

Carbon Mitigation through Restoration of Urban Forests: Forterra and its Green City Partnerships



Fast Facts

Overview

Activity: Restoration of forested natural areas

Launch Date: March 2010

Purpose: To mitigate carbon emissions by improving urban forest condition and vigor through removal of invasive species and planting of native conifers.

Tree Ownership: Targeted acres of forested natural areas are located in and owned by the cities of Seattle, Kent, Kirkland, and Redmond, WA.

Funding: The price per acre restored for carbon mitigation depends on the percent of current invasive species cover and native tree composition. The pilot project for the *Carbon Mitigation Program* totaled \$210,000, paid in full up front.

Protocol: The Climate Action Reserve's *Urban Forest Project Protocol (3)* was used to guide methodology.

Verifier: None used

Payment Mechanism: Funds for the *Carbon Mitigation Program* are paid in full before restoration work is commenced and placed in a restricted account.

Price: Price per metric tonne of carbon dioxide equivalent (mtCO₂e) ranges from \$30-\$125 (see page 3 for details)

Climate Benefits: When completed, the pilot project (and only project as of January 2011) will result in 7,000 mtCO₂e mitigated through the restoration of 33 acres.

Co-Benefits: Restoration of these urban forests will increase their benefits: reduction of stormwater runoff, erosion control, improved water quality, wildlife habitat, noise and heat reduction in the cities, community involvement through volunteerism, and recreation.

Formerly the Cascade Land Conservancy, Forterra's innovative *Carbon Mitigation Program* was launched in the spring of 2010. Building upon the organization's Green City Partnerships Program, carbon emissions are mitigated through restoration of forested natural areas in, as of 2011, four municipalities in the Puget Sound region. Calculations and methodology for the program were developed internally but were guided by the Climate Action Reserve's *Urban Forest Project Protocol (3)* and the U.S. Forest Service report *Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types in the United States (12)*. The *Carbon Mitigation Program's* pilot project was a collaborative effort with the band Pearl Jam to mitigate its 2009 world tour carbon footprint of 7,000 mtCO₂e for \$210,000 through the restoration of 33 acres spread throughout Seattle, Kent, Kirkland, and Redmond, WA. Invasive species removal and planting of native conifers are for the most part completed by contracted groups while citizen volunteers assist with maintenance and monitoring activities.

The Program

With the experience of two smaller carbon projects under their belt, Forterra staff began developing their *Carbon Mitigation Program* in late 2009. In 2004 the organization partnered with Vivace Coffee Roasters to mitigate 50 tCO₂e through the planting of 4,000 trees and in 2008 800 trees were planted for Kennedy & Associates to help them reach their carbon mitigation goal. Motivated by an interest from longtime partner Pearl Jam, however, the *Carbon Mitigation Program* was intended to be an established service offered by Forterra and to incorporate rigorous carbon calculations. With the help of a consultant from EcoFor LLC, a firm that assists in carbon accounting and project implementation in the Pacific Northwest, Forterra staff developed a methodology for estimating carbon figures and to price tonnes of carbon dioxide equivalent mitigated appropriately. The Climate Action Reserve's (CAR) *Urban Forest Project Protocol* (3) was used as a guide throughout this process. However, since that protocol is intended for carbon accounting of individual street trees and Forterra's program focuses on carbon mitigation in urban forest stands and park spaces, the CAR protocol was not entirely applicable.

The basis of the *Carbon Mitigation Program* is that without restoration, forested natural areas in Seattle-area cities will succumb to aggressive non-native vegetation such as English ivy, Scot's broom, and Himalayan blackberry as the aging tree population dies. By removing the invasive species and replanting native

shrubs and coniferous trees, the health of the urban forests will be restored and their carbon storage and carbon dioxide sequestration capacities will increase greatly over time (4).

Through Forterra's *Green City Partnership Program*, which started in 2004, forested natural areas can be prioritized and restored. The first *Green City Partnership*, the Green Seattle Partnership, was formed with the city of Seattle in 2004 and since then the cities of Kent, Kirkland, Redmond, and Tacoma have also committed to long-term conservation planning through the program. Forterra currently has funding to perform restoration on approximately 10-30 acres annually throughout the five cities but would like to increase that acreage, which is where the *Carbon Mitigation Program* comes in. Funds solicited through the program are intended to fill the funding gap and allow for additional restoration work that would not be otherwise possible.

The 20-year strategic plans developed for each Green City Partnership involve an assessment of the current state of forested natural areas. Land is classified according to the *Tree-iage* model, a system developed by the Green Seattle Partnership staff. Acres are categorized by value and threat level based on the current tree composition and current percentage of invasive species cover. The details of the *Tree-iage* model are highlighted below in Figure 1. Acres that fall into categories 1, 2, or 3 are well stocked with native conifers, are already considered high value, and have good existing tree cover so they have been excluded

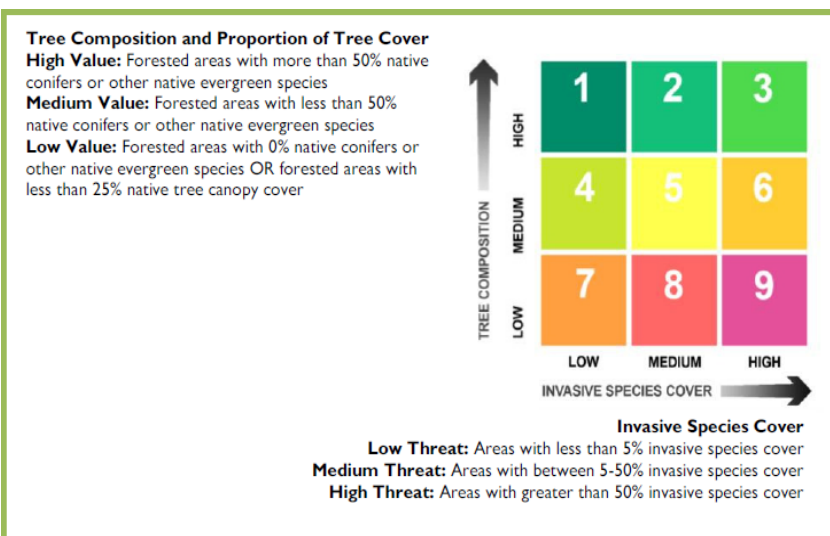


Figure 1: The *Tree-iage* model used to categorize forested acres for restoration priority in Green City Partnerships.

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from the *Carbon Mitigation Program's* priority restoration efforts. Restoration of acres in categories 4 through 9 have been priced based on field costs, such as the physical removal of invasive species, site preparation, plant material, planting and irrigation tools, and other maintenance necessary to ensure plant establishment and survival. Also included in the price is the Forterra staff time needed to administer the program and to coordinate and manage contractor and volunteer activities for the acres anticipated to be restored through the *Carbon Mitigation Program* annually. Prices per acre per *Tree-iage* category can be found in Table 2 on page 3 (1, 4, 8).

To calculate the existing, future, and additional carbon associated with restored forest acres in

each *Tree-iage* category, Forterra staff referred to the US Forest Service’s General Technical Report NE-343, *Methods for calculating forest ecosystem and harvest carbon with standard estimates for forest types in the United States* (12). Using estimates of carbon stocks for the Douglas-fir and alder-maple forest types (the two generalized forest types in the report applicable to the region) combined with the general forest stocking level and percent of invasive species cover associated with each *Tree-iage* category, total existing carbon was found to range from 73.5 tonnes/acre for category 4 to 86 tonnes/acre for category 9. Projecting out 125 years and assuming that the forests have been restored to 100% native conifer and evergreen shrub cover, each category’s projected future carbon stock was estimated to be 169.5 tonnes/acre. Finally, to estimate the additional carbon stored in the forested natural areas through restoration activities, existing carbon stocks were subtracted from future carbon stocks for each *Tree-iage* category. To account for assumptions and overestimations, Forterra staff was conservative on all estimates and reduced the final additional carbon figure by 30%. Table 1 below shows each category’s additional carbon stored as well as the associated additional CO₂ sequestered, which is determined by multiplying the carbon by 44/12 to convert it to CO₂ (13).

The trees planted through the *Green City Partnership* restoration efforts are small seedlings and whips, generally bought as bare root or in 1-gallon pots. Plantings consist of roughly one quarter western red cedar and three quarters mixed Douglas-fir, grand fir, and western hemlock. Locally sourced trees are preferable but most likely Forterra will purchase from other nurseries when they are heavily planting. Contracted nonprofit restoration groups such as Earthcorps, Washington Conservation Corps, and the Student Conservation Association are hired by Forterra do to the majority of the restoration work. According to



Volunteers assist with maintenance activities to restore urban forests through the Cascade Land Conservancy's Green City Partnership Program.

Forterra staff roughly 90% of tree plantings are contracted and 10% are volunteer-driven through high profile events. Additional volunteer activities focus on maintenance and monitoring, which are mostly performed by residents trained as Forest Stewards through the individual *Green City Partnerships* (4).

"Tree-iage" Categories (4-9)	Additional Carbon <i>all carbon numbers are in tonne/acre</i>			
	Preliminary additional tonne/acre (future - existing)	Deduction for uncertainty	Total additional carbon sequestered	Total additional CO ₂ sequestered
4	96.0	30%	67.2	246.3
5	91.0	30%	63.7	233.5
6	76.5	30%	53.5	196.3
7	103.0	30%	72.1	264.4
8	98.0	30%	68.6	251.6
9	83.5	30%	58.5	214.4

Table 1: Total additional carbon sequestered through restoration in each *Tree-iage* category © Forterra

Table 2: Costs associated with the Forterra's Carbon Mitigation Program based on *Tree-iage* category and cost per tonne of CO₂ mitigated through restoration of forested natural areas.

"Tree-iage" Categories (4-9)	Cost	
	Average cost per acre	Cost per tonne of CO ₂
4	\$7,309	\$30
5	\$14,278	\$62
6	\$19,056	\$98
7	\$12,581	\$48
8	\$22,287	\$89
9	\$26,701	\$125

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When an entity is interested in participating in the *Carbon Mitigation Program*, they are by default also assisting the five cities involved with the *Green City Partnerships*. The first step is to calculate the amount of emissions desired to be mitigated. Forterra provides a link to the *Seattle Climate Now Calculator* on their website to aid in determining a figure. From there, collaboration with Forterra staff will determine how many acres to be restored to achieve the target and in which *Tree-iage* categories the restored acres would fall, based on price and available or desired locations (8).

The Pilot Project: Pearl Jam

Forterra has partnered with Seattle-based band Pearl Jam for years on traditional conservation projects. Guitarist Stone Gossard expressed interest in collaborating on a carbon project to mitigate the band's 2009 world tour footprint after participating in a city park tree planting and becoming aware of the problems facing urban forests. Both Pearl Jam and Forterra staff recognized that they were entering new territory and that there were few models to guide the idea, but both parties were up for the challenge.

While Forterra staff developed the program, Pearl Jam had their carbon footprint calculated by an external entity, Conservation International. The band's 2009 world tour had 32 dates and approximately 484,000 concert attendees (9). The final carbon footprint was calculated based on band travel and equipment transport, hotel rooms, venue emissions, and attendee travel. Figure 2 below shows Conservation International's emissions breakdown.

The band was consulted throughout the development of the *Carbon Mitigation Program* and when both parties were comfortable and confident in the calculations Pearl Jam ultimately decided that it would fund the mitigation of an even 7,000 mtCO₂e. Drawing from category 4 of the *Tree-iage* model, Pearl Jam donated \$210,000, which was dedicated to 33 selected acres across four of the five cities involved with the *Green City Partnership Program*. The project was officially announced in March of 2010 and restoration work began that fall. The project's

anticipated completion date is December 2013. The \$210,000 was paid up front and was placed in a restricted account (4).



Top: Invasive species such as English ivy are a serious threat to forested natural areas in the Puget Sound region. By aggressively choking out trees and leaving no room for native species to regenerate, this image demonstrates the damage that can be done. Bottom: *The Green City Partnerships* promote restoration of forests by removing invasive species and planting native conifers.

Restored forests are full of trees and that store carbon and sequester CO₂, providing many other benefits as well.

Figure 2: Greenhouse gas emissions (in carbon dioxide, CO₂, equivalents) released during Pearl Jam's 2009 world tour.

© Michael Totten, Chief Advisor, Climate, Energy, & Green Technologies, CELB, Conservation International, 2010.

Activity	Metric Tons CO ₂	Key Assumptions
BAND & CREW (3,135 tons CO₂)		
Trucks and Buses Freight Shipment	22 1,630	55,000 miles, 14 trucks, 6 buses, 8,209 gallons, ALL biodiesel fuel 1.98 million air ton-miles (1588 tons), 103,473 sea ton-miles (42 tons), and 568 ground ton-miles (0.28 ton)
Air travel – band and crew	1,182	899,525 passenger miles for crew and band, plus 40.7 tons jet fuel for band members in domestic AU/NZ flights
Hotel rooms – band and crew	114	3,183 hotel room-nights (951 band and 2232 crew)
Arenas	187	32 venues (28 sheds and 4 amphitheaters), total of 484,800 kiloWatt-hours (kWh) electricity consumption
FANS (2,339 tons CO₂)		
Driving to and from concerts	2,180	380,000 fans, 2 fans per car, 23.6 miles round trip travel, 21.9 miles per gallon average fuel economy
Using Public Transit	159	100,000 fans, each 15.5 miles roundtrip on public transit
TOTAL metric tons CO₂-equivalent emissions	5,474	Calculation includes global warming factor of 2.3 applied to air travel (previous tour offsets used factor of 2), and factor of 1.2 applied to non-aviation emission activities that account for all other greenhouse gas emissions in addition to direct carbon dioxide (CO ₂) emissions. This is based on estimates from the 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

Market Chain Map

The market chain map summarizes the roles of participants and contributors to market-based initiatives (11). The Enabling Environment section indicates the external factors that facilitated the development of this urban forest carbon program. The Market Chain Actors and Linkages section includes the producers, purchasers, facilitating intermediaries and flow of funds. The Supporting Institutions section lists entities that provided critical support, but were not part of the market transaction. Because forest carbon markets are newly emerging, the same organizations may show up in more than one capacity as they work to develop all of the components needed for a successful, market-based program. The dollar signs indicate flow of funds and the leaves indicate trees planted.

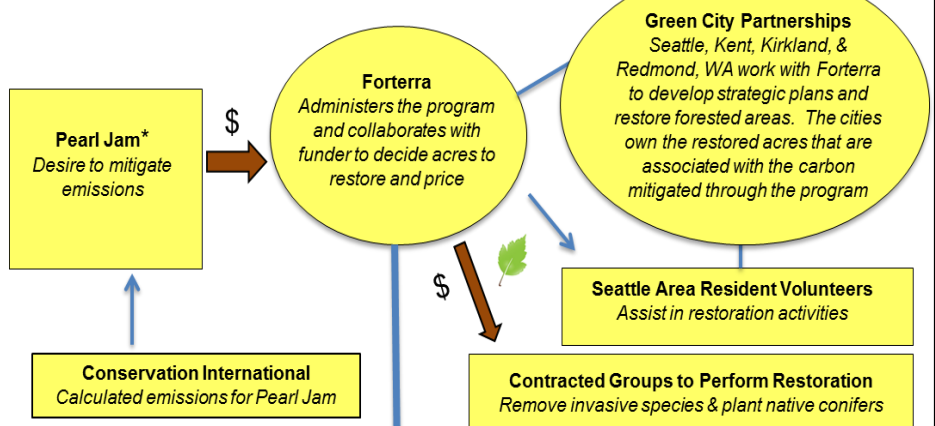
Forterra's strong citizen volunteer base, its long-standing relationship with Pearl Jam, and an increasing interest in local projects addressing climate change impacts were all conditions that contributed to the decision of Forterra staff to pursue its

Carbon Mitigation Program. A funder comes to Forterra (indicated by the * on the map) with an idea of how much carbon they'd like to offset and enters into an agreement with the organization based on the *Tree-iage* model. Funds are appropriately allocated to perform invasive species removal and native tree species tree plantings through the *Green City Partnerships Program*. Information available from the Climate Action Reserve and the U.S. Forest Service's Urban Ecosystems & Social Dynamics Program was used in developing the program. Forterra was also supported by a strong relationship with the City of Seattle and by staff from Ecofor LLC, who assisted in program development.

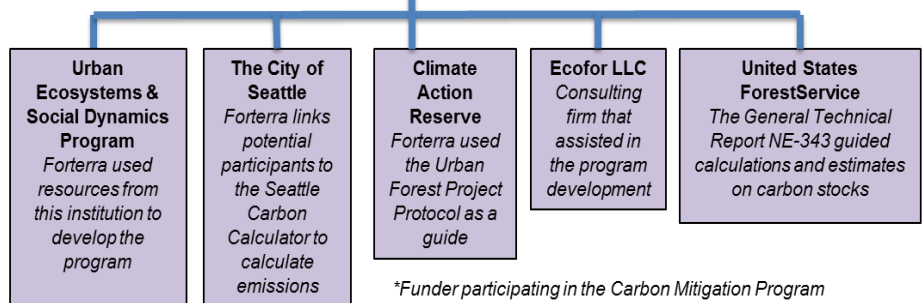
Enabling Environment



Market Chain Actors and Linkages



Supporting Institutions



*Funder participating in the Carbon Mitigation Program

Participant Perspectives

At Forterra, Ara Erickson administers the *Carbon Mitigation Program* and works closely with Marketing Director Natalie Cheel, Conservation Policy Program Director Dan Stonington, and each of the *Green City Partnership* project managers to design and implement the program. Forterra was concerned with the validity of the carbon calculations from the beginning and recognized early on that "there has been an assumption that a [carbon] project has to be perfect, verified by a third party, and tradable on the market but with the voluntary carbon markets there is still not a clear way for a project to be designed". The team had to work

through the details one at a time, exploring and experimenting, and knew that they were on the cutting edge of incorporating urban forestry and a voluntary carbon market mechanism.

Erickson cited two major challenges with the development of the *Carbon Mitigation Program*. The first was figuring out all of the carbon and pricing calculations and feeling entirely comfortable with them. As mentioned earlier, Forterra staff were very conservative with their estimates, given the assumptions made about forest age, composition, and timber volume in the present and future. Further, they needed to be careful about the wording used; there is a difference

Between “offset” and “mitigation” and since they were not going to be matching each dollar with a specific tonne of carbon dioxide equivalent, they were not comfortable with using the former term.

The second major challenge was fostering and maintaining good relationships with the funder and each of the city partners, especially in light of the uncertainties around carbon mitigation and how it really works. This challenge was echoed by Tracy Morgenstern, Climate Protection Advisor with the Seattle Office of Sustainability & Environment, and participant in the Green Seattle Partnership with Forterra. Morgenstern also mentioned how constant communication throughout the development of the *Carbon Mitigation Program* was essential since restoration work performed to mitigate the carbon will be done on land owned by the *Green City Partnership* cities.

Erickson and her colleagues at Forterra have devoted much time to developing the *Carbon Mitigation Program*. However, as Erickson noted, this would probably be the case for any organization developing an idea from bare bones to a fully functioning program in a short period of time. Forterra was motivated by Pearl Jam’s interest and worked hard to put together a scheme that would be easily applicable to the interest of future funders. Further, they wanted to make sure that they were providing information about climate change and educating their website visitors about other ways to address or reduce greenhouse gas emissions.

Erickson is confident in the program and thinks that there is a market for tangible, local projects that address climate change and provide opportunities for people to participate. There are individuals motivated by climate change, there are those that just want to take part in something novel and taking place in their community, and then there are those that are preparing for a real regulated market in the future. Considering the high price per tonne of CO2 mitigated, especially in the higher categories of the *Tree-iage* model, Forterra staff anticipate that they will appeal to all three of these populations. Erickson knows that they are not going to be getting calls from people that want an inexpensive offset program but rather from local groups, businesses, and residents who already have the knowledge of Forterra and the great work it accomplishes.

In a 2010 article titled *Pearl Jam Touring Less, Planting Trees to Cut Carbon Footprint* (9), band guitarist and co-founder Stone Gossard was quoted as saying

“businesses have an opportunity to lead the way in becoming a more conscious economy, one that views the health of our environment as inseparable from our personal and economic well-being. Tracking and mitigating the band’s carbon footprint is a big first step that our business is taking in that direction, and we hope other businesses will join us in this effort. Pearl Jam is a band but we’re also a business. More importantly, we’re also a Washington business”.

Personal communication with the Pearl Jam liaison Natalie Cheel at Forterra reflected a similar perspective from the band; Cheel relayed a statement from Stone Gossard that, “since 2003 we have elected to mitigate our carbon output by tracking and calculating our emissions and contributing money to projects that strategically work to improve the environment. We view this simply as a cost of doing business.”

Looking Forward

Since the 2010 launch of the *Carbon Mitigation Program*, Forterra has received a number of inquiries, particularly from individuals interested in small contributions. However, the organization is currently focused on bringing in large donors and local businesses to replicate the type of collaboration it saw with Pearl Jam. Eventually Forterra staff would like to have the capacity to take individual donations or to aggregate single donors into groups. While the pricing scheme of the *Tree-iage* model currently assigns higher costs per tonne of carbon equivalent mitigated to higher priority restoration areas, Forterra is not committed to this system and has begun to explore a single cost for all categories or bulk discounts for large purchases (4).

The March 2010 launch incorporated web-based marketing and detailed information can be found on the organization’s website, www.forterra.org. As the program grows and evolves, Forterra staff members anticipate moving into the world of paper-based marketing as well. In the spring of 2011, there were several opportunities for local volunteers to plant trees through the Pearl Jam pilot project.

Lessons Learned

Forterra's *Carbon Mitigation Program* is an innovative approach to participating in a voluntary carbon market. Through detailed planning, thoughtful utilization of available resources, and consideration of aligning with existing strengths and activities, Forterra staff have developed a program that is not only science-based but interesting and relevant to the region and the large base of citizens and businesses in the Puget Sound region that are concerned with the health and future of the Pacific Northwest forests. While the impetus for the *Carbon Mitigation Program* was Pearl Jam's interest in addressing its world tour emissions, Forterra staff were interested in developing a program that would be applicable to future funding partners and would be publically offered by the organization as a service. This approach, in contrast with one-off forestry carbon projects that represent a single agreement between a tree planting group and a funder, is proactive and demonstrates Forterra's ability to push the envelope. Specific lessons learned from the *Carbon Mitigation Program* include:

- ◆ *It is worth putting in the work to ensure that all parties involved are comfortable with the methodology of a carbon project as well as the science behind the carbon accounting.*
- ◆ Similarly, though it might increase the front-end workload for a project, *projecting future costs as accurately as possible and accounting for uncertainty is important.*
- ◆ As mentioned earlier in this case study, the materials that Forterra staff used to develop the *Carbon Mitigation Program* were all available, free of charge, on the internet. *The accessibility of US Forest Service's General Technical Reports, the US Forest Service's Urban Ecosystems & Social Dynamics website, and the Climate Action Reserve's Urban Forest Project Protocol contributed greatly to the development of the program.*
- ◆ *Building upon existing programming (in this case, Forterra's Green City Partnerships Program) is a good way to approach developing an urban forest project for a voluntary carbon market, though the concept of additionality must be considered. A group should be able to demonstrate that in the absence of the funds*

acquired through the carbon mitigation (or offsetting), the trees planted or work done would not be possible.

- ◆ Forterra staff suggests that future *funders should have their emissions calculated independently* so that they can approach the organization with specific numbers, facilitating a more efficient and personalized partnership.
- ◆ *It is important to consider and plan for marketing of an urban forest carbon project.* Forterra staff incorporated a marketing plan of the *Carbon Mitigation Program* throughout its development and ensured that the details of the program were established before introducing the pilot project with Pearl Jam.

Program Partners



Forterra, formerly the Cascade Land Conservancy, was founded in 1989 and is Washington's largest conservation, stewardship, and community-building organization, focused primarily in the Puget Sound and Olympic Peninsula

area. The organization works in traditional land conservation, acquisitions, and policy development and is also focused on community-based stewardship. Forterra has led efforts to conserve more than 158,000 acres of parks natural areas, forests, shorelines, and farms. The *Carbon Mitigation Program* is administered as a compliment to the *Green City Partnership Program*, to which approximately ten employees are dedicated (1).



Many of Forterra's programs involve volunteer opportunities; local residents and businesses are encouraged to participate in restoration activities that contribute to the overall goals of the organization.



The *Green City Partnerships Program* has established a network of public-private

partnerships with municipalities to develop strategic plans and to promote community-based stewardship programs for forested natural areas in the Puget Sound region. The program also provides the foundation for the *Carbon Mitigation Program*. Each *Green City Partnership* is administered by Forterra but officials from each city are integral to the success of the partnership. Four of the five existing *Green City Partnerships* (with Seattle, Kent, Kirkland, and Redmond) were incorporated into the pilot project of the *Carbon Mitigation Program*. Information about these specific Green City Partnerships follow (1).



The *Green Seattle Partnership* was established in 2004 and involves CLC, Seattle Parks and

Recreation, the Seattle Office of Sustainability and Environment, and Seattle Public Utilities. A nine-member executive council governs the partnership and thousands of community volunteers have actively worked to restore and maintain the city's forested parklands. The 20-year strategic plan developed through the partnership represents dedication and investment to the restoration of Seattle's urban forest and is available on Forterra's website. The *Green Seattle Partnership* staff are currently advertising the Pearl Jam Carbon Mitigation Project and are soliciting volunteer groups to host restoration events to support the project (8).



Through the *Green Kirkland Partnership* a 20-year strategic plan was developed with the Kirkland

Department of Parks and Community Services and was officially adopted in 2008. The main objectives of the Green Kirkland Partnership are to tackle the growing invasive species problem in the city's urban forests and to promote community stewardship (6).



Established in 2007 the *Green Redmond*

Partnership aims to build a sustainable network of healthy urban greenspace by actively managing over 1,000 acres of Redmond's forested parkland. The Redmond Parks and Recreation Department will work with Forterra and the city's dedicated community volunteers to remove invasive species and plant native trees and shrubs throughout the city's 21 parks (7).



The *Green Kent Partnership* is the newest *Green City Partnership* and, as of

early 2011, is still finalizing its 20-year strategic plan. Forterra and the City of Kent have focused on training citizens to become Green Kent Stewards in its first year to aid in leading restoration activities throughout the city's parks (5).

Each of the *Green City Partnerships* are based on the idea that through public-private collaboration and by fostering citizen stewards, forested parklands and natural areas can be restored. Here a volunteer in Kirkland removes invasive species, which, paired with the planting of native coniferous trees and evergreen shrubs, will not only increase the health of the forest but is the key to Forterra's *Carbon Mitigation Program*.



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