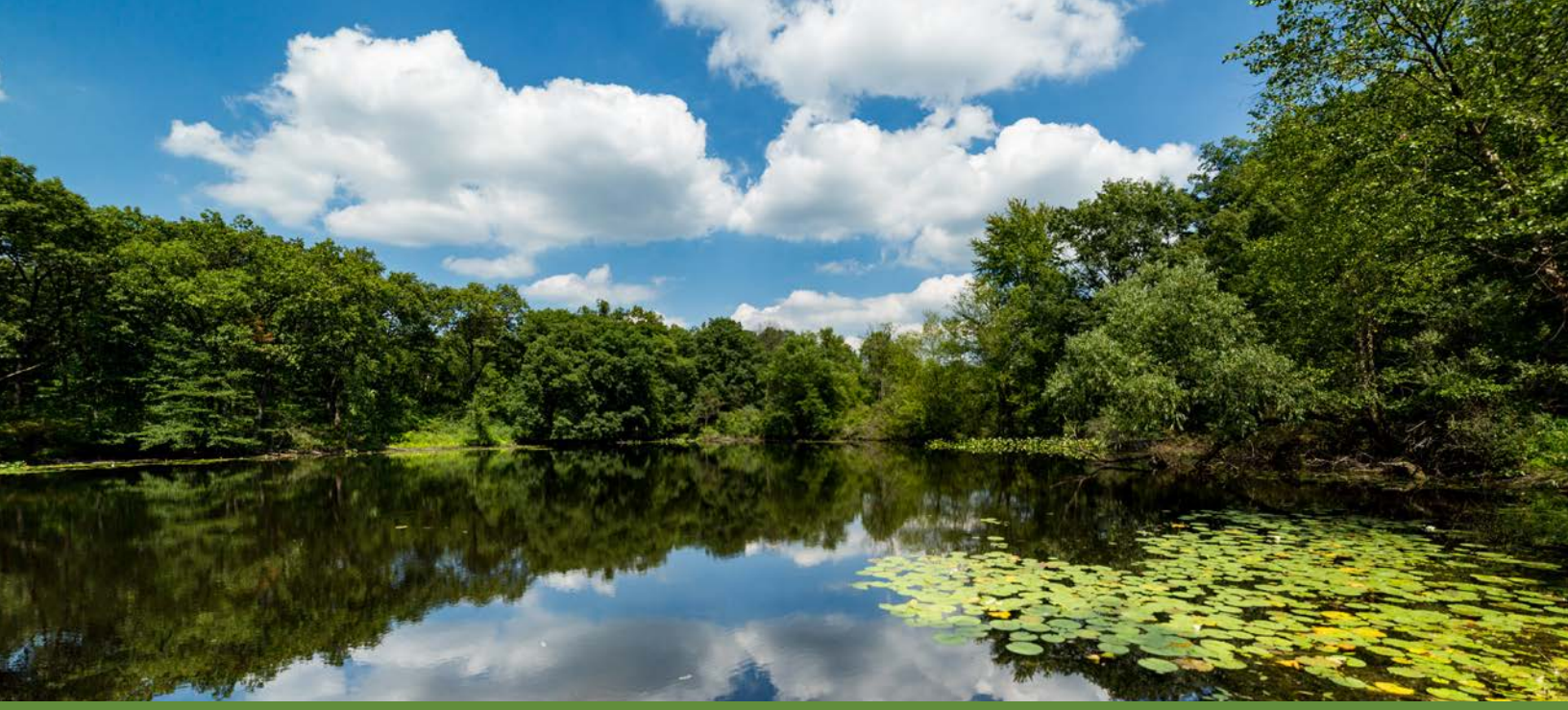

WHC White Paper

Nature-based Solutions to Prevent Pollution and Support Biodiversity

Opportunities for the Automotive Industry

Sponsored by

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wildlifehc.org

Fruit trees at GM's SGMW site in Guangxi, China, provide habitat and food for wildlife.

Message from our sponsor:

The state of nature requires everyone's participation. GM is committed to actively promoting and preserving biodiversity across our sites — our participation in WHC's (Wildlife Habitat Council) certification program is just one way we accomplish this.

The GM Biodiversity by Design catalogue, developed in collaboration with WHC, shares best construction practices that integrate more sustainable design into new builds, retrofits, expansions and land management at GM facilities. We have incorporated these best practices into recent GM facility transformations including enhanced facility grounds with living walls and no-mow zones, tree plantings and using native plants for landscaping as some examples. Integrating nature-based solutions into the design of our buildings and landscapes helps the organization to enhance biodiversity at our facilities.

Nature, biodiversity and ecosystems are linked to our business. By actively creating positive outcomes for nature at our facilities and in surrounding communities, we can help to preserve biodiversity and restore natural ecosystems.

The various case studies showcased in this white paper offer examples on how investments into nature-based solutions can produce positive environmental outcomes. When nature-based solutions are designed into our overall business practice, we can develop strategies to be more resilient regarding the resources we all rely on to operate in today's competitive landscape.

Together, we as an industry can help to improve biodiversity and local ecosystems in our communities. Nature is everyone's business.

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Introduction

Industries are increasingly recognizing the value of nature across the supply chain. Through practices such as utilizing sustainable materials, investing in circular economics and conserving natural resources, many corporations are making business decisions that result in positive benefits for the planet as well as for the company's bottom line. Nature-based solutions (NbS) are another strategy that businesses can employ to produce a positive impact on nature, productivity and the surrounding community.

The International Union for Conservation of Nature defines NbS as "actions to address societal challenges through the protection, sustainable management, and restoration of ecosystems, benefiting both biodiversity and human well-being."[1] In addition to preserving biodiversity of wildlife and plant species, NbS also deliver environmental co-benefits such as climate change resilience and improved air, water and soil quality, as well as community benefits such as recreation, aesthetics and environmental education.

Of particular use to many industries are the pollution prevention capabilities of NbS. NbS that are well-suited for various industries and scalable across operations support the prevention, reduction or elimination of pollution at its source prior to recycling, treatment or disposal, also known as source reduction.[2] Pollution prevention provides both financial and environmental benefits, as it reduces the need for waste management while preventing detrimental impacts to the surrounding ecosystem and human health.

The U.S. Environmental Protection Agency (EPA) notes that auto manufacturers largely release organic solvent chemicals such as xylenes, n-butyl alcohol and glycol ethers into the air, while metals and metal compounds make up approximately 71% of the chemical waste managed by the auto industry.[3] In addition, automotive manufacturing produces greenhouse gas (GHG) emissions throughout the entire life cycle of a vehicle. Mining or extracting raw materials for auto parts, transporting components from suppliers to

manufacturers, producing vehicles and recycling parts all contribute to a significant carbon footprint — a 2019 report found that the global car industry's GHG emissions exceed that of the European Union.[4]

Source reduction helps automotive companies meet company-wide, national and international goals related to pollution prevention and emissions reduction. Pollution prevention directly addresses various UN Sustainable Development Goals, including Goal 3, Good Health and Well-Being; goal 6, Clean Water and Sanitation; and Goal 11, Sustainable Cities and Communities. The broader environmental and social impacts of reduced pollution extend to address goals related to poverty, hunger and equity as well. NbS can address regulatory policies related to source reduction as well. In the U.S., the Pollution Prevention Act of 1990 established a national policy implemented by the EPA that emphasizes the prevention of pollution at the source and the use of environmentally safe practices to recycle or treat pollution that cannot be prevented at the source.

Many automotive manufacturers have been meeting these national and international goals by going beyond reducing vehicle emissions and incorporating pollution prevention strategies throughout the supply chain and manufacturing process. Pollution prevention approaches in the automotive industry take many forms, including using waste minimization practices, green chemistry and sustainable materials, energy-efficient processes and environmentally benign fuel sources. NbS are another set of tools that auto manufacturers and their suppliers can deploy to prevent pollution.

This white paper is part of a series of deliverables supported by a grant from the U.S. EPA to explore opportunities for the automotive industry to implement NbS for pollution reduction, with particular focus on EPA region 4, encompassing Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and six indigenous tribes. Throughout this project, WHC has partnered with the Suppliers Partnership for the Environment (SP) on these grant deliverables as well as other efforts to support the automotive sector and its supply chain in biodiversity uplift efforts.

This white paper explores how the automotive industry can implement nature-based solutions to prevent pollution. Case studies from WHC-certified programs as well as automotive manufacturers around the world illustrate how nature-based solutions reduce pollution and offer co-benefits for biodiversity and communities.

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Restoring Wetlands to Support Wildlife

While automotive manufacturers are decreasing their water use in recent years in order to conserve this vital natural resource, corporations have an opportunity to go above and beyond a mere reduction in usage by preserving water at its source – wetlands, waterbodies and watersheds.

Wetlands provide many ecological services, including wildlife habitat, flood protection, water quality and erosion control. The auto sector can support the important role of wetlands by restoring and rehabilitating streams and wetlands, naturalizing shorelines and planting vegetative buffers.

NbS that focus on wetland and waterbody restoration reduce sediment and runoff, greenhouse gases (specifically CO_2) and pathogens, which results in improved water quality. Blue carbon refers to the ability of wetlands and water bodies to absorb and sequester carbon, making wetland restoration an important part of climate change mitigation efforts.

Additional co-benefits of wetland restoration are the wildlife habitat and recreational opportunities created by healthy, accessible wetlands.

CONSERVATION IN ACTION

WM | TENNESSEE, U.S.A.
US EPA REGION 4

Since 2010, WM has worked to restore 30 acres of wetlands at the Southern Services Landfill. The site is located in the area of a major automotive production region in Nashville, Tennessee, on an alluvial plain of the Cumberland River. As such, this site serves as a buffer zone for the river. Trees and shallow water of the wetland provide habitat and food sources for wildlife, and when the wetlands flood, fish wash up into the shallow area, creating an accessible food source for waterfowl when the flood waters recede.

A significant portion of WM's efforts to enhance the wetland includes the eradication of invasive species — particularly Bradford pears, honey suckle bush, poison ivy and Johnson grass. Along with this effort came the opportunity to facilitate native plantings, and in spring 2021, WM worked with the Tennessee Environmental Council to plant 300 native trees, further enhancing the biodiversity on-site.

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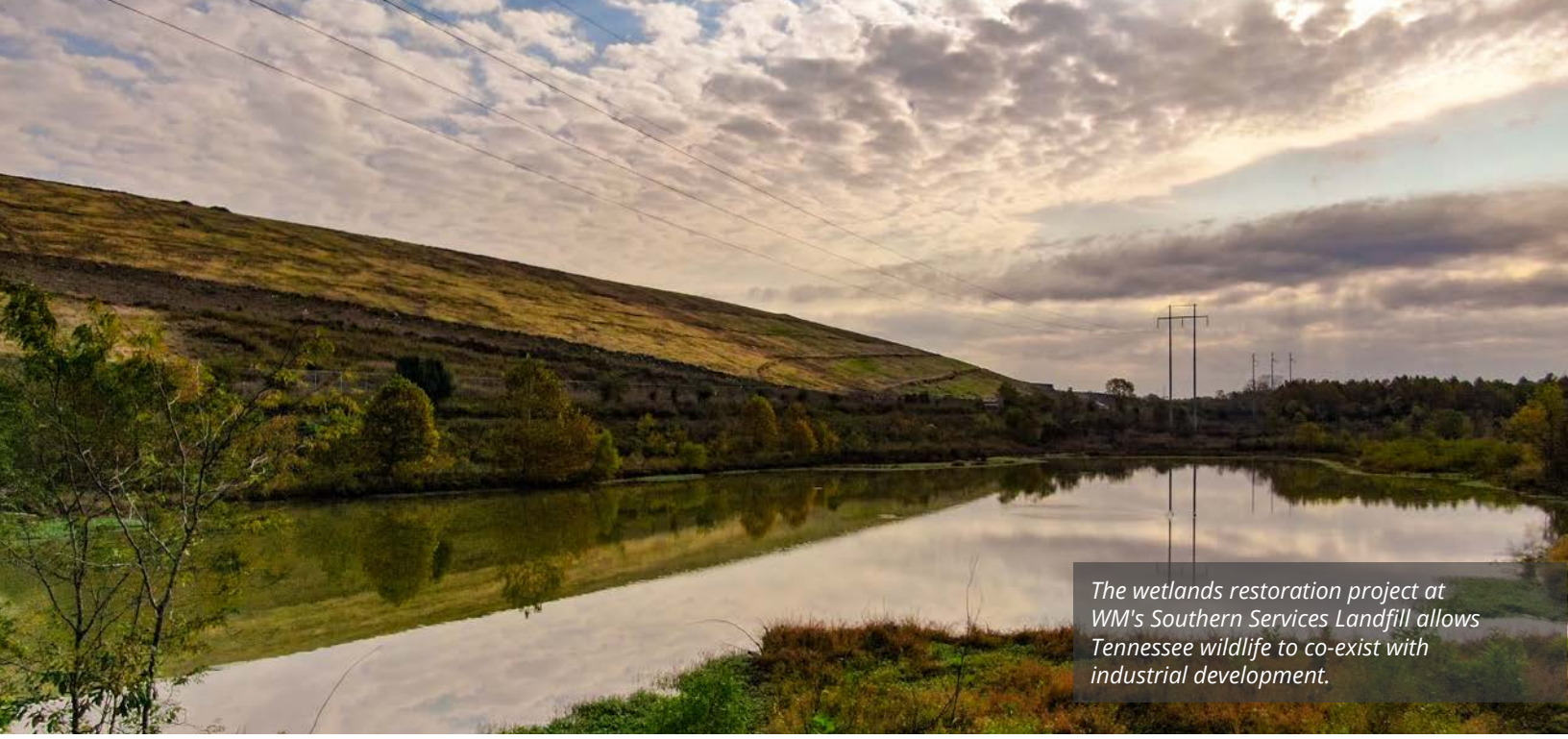

The wetlands restoration project at WM's Southern Services Landfill allows Tennessee wildlife to co-exist with industrial development.

Because of the proximity of the landfill to the wetlands, WM takes particular care to prevent landfill activities from impacting the wetland. The company developed a stormwater pollution prevention system, wherein layers of silt fencing prevent silt from building up in the wetland. Weekly inspections of the system ensure that it is operating properly, and if needed, the upgradient area is seeded and silt and mud are removed.

Wildlife game cameras indicate that the wetland is a thriving habitat, showing presence of coyotes, a bobcat and armadillos. By clearing invasive plants from the site, WM has opened up access for wildlife, and the inclusion of native plants supports air, water and human health.

WHC-CERTIFIED SINCE 2011

Alluvial Plains

These large, flat land surfaces are created by river sediment deposits over time. Alluvial soils serve an important ecosystem service by filtering nutrients, sediment and contaminants from adjacent waterways, improving downstream water quality.[5] Due to these sediment deposits, alluvial plains contain fertile, moist soils that prove successful for agriculture.

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The wetlands restored by Volkswagen in Chattanooga is home to 167 species of birds. Photo courtesy of the Chattanooga Times Free Press.

CONSERVATION IN ACTION

VOLKSWAGEN | TENNESSEE, U.S.A.
US EPA REGION 4

Located in Chattanooga, Tennessee, the Enterprise South Industrial Park is home to an auto plant as well as several other industries. From 1942 to 1977, the site served as an ammunition plant for the U.S. Army, the operations of which impacted much of the existing wetland.

In 2008, German automaker Volkswagen announced plans to open a production plant in Chattanooga. While water quality in the wetlands was safe, there was very little wildlife inhabiting the area, so when Volkswagen purchased the property, the company included wetlands restoration in its environmental stewardship goals.[6] By 2020, Volkswagen had restored 40 acres out of a total 88.[7]

The wetlands provide habitat for 15 endangered species, over 160 species of birds and a variety of wildlife including beavers, deer, turtles, dragonflies and otters. Regular testing ensures water quality remains at a high standard, reaching the highest grade in Tennessee. Restriction ensures that hunting and fishing in the wetlands are prohibited, although visitors are welcome to recreate in the area. Volkswagen has also developed a partnership with local animal rehabilitators, who utilize the wetland as a safe area to release rehabilitated animals.[8]

By restoring a wetland impacted by previous industrialization, Volkswagen is not only improving wildlife habitat and maintaining water quality, but the company is also providing educational and recreational opportunities for the community.

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Building Forests on a Smaller Scale

Trees provide vital ecosystem services for wildlife and humans as well as co-benefits that reduce pollution, making forestry a key nature-based solution that can aid companies in their biodiversity and climate change mitigation work. While large-scale reforestation efforts have immense benefits, smaller-scale projects such as urban forestry or microforestry can also prevent pollution and support biodiversity and community needs.

Broadly defined, urban forestry encompasses any collection of trees in an urban setting such as trees along a street, in a park or in an unused lot. The development of microforests accelerates the process of forest maturation, as they grow up to 10 times faster than a traditional forest.[9] Once a microforest is established, typically after three years, maintenance is no longer needed. Microforests are typically 100 square meters in area, although the shape can vary widely.

The main pollutants targeted by forests include greenhouse gases, particularly CO_2, and runoff. Beyond their pollution prevention capabilities, trees also provide a number of co-benefits for biodiversity and communities. Trees are well-known for their carbon sequestration – a mature tree will absorb 48 pounds (21.7 kilograms) of carbon per year.[10] Trees also capture particulate matter by absorbing pollutants into the leaf's pores, also known as stomata. Removing CO_2 and other pollutants from the air improves air quality for humans and wildlife. Trees' root systems also stabilize the soil, preventing erosion as well as promoting infiltration of runoff, which in turn controls flooding.

The availability of green space, particularly in urban environments, provides recreational opportunities, while the leaf canopy reduces the urban heat island effect, cooling areas that may be particularly prone to high temperatures due to industrial activities and impervious pavement.

CONSERVATION IN ACTION

TOYOTA | KENTUCKY, U.S.A.
US EPA REGION 4

Serving as headquarters for the company's Production Engineering division, Toyota's Production Engineering

The morizukuri microforest planting at PEMC allowed for employee participation as well as collaboration with local experts and NGOs.

and Manufacturing Center (PEMC) is located on just over half an acre of former pastureland in Georgetown, Kentucky.

Prior to any forestry projects, the land was largely populated with non-native grasses. In order to observe the practice of morizukuri, a Japanese concept of forest creation by planting groups of trees and grasses, Toyota developed a 22,600-square-foot microforest at the PEMC site in 2020. The first planting consisted of 24 species of trees native to the Bluegrass region of Kentucky, including sycamore, tulip poplar and black walnut. The following year, four more native tree species were added.

The plantings followed the Miyawaki method, developed by Dr. Akira Miyawaki, a Japanese botanist who worked with Toyota for years to develop forests on the company's property. The Miyawaki microforestry method relies on amending the soil and using native species to accelerate forest maturation, focusing efforts on species that naturally occur later in the vegetation succession.[11]

Toyota involved employees in the plantings, ultimately providing an opportunity for more than 70 employees to learn more about the microforestry process. The morizukuri microforest is also part of Toyota's 1.8-mile Biodiversity Trail, thus extending the educational and recreational benefits of this project to the general public.

WHC-CERTIFIED SINCE 2020 **CERTIFIED SILVER**

Planting a Microforest

The Miyawaki microforestry method encourages mimicking natural forest communities, so studying the abundance of species in nearby climax forests can inform microforestry plant selection. These tree, shrub and grass species are then densely planted in groups, with approximately three plants per square meter.

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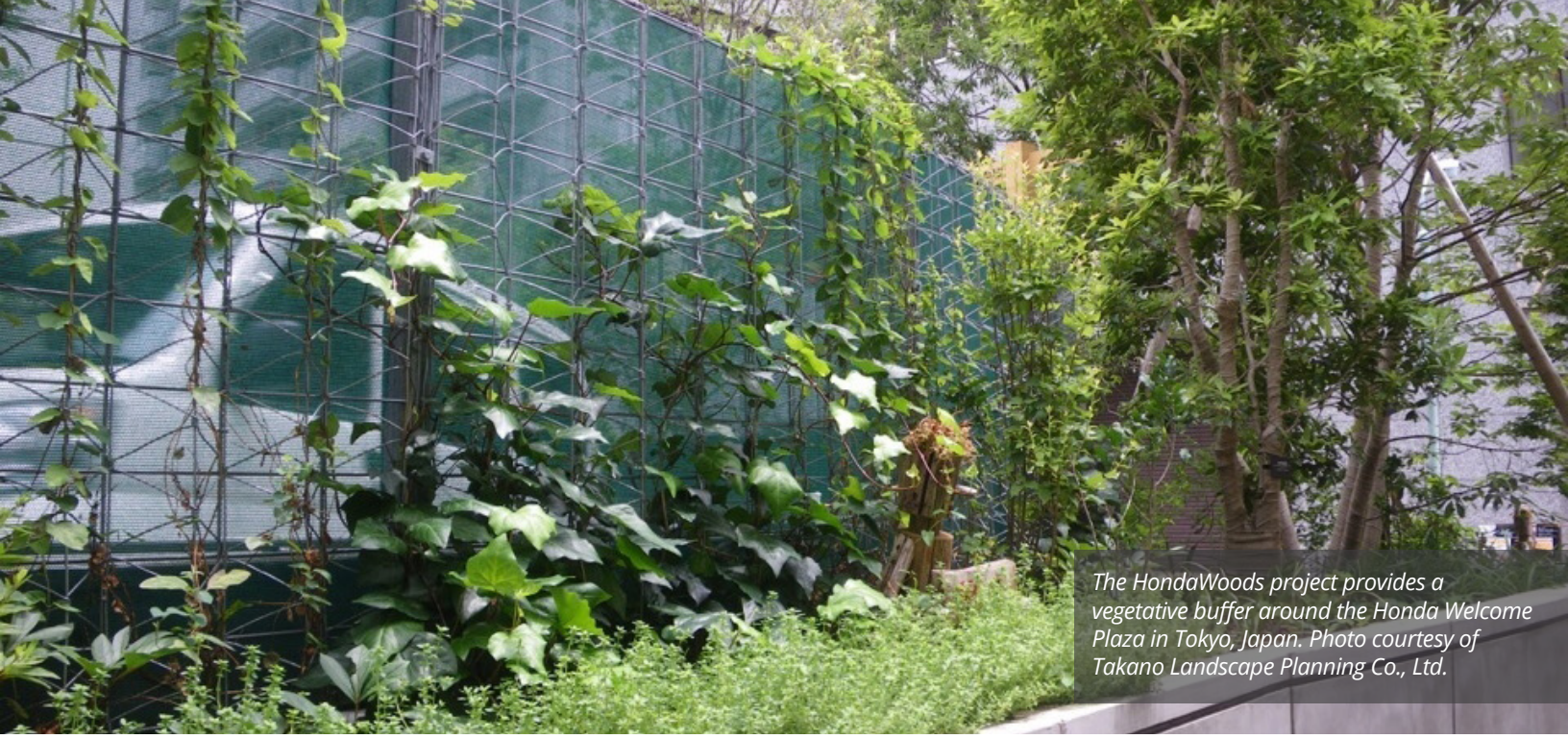

The HondaWoods project provides a vegetative buffer around the Honda Welcome Plaza in Tokyo, Japan. Photo courtesy of Takano Landscape Planning Co., Ltd.

CONSERVATION IN ACTION

HONDA | TOKYO, JAPAN

Afforestation Is not limited to vast, rural spaces. Urban forestry, such as the HondaWoods project located in the Aoyama district of Tokyo, Japan, takes advantage of small spaces to provide environmental benefits.

Beginning in 1976, Honda began planting woodlands around factories, calling them "home-woods." These home-woods were meant to honor the wishes of the company's founder Soichiro Honda, who stated that there should not be walls dividing factories from the community, but rather there should be a unifying factor between them.[12] However, when these home-woods grew too thick, blocking out sunlight and resulting in leaf litter that interfered with neighbors, Honda sought another way to build an urban forest that worked in harmony with the community.

The company partnered with local landscaper Takano Landscape Planning to create a new system called HondaWoods around the Honda Welcome Plaza. This project removed the broadleaf trees from the previous home-woods planting, repurposing the wood as decorative signs around the campus. These trees were replaced with smaller trees whose root spread would be less likely to damage the adjacent walkways, and a groundcover of native shrubs and grasses was installed.

These urban forests not only created a buffer around facilities to absorb air pollution and runoff, but they also provided an aesthetic space for employees and community members to enjoy, embodying the Japanese concept of satoyama, a landscape that sits between nature and human development.[13]

WHC

Restoring Native Grasslands and Remediating Through Natural Means

Preventing pollution via NbS includes harnessing the power of soils and plants to filter and remove pollutants, using strategies such as grassland restoration or various forms of natural remediation. One of the major pollutants targeted by grasslands is CO_2 — in fact, grasslands, meadows or rangelands have the capacity to store up to 20% of the world's soil organic carbon.[14] In addition, grassland restoration supports improved air and water quality, wildlife habitat, a reduction in air temperature, erosion control and opportunities to support endangered or threatened species that rely on grassland habitats.

Phytoremediation, or the use of plants to remediate polluted air and water, is considered one of the most sustainable remediation techniques; it is cost-effective and non-invasive when compared with traditional remediation approaches like dredging, flushing or excavating. There is growing public acceptance of phytoremediation, particularly in the U.S., where remediation methods have been deployed successfully at 10 Superfund sites.[15] Phytoremediation mainly targets heavy metal toxins, pesticides and other common chemicals, and the process reduces the risk of secondary air or water pollution from traditional remediation techniques, while reclaiming polluted soil and improving soil fertility. Both grasslands restoration and phytoremediation offer opportunities for corporations to partner with universities, landscaping societies and other organizations to facilitate a sharing of expertise and the expansion of research.

Bee balm, one of the native plants chosen for Subaru's meadow, attracts pollinators like bees, hummingbirds and hawk moths.

CONSERVATION IN ACTION

SUBARU | NEW JERSEY, U.S.A.

In 2018, Subaru opened its new national headquarters in Camden, New Jersey, partnering with the Pennsylvania Horticultural Society to develop a sustainable landscaping plan. Particularly, Subaru wanted to utilize native landscaping that would not require an irrigation system, saving on maintenance costs and water usage. A portion of the project also focused on supporting pollinators, so plants were selected based on their attraction of pollinators. The native plants chosen include coneflowers, bee balm, Joe Pye weed and gayfeather.[16] Team members have observed a variety of insects, birds such as finches and bees throughout the meadow.

This site demonstrates how multiple NbS can be implemented simultaneously, as the meadow also features a rain garden that helps filter and mitigate stormwater. An added co-benefit of is the opportunity for employees to recreate and grow food. Subaru's "Share the Love Garden" is a food plot where employees work with a local non-profit, the Center for Environmental Transformation, to grow and harvest crops that are donated to local food banks.[17] Since 2009, Subaru has donated over 8,000 pounds of produce from the garden.

By embracing a natural landscape style and utilizing native plants, Subaru supports biodiversity and wildlife while promoting positive land management strategies.

Native Plants

While corporate landscaping often uses non-native, ornamental plants, these species provide little value for wildlife and cost more in maintenance and irrigation than native plants. As they are adapted to the region's climate and environmental conditions, native plants only require initial maintenance at the beginning of the planting season to become established.

Purdue University professor Richard Meilan developed the transgenic poplars used to remediate soil pollution. Purdue Agricultural Communication file photo/Tom Campbell.

CONSERVATION IN ACTION

CHRYSLER/STELLANTIS | INDIANA, U.S.A.

In 2008, Chrysler (which would later merge with French automotive manufacturer Peugeot to form a new company called Stellantis) collaborated with Purdue University to develop a phytoremediation project at Peter's Pond in Kokomo, Indiana. The site was formerly used as an oil storage facility, where contaminated oil had seeped into the ground.[18] The company planted poplar trees, which are well-suited to Indiana's climate, to remediate trichloroethylene (TCE), a volatile liquid organic chemical and carcinogen that was used in the manufacture of automotive degreasers, brake cleaner and other products.

The particular poplars used in this project were transgenic, as they were injected with a gene that assists in breaking down TCE and other pollutants. The researchers took care to ensure that the transgenes did not incorporate into nearby tree populations. Researchers found that these transgenic poplar trees showed increased removal rates of pollutants including TCE from the soil as well as from the air, removing TCE 100 times faster than natural, unaltered poplars.[19]

Not only did this project make advances in the use of phytoremediation, but it also offered research opportunities to a nearby university, further expanding the understanding of the use of this nature-based solution.

WHC

Managing and Filtering Stormwater

Impervious surfaces such as parking lots, streets and roads lead to stormwater runoff, which pick up pollutants in industrial areas before flowing into watersheds, thus impacting water quality. Nature-based stormwater management solutions —including rain gardens, bioswales and wet detention systems — work to address stormwater runoff by filtering, redirecting or capturing it for reuse.

Bioretention, the process through which plants and soils filter pollutants from stormwater, is well-suited for commercial and urban locations. In fact, rain gardens were initially designed for businesses, particularly those with limited space. Bioswales, channels or trenches that slow and filter stormwater, are inexpensive solutions that can be easily implemented and retrofitted through landscape modifications or resurfacing of parking lots or streets. Wet detention systems refer to detention or retention ponds: Detention ponds hold stormwater runoff temporarily, gradually filtering and eventually releasing the runoff, while retention ponds hold water permanently. The main pollutants targeted by these nature-based solutions are solids, organic material, nutrients from wastewater, greenhouse gases, chemical runoff and pathogens.

The co-benefits of stormwater management solutions are many. In addition to the reduction of pollution in freshwater and stormwater, these solutions reduce the potential of eutrophication and recharge groundwater. Solutions such as retention ponds and rainwater provide both food and habitat for wildlife. Rain gardens and wet detention systems control flooding and reduce erosion, and the vegetation associated with these solutions moderate air temperature while providing space for recreation.

CONSERVATION IN ACTION

DENSO | TENNESSEE, U.S.A.
US EPA REGION 4

Established in 1988, DENSO Manufacturing Tennessee, Inc. (DMTN) in Maryville, Tennessee, is the company's largest manufacturing facility in the United States.[20] *Established in 1988, this site produces starters, alternators and electronic products for automobiles as well as inverters for hybrid vehicles, and it supplies parts to customers like Stellantis, Ford, General Motors, Toyota, Subaru and more.*

In recognition of both organizations' 20-year anniversaries in the area, DMTN partnered with Keep Blount Beautiful (KBB), a local non-profit

The rainwater captured at Aiken County Off Road Tire Plant is reused for irrigating lawns, flushing toilets and producing steam.

that encourages residents to participate in litter prevention, waste reduction and beautification projects. Together, DMTN and KBB developed an EcoPark on-site. The EcoPark, which opened in 2011, provides education opportunities for local students and community members, as they can learn about recycling, compositing and pollution prevention.

A detention pond located in the EcoPark detains and filters stormwater runoff from the campus's rooftops, parking lots and roads, before it flows into nearby Culton Creek. DENSO also works to manage the flow of water into the creek and reduce any soil erosion.[21] Not only does this project manage stormwater runoff and filter pollutants, thus improving water quality, but it also provides the co-benefits of educational and recreational opportunities for local students.

CONSERVATION IN ACTION

BRIDGESTONE | SOUTH CAROLINA, U.S.A. EPA REGION 4

Bridgestone Americas is among the world's largest manufacturers of tires, with over 180 facilities in 24 countries.[22] Its Aiken County Off Road Tire Plant is located in Trenton, South Carolina. This 1.5-million-square-foot facility produces Bridgestone's large, off-road radial tires. In 2019, the plant received Leadership in Energy and Environmental Design (LEED) certification, demonstrating the company's dedication to environmental protection.

STEM Programming

The Aiken County Off Road Tire Plant is also home to the Bridgestone Environmental Education Program (BEEP), an outdoor classroom located within the longleaf pine forest on-site. Local K-12 students visit the site for field trips, where they participate in a scavenger hunt, an archeological soil activity, a stream dipping experiment and more.

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The BMW Site Operations Center, designed by architects Perkins + Will, saves 40% on energy and water usage. Photo by Nick Merrick, courtesy of Perkins + Will.

In addition to using sustainable building materials, the facility features a rainwater harvesting system, using a geomembrane pond liner to create retention ponds that capture roof runoff.[23] The goal of this system was to ensure that no stormwater was discharged from the site. Through the harvesting system, stormwater is reused for process water or in facility restrooms, or it is returned to the water table.[24] Since 2015, Bridgestone has harvested over 16 million gallons of rainwater.[25]

Bridgestone's commitment to sustainability is evident not only in its pursuit of LEED and WHC Certification, but also through the environmental benefits of voluntarily developing a rainwater harvesting system.

WHC-CERTIFIED SINCE 2013 **CERTIFIED SILVER**

CONSERVATION IN ACTION

BMW | SOUTH CAROLINA, U.S.A.
EPA REGION 4

In 1992, German automaker BMW announced plans to build its first manufacturing facility outside of Germany. Construction of BMW's 65,000-square-foot Site Operations Center in Spartanburg, South Carolina, was completed in 2016. The facility houses office space on the wooded, 78-acre grounds of BMW's Plant 10, which produces 1,500 vehicles each day.[26]

Spartanburg sits in the Piedmont region, an area in the eastern U.S. characterized by plateaus and rolling foothills.[27] When planning the siting of the facility, project architect Perkins + Will recognized that water flowed down an incline on-site from east to west. Rather than disrupt this natural swale, the architects took care to incorporate it into the design of the facility, thereby preserving the natural drainage slopes. After determining where stormwater naturally pooled, the team strategically planted several rain gardens, complete with native plants, between parking lot bays to intercept runoff.[28]

By managing and filtering runoff from the site, these rain gardens help support downstream health, as they prevent pollutants from entering the watershed. In addition, the native plants chosen are well-suited for the location's Piedmont region, saving on maintenance and irrigation costs.

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Incorporating Green Architecture

Green architecture, also sometimes referred to as green infrastructure, is an approach to mitigating environmental challenges using vegetation, soils and natural processes as part of a living engineered solution. Common types of green architecture include permeable pavement, blue or green roofs and living walls.

Permeable pavement, the function of which overlaps significantly with stormwater management nature-based solutions, is a form of paver that allows rainwater to drain through and infiltrate the ground below. Not only does permeable pavement reduce stormwater runoff, but it also recharges the groundwater and reduces erosion. Green roofs include a layer of vegetation that is planted on a waterproofing system, and blue roofs incorporate water detention systems; thus, a combination blue-green roof stores and filters rainwater via both the soil and vegetation. Living walls are walls covered with a layer of vegetation growing from a vertically applied medium. The plants that make up the living wall are rooted to the wall, which helps to insulate the building, thereby decreasing energy costs, and reduces the urban heat island effect.

The primary pollutants targeted by these green architecture solutions include CO_2, NO_2, SO_2, particulate matter and pathogens. Resulting co-benefits of green architecture reduce business costs, as fewer resources must be devoted to maintenance, irrigation or energy. Reducing sitting water on surfaces prevents icing and hydroplaning, increasing on-site safety for employees. When native plants are included in green roofs or living walls, biodiversity increases, and wildlife species thrive.

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The rooftop garden at General Motors World Headquarters includes several planters of wildflowers to support on-site honey bee hives.

CONSERVATION IN ACTION

GENERAL MOTORS | MICHIGAN, U.S.A.

General Motors (GM) World Headquarters is located in Detroit, Michigan at the GMRENCEN, a complex comprised of seven skyscrapers along the Detroit International Waterfront and the tallest building in Michigan. GM developed a living wall on the rooftop garden to address two concerns: to supplement resources for pollinators in a dense urban area and to protect the other rooftop gardens on-site.

The rooftop area already housed a vegetable garden, beehives and flowers that support monarch butterflies. However, because these projects are located on the roof of a publicly accessible parking garage, the area was vulnerable to vandalism. The living wall blocks unauthorized access to these areas while still beautifying the area.

The wall itself is comprised of 13 four-foot by five-foot repurposed wooden crates stacked and filled with composted dirt made from food scraps from the building's restaurants and office kitchens. Plants in the living wall include moonflowers, lavender, rosemary, verbena, black-eyed Susan, purple coneflowers, and swamp and common milkweed.

The position of the living wall captures roof runoff, and when GM determined that additional irrigation was needed, the company installed a 50-gallon rain barrel to capture water for the living wall. Staff incorporate the living wall into building tours for the approximately 3,000 daily visitors, making this nature-based solution an opportunity to educate the public.

WHC-CERTIFIED SINCE 2005 **CERTIFIED GOLD**

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The roof of the Ford Rouge Truck Plant was redesigned as a green roof in 2000. Photo by Ted Eytan, used under CC BY-SA 2.0.

CONSERVATION IN ACTION

FORD | MICHIGAN, U.S.A.

One of the largest living roofs in the world can be found in Dearborn, Michigan, at the Ford Rouge Truck Plant. This green roof spans 454,000 square feet, and it is planted with drought-resistant sedum that grows from a layered pre-vegetated mat. This lightweight mat, recommended by researchers at Michigan State University, protects the structural integrity of the factory's roof by avoiding the additional weight of loose soil.[29]

Sedum is a popular plant chosen for green roofs, as it traps air pollution, including dust, dirt and CO2. The plant species provide habitat and food for a variety of wildlife, with 35 different spider, insect and bird species observed.

Ford's living roof delivers stormwater benefits, as it retains about half the rainfall it receives.[30] *The rooftop system also works with Ford's other on-site stormwater management tools, including permeable pavement and underground water storage basins. This system improves water quality and reduces the stormwater flowing into the nearby River Rouge.*

Green roofs are known for their insulating properties, and the Ford Rouge roof keeps the truck plant an estimated 10 degrees warmer in the winter and 10 degrees cooler during the summer,[31] *which amounts to about a five percent energy savings.*[32] *Ford's living roof is a clear example of a nature-based solution that provides numerous environmental and financial benefits for the company and community at large.*

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A Call to Action for Corporate Landowners

While many national and international regulations govern source reduction in the automotive industry, there is an opportunity for corporate landowners to go above and beyond regulatory requirements. As the case studies included in this white paper have shown, the results of NbS extend beyond pollution prevention to provide financial, reputational, wildlife and climate change resilience benefits.

At a moment where building global climate change resilience is critical, nature-based solutions offer the auto industry a method to help satisfy source reduction regulations while also meeting company-wide commitments to sustainability.

By invoking a "with nature" approach to land management, automotive companies across the supply chain can incorporate NbS to not only prevent pollution, but also support biodiversity and provide benefits for local communities.

The solutions catalogued in this white paper are by no means exhaustive, but they do represent a starting point for corporations looking to determine the feasibility of NbS.

The auto industry can implement NbS to prevent pollution and uplift biodiversity by:

- Restoring nearby wetlands and waterbodies to support the local watershed and provide habitat for wildlife.
- Reforesting or afforesting on a small scale through microforests or urban forests.
- Restoring native grasslands or planting native meadows.
- Incorporating phytoremediation efforts to filter air, soil or water pollution.
- Managing stormwater via rain gardens, bioswales or retention and detention ponds.
- Developing green architecture solutions such as living walls, green roofs or blue-green roofs.
- Sharing your story of a successful project that incorporates NbS by seeking WHC Conservation Certification, a rigorous, third-party standard. Through various themes including Wetlands & Water Bodies, Forests, Remediation, Green Infrastructure and more, WHC Conservation Certification recognizes and incentivizes voluntary conservation activities that utilize NbS to prevent pollution.

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