

Opportunities for Growth: Nature-Based Jobs in NYC



Public Works
Partners



**NEW YORK CITY
ENVIRONMENTAL
JUSTICE ALLIANCE**

**The Nature
Conservancy**



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FOREWORD

New York City (NYC) is home to over 30,000 acres of parks,¹ 520 miles of coastline,² 7 million trees that make up an urban forest whose canopy covers about 22% of the landscape,³ 5,650 acres of wetlands,⁴ thousands of vegetated right-of-way green infrastructure installations,^{*} and 2,029 plant species that provide rich biodiversity to the city.⁵ Despite the enormous extent of these natural assets, all of which need some level of care, there appears to be a deficit of jobs to support them. The urban forest of NYC, alone, has been estimated to be worth \$5.7 billion standing, while providing \$260 million in benefits every year,⁶ and there are opportunities to expand this and other natural resources across the city. This vast, multi-billion dollar network of assets needs a workforce equipped to manage them today and to meet future needs by taking advantage of opportunities for additional growth. Yet, little is known about the present or projected workforce for these assets.

The Just Nature NYC partnership between the New York City Environmental Justice Alliance (NYC-EJA) and The Nature Conservancy in New York Cities Team (TNC-NY) advances our shared purposes of increasing nature-based solutions (NBSs) across NYC to support climate justice and equity. We have worked together to describe how improving and maintaining NYC's urban forest can support equity and environmental justice through resources that include [Just Nature NYC: How a Healthy and Equitable Urban Forest Can Help Communities Thrive](#)⁷ and the broader [NYC Urban Forest Agenda](#).⁸ Through such efforts, we discovered a lack of available information about nature-based jobs (NBJs) – the workforce maintaining and growing our urban forest, green spaces, and other NBSs – and launched this research to generate greater understanding of this important topic.

New Yorkers face many challenges including air pollution, urban heat island effect, climate



change impacts, and lack of green space in their communities. NBSs are vital to improving environmental health and building climate resilience – particularly in environmental justice communities. Climate scientists project that the frequency of annual heat waves in NYC will increase three-to-five-fold by 2050, and heat waves are expected to last longer than those of the recent past. Heat waves are the leading weather-related cause of death nationally, and in NYC many low-income communities and communities of color – particularly with a high proportion of Black residents – have been identified by the NYC Department of Health and Mental Hygiene as among the most vulnerable to health impacts of extreme heat.

Urban green spaces and NBSs offer a variety of benefits to people; their presence or absence can have significant and direct effects on a community – including on public health and well-being, urban heat island effect mitigation, air quality improvements, stormwater management, coastal resiliency, and ecological benefits. In frontline

* Based on data on Green Infrastructure from the NYC Department of Environmental Protection, available at: <https://data.cityofnewyork.us/Environment/DEP-Green-Infrastructure/spjh-pz7h> (accessed Oct. 2021).

communities, NBSs can yield additional benefits such as providing public and community spaces, creating more livable streets, and reducing building energy consumption and costs. Equitable access to green spaces and NBSs of various forms, especially in cities where they are at a premium, is critical for human well-being.

As the COVID-19 pandemic ravaged our city, open spaces like parks, waterfronts, gardens, and open streets became increasingly important places for people to move around and safely access the outdoors. We have long been proponents of expanding and embracing green spaces and green infrastructure in our urban environment, and COVID-19 further and more clearly demonstrated the importance of NBSs. As NYC implemented COVID-19 safety measures, the outdoors became more of a sanctuary for many New Yorkers, who may now further recognize the value of NBSs.

To successfully maintain, and ultimately expand, our natural assets, we need to first understand gaps and opportunities in their care. One area that is ripe for exploration is in the related workforce. In *Opportunities for Growth: Nature-Based Jobs in New York City*, we sought to create a framework for NBJs that clearly outlines the complexities and the variety of nature-based career paths and roles. Early in the project, we identified real limits in what we could do with available data. Rather than simply utilize existing workforce categories to inventory NBJs, we sought to better demonstrate the full NBJ spectrum by describing them on a continuum. The limits we encountered point to opportunities for future research. For example, while there are standardized categories such as “green jobs,” which include jobs in the renewable energy sector, there are no standardized categories of employment specific to NBSs. However, we were able to arrive at valuable conclusions. For example, we found that NBJs are driven by both public and private investments, can be connected to a natural asset from its initial conceptualization to ongoing maintenance and community programming, and can have varying degrees of NBS focus. For instance, urban forestry positions are

functionally always NBJs, whereas construction positions sometimes contribute to creation of NBSs, generally as a small portion of their work. There is an opportunity to continue to better define or categorize NBJs.

To successfully maintain, and ultimately expand, our natural assets, we need to first understand gaps and opportunities in their care.

Our research suggests some important questions. How will future investments in NBSs impact job growth? Will the increased prioritization of green spaces lead to more robust career paths for those who care for them? Or will the mismatch between the number of NBJs and the scale of natural systems persist in NYC? We have an opportunity to make a proactive change to avoid this possibility, thus strengthening resources such as the NYC urban forest, protecting environmental justice communities, and bolstering a Just Transition through robust NBJs and career pathways. There are various prospects for further adoption of NBSs, but at present, we are lacking the public investment and political will to prioritize the maintenance and growth of NBSs in NYC. We hope that new federal, state, and local leadership prioritize NBSs and the NBJs that it will take to support them to meet the current and escalating climate and environmental challenges. We anticipate that this assessment of the jobs and workforce that support, protect, and expand NYC’s NBSs will help stimulate discussion and support for long-term investment in climate resiliency. Future equitable investments in NBSs across NYC are necessary to create healthy, equitable, and resilient communities.

- The Just Nature NYC Team

EXECUTIVE SUMMARY

New York City is the largest, most populous city in the United States, and home to large, yet insufficient and inequitably distributed quantities of trees, parks, natural coastlines, and local flora and fauna. The operations of supporting and maintaining this massive ecosystem requires a large workforce with a range of skills and expertise. This report, commissioned by Just Nature NYC, a partnership between The Nature Conservancy in New York Cities Team and the New York City Environmental Justice Alliance, seeks to understand the jobs that support this ecosystem by formalizing a definition of “nature-based jobs” and positioning them within the larger context of environmental change and the green regenerative economy, ultimately creating a first-of-its-kind overview of these jobs and their roles within the New York City labor market.

Nature-based jobs (NBJs) are defined as jobs that directly contribute to natural infrastructure and nature-based ecosystems with the goal of enhancing human health and well-being and promoting biodiversity. NBJs fall into four job categories considered here that mirror stages of project development – *Conceptualization, Implementation, Functional Maintenance, and Value Maintenance* – and include a wide range of occupations, such as Foresters, Gardeners, Conservation Scientists, Landscape Architects, and Construction Laborers.

The exact number of NBJs in New York City is challenging to quantify, stemming from the lack of a federal definition to aid in data collection and statistical analysis. In addition, jobs may differ in the degree to which they are nature-based, depending on the actual share of all workers in that occupation engaged in nature-based work on a regular basis. However, the analysis points to a tendency for those positions with higher NBJ representation to be employed in far smaller numbers than positions with lower NBJ representation. In this analysis, there were an

estimated total of 761 jobs considered to have high NBJ representation in 2020,* suggesting a substantial mismatch between the scale of the city’s natural environment and its capacity to manage it.

While both the public and private sector hire for NBJs, they typically hire for different occupations. The public sector hires primarily for *Functional Maintenance* positions and for occupations that are more deeply representative of nature-based work. The private sector is a larger employer of *Implementation* positions and for occupations where nature-based activities are less a component of day-to-day responsibilities. This suggests the need for discrete and tailored approaches when developing policies and initiatives that seek to grow and support the presence of NBJs based on the desired outcome.

Nature-based jobs (NBJs) are defined as jobs that directly contribute to natural infrastructure and nature-based ecosystems with the goal of enhancing human health and well-being and promoting biodiversity.

NBJs offer limited career pathways across all categories, meaning workers that gain entry-level positions have few opportunities to advance professionally based on work experience alone and may struggle to obtain a reasonable living wage. Although there are some higher paying jobs and career paths for those workers that obtain the appropriate credentials, the demographics of workers in these positions are predominantly white, male, and highly educated. This points to a need to promote more equity, diversity, and representation in the workforce – and the associated educational and training pathways.

* High NBJ representation jobs included: Hydrologists, Soil and Plant Scientists, Tree Trimmers and Pruners, Foresters, Forest and Conservation Technicians, and Conservation Scientists.

Job projections from secondary sources suggest there will be growth in NBJs over the next five years, however, the reality is likely far more complex given the challenges of securing public investment. There continues to be uncertainty around the long-term economic effects of the COVID-19 pandemic, and NBJs are a nascent concept that traditional labor market analyses are ill-equipped to reliably quantify. Many subject matter experts largely agreed that if the

number of NBJs in New York City is to be sustained and scaled over time, it will be important to drive additional investments to related projects and to educate the public as to the value of nature-based work. With the growing risks of climate change, it's vital to invest in NBSs in climate vulnerable communities.



Photo by Noemi Gonzalo-Bilbao Fernández

HOW TO READ THIS REPORT

The goal of this report is to define and summarize that state of ‘nature-based jobs’ (NBJs) in New York City. The analysis shared is based on a mixed-methods approach involving interviews, research, and analysis of labor market information. For readers that are new to labor market data, this section provides an introductory overview of common terms and concepts to help orient them to findings presented in this report.

Occupations and Industries

Occupational employment is measured by Federal statistical agencies using the Standard Occupational Classification (SOC) system. All workers are classified into one of 867 detailed occupations according to their occupational definition. In this report, SOC codes are used to identify and analyze select NBJ titles.*

Industry employment is measured by Federal statistical agencies† using the North American Industrial Classification Systems (NAICS). Each business is classified into a six-digit NAICS code number based on the majority of activity at the business. The Census Bureau tabulates the data into summary totals from the two-digit to six-digit NAICS levels. In this report, NAICS codes are used to understand areas of the economy and general sectors and types of employers with specific nature-based occupations.‡

An industry may employ hundreds of different occupations, and a single occupation can appear across a range of industries. To illustrate this, Table 1 presents the leading ten industries (based on the two-digit NAICS level) employing Landscaping and Groundskeeping Workers (SOC Code 37-3011).

NAICS	Industry	Occupation Jobs in Industry	% of Occupation in Industry	% of Total Jobs in Industry
90	Government	2,964	30.4%	0.5%
53	Real Estate and Rental and Leasing	1,825	18.7%	1.4%
56	Administrative and Support and Waste Management and Remediation Services	1,508	15.5%	0.6%
71	Arts, Entertainment, and Recreation	905	9.3%	1.1%
81	Other Services (except Public Administration)	815	8.4%	0.5%
54	Professional, Scientific, and Technical Services	441	4.5%	0.1%
61	Educational Services	312	3.2%	0.2%
72	Accommodation and Food Services	266	2.7%	0.1%
23	Construction	210	2.1%	0.1%
62	Health Care and Social Assistance	209	2.1%	0.0%

Table 1 - Employment by Industry for Landscaping and Groundskeeping Workers in NYC, 2020

Source: New York Department of Labor, Division of Research and Statistics. Percentage was calculated using Inverse Staffing Patterns from Emsi Q2 2021 Data Set, which uses state data from the New York Department of Labor, Division of Research and Statistics. This data provided counts for each SOC title for 2-digit NAICS industries. Government jobs are defined by NAICS Code 92 – Public Administration. Landscaping and Groundskeeping Workers are considered to be medium representation NBJs (see Table 2), meaning not all workers are engaged in nature-based work.

* Detailed descriptions for all SOC occupations are available on the O*NET OnLine website: <https://www.onetonline.org/>

† Federal Statistical Agencies are defined by the Federal Committee on Statistical Methodology: <https://nces.ed.gov/fcsm/agencies.asp>

‡ Detailed descriptions for each NAICS category are available on the Bureau of Labor Statistics (BLS) website: https://www.bls.gov/iag/tgs/iag_index_alpha.htm

Civil Service Titles

A Civil Service Title is a job classification designated for all city government roles by the City of New York. There are four categories of Civil Service Titles: Competitive Class, Non-Competitive Class, Labor Class, and Exempt Class. In this report, Civil Service Titles are used to refer to a specific set of nature-based occupations that exist solely within the local NYC government system. More information regarding the New York City Civil Service System and Civil Service Titles are available on the NYC Department of Citywide Administrative Services website: <https://www1.nyc.gov/site/dcas/employment/what-is-civil-service.page>

Labor Market Data Limitations

Readers of this report may question why certain nature-based occupations were not included in this analysis. This is because many job titles which may be equated with NBJs do not align with the occupational titles in the SOC system or in the NYC Civil Service System. Non-governmental job titles, such as what might be included in an employer job posting, vary considerably by industry and employer, and expand well beyond the occupational titles included in this analysis. For this reason, those titles analyzed in this report represent a sample of all NBJs and demonstrate the overall diversity of occupations that may be considered nature-based.

Key Terminology

- **Nature-Based Solutions** – The Nature Based Solutions Initiative at Oxford University explains that “nature-based solutions... involve working with nature to address societal challenges, providing benefits for both human well-being and biodiversity. Specifically they are actions that involve the protection, restoration or management of natural and semi-natural ecosystems; the sustainable management of aquatic systems and working lands such as croplands or timberlands; or the creation of novel ecosystems in and around cities. They are actions that are underpinned [by] biodiversity and are designed and implemented with the full engagement and consent
- of local communities and Indigenous Peoples.”⁹ NBSs are beneficial for both mitigation of and adaptation to climate change by helping reduce greenhouse gas emissions and localized pollution as well as the impacts of natural disasters, such as urban flooding or heat waves.
- **Green Economy** – The United Nations Environment Programme defines a green economy as “low carbon, resource efficient, and socially inclusive, where growth in employment and income are driven by public and private investment into such economic activities, infrastructure, and assets that allow reduced carbon emissions and pollution, enhanced energy and resource efficiency, and prevention of the loss of biodiversity and ecosystem services.”¹⁰
- **Green Infrastructure** – The NYC Department of Environmental Protection defines Green Infrastructure as “an array of practices that use or mimic natural systems to manage stormwater runoff. Green Infrastructure controls stormwater by using it as a resource rather than a waste. Stormwater is either directed to engineered systems for infiltration or detained at a slower rate before it enters the combined sewer system.”¹¹
- **Green Jobs** – The United States Bureau of Labor Statistics defines Green Jobs as either “Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources,” or “Jobs in which workers’ duties involve making their establishment’s production processes more environmentally friendly or use fewer natural resources.”¹²
- **Entry-level positions** - Refers to occupations that require little to no previous work experience in a chosen field, and tend to have lower wages, less benefits, and less stable hours relative to experienced positions.
- **Low-barrier positions** – Refers to occupations with minimal experience, education, and credential requirements.

WHAT IS A NATURE-BASED JOB?

The term nature-based job derives from the concept of nature-based solutions, which refers to the sustainable management and use of nature for tackling challenges such as climate change, stormwater runoff, air quality, water and food security, biodiversity protection, urban heat island effect, human health, coastal and flooding risks, and disaster risk management. Nature-based jobs include occupations promoting nature-based solutions and occupations centering activities supporting and caring for nature for nature's own sake.

There is no established formal definition for nature-based jobs, which makes performing a traditional labor market analysis and landscape assessment challenging. Unlike the term Green Jobs, there is no Census definition, and nature-based jobs have never been reported as a specific category by the Bureau of Labor Statistics.* For purposes of this analysis, a working definition needed to first be created, which was accomplished by holding 11 interviews with subject matter experts to develop a baseline understanding of nature-based jobs. These experts included representatives from private contractors, public agencies, nonprofit organizations, and academic institutions, and aided in developing the below definition:†

Nature-based jobs (NBJs) directly interact with natural infrastructure and nature-based ecosystems with the goal of enhancing human health and well-being and promoting biodiversity. These jobs address challenges related to climate change, water security, water pollution and stormwater runoff, air quality, food security, urban heat island effect, and disaster risk management.

All interviewees agreed the description for NBJs resonated. They understood the value of these roles in the New York City labor force to

create and sustain NBSs and their accompanying benefits.

Interviewees also noted that NBJs have been subject to the same negative consequences of the COVID-19 pandemic as the broader New York City workforce. An estimated 42 percent of all jobs lost in the United States during the pandemic will not return.¹³ Economic analysis indicates lower wage workers have been hit hardest, widening inequalities, and harming those already most vulnerable. Interviewees confirmed the pandemic has similarly decreased hiring demand for NBJs and increased competition amongst jobseekers, particularly for entry-level positions and internship opportunities with low barriers to employment.

These hardships have had a compounding effect. A report from NYC Parks and Open Space Partners NYC, a coalition of nonprofit organizations that formed during the COVID-19 pandemic, states there are over 25 nonprofit organizations with agreements to provide maintenance and service support for City-owned parks and open spaces. Yet, the declines in donations and earned revenue for FY2020 equated to \$37 million fewer dollars of investment, 40,000 lost hours of maintenance, and 110,000 lost hours of horticultural care citywide during a time when the pandemic made it “resoundingly clear that parks and open spaces are essential to the physical and mental health of our communities.”¹⁴

City agencies reported uncertainty about their ability to fund projects and initiatives employing NBJ workers. One interviewee suggested that NBJs may sometimes be perceived as a “luxury” and a place where agencies look to impose cuts, noting the suspension of the NYC Department of Sanitation’s curbside composting program in May 2020 and the negative impact on community composting companies.¹⁵ This is indicative of a

* Due to spending cuts, the U.S. Bureau of Labor Statistics eliminated all “measuring green jobs” products in 2013. Green Job counts are no longer collected but the Census definition can still be found on their website: <https://www.bls.gov/green/#definition>

† For list of interviewees, see the Acknowledgements section of this report.

huge challenge for NBSs – they are often construed as a luxury, rather than “imperative for addressing the dual global crises of biodiversity loss and climate change.”¹⁶ Interviewees agreed that establishing a working definition for NBJs was an important first step towards realizing this goal.

Examples of Nature-Based Jobs

After hearing the definition, interviewees provided examples of occupations that best exemplified and demonstrated qualities of an NBJ. Their responses, supplemented with additional research, are presented below in Table 2 as a list of Bureau of Labor Statistics Standard Occupational Classifications (SOC), and in Table 3 as a set of NYC Civil Service Titles.* Instances where the two lists include similar classifications (e.g., SOC Title “Tree Trimmers and Pruners” vs. NYC Civil Service Title “Climbers & Pruners”) provide an opportunity to speak about comparable occupations at both the citywide and local government scales.

The occupations analyzed in this report do not reflect the entire universe of NBJs, but instead provide a sample that demonstrates the range and diversity of positions that can be considered nature-based. Moreover, the SOC and Civil Service Titles included in this report do not exemplify NBJs to the same degree. For example, “Construction Laborers” are essential for implementing NBSs, but only a small percentage in the New York City workforce implement NBSs on a regular basis. Conversely, interviewees frequently mentioned “Foresters” as an example of a prototypical NBJ. In recognition of this nuance, Tables 2 and 3 also include a column indicating the degree of NBJ representation for each job title. The degree of representation for “Construction Laborers” is categorized as “Low,” indicating only a small portion of all construction laborers are actively engaged in nature-based

work. “Foresters” is categorized as “High,” suggesting a large share of these workers are regularly engaged in nature-based work.†

SOC Code	Job Title	Degree of NBJ Representation
19-1031	Conservation Scientists	High
19-1032	Foresters	High
19-4071	Forest and Conservation Technicians	High
37-3013	Tree Trimmers and Pruners	High
19-2043	Hydrologists	High
17-1012	Landscape Architects	Medium
19-1013	Soil and Plant Scientists	Medium
19-3051	Urban and Regional Planners	Medium
37-3011	Landscaping and Groundskeeping Workers	Medium
11-9021	Construction Managers	Low
17-2111	Health and Safety Engineers	Low
47-2061	Construction Laborers	Low

Table 2 – Standard Occupational Classifications

Source: U.S. Bureau of Labor Statistics. Job titles are as stated by source.

Civil Service Title Code	Job Title	Degree of NBJ Representation
60421	Urban Park Ranger	High
81310	Gardener	High
81361	Forester	High
21315	Landscape Architect	Medium
21538	Scientist (Water Ecology)	Medium
81303	Climber & Pruner	Medium
90641	City Park Worker	Medium
90645	Caretaker (Housing Authority)	Low
90756	Construction Laborer	Low

Table 3 – New York City Civil Service Titles

Source: NYC Department of Citywide Administrative Services. See the Methodology section of this report for an explanation of Civil Service Title data sources. Job titles are as stated by source.

* It is assumed there are analogous positions that exist at the State and Federal level. However, the City of New York typically employs these positions to a substantially larger degree and so this report places additional emphasis on using New York Civil Service Titles as a means for understanding NBJs within the local context.

† See the Appendix B for an explanation of how these determinations were assigned.

WHAT ARE THE DIFFERENT TYPES OF NATURE-BASED JOBS?

Interviews with employers and subject matter experts helped to distill NBJs into four main categories (Figure 1). These categories largely resemble the phases of project development, beginning with planning, followed by construction and implementation, and then ongoing maintenance and monitoring. This makes intuitive sense considering NBJs are largely centered on creating, maintaining, and supporting realization of benefits of nature-based infrastructure and assets. While many kinds of nature-based infrastructure require planning and implementation, others, such as existing natural areas, require only maintenance and support.

Jobs that involve research and planning, such as Landscape Architects and Soil and Plant Scientists, fall into the *Conceptualization* category. Many of these jobs are in the STEM fields and typically require more education and professional certifications. Occupations centered on construction and initiation of projects, such as Construction Laborers and Managers, are included in the *Implementation* category. Many of the jobs in this group are entry-level positions in the private sector and often seasonal or contract-based. Jobs in the *Functional Maintenance* category are responsible for the ongoing maintenance and monitoring of nature-based projects

and initiatives. These jobs appear across the public and private sectors, with examples like Landscaping and Groundskeeping workers and Tree Trimmers and Pruners. The final category, *Value Maintenance*, refers to occupations providing education and instruction in support of NBSs, although this type of work may frequently appear as a component of the tasks and responsibilities of workers in the other categories.*

Interviewees and supplemental research indicated the *Implementation* and *Functional Maintenance* categories represent the largest share of NBJs in the workforce and the greatest potential for near-term job growth. *Conceptualization* jobs are smaller in number and less accessible for workers early in their careers, but are essential for driving innovation and planning around NBSs. *Value Maintenance* jobs are the hardest of the four categories to define and quantify but are critical as a means of promoting and scaling nature-based work.

Overall, individuals in NBJs across all four categories struggle with a lack of accessible and clear career pathways, meaning workers that gain entry-level positions have limited opportunities to advance professionally based on work

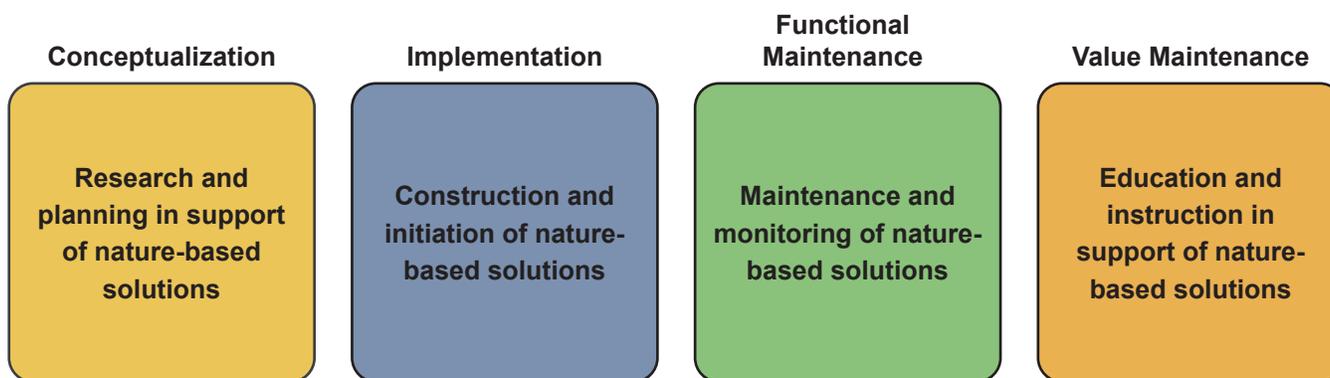


Figure 1: Four Categories of Nature-Based Jobs

* These job categories are not rigidly defined, as there are NBJs that may demonstrate characteristics of multiple (if not all) categories as part of their day-to-day responsibilities. Nevertheless, applying this framework enabled interviewees to comment on the larger landscape of these professions and workforce trends

experience alone and may struggle to obtain a reasonable living wage.* Higher paying NBJs are predominantly held by white, male, highly educated workers, pointing to a need to promote more equity, diversity, and representation in the workforce – and the associated educational and training pathways.

Conceptualization

NBJs include those professions where core tasks involve research and planning of NBSs. This can include researching and developing innovative new approaches (e.g., experimenting with native plants to create a lower-maintenance rain garden) or planning and designing for existing approaches (e.g., utilizing GIS mapping to identify areas of the City lacking robust tree coverage).

Table 4 shows the typical characteristics of NYC workers in *Conceptualization* NBJs in 2020. This category is well represented by high-earning STEM roles and skilled workers with a high degree of subject matter expertise. Local median salary for these roles typically exceeds national

median salary and is sufficient to meet the living wage requirements for a family of four. Jobs are found across both the public and private sector. Although there are fewer types of these jobs relative to the *Implementation* and *Maintenance* job categories, the degree of NBJ representation is high.

Overall, there are fewer entry-level positions and significant barriers to career advancement in this category. Opportunities to advance are typically based on educational or professional credentials over years of experience. The demographics of individuals holding these positions are predominantly white and highly educated, with almost all workers having at least a Bachelor's degree and a significant percentage with Doctoral or professional degrees. Workers also tend to skew male but there are examples of specific occupations, such as Urban and Regional Planners, with representation closer to parity between male and female workers.

SOC Job Title	Typical entry-level education	Typical on-the-job Training	Male / Female	Race and ethnicity	Median Salary - NYC	Median Salary - National
Hydrologists	Bachelor's degree	None	71.1% / 28.9%	White / 75.3% Asian / 8.5% Black / 7.8% Latinx / 6.2%	\$82,576	\$81,266
Landscape Architects	Bachelor's degree	Internship/residency	67.9% / 32.1%	White / 60.3% Asian / 22.8% Latinx / 10.8% Black / 4.4%	\$80,080	\$69,368
Soil and Plant Scientists	Bachelor's degree	None	67.6% / 32.4%	White / 70.9% Asian / 16.3% Latinx / 5.5% Black / 5.5%	\$67,780	\$63,211
Urban Planners	Master's Degree	None	58.1% / 41.2%	White / 67.7% Asian / 10.4% Black / 10.0% Latinx / 9.2%	\$88,872	\$74,360

Table 4 - Typical Worker Characteristics for Conceptualization Nature-Based Jobs in NYC, 2020

Source: QCEW, modified using Emsi's proprietary methods

* Living wages estimates were determined based on two measures. The first measure was whether median salary was sufficient to sustain a single adult with no children (\$41,600 annual salary). The second measure was whether median salary was sufficient to sustain a family of four (two adults and two children) with only one adult working (\$79,310 annual salary). Living wage estimates are based on the Massachusetts Institute of Technology Living Wage Calculator estimates for New York-Newark-Jersey City, NY MSA. For additional information, visit the Living Wage Calculator website: <https://www.livingwage.mit.edu>

SOC Job Title	Typical entry-level education	Typical on-the-job Training	Male / Female	Race and ethnicity	Median Salary - NYC	Median Salary - National
Construction Laborers	No formal educational credential	Short-term	95.5% / 4.5%	White / 39.5% Latinx / 36.8% Black / 15.6% Asian / 6.5%	\$51,096	\$36,858
Construction Managers	Bachelor's degree	Moderate-term	96.2% / 3.8%	White / 66.9% Latinx / 18.1% Black / 9.3% Asian / 4.4%	\$96,564	\$66,206
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	Bachelor's degree	None	79.5% / 20.5%	White / 56.4% Asian / 22.3% Latinx / 11.5% Black / 8.3%	\$104,732	\$91,416

Table 5 - Typical Worker Characteristics for Implementation Nature-Based Jobs in NYC, 2020

Source: QCEW, modified using Emsi's proprietary methods

Implementation

NBJs include those professions where core tasks focus on the construction and execution of plans developed by those in the *Conceptualization* category, whether that be planting urban street trees, installing green roofs on school buildings, or planting native grasses to restore saltwater marshes in Jamaica Bay. Table 5 shows the typical characteristics of NYC workers in *Implementation* NBJs in 2020. This category has a high number of entry-level positions, values on-the-job experience, and encourages industry-specific qualifications and credentials to advance professionally. Interviewees suggested that a large share of the universe of all NBJs are *Implementation* jobs, but a small share of *Implementation* jobs are likely to be NBJs. Most of these jobs are found in the private sector as project-based contract work.* This can make it challenging for workers in entry-level positions to earn a reliable and regular salary.

Local median salary for these jobs exceeds their national salary equivalents and are typically sufficient to meet the living wage requirement for a single adult, though some advancement into more experienced positions is required to earn sufficient salary to sustain a family of four. Similar observations can be seen regarding

Local Laws 92 and 94

In 2019, NYC's Climate Mobilization Act prompted the passage of Local Laws 92 and 94, requiring "new buildings, new roofs resulting from enlargement of existing buildings, and existing buildings replacing an entire existing roof deck or roof assembly to be provided with a 'sustainable roofing zone', 100 percent of which must be a solar photovoltaic electricity generating system, a green roof system, or a combination thereof." The passage of these Local Laws, coupled with DEP private property incentive programs, has helped create work for green roofing companies. An analysis of Emsi job postings data revealed the number of unique employer postings with reference to green roofs increased by 250% between December 2016 and December 2020.

Interviewees affirmed that smaller "boutique" contractors have had success implementing green infrastructure assets cost effectively and efficiently, but public grants and incentive programs often go underutilized. One such contractor interviewed believed agencies could be doing more to publicize these programs and more work could be done to help the public understand the value of nature-based solutions.

* Construction and implementation of publicly funded nature-based solutions is primarily performed by private contractors. Agency representatives reported this was due in part because these contractors are better positioned to use the heavy machinery required for these projects. A representative from the DC37 union stated this is more likely due to a longstanding policy position and a cost-cutting measure and that public employees are well-positioned to perform this work if the opportunity were provided.

educational attainment. Approximately 30 percent of Construction Laborers have less than a high school diploma, whereas the number of workers with advanced degrees increases for Construction Manager and Health and Safety Engineer positions. Due to the higher number of entry level positions and lower barriers to advancement, the demographic composition of these jobs tends to show more racial and ethnic diversity, but skews predominantly male.

Functional Maintenance

NBJs are often directly related to those in the *Implementation* category, in that their core activities often pertain to the maintenance and monitoring of nature-based assets developed by the former. Examples include City Park Workers and Gardeners responsible for performing routine maintenance on NYC Department of Environmental Protection (DEP) rain gardens, or an arborist pruning street trees and trees in landscaped park areas. Some *Functional Maintenance* roles accompany naturally occurring nature-based infrastructure that do not necessarily involve *Conceptualization* and *Implementation* phases. For example, management of natural ecosystems can involve invasive species removal, habitat restoration, and creation or maintenance of trails.

Table 6 shows the typical characteristics of NYC workers in *Functional Maintenance* NBJs in 2020. This category, like *Implementation*, also includes a high number of entry-level positions with

City Cleanup Corps

The City Cleanup Corps is a New Deal-inspired economic recovery program that aims to make New York City the cleanest, greenest city in the United States. The program planned to hire 10,000 New Yorkers beginning in April 2021. As of October 2021, thousands had been employed – 3,200 by NYC Parks – and jobs were still available.¹⁸ Agencies hiring include NYC Parks, New York City Housing Authority, and NYC Department of Environmental Protection with tasks involving working to revitalize New York City’s public spaces and neighborhoods, beautifying parks and green spaces, and bringing art to the city’s open spaces. This initiative, a direct response to the COVID-19 pandemic, represents a substantial investment in the New York City workforce and in entry-level *Functional Maintenance* positions.

“Values need to change. For the success of nature-based systems, maintenance must be given higher priority than it gets right now. This is where job growth needs to happen. I would love to see these workers recognized as skilled workers and their work as meaningful work.”
-Elliot Maltby, Thread Collective

SOC Job Title	Typical entry-level education	Typical on-the-job Training	Male / Female	Race and ethnicity	Median Salary - NYC	Median Salary - National
Landscaping and Groundskeeping Workers	No formal educational credential	Short-term	92.7% / 7.3%	Latinx / 41.3% White / 39.3% Black / 14.9% Asian / 3.0%	\$37,387	\$30,430
Tree Trimmers and Pruners	High school diploma or equivalent	Short-term	91.0% / 9.0%	White / 40.3% Latinx / 39.6% Black / 15.5% Asian / 3.0%	\$58,679	\$39,978
Foresters	Bachelor’s degree	None	80.9% / 19.1%	White / 89.1% Latinx / 4.2% Black / 3.3% Asian / 1.4%	\$57,510	\$61,797

Table 6 - Typical Worker Characteristics for Functional Maintenance Nature-Based Jobs in NYC, 2020

Source: QCEW, modified using Emsi’s proprietary methods

well-defined pathways for career advancement, a higher degree of ethnic and racial diversity, and a tendency for workers to skew male. Approximately 70 percent of Landscaping and Groundskeeping Workers and Tree Trimmers and Pruners had a high school diploma equivalent or less. However, local median salaries for these jobs do not always exceed their national salary equivalents. As an example, Tree Trimmers and Pruners in New York City earn almost \$9,000 more annually than the national median, whereas Foresters earn approximately \$4,000 less. While some positions were sufficient to provide a living wage for a single adult, none of the jobs in the sample were sufficient to cover a living wage for a family of four.

Functional Maintenance jobs are more widely represented in the public sector relative to the other job categories, and there are several NYC Civil Service Titles that may be regarded as prototypical *Functional Maintenance* NBJs. See Figure 2 “Potential Career Pathway for a City Park Worker” for an illustration of a potential career path for a City Park Worker at NYC Parks. Advancement is contingent largely on prior service, possession of a Driver’s License, passing

Foresters in NYC

According to Emsi, in 2019 the median compensation for Foresters in New York City was \$27.65/hr. Based on the national median wage of \$29.71/hr, this means employers spent about 7 percent less to employ Foresters in the city. At the same time, local worker purchasing power was 49 percent less than the national median, making the city less attractive for talent.

There are limited forestry credential programs in the city; none of the City University of New York institutions have forestry degree programs, nor to our knowledge do any private NYC-based colleges or universities. This, combined with a lack of forester positions (less than 100) means those looking to pursue this career are incentivized to leave the City and disincentivized from returning.

a drug screening, and successful completion of a Civil Service exam for the new job title.

Overall, the City is more likely to directly employ workers in maintenance and operational roles and to contract out construction

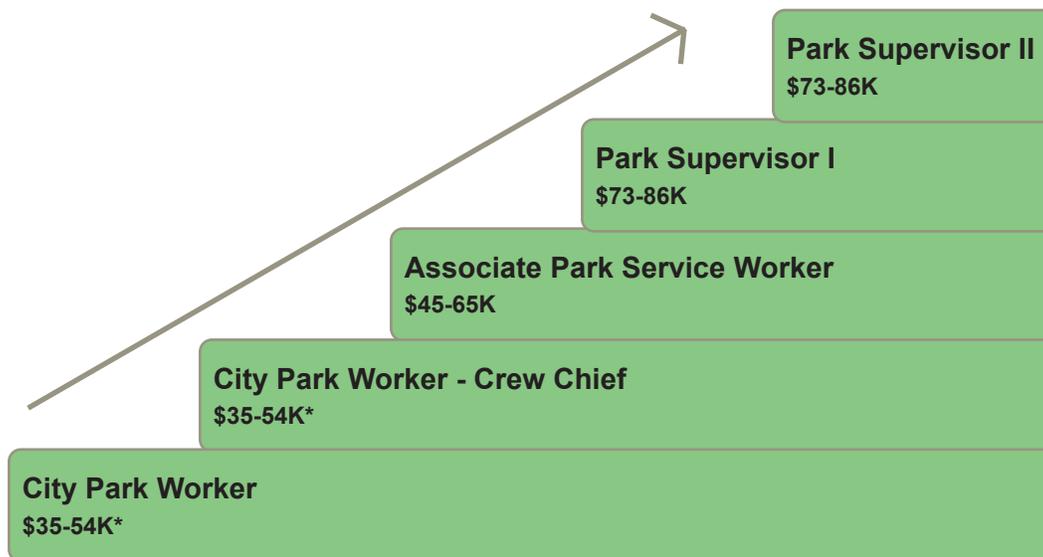


Figure 2: Potential Career Pathway for a Park Worker. Salaries are from The City of New York, Adopted Budget Fiscal Year 2021, Supporting Schedules. Please note that the Supporting Schedules do not provide salary ranges for each level within an overarching job title; the salary range covers all levels within the overarching title (i.e. City Park Worker and City Park Worker - Crew Chief have the same salary range, as do Park Supervisor I and Park Supervisor II). It is presumed that higher levels within the title have a higher starting salary.

* City Park Worker and City Park Worker - Crew Chief can also be seasonal roles that are paid hourly wages.

and implementation work to private companies. In acknowledging this point, interviewees emphasized the importance of funding dedicated operations budgets to ensure that maintenance of publicly owned nature-based assets and infrastructure can continue. This represents a looming challenge due to the impacts of COVID-19 and depleted agency budgets. Many NYC Parks workers are represented by the labor union, District Council 37, which has played an important role advocating for increased funding for parks as a co-founder of the Play Fair for Parks campaign.

Despite this challenge, there is optimism in the City's ability to hire for *Functional Maintenance* roles. A representative from DEP expressed confidence they will increase their number of direct hires as many of their newly constructed green infrastructure assets (e.g., rain gardens and bioswales) are projected to come online over the coming years, which will lead to the agency assuming responsibility for maintenance and upkeep from contractors. The City Cleanup Corps is another immediate initiative seeking to create over 10,000 new jobs by the end of 2021.

Value Maintenance

NBJs seek to drive awareness and support for NBSs by demonstrating their value and their myriad benefits. Day-to-day responsibilities are highly interpretive and predicated on person-to-person interactions. Some examples of this include work performed by an outreach coordinator providing information about an environmentally sensitive project in a waterfront neighborhood, an urban park ranger leading a tour of Prospect Park, or a nonprofit instructor working to teach young NYCHA residents urban farming skills. This group of jobs could be perceived as an outlier compared to the others defined in this report because it does not reflect a stage within a project development and construction process. However, *Value Maintenance* NBJs are critical for demonstrating the value of NBSs and imperative for ensuring more widespread awareness and adoption of them. Additionally, these jobs are vital for maximizing

“The COVID-19 pandemic showed us just how important parks and other outdoor spaces are for New Yorkers. District Council 37 members keep those spaces clean and safe, but they need support. Growing nature-based jobs in New York City plans for a future where everyone from all communities can enjoy the beautiful spaces this city has to offer.”
- District Council 37

Swale — A Floating Nature-Based Demonstration

Swale is “a floating food forest built atop a barge that travels to public piers in New York City welcoming visitors to harvest herbs, fruits and vegetables for free.” It was founded in 2016 by artist Mary Mattingly, and launched at Concrete Plant Park in the South Bronx, one of the largest food deserts in the United States. Since then, Swale has hosted 205,000 visitors, over 800 guided tours, 75 school field trips, 50 free public programs and 38 Summer Youth Employees. Swale is a dynamic demonstration of alternate models of community-based food production and regenerative ecosystems. As a result of the efforts of the individuals, community groups, and city organizations involved, NYC Parks opened their first land-based pilot in 2017 — a public “Foodway” at Concrete Plant Park. The current programming is deeply emblematic of the tasks and responsibilities typical of *Value Maintenance* NBJs, seeking to drive awareness and promote the efficacy of nature-based solutions. Learn more at swaleny.org.

the community benefits of nature-based infrastructure for local residents and supporting social cohesion.

Value Maintenance NBJs are the hardest to quantify and analyze. All the examples given earlier in this section are challenging to assign with an SOC title. Although the concept of this category resonated with interviewees, most felt there were fewer of these positions relative to the other job

categories. Interviewees also indicated occupations from other categories likely engage in tasks and responsibilities typical of *Value Maintenance* as a component of their work. An example would be a Hydrologist (*Conceptualization*) that works as an adjunct professor and teaches a class about green infrastructure and stormwater capture. Table 7 shows the typical characteristics of NYC workers in roles that may be *Value Maintenance* NBJs.

SOC Job Title	Typical entry-level education	Typical on-the-job Training	Male / Female	Race and ethnicity	Median Salary - NYC	Median Salary - National
Forest and Conservation Technicians	Associate's degree	None	52.8% / 47.2%	White / 59.2% Latinx / 13.5% Black / 11.6% Asian / 12.3%	\$45,753	\$45,490
Conservation Scientists	Bachelor's degree	None	74.9% / 25.1%	White / 84.8% Latinx / 7.0% Black / 3.7% Asian / 1.5%	\$87,510	\$62,650

Table 7 - Typical Worker Characteristics for Value Maintenance Nature-Based Jobs in NYC, 2020

Source: QCEW, modified using Emsi's proprietary methods



Photo by Jonathon Grassi

WHERE ARE NATURE-BASED JOBS FOUND?

With the developed understanding of the different categories of NBJs, the next step is to understand where they appear in the workforce. Several areas of work surfaced over the course of research and provide a means for framing the projects, policies, and initiatives that employ and drive growth in NBJs, illustrated in Table 8.

Although the subject matter for the four areas of work may differ, conversations with interviewees and research evidenced that occupations sometimes overlap. This suggests there is a core set of skills and competencies possessed by NBJ workers that are transferable across different contexts, although the Facilities and Operations area of work may be an exception in that it is largely limited to Landscaping and Groundskeeping workers. This suggests Facilities and Operations is a good source of entry-level positions, but NBJ workers in this area may find it challenging to advance and gain experience in nature-based careers.

Moreover, waterfronts represent an emerging sector with the potential to create new NBJs focusing on studying, building, maintaining, and improving coastal resiliency, restoration, and open space on New York City's waterfronts. With government funding, including direct federal investments, this sector may have a substantial opportunity to grow in the near future. For example, the US Army Corps of Engineers' *New York/New Jersey Harbor and Tributaries Coastal Storm Risk Management Feasibility Study* projects that interventions could range in cost from about \$15 to \$118 billion, a sizable investment in NYC's 520 miles of coastline.¹⁷ See call out box on the Newtown Creek Nature Walk for a recent example of a publicly-funded waterfront project.

The Newtown Creek Nature Walk

The Newtown Creek Nature Walk was built by the New York City Department of Environmental Protection (DEP) through the New York City Department of Cultural Affairs' Percent for Art Program in conjunction with the Newtown Creek Wastewater Resource Recovery Facility (WRRF) upgrade. The Nature Walk seeks to promote interest in the waterway and educate visitors about the industrial area's history, as well as incorporate native trees, shrubs, grasses, and wildflowers. Design elements pay tribute to the Lenape people who once lived in Greenpoint and portholes allow visitors to look into the WRRF.



Photo by Natural Areas Conservancy

Description	Typical Job Requirements	Example Nature-Based Jobs	Example Policies and Initiatives*
Parks, Greenery, and Urban Forest			
Jobs promoting, studying, maintaining, and improving trees, parks, greenery, and other contributions to the urban forest.	Baseline understanding of tree and plant knowledge and a minimum one year of experience.	<ul style="list-style-type: none"> • Conservation Scientists • Forest and Conservation Technicians • Foresters • Landscape Architects • Landscaping and Groundskeeping Workers • Soil and Plant Scientists • Tree Trimmers and Pruners 	<ul style="list-style-type: none"> • Community Parks Initiative • Forest Management Framework for NYC • Cool Neighborhoods NYC: A Comprehensive Approach to Keep Communities Safe in Extreme Heat • NYCHA's Urban Forest: A Vital Resource for New York City
Waterfronts			
Jobs promoting, studying, building, maintaining, and improving coastal resilience, restoration, and open space on New York City's waterfronts.	An understanding of coastal resiliency, climate change, land-use planning, and emergency management.	<ul style="list-style-type: none"> • Conservation Scientists • Construction Laborers • Construction Managers • Forest and Conservation Technicians • Foresters • Health and Safety Engineers • Hydrologists • Landscape Architects • Soil and Plant Scientists • Urban and Regional Planners 	<ul style="list-style-type: none"> • Comprehensive Waterfront Plan • Hunts Point Resiliency Project • Lower Manhattan Coastal Resiliency Project • East Side Coastal Resiliency Project • New York City Wetlands Strategy • New York City Wetland Management Framework • US Army Corps of Engineers' NY-NJ Harbor and Tributaries Study • <i>Water Resources Development Act of 2020</i> • <i>NY-NJ Watershed Protection Act</i> • Citywide Climate Adaptation Plan
Green Infrastructure (GI)			
Jobs that use plant or soil systems, permeable surfaces, stormwater harvest and reuse, and landscaping to divert stormwater from sewer systems and surface waters.	Familiarity with Green Infrastructure assets that may include rain gardens, bioswales, permeable pavers, green roofing, and related assets.	<ul style="list-style-type: none"> • Conservation Scientists • Construction Laborers • Construction Managers • Forest and Conservation Technicians • Foresters • Health and Safety Engineers • Hydrologists • Landscape Architects 	<ul style="list-style-type: none"> • <i>New York City Combined Sewer Overflow (CSO) Consent Order</i> • NYC Department of Environmental Protection Green Infrastructure Program • <i>Local Laws 92 and 94</i> • Citywide Climate Adaptation Plan • NYC Stormwater Management Program/Municipal Separate Storm Sewer Systems (MS4) Program
Facilities and Operations			
Jobs that are partially nature-based, but often prioritize other responsibilities, such as cleaning and facilities maintenance. This area of work may be an area of opportunity to impart workers with skills and training necessary to pursue more nature-based career opportunities. (See callout: NYCHA and NYC Parks Cross-Departmental Collaborations)	Typically entry-level positions with minimal requirements except for some prior work experience in a similar context.† OSHA certification desirable.	<ul style="list-style-type: none"> • Landscaping and Groundskeeping Workers 	Not a policy or initiative, but it is worth noting that staff who maintain parks and other green spaces on public spaces, such as those under NYC Parks jurisdiction or on NYCHA properties, are considered performing NBJs

Table 8 – Areas of Work for Nature-Based Jobs

* Italics denote policies, generally enacted by legislative bodies or as part of regulatory efforts. All other entries are initiatives, in which we include formal recommendations and frameworks, as well as funded efforts such as those from the Mayor's office.

† A Job Posting Notice for a NYCHA Caretaker position lists the following among typical job responsibilities: "Sweep and mop public building spaces...Remove snow and encumbrances...Light and clean incinerators...Clean ramps, drains, roofs and canopies...Clean grounds and vacant apartments... Perform general gardening work, including cutting lawns, trimming hedges, transplanting, reseeding, and spreading fertilizer and topsoil." For additional reference, see NYC.gov website: https://a127-jobs.nyc.gov/index_new.html?agency=996

Industries & Nature-Based Jobs

A labor market analysis of SOC titles suggests NBJs appear across several leading North American Industrial Classification Systems (NAICS) industries: Government^{*}; Administrative and Support and Waste Management and Remediation Services; Professional, Scientific, and Technical Services; and Construction. Cross-referencing this information with the degree of NBJ representation for a given SOC title highlights a positive correlation with jobs located in Government and a negative correlation with jobs located in Construction and Professional, Scientific, and Technical Services. This suggests that the public sector is more likely to employ prototypical examples of NBJs than private companies, and that efforts to support and promote NBJs may require different approaches based on the type of employer. Table 9 shows how different job titles align with industries and the

percentage of the occupation employed by the government.

Nature-Based Jobs in Government Agencies in NYC

In recognition of the outsized role city and state government plays in employing more representative NBJs, NYC Civil Service Title data helps identify how individual agencies are hiring. This analysis looks at three such agencies: NYC Department of Parks and Recreation (NYC Parks), the NYC Department of Environmental Protection (DEP), and the NYC Housing Authority (NYCHA).[†] It may at first appear as though NYCHA has the largest number of NBJs, with more than 4,000 Caretaker positions (Table 10). However, while Caretakers are responsible for gardening and landscaping on NYCHA properties, they are also responsible for other tasks that include sweeping and mopping, snow removal,

SOC Job Title	Industries with Greatest Share of Occupation Jobs (2020)	% of Occupation in Government (2020)	Degree of NBJ Representation
Hydrologists	Government	89.4	High
Forest and Conservation Technicians	Government	88.3	High
Urban and Regional Planners	Government	84.5	Medium
Conservation Scientists	Government	59.2	High
Foresters	Government	55.9	High
Tree Trimmers and Pruners	Administrative and Support and Waste Management and Remediation Services	34.9	High
Landscaping and Groundskeeping Workers	Government	32.8	Medium
Soil and Plant Scientists	Professional, Scientific, and Technical Services	27.8	Medium
Health and Safety Engineers	Professional, Scientific, and Technical Services	21.2	Low
Construction Laborers	Construction	6.5	Low
Construction Managers	Construction	6.2	Low
Landscape Architects	Professional, Scientific, and Technical Services	5.8	Medium

Table 9 - Leading Industry and Share of Government Employment by SOC Title

Source: New York Department of Labor, Division of Research and Statistics. Percentage of occupation in government was calculated using Inverse Staffing Patterns from Emsi Q2 2021 Data Set, which uses state data from the New York Department of Labor, Division of Research and Statistics. This data provided counts for each SOC title for 2-digit NAICS industries. Government jobs are defined by NAICS Code 92 – Public Administration. Job titles are as stated by source.

* Includes federal, state, and local government jobs that include jobs categories more specifically represented at the individual level in the private sector.

† These agencies operate under different mandates and receive funding from different sources. As an example, NYCHA differs from the other agencies in that it is a New York State public benefit corporation and is not under the jurisdiction of the NYC Mayor's Office. These distinctions may impact the presence and ability of each to support and hire NBJs.

garbage collection and waste removal, and other facilities tasks. In reality, only a fraction of these roles are likely to engage in work typical of NBJs on a regular basis.

New York Civil Service Title data and conversations with interviewees identified NYC Parks as far and away the leading employer of NBJs in terms of both count and different types of jobs. With 30,000 acres (about 14% of the city’s land area) to maintain, many NYC Parks jobs are *Functional Maintenance* roles, such as City Park Worker. DEP employs some of the same roles as NYC Parks in smaller numbers but also employs almost all of the Construction Laborer positions across local government. This seems to suggest DEP is a strong source of *Implementation* jobs. However, input from interviewees and a review of the Civil Service Title job description indicates that typical day-to-day responsibilities for Construction Laborers are more representative of a *Functional Maintenance* role, involving routine repair and ad hoc support for private contractors. It is also worth noting that Construction Laborers are considered low representation NBJs; not all roles regularly engage in nature-based work.*



Civil Service Title	Minimum Salary Rate (Annual)	All Agencies		DPR		DEP		NYCHA	
		Count	Count	As % of Total	Count	As % of Total	Count	% of Total	
Caretaker (Housing Authority)	\$35,975	4044	-	-	-	-	4044	100%	
City Park Worker	\$39,923	1426	1355	95%	71	5%	-	-	
Urban Park Ranger	\$50,635	439	430	98%	-	-	-	-	
Construction Laborer	\$91,603	348	-	-	319	92%	-	-	
Gardener	\$49,922	240	220	92%	17	7%	-	-	
Climber & Pruner	\$64,177	126	120	95%	-	-	-	-	
Scientist (Water Ecology)	\$52,255	113	-	-	75	66%	-	-	
Landscape Architect	\$77,921	99	90	91%	1	1%	2	2%	
Forester	\$49,933	69	68	99%	1	1%	-	-	
Total		6,904	2,283		484		4046		

Table 10 - Civil Service Titles Employed by Select NYC Agencies, including NYC Department of Parks and Recreation (DPR), NYC Department of Environmental Protection (DEP), and NYC Housing Authority (NYCHA).

Source: Department of Citywide Administrative Services – Civil List (2019). Construction laborer salary is reported as an hourly wage. To determine annual salary, this table multiplied the hourly rate by 40 hours a week for 52 weeks (\$44.04 per hour x 40 hours per week x 52 weeks = \$91,603). Job titles are as stated by source.

* For Construction Laborer job description, see DCAS website: <https://www1.nyc.gov/assets/dcas/downloads/pdf/noes/20200502000.pdf>

NYCHA and NYC Parks Cross-Departmental Collaborations

The Samuel N. Bennerson 2nd Playground of Manhattan's Amsterdam Houses has been an NYC Park located on NYCHA property since it opened in 1949. After a period of decline, the park underwent a multi-million-dollar renovation using city capital funds and now stands as a model example of NYC Parks stewardship over a NYCHA open space.

In their 2019 report, *Time to Act: Restoring the Promise of NYC's Public Housing*, the Regional Plan Association suggested pursuing more opportunities to combine NYCHA open space and parks open space into larger community assets managed by the NYC Parks, encouraging their use not just by NYCHA residents, but of entire neighborhoods and the City as a whole. This cross-departmental collaboration could help promote sharing knowledge and skills between the two agencies' respective workforces and NYCHA residents.

"NYCHA caretaker's jobs are partially nature-based, but with limited staffing, their ability to put time into caring for the landscape comes after other responsibilities like waste removal. NYCHA does not currently have the resources or expertise to be able to care of its open spaces to the same standards as the Parks Department, but we are working to strengthen cross-agency partnerships and secure additional resources to improve the health and resiliency of NYCHA's landscape"

-Siobhan Watson, NYCHA Program Manager



Photo by Tami Lin-Moges

FUTURE OUTLOOK

A traditional labor market analysis suggests the overall number of NBJs is low, but projects growth across all SOC titles referenced in this report between now and 2025 (Table 11). The top three occupations for projected growth are Soil and Plant Scientists (41 percent), Conservation Scientists (27 percent), and Foresters (22 percent). Collectively, these three occupations represented a small portion of the jobs – only 159 – in 2020, compared to 9,749 Landscaping and Groundskeeping roles, for example, in the same period. Conservation Scientists and Foresters also saw double-digit percent declines between 2015 and 2020 (-39 percent and -42 percent respectively). This suggests there may be cause for optimism regarding anticipated growth, but also a need to recognize that growth can be volatile when the number of overall jobs is low.

Traditional labor market analyses also fail to fully capture the impacts of the ongoing COVID-19 pandemic and underscore why the perspectives of interviewees are essential for understanding the outlook for these positions.

Interviewees agreed the *Implementation* and *Functional Maintenance* categories compose the majority of all NBJs, whereas *Conceptualization* and *Value Maintenance* roles contribute a significantly smaller share. *Implementation* and *Functional Maintenance* roles are also where there appear to be the greatest opportunity to grow and support the number of NBJs in the near term, evidenced by initiatives like the City Cleanup Corp, DEP’s investment in citywide green infrastructure, and the numerous coastal resiliency projects taking place on the city’s waterfronts.

SOC Job Title	Job Count (2020)	% Change (2015-2020)	Projected % Change (2020-2025)
Conceptualization			
Soil and Plant Scientists	44	6%	41%
Hydrologists	51	-14%	17%
Urban and Regional Planners	753	13%	16%
Landscape Architects	773	8%	6%
Implementation			
Construction Managers	9,774	0%	9%
Construction Laborers	23,093	13%	7%
Health and Safety Engineers	657	10%	6%
Functional Maintenance			
Foresters	30	-42%	22%
Tree Trimmers and Pruners	385	92%	9%
Landscaping and Groundskeeping Workers	9,749	-3%	8%
Value Maintenance			
Conservation Scientists	85	-39%	27%
Forest and Conservation Technicians	166	117%	6%

Table 11 - Current Counts, Past Growth, and Projected Growth by SOC Title for New York City

Source: QCEW, modified using Emsi’s proprietary methods

CONCLUSION

Supporting and maintaining New York City's extensive natural infrastructure requires a large workforce. The analysis in this report suggests the number of NBJs in the city may be rather small, indicating a mismatch between need and capacity, and prompting questions of where to focus efforts to grow the number of NBJs. Interviewees identified the *Implementation* and *Functional Maintenance* categories as contributing the largest share of current NBJs and providing the greatest opportunity for growth in the near term. However, they also cautioned that this should not diminish the role of the *Conceptualization* and *Value Maintenance* categories. Rather, interviewees were adamant that scaling the number and impact of NBJs in New York City is contingent on work these two categories are uniquely positioned to perform.

The goal of this report was to create a framework for discussion and a vocabulary for talking about NBJs in hopes this area of study can continue to be built upon, creating a firm foundation for ongoing advocacy and advancement of an essential segment of the city's workforce. It is unrealistic to expect to solve all the challenges at once. As a result, there are several paths forward to support NBJs based on preferred outcomes:

- **Drive near-term growth in nature-based jobs** – Achieving this goal would involve continuing to work with the public sector to develop initiatives and projects that drive nature-based work, which would equate to more demand for *Implementation* jobs in the private sector and *Functional Maintenance* jobs in the public sector. While this approach increases the overall number of NBJs, the largest gains will likely continue to be in seasonal and contract-based entry-level positions. DEP's Green Infrastructure Program and the City Cleanup Corp are examples of this approach.
- **Increase nature-based job equity, accessibility, and quality** – In recognition of limited career pathways, particularly for entry-level non-white, non-male workers, this approach

would involve several strategies to support workers and increase their access to better job opportunities. Examples include convening NBJ employers to better understand in-demand skills, developing training curriculums and internship opportunities to bolster worker resumes, addressing the dearth of nature-based degree programs in the city, advocating for the creation of nature-based Civil Service Titles, or funding research and innovation into more sophisticated NBSs to drive demand for more sophisticated NBJs. These strategies have the potential to impact workers across all four job categories.

- **Promote deeper public appreciation for nature-based solutions** – Interviewees generally agreed there is substantial work that needs to be done to encourage more widespread adoption of NBSs. Without changing mindsets, long-term growth in NBJs will remain a challenge. *Value Maintenance* occupations and organizations provide a means to demonstrate to the public how NBSs effectively address some of society's most imminent challenges, improve quality of life, enhance our enjoyment of nature, and do all these things as cost-effectively as non-nature-based or gray infrastructure approaches. Highlighting real-world examples, such as rain gardens, trees, and community gardens, leveraging demonstrations like Swale, or reporting on the cost-effectiveness of green roofs are examples of this approach, with potential to impact demand for workers across all four job categories.

Moving forward with any one of these three paths will require continuing to validate the definition of NBJs by holding conversations with subject matter experts. This work is essential to deepening a collective understanding of nature-based jobs and to moving this work forward to build more nature-based solutions equitably across the five boroughs.

“The most important thing needed for nature-based jobs to really take off, besides funding for training and political support, is awareness. We need awareness of these types of jobs on the front end, to create the base for future workers, and most importantly, we need the potential drivers of this work to be aware that it is something they can initiate. The potential drivers are the owners of the infrastructure that needs to be upgraded. They need to know that incentives exist, a workforce exists, and the future needs them.”

-Inger Yancey Brooklyn Green Roof



APPENDIX A: NATURE-BASED JOB POLICIES AND INITIATIVES

Name	Type	Description
Parks, Greenery, and Urban Forest		
Community Parks Initiative	Initiative	Begun in 2014, this initiative is NYC Parks' leading park equity initiative that will invest \$130 million capital dollars and bring enhanced programming, maintenance, and community partnership building to neighborhood parks in the city's more densely populated, faster-growing, and higher-poverty communities.
Forest Management Framework for NYC	Initiative	This framework, developed by the Natural Areas Conservancy and NYC Parks, is intended to guide the restoration and management of NYC Parks' 7,300 acres of forested natural areas and calls for an investment of \$385 million over 25 years.
Cool Neighborhoods NYC: A Comprehensive Approach to Keep Communities Safe in Extreme Heat	Initiative	Cool Neighborhoods NYC is a \$106 million program designed to help keep New Yorkers safe during hot weather, mitigate urban heat island effect drivers, and protect against the worst impacts of rising temperatures from climate change. The plan includes a \$16 million investment to support planting trees in parks and an additional \$7 million investment to support forest restoration across the five boroughs.
NYCHA's Urban Forest: A Vital Resource for New York City	Initiative	This report examines the segments of the urban forest under the jurisdiction of the New York City Housing Authority. It includes steps the agency can take to better understand and manage its trees, including hiring staff specifically for tree care and expanding a partnership with Green City Force and other organizations to create urban forestry career pathways.
Waterfronts		
Comprehensive Waterfront Plan	Initiative	The 2011 Comprehensive Waterfront Plan (CWP), referred to as Vision 2020, establishes eight broad goals and offers hundreds of recommendations for the waterfront and waterways for the next decade and beyond. Vision 2020 builds on the earlier 1992 CWP and reasserts New York City's commitment to the priorities established in the earlier plan, including expanding public access, supporting the working waterfront, and restoring the ecology of the city's shores.
Hunts Point Resiliency Project	Initiative	To help improve resiliency in the area, the Department of Housing and Urban Development awarded the City \$20 million to work with the Hunts Point community to study and plan for climate risks in Hunts Point, and to advance a pilot resiliency project into implementation. The City supplemented this funding with additional Community Development Block Grant Disaster Recovery and City Capital funds to bring the total project budget to \$71 million. This investment will go towards addressing the vulnerability of critical industrial and community facilities by providing reliable, dispatchable, and sustainable power to Hunts Point through a combination of energy generation and storage solutions.
Lower Manhattan Coastal Resiliency Project	Initiative	Following the 2019 publication of the Lower Manhattan Climate Resiliency Study, the City allocated \$500 million towards capital investments and planning for climate resiliency projects for Lower Manhattan. The Project specifically aims to reduce flood risk caused by coastal storms and sea level rise while protecting and encouraging public access to the Manhattan waterfront.
East Side Coastal Resiliency Project	Initiative	Funded by the Federal and City governments, the East Side Coastal Resiliency Project seeks to reduce flood risk caused by coastal storms and sea level rise on the east side of Manhattan from East 25th to Montgomery Street. Construction began in 2020 and will continue through 2025.
New York City Wetlands Strategy	Initiative	Published in 2012 and now in the process of redevelopment, the New York City Wetlands Strategy established a framework for bolstering the city's wetland areas. The report and associated projects marked an unprecedented commitment to overhauling New York's wetlands through four key areas of focus: protection, mitigation, restoration, and assessment.

New York City Wetlands Management Framework	Initiative	This framework, developed by the Natural Areas Conservancy and NYC Parks, is intended as a vision to guide the restoration and management of the 2,820 acres of wetlands under the jurisdiction of NYC Parks. It calls for greater investment and staff to protect the city's wetlands.
US Army Corps of Engineers' New York New Jersey Harbor and Tributaries Study	Initiative	Coastal storms have severely impacted the North Atlantic Coast and the New York-New Jersey Harbor region. As part of this study, the US Army Corps of Engineers is investigating measures to manage future flood risk in ways that support the long-term resilience and sustainability of the coastal ecosystem and surrounding communities and reduce the economic costs and risks associated with flood and storm events.
Water Resources Development Act of 2020	Policy	The Water Resources Development Act was developed by the Federal Transportation and Infrastructure Committee and has been passed on a bipartisan and biennial basis since 2014. It includes key provisions to invest in ports, harbors, and inland waterways; build more resilient communities; and ensure that the U.S. Army Corps of Engineers carries out projects in an economically and environmentally responsible manner.
New York-New Jersey Watershed Protection Act	Policy	The New York-New Jersey Watershed Protection Act was a bill introduced by U.S. Representative Paul Tanko in September 2020. While the bill ultimately was not put to a vote in the House, it sought to direct funds to the restoration and protection of New York and New Jersey watersheds that are linked to the New York-New Jersey harbor.
Citywide Climate Adaptation Plan	Initiative	The Citywide Climate Adaptation Plan bill, passed by the NYC City Council in October 2021, requires the Mayor's Office to release a plan that considers and evaluates various climate hazards impacting the City and its shoreline. The Citywide Climate Adaptation Plan will include recommendations for resiliency and adaptation measures to protect residents from multiple climate hazards, including extreme storms, sea level rise, tidal flooding, extreme heat, extreme precipitation, extreme wind, wildfire, and flooding surge events associated with a storm. The plan will also prioritize communities highly vulnerable to climate hazards and consider the potential impact on environmental justice areas.
Green Infrastructure (GI)		
New York City Combined Sewer Overflow (CSO) Consent Order	Policy	The Department of Environmental Protection (DEP) is required under a 2005 Order on Consent to reduce combined sewer overflows (CSOs) from its sewer system to improve the water quality of its surrounding waters, such as Flushing Bay, Jamaica Bay, and tributaries to the East River, Long Island Sound, and Outer Harbor.
NYC Department of Environmental Protection Green Infrastructure Program	Initiative	As of early 2020, NYC DEP's GI Program has committed over \$800 million in capital funds since fiscal year 2012 and has approximately \$850 million currently budgeted through fiscal year 2030 to support various GI initiatives, including construction of green infrastructure on public properties, enforcement of green infrastructure protections, and new programs and rules to expand green infrastructure implementation on private properties.
Local Laws 92 and 94	Policy	NYC Local Laws 92 and 94, adopted in April 2019, require any existing roof (or new construction) undergoing major construction be covered in either solar panels or a green roof. These local laws play a role in achieving the central goal of the Climate Mobilization Act: moving New York City away from carbon-focused energy towards renewable energy sources.
Citywide Climate Adaptation Plan	Initiative	The Citywide Climate Adaptation Plan bill, passed by the NYC City Council in October 2021, requires the Mayor's Office to release a plan that considers and evaluates various climate hazards impacting the City and its shoreline. The Citywide Climate Adaptation Plan will include recommendations for resiliency and adaptation measures to protect residents from multiple climate hazards, including extreme storms, sea level rise, tidal flooding, extreme heat, extreme precipitation, extreme wind, wildfire, and flooding surge events associated with a storm. The plan will also prioritize communities highly vulnerable to climate hazards and consider the potential impact on environmental justice areas.
NYC Stormwater Management Program	Initiative	The Municipal Separate Storm Sewer Systems (MS4) permit requires the NYC Department of Environmental Protection (DEP) to develop a Stormwater Management Program (SWMP), which includes numerous programs designed to reduce pollution in stormwater runoff, including green infrastructure to help improve water quality.

APPENDIX B: METHODOLOGY

Data Sources

Interviews

In the absence of an existing Census definition for NBJs, this report relied on interviews with stakeholders to help establish a list of qualifying job titles and to understand the current landscape for these positions, including relevant policies and initiatives that may impact their future outlook.

Emsi

Emsi is a labor market information vendor that gathers and integrates economic, labor market, demographic, education, profile, and job posting data from government and private sector sources to create a comprehensive and current dataset with full United States coverage. Emsi's core LMI data is updated quarterly, and job postings data is updated every two weeks. Job postings data is gathered by scraping over 100,000 websites.

This report used Emsi's proprietary data to collect information on occupation counts, employment projections, demographics, earnings, industry staffing patterns, and job postings. More information on Emsi can be found at: <https://kb.emsidata.com/methodology/emsi-data-basic-overview/>.

O*Net

O*Net OnLine provides a database containing standardized and occupation-specific descriptions on almost 1,000 occupations, using a taxonomy based on the Standard Occupational Classification, and periodically revised to reflect the changing occupational landscape. The O*Net Program is developed under the sponsorship of the U.S. Department of Labor/Employment and Training Administration (USDOL/ETA).

This report utilized O*Net occupational descriptions to understand the mix of knowledge, skills, and abilities typically required to perform a particular occupation and typical activities and tasks. This information was used to help determine the list of SOC titles to be profiled in this report. More information about the O*Net Program can be found at <https://www.onetcenter.org/>.

NYC Open Data

NYC Open Data curates nearly 3,000 different datasets across New York City agencies and other City organizations, making them available for public use as part of a broader initiative to improve the accessibility, transparency, and accountability of City government. This report utilized the NYC Open Data portal to analyze datasets from the NYC Department of Citywide Administrative Services that provided the number of individuals employed by the City of New York by agency and Civil Service Title. These datasets include:

- NYC Civil Service Titles – List of Civil Service titles codes and title descriptions used by City of New York Agencies¹⁹
- Civil List – Reports the agency code, first initial and last name, agency name, title code, pay class, and salary of individuals who were employed by the City of New York at any given time during the indicated year²⁰

The most recent datasets available at the time of writing this report were for the year 2019 and do not reflect impacts from the COVID-19 pandemic.

Verifying SOC Codes and NYC Civil Service Titles as Nature-Based Jobs

Research for this report sought to analyze examples of SOC and NYC Civil Service job titles that demonstrated qualities of NBJs, rather than endeavoring to analyze an entire population. Jobs were selected for this report based on collaborative discussion between Just Nature NYC and Public Works Partners and their ability to meet at minimum one of the below criteria:

- Interviewee(s) described the job title as an exemplary example of a NBJ when applying the definition presented in this report.
- Interviewee(s) described the job title as making a partial contribution to the larger population of NBJs with the potential for policies and initiatives to scale their impact.
- O*Net descriptions for an SOC code reflected tasks and activities representative of the definition presented in this report.
- Emsi job postings and/or DCAS Exam Notices for the job title reflected tasks and activities representative of the definition presented in this report.

Determining Degree of Nature-Based Job Representation for SOC and NYC Civil Service Title Codes

After determining the sample job titles to be profiled in this report, Emsi was used to provide a count of unique job postings for each SOC code between January 2020 and December 2020. These resulting unique job posting counts were then filtered based on whether they included at least one of a set of keywords informed by the definition for NBJs presented in this report: Biodiversity; Green Infrastructure; Forest; Native; Natural; Outdoors; Plants; Resiliency; and Storm Water Filtering. This provided a smaller sample of what were then regarded as “NBJ-specific postings”. For each occupation, the count of “NBJ-postings” was divided by the original count of postings to yield a percentage value. The percentage value was then used to determine a Low/Medium/High value based on three equal intervals, illustrated in the rubric below.

% of NBJ Representation	Degree of NBJ Representation	Description
1-33	Low	NBJs compose only a small portion of the overall population of these occupations
34-66	Medium	A moderate portion of these occupations can be considered NBJs or demonstrate tasks and activities common to NBJs
67-100	High	These occupations are considered good examples of NBJs

SOC Job Title	All Postings	NBJ Postings	% of NBJ Representation
Foresters	11	11	100.00%
Tree Trimmers and Pruners	66	62	93.94%
Soil and Plant Scientists	22	17	77.27%
Hydrologists	4	3	75.00%
Forest and Conservation Technicians	13	9	69.23%
Conservation Scientists	74	51	68.92%
Landscaping and Groundskeeping Workers	627	352	56.14%
Landscape Architects	145	75	51.72%
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	1129	188	16.65%
Urban and Regional Planners	421	66	15.68%
Construction Laborers	568	68	11.97%
Construction Managers	4,463	394	8.83%

The degree of NBJ representation determination for NYC Civil Service Titles was based on input from stakeholder interviews and a review of DCAS Civil Service Title descriptions.

Disclaimer

Just Nature NYC, a collaboration between The Nature Conservancy in New York Cities Team and NYC Environmental Justice Alliance, engaged Public Works Partners to analyze the present and future opportunities of “nature-based jobs” in New York City and to prepare this written report. In preparing this report, Public Works Partners relied, in whole or in part, on data and information provided by third parties and on publicly available data and information that were not independently verified by Just Nature NYC or Public Works Partners and assumed to be accurate, complete, reliable, and current. Therefore, although Just Nature NYC and Public Works Partners have utilized best efforts in preparing this report, Just Nature NYC and Public Works Partners do not warrant or guarantee the conclusions set forth in the report and shall not be liable for any reliance thereon by third parties.

Photos shown in this report primarily, but not exclusively, depict paid workers. They may also include unpaid volunteers and trainees completing similar nature-based work.

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