urban environment. Or they may re-design spaces where the use of the land will be changed. They often work closely with **Urban Foresters** and **Soil Scientists** as large city projects are prepared.

Landscape Architects also team with builders who are planning large office buildings or apartment houses and with those who want to build or renovate a family home.

After the buildings are erected, they create the design for new trees, shrubs and flowers that will surround the outside. Builders and home-owners help with the design as it is prepared.

Landscape Architects then order the trees, shrubs and flowers and supervise the planting of what has been chosen. They work closely with **Arborists** in this part of their jobs. They help to create green infrastructure that respects the environment and helps to improve it.

Community gardens are also sites for the work of **Landscape Architects**. As community activists adopt un-used and neglected lots in their neighborhoods, they often need professional advice in planning what should be designed and planted.

landscape architect

They combine art, mapping and knowledge about plants to create designs for spaces in the urban environment.



One large project in New York City where **Landscape Architects** employed by the Parks Department are working is Fresh Kills Park in Staten Island. Fresh Kills was once a huge landfill, where garbage and trash from around the city were deposited each day. Several years ago, Fresh Kills was closed as a landfill. Now **Landscape Architects** are working to create a park that will be one of the city's largest green and open spaces.



learn more online

SEARCH: Horticulture, Gardening



learn more online

SEARCH: Landscape Architecture

Water All Around!

Marine Careers

New York City is surrounded by water: the Atlantic Ocean, Jamaica Bay and many other inlets, the Upper and Lower Harbor, the East River and Harlem River (not true rivers, but bodies of connecting water), Long Island Sound and, of course, the mighty Hudson River. All these waters are salty or brackish, which is a combination of salt and fresh water. The exception is the fresh-water Bronx River, flowing south through the Bronx to the Sound.

With this huge marine resource, many environmental careers are possible, including **Marine Science Biologist** or **Ecologist**, based on biology and zoology, **Marine Geologist**, exploring the effects on the water from the earth under the bottom, and **Marine Conservationist**, whose work focuses on the protection of the water environment and its vast wildlife. All of these careers demand extensive work beyond high school, with the focus on science and math.

Many other careers, such as those in **Architecture, Archeology, Hydrology** and **Professional Engineering**, can also focus on the marine environment. These careers, which require higher education, also connect to part of a much larger

marine scientists

Their focus on the protection of the water environment and its vast wildlife requires study beyond high school, with emphasis on science and math.

group of jobs that don't always demand many years of in-school study. Many of these are "learn on the job" careers, such as **Deckhands** or **Engineers** on all sorts of harbor boats, **Captains** or "**Skippers**" who guide vessels both large and small, and **Technical Specialists**, who are trained in special skills such as **Diving** or **Marine Rescue**. And, as you know from watching the news on TV, many heroic rescues are necessary in the harbor every year, mainly from specially trained **Police** or **Firefighters**.

You have many opportunities to observe all these jobs and more by visiting the hundreds of waterfront piers, which serve both for pleasure boats and for commercial uses. You may go out on one of the many fishing boats yourself, or cruise on the old-fashioned sailing ships at South Street Seaport in Manhattan. One of the best and easiest ways to learn about jobs on boats is to ride the Staten Island Ferry, observing the **Pilots** on the high bridge and the **Crew** helping to manage the huge boat.



learn more online

SEARCH: Marine Science, Marine Geology, Marine Architecture, Marine Archeology, Marine Engineering, Hydrology, Motorboats, Sailboats



Meteorology and Atmospheric Science

Meteorologists are scientists who study the atmosphere and the effects of major air currents, temperature, wind, rain, and snow around our planet. From ancient times, people have always observed the weather every day and there have been continual efforts to understand and predict it better. Great advances in knowledge have come in the past 200 years with the development of new data and instruments. Research is continuing in every country around the globe.

You may be most familiar with **Meteorologists** as the weather forecasters on TV or on the radio. The best of these have studied the science in a serious way and have been given the “Seal of Approval” by the American Meteorological Society and the National Weather Association.



However, professional **Meteorologists** have high-level degrees in science and often work for major governmental agencies such as the National Oceanic

meteorologist

Professionals have high-level degrees in science and often work for major governmental agencies and as researchers in universities.

and Atmospheric Administration and as researchers in universities and colleges. Private companies also employ **Meteorologists** and information is often shared. Since local weather and climate are influenced by what happens in many other areas, it is important for **Meteorologists** to understand the “big picture” around the world.

Weather forecasting by **Meteorologists** is not only relied upon by all of us as we decide whether or not to take an umbrella when we go out. Farmers and many business people are greatly affected by weather patterns and need correct and long-range information in order to plan their activities. Weather often dictates success or failure.

In New York City and in many other places, there is an increased understanding that climate and weather conditions are changing, which may lead to more frequent storms and flooding. New Yorkers saw these conditions in Hurricane Sandy in the fall of 2013. The work of **Meteorologists** is becoming ever more important.

Ornithology, Zoology and Wildlife Management

Ornithologists and **Zoologists** are highly trained scientists who focus on researching animals, such as birds and mammals. Their work is part of a long natural history, and is important in the understanding of evolution and ecology. Many of them started as children by closely observing birds, domestic or wild animals or farm animals. Through advanced education, their knowledge and skills have helped them combine their work with that of **biologists** and **ecologists**

Professional **Ornithologists** and **Zoologists** use old and new knowledge and technical information to advance their research. The science of observation and study became more professional about 250 years ago, as more people began exploring parts of the world that held thousands of species they had never seen. Swedish scientist Carl Linnaeus developed a system for identifying each bird or animal by its own special name. By the late 19th century, his system was in wide use and many technical aids were also developed.

Most professional **Ornithologists** and **Zoologists** work at colleges and universities or at science centers in museums or zoos. Much of their work is outdoors, as **Wildlife Managers**, tracking wild creatures who, of course, don't stay in one place. At their work in zoos, they

ornithologist and zoologist

Most are highly trained scientists who focus on researching animals, such as birds and mammals.

specialize in observation of animals in captivity. They must stay in contact with other scientists, both near and far, to study these populations together. They pay special attention to habitat – the places where birds and other wild animals live.

Many **Ornithologists** and **Zoologists** also work for governmental agencies or for large private scientific companies. In addition, there are certain non-profit organizations that provide jobs for **Ornithologists** or **Zoologists**. Two that are well-known are the National Audubon Society and the World Wildlife Fund.

Their combined knowledge has been crucial in counting birds and other animals to identify those with such small populations that they are in danger of extinction. We now have the categories of “**endangered**” or “**threatened**”, where much care is needed to try to bring back and guarantee a larger population for the future. One success was the saving of the Peregrine falcon – a bird that has found good nesting spots on New York City bridges.

learn more online

SEARCH: Ornithology, Zoology, Wildlife Management



learn more online

SEARCH: Meteorology, Atmospheric Science, Climate Science



learn more online

SEARCH: Ornithology, Zoology, Wildlife Management

Soil Science Research

Soil Science Researchers study the soil in which our trees and other plants grow. Their work requires a deep knowledge of science and geology. **Soil Science Researchers** often work for colleges or universities, but also for governmental agencies or private companies.

Soil is not “dirt”. It’s the all-important surface of the earth that is based on rock, but is slowly changed by the effects of water, air and living and dead organisms. Depending on how it’s created, soil can allow trees and other plants to grow well. But sometimes it may not have the proper mixture to sustain healthy growth. **Soil Science Researchers** study the types of soil by conducting surveys that sample soil in the ground, itself, through field studies that often involve digging beds (large, deep holes) in the soil. They look at layers of soil for color, texture, mixture of minerals and location. They study the chemical pH in the soil to see if it is acid or alkaline. They continue their studies in laboratories.

Depending on what they find, **Soil Science Researchers** may advise others caring for the urban environment to add items to the soil to make it better. This could include organic fertilizer, decaying leaves or plant stems or other once-living matter that will release nutrients that are essential for plant growth. They may advise that caked soils need sand added

soil science researcher

With a deep knowledge of science and geology, they often work for universities, governmental agencies or private companies.

to break them up. Sometimes, they may advise that certain soils will not support successful growth.



Soil Science Researchers may also test how much water is in the soil or how much water the soil can hold when water is added to it. Some trees, for example, thrive in soil that has a lot of water. Others may die if there is too much water around their roots.

In addition to their field work, **Soil Science Researchers** need to be good writers because they need to share their findings with others, such as **Foresters, Arborists, Gardeners** and **Farmers**, whose work depends on good soils. They often work closely with the community as plans for successful growth are put in place.

Solar Energy Production

Heat energy from the sun has always been a crucial part of life. In modern times, we are learning how to capture it for more specific use, especially in buildings. The development of solar energy is growing and will replace some of the use of fuels such as coal, oil and gas, though they are also expected to continue as part of our country’s energy mix.

Solar Energy is now being planned for use in new construction and in renovations of older buildings. In many cases, the plans call for solar collectors to be put on roofs or near structures and are then connected to electrical energy use or for heating water in water tanks or in furnace boilers for heat. Most of the collection systems are connected to the electrical power grid from large companies that supply electricity. New and growing businesses are being established as solar energy continues to be captured.



Entrepreneurs are people who decide to create private companies that will offer solar collectors and other hardware for sale to the public as building designs are put in

solar energy producer

Heat energy from the sun has always been a crucial part of life, and now we are capturing it for more specific use.

place. They provide the “up-front” money to make establishment of businesses possible. As sales of products develop, they expect their businesses to create profits and survive. Jobs are available in the companies as they develop.

Designers must be part of the business to create plans that are based on science and math that will successfully capture the heat energy of the sun and transfer it elsewhere to be used.

Electrical, Structural, Mechanical and Environmental Engineers take the designs and turn them into detailed plans for the manufacturing and installation of products such as solar collectors and the systems that transfer the heat energy to uses such as heating water or providing heat for homes and office buildings.

Manufacturers make the products that will capture the heat energy of the sun and transfer it to water heaters and furnaces or boilers. Once the products are available, **Salespersons**, usually working for **Manufacturers** or **Entrepreneurs**, will then offer them for sale to the public for use in constructions.

A wide variety of careers is being developed in this new and growing field.

learn more online

SEARCH: Solar Energy, Solar Design, Solar Engineering, Environmental Engineering, Entrepreneur



learn more online

SEARCH: Soil Science

Urban Forestry

Urban Foresters work in the urban forests of street and park trees. They look at the “big picture”. They take the lead in how urban forests should be designed and managed to improve the quality of life where people live. They study written information and maps to see where open green spaces and trees already exist and identify new areas that might be planned and planted. They often work for governmental agencies, and also for private companies.

Urban Foresters work outdoors to conduct a tree inventory that tells them exactly where, how many and what kind of trees are already growing on city streets and in other green spaces. To record this information, they use hand-held computers and other technical devices, but at other times it's plain old pencil and paper. Interested citizens, including students, often help take the inventory.

The information received helps **Urban Foresters** understand where to plant new trees on streets or in parks or playgrounds. They also are able to identify trees that are dead or diseased and need to be removed. Removals open up spots for new trees to be planted. All this information is added to the information and maps they already have in place.

urban forester

They take the lead in how urban forests should be designed and managed to improve the quality of life where people live.

As **Urban Foresters** plan their work, they often meet in public meetings to explain their projects to the community and get local advice. Or they visit schools to help students and teachers become part of their projects.



Urban Foresters then work with other **Foresters, Arborists** and **Landscape Architects** to select the best trees for the sites and arrange for them to be planted.

Last, but not least, **Urban Foresters** plan how the newly planted trees will be cared for, especially the need for regular watering and pruning. Citizens are often asked to help with regular watering of newly planted trees.

Helpful Resources

Public High Schools to Consider

Colleges and Universities

Governmental Agencies

Non-profit Organizations



learn more online

SEARCH: Urban Forestry, City Planning

Public High Schools to Consider

Some of the following high schools have the environment as their focus. Others feature special environmental or natural resources programs as part of a larger school. All are part of the public school system and are open to students from all boroughs. However, some of them require taking a special test to qualify for admission.

PUBLIC HIGH SCHOOLS	
<i>Bronx</i>	Bronx High School of Science
	Mott Hall Bronx High School
	Urban Assembly School for Wildlife Conservation
<i>Brooklyn</i>	Academy for Conservation and the Environment
	Brooklyn Academy of Science and the Environment
	Brooklyn Technical High School
	Edward R. Murrow High School
	Green School: An Academy for Environmental Careers
	Leon M. Goldstein High School for the Sciences at Kingsborough Community College
	New York Harbor School (Governors Island)
	Rachel Carson High School for Coastal Studies
<i>Manhattan</i>	Academy for Environmental Leadership (LEAF of Nature Conservancy)
	Academy of Urban Planning (LEAF of Nature Conservancy)
	High School for Environmental Studies
	Stephen T. Mather Building Arts & Craftsmanship High School
	Stuyvesant High School
	Urban Assembly School for Green Careers
<i>Queens</i>	Expeditionary Schools in Queens and Staten Island
	Grover Cleveland High School
	John Bowne High School
<i>Staten Island</i>	Expeditionary Schools in Queens and Staten Island
	Staten Island Technical High School

Colleges and Universities

There are colleges and universities in New York State and in the New York City Metropolitan Area that are well-known for programs in the environment and natural resources. Listed is a small selection that you may want to learn more about.

COLLEGES AND UNIVERSITIES	
<i>Cobleskill, NY</i>	State University of New York (SUNY)
<i>Doylestown, PA</i>	Delaware Valley University
<i>Farmingdale, NY</i>	State University of New York (SUNY)
<i>Hoboken, NJ</i>	Stevens Institute of Technology
<i>Ithaca, NY</i>	Cornell University
<i>Morrisville, NY</i>	State University of New York (SUNY)
<i>New Brunswick, NJ</i>	Rutgers University
<i>New York, NY</i>	City University of New York (CUNY) Senior Colleges: Lehman, Queens, Brooklyn, Staten Island
	City University of New York (CUNY) Community College: Kingsborough
<i>Paul Smiths, NY (Adirondack Mountains)</i>	Paul Smiths College
<i>State College, PA</i>	Penn State University
<i>Stony Brook, NY</i>	State University of New York (SUNY)
<i>Syracuse, NY</i>	SUNY College of Environmental Science and Forestry at Syracuse University

Governmental Agencies and Non-profit Organizations

The following governmental agencies and nonprofit organizations can be helpful to high school students in their studies. Their websites will direct you to their own information and provide other sites for exploration.

These agencies and organizations oversee major outdoor and indoor facilities that you may visit for more learning or for enjoyment. These include parks and outdoor installations in all boroughs, as well as botanical gardens and other sites. They also sponsor programs and projects that you may join.

Governmental agencies and nonprofit organizations also provide internships during the school year or during the summer, though the numbers may be limited. In some cases, there will be a small stipend. Most of the internships will be able to offer you credit toward a high school diploma or provide useful information for college applications.

All those on the list may be best accessed by searching their websites on the Internet.

GOVERNMENTAL AGENCIES

<i>City Agencies</i>	New York City Department of Parks & Recreation
	New York City Department of Environmental Protection
	New York City Department of Transportation
<i>State Agencies</i>	New York State Department of Environmental Conservation
	New York State Office of Parks, Recreation and Cultural Preservation
<i>Federal Agencies</i>	United States Environmental Protection Agency
	US Department of Agriculture/Forest Service
	US Department of the Interior/Parks Service

NON-PROFIT ORGANIZATIONS

<i>Bronx</i>	Bronx River Alliance
	New York Botanical Garden
	New York Wildlife Conservation Society (Bronx Zoo)
	Sustainable South Bronx
<i>Brooklyn</i>	Brooklyn Botanic Garden
	Gowanus Canal Conservancy
	Magnolia Tree Earth Center of Bedford-Stuyvesant
	Prospect Park Alliance
<i>Queens</i>	Alley Pond Environmental Center
	New York Museum of Science
	Queens Botanical Garden
<i>Manhattan</i>	American Museum of Natural History
	Central Park Conservancy
	Cornell University Cooperative Extension – NYC
	Green Guerillas
	GrowNYC
	Horticultural Society of New York
	Lower East Side Ecology Center
	New York City Audubon
	New York Restoration Project
	Trees New York
<i>Staten Island</i>	Greenbelt Nature Center
	Staten Island Botanical Garden at Snug Harbor
	Staten Island Science Museum