PORTLAND PARKS & RECREATION

Healthy Parks, Healthy Portland

ECOLOGICALLY SUSTAINABLE LANDSCAPE INITIATIVE

June 2015

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Table of Contents

Perennial flower bed at Pittock Mansion

Executive Summary

The City of Portland and Portland Parks & Recreation (PP&R) have developed a national reputation for sustainable planning, design, and operations. As examples, PP&R is the only certified "Salmon Safe" park system in North America. However, as sustainability becomes more mainstream and widespread, professionals are learning more effective ways to incorporate ecological processes into park plans, designs, and maintenance procedures. It is timely for PP&R to incorporate the most current best practices to maximize the ecological function of the landscapes it has responsibility to manage.

This report builds on established ecological and sustainable best management practices, identifies desired future landscapes for increasing ecological functions throughout the park system by diversifying landscapes to make them more sustainable and provide additional ecological function, sets priorities for identifying enhancement areas, and suggests a process for collaboratively working together. This report also introduces the concept of creating habitat patches in developed parks. Habitat patches are areas planted with a predominance of native vegetation and may include trails, viewing areas, and/or picnic tables. They will give people access to nature in their neighborhood park. This is also an effective strategy to address environmental justice issues that disproportionately impact low income and communities of color, allowing PP&R to incorporate equity into ecologically sustainable practices.

Focusing on landscape ecology at a systemwide level – the relationship between living organisms and their environment, and the functions and processes they provide – PP&R developed a set of guiding principles for ecologically sustainable landscapes. The principles are placed in four categories:

1. **Site Design or Modifications**
2. **Ecology**
3. **Operations and Maintenance**
4. **Parks Staff and User Community**

Establishing ecologically sustainable landscapes is a long-term adaptive process. This includes establishing and refining best management practices from turf to natural areas. Ecological resiliency allows our park system to adapt to ecological disturbances and climate change while retaining ecosystem functions and contributing to watershed health and wildlife habitat. As more people move to Portland, the pressures of urbanization and population density will increase.

To reduce the population impacts on ecosystem functions, PP&R's acquisition, planning, design, construction, operations and maintenance, and public involvement staff need to work collaboratively to identify opportunities to restore ecological processes and functions in new and existing parks.

Based on the PP&R Guiding Principles, three overall goals were developed for the Ecologically Sustainable Landscape Initiative:

1. **Continue to use and refine best management practices to increase soil and plant health, and to reduce inputs (consumption of water resources, fertilizers, herbicides, maintenance, machinery, and labor).** PP&R developed and implemented numerous best management practices (BMP) to reduce water, fertilizers and pesticide use, enrich soil, and maintain plant health. These are key components in developing and maintaining ecological processes and functions. Healthy soil and planting the right plant in the right place increase nutrient recycling and reduce maintenance costs, herbicide use, and operation expenses. This report updates BMPs that will support ecologically sustainable landscapes.
2. **Maintain and create diverse park landscapes by converting under utilized park spaces to habitat patches, adding groundcover and maintaining solar penetration for healthy turf.** Extending ecologically diverse landscapes throughout the park system requires a series of actions within a park that range from conversion of underused turf to a habitat patch, planting understory plants or groundcover, and/or renovating turf by removing small trees to allow solar penetration. Areas that have low recreational and social value are candidate sites for conversion. By reintroducing ecological functions and process there is the opportunity to provide a full range of life-cycle needs for wildlife, while improving watershed health within the city and our region. This goal also includes expansion of unique landscapes such as community gardens, the urban canopy, and specialty gardens. Additionally, PP&R's commitment to equity encourages consideration of how and where investment in the propose changes will be located.
3. **Plan, design, and manage landscapes through collaboration among PP&R staff and community members.** This goal provides the process for continuing and improving collaboration within PP&R and with others. To successfully meet this goal, teams work together to make decisions across multiple disciplines for new park development or sustainable landscape modifications.

In order to meet these three goals (Ecologically Sustainable Landscapes, Maximizing Ecological Effectiveness, and Internal Processes and Collaboration), progress must be measured over time. The report develops performance measures to gauge PP&R's progress. Example performance measures include acres of habitat patches developed, increase in turf health, and installation of pollinator gardens.

Having a diversity of landscapes in parks provides multiple and deliberate sets of experiences for users. However, in some cases, these changes in landscape type and management may not meet the traditional expectation of park users. To help encourage public acceptance and support there are variety of design elements that can be incorporated. They include planting arrangements, an orderly perimeter around a habitat patch or tall grass meadow, boardwalks, buffers, and overlooks.

Designing and maintaining for landscape change in parks is financially, socially, and economically sustainable and provides a new, intentional legacy for future generations. Building public awareness and acceptance through education and stewardship will allow PP&R to reach its goals for enhanced ecological process and functions while still providing for recreation and programs over the next 30 to 50 years.

Multi-layered landscape at the Holocaust Memorial

Introduction

The City of Portland and Portland Parks & Recreation (PP&R) have developed a national reputation for sustainable planning, design, and operations. As examples, PP&R is the only certified "Salmon Safe" parks system in North America. Water conservation practices have received awards, Integrated Pest Management practices are nationally renowned, and two golf courses are certified as habitat-friendly by the Audubon Society.

However, as sustainability becomes more mainstream and widespread, professionals are learning more effective ways to incorporate ecological processes into park plans, designs, and maintenance procedures. It is timely for PP&R to incorporate the most current best management practices to maximize the ecological function of the landscapes it has responsibility to manage.

Portland Parks & Recreation's Parks 2020 Vision represents a long-term plan for strengthening and improving park practices. It includes a vision statement for the bureau: "Portland's parks, public places, natural areas and recreational opportunities give life and beauty to our city. These essential assets connect people to place, self and others. Portland's residents treasure and care for this legacy, building on the past to provide for future generations." (Parks 2020 Vision)

To implement this vision, PP&R develops multi-year strategic plans. In the 2012-2015 Strategic Plan, one of the strategic themes is sustainability. The goal of this theme is to "Extend ecologically sustainable landscape management practices over the entire spectrum of PP&R's green infrastructure." Green infrastructure is defined as natural resources or designed facilities that protect, support, or mimic natural systems to provide stormwater management, water quality, public health and safety, wildlife habitat, open space, and other complementary ecosystem services. Examples include trees, natural areas, parks, ecoroofs, green street facilities, wetlands, and natural waterways.

During the past 20 years, PP&R has been moving towards more sustainable landscape practices. Examples include:

- Mulching plant beds and around trees to suppress weeds.
- Recycling green waste and using the resulting compost.
- Planting Northwest natives and hardy, non-invasive cultivated varieties of trees, shrubs and herbaceous species.
- Practicing an integrated pest management program since 1988.
- Practicing irrigation conservation practices (computerized system since 1993).

- Managing the urban canopy to maintain and enhance the forest (1994 Forestry Management Plan was updated in 2004).
- Protecting and enhancing natural areas (formation of City Nature in 2004).
- Being the first municipal park system to be SalmonSafe Certified in 2005.
- Developing 50 community gardens for a total of 2,200 plots.
- Having certified Audubon Cooperative Sanctuary Program for Golf Courses: Eastmoreland – 2014 (in progress) and Heron Lakes – 1996.

This initiative builds on these established ecological and sustainable best management practices, identifies desired future landscapes for increasing ecological functions throughout the park system by diversifying landscapes to make them more sustainable and provide additional ecological function, sets priorities for identifying enhancement areas, and suggests a process for collaboratively working together. This initiative also introduces the concept of creating habitat patches in developed parks. Habitat patches are areas planted with a predominance of native vegetation and may include trails, viewing areas, and/or picnic tables. They will give people access to nature in their neighborhood park. This initiative applies to landscapes in new parks as well as areas in existing parks.

The City of Portland has adopted two relevant citywide plans that address climate change and watershed health. PP&R also developed a Climate Action Plan. These plans are used as guiding documents for this initiative.

CITY OF PORTLAND AND MULTNOMAH COUNTY CLIMATE ACTION PLAN (2009)

The Climate Action Plan is "Portland's roadmap to cut carbon emissions 80% by 2050" compared to 1990 levels. The plan states objectives and actions for achieving the desired outcomes for the urban forest and natural systems that include:

- Expanding the urban forest canopy to cover one-third of Portland by encouraging public and private tree plantings to increase shade cover and controlling invasive species.
- At least 50 percent of the total stream and river length in the city meets urban water temperature goals as an indicator of watershed health.
- Significantly increasing consumption of local food.

PORTLAND WATERSHED MANAGEMENT PLAN (2005)

The Portland Watershed Plan "will guide City decisions and projects by providing a comprehensive approach to restoring watershed health." The plan identifies six strategies for improving watershed health:

1. Stormwater Management – reduces impervious area, increases infiltration, and removes pollutants.
2. Revegetation – slows runoff, increases infiltration, traps sediments, and absorbs pollutants.
3. Aquatic and Terrestrial Enhancement – improves stream flow, recharges groundwater, provides flood storage, reduces heat island effects, provides connectivity, protects biodiversity, and provides habitat for native fish and wildlife species.
4. Protection and Policy – preserves remaining natural areas and ensures sustainable development.
5. Operations and Maintenance – increases efficiency, reduces waste, and prevents pollution.
6. Education, Involvement and Stewardship – enhances public understanding, generates support, and ensures success.

Large trees shade turf in Columbia Park

Guiding Principles

This report focuses on landscape ecology at a systemwide level – the relationship between living organisms and their environment, and the functions and processes they provide. The following concepts are specifically for parks; however, they could also be applied to other landscapes citywide to restore ecological functions and processes that would assist in meeting climate change and watershed goals in collaboration with PP&R.

The American Society of Landscape Architect's Sustainable Sites Initiative (SITES)[1] and the New York High Performance Landscape Guidelines[2] are two examples of comprehensive sustainable landscape programs emphasizing sustainable guiding principles and best practices for parks that were used as references. Examples of best management practices include a complete site analysis, soil conservation and enhancement, protection of existing vegetation, planting native vegetation, tree protection and replacement, water conservation, stormwater treatment, use of local materials, reduction in herbicides, energy conservation, local food initiatives, and stewardship.

SITES defines "Ecosystems services are goods and services of direct or indirect benefit to humans that are produced by ecosystem processes involving the interaction of living elements, such as vegetation and soil organisms, and non-living elements such as bedrock, water, and air." SITES outlines a short list of factors that sustainable sites can strive to protect or generate through design, construction, and best management practices. For this initiative, the following ecosystem services have been selected from SITES list:

1. Global climate regulation: maintaining balance of atmospheric gases at historic levels, creating breathable air, and sequestering greenhouse gases.
2. Local climate regulation: regulating local temperature, precipitation, and humidity through shading, evapotranspiration, and windbreaks.
3. Air and water cleansing: removing and reducing pollutants in air and water.
4. Water supply and regulation: storing and providing water within watersheds and aquifers.

[1] The Sustainable Sites Initiative: The Case for Sustainable Landscapes. The American Society of Landscape Architect, Lady Bird Johnson Wildflower Center at the University of Texas at Austin, United States Botanic Garden (2009).

[2] High Performance Landscapes Guidelines 21st Century Parks for NYC. Design Trust for Public Spaces and the NYC Department of Parks & Recreation (2010).

5. Erosion and sediment control: retain soil within an ecosystem, preventing damage from erosion and siltation.
6. Pollination: providing pollinator species for reproduction of crops and other plants.
7. Habitat functions: providing refuge and reproduction habitat to plants and animals, thereby contributing to conservation of biological and genetic diversity and evolutionary processes.
8. Waste decomposition and treatment: breaking down waste and cycling nutrients.
9. Human health and well-being benefits: enhancing physical mental and social well-being as a result of interaction with nature.
10. Food and renewable non-food products: producing food, fuel, energy, medicine, or other products for human use.
11. Cultural benefits: enhancing cultural, education, aesthetic, and spiritual experience as a result of interaction with nature.

PP&R GUIDING PRINCIPLES

Portland Parks & Recreation adopts the following guiding principles for ecologically sustainable landscapes within its park system:

I. Site Design or Modifications

1. Strive to preserve and enhance ecosystem services of the site while maintaining recreational use by park users.
2. Conduct a thorough site analysis, identifying key features, characteristics, opportunities and constraints prior to design.
3. Preserve and/or create microclimates, areas that are different from the adjacent landscape often created by topography, that support a diversity of vegetation by designing with the topography and reduce grading.
4. Use predominately Northwest native vegetation and hardy, non-invasive cultivated varieties of trees, shrubs and herbaceous species in planting design.
5. Design sites so they adapt to demographic and environmental changes over time.
6. Engage all users – park staff and community members and be open to contributions from all affected parties.
7. Work as a team to acquire, plan, design, construct, and maintain ecologically sustainable landscapes in parks in balance with aesthetic and recreational goals.

8. Offer a variety of ways for users to engage with nature at park sites.

II. Ecology

1. Build resiliency in our system through designing for and modifying existing landscapes to allow for ecological succession prompted by climate change.
2. Restore or regenerate lost or damaged ecosystem services.
3. Preserve and/or support the complex relationship between soils, vegetation, water, and fauna.
4. Create corridors between individual parks and natural areas to enhance larger-scale ecological connectivity and function.
5. Increase native vegetation and biological diversity in underutilized or difficult to maintain open spaces to create habitat patches.
6. Protect and enhance the urban forest and canopy cover.
7. As our knowledge and understanding of site ecology and best management practices expands, update our practices accordingly.

III. Operations and Maintenance

1. Include operations and maintenance considerations for short- and long-term practices and resources to assure the landscape will thrive without extensive modifications.
2. Learn from past challenges and ensure they are not repeated.
3. Minimize amount of supplemental water, fertilizers, herbicides, machinery, fuel, and labor needed to achieve a satisfactory maintenance level.
4. Continue to improve best management practices that conserve resources.

IV. Community

1. Continue to foster an ethic of environmental stewardship within staff and park users.
2. Create spaces and activities that encourage public interaction with nature while protecting ecosystem functions.
3. Continue to provide the opportunity to grow food and enjoy local abundance through community gardens and other strategies.
4. When possible, prioritize the implementation of these practices in areas that could benefit most from enhanced environmental benefits and access to nature such as low income and communities of color.

Guiding Principles

Park landscapes are often designed and managed for a certain function and aesthetic, and are expected to be managed and maintained in accord with the original design intent. Successful park plans and designs understand that landscapes change over time. Trees grow and shade turf, plants mature and die, users change and so do their desires for activities within parks. The best plans envision the desired mature vegetation, while incorporating flexibility of use into the site design. Done well, the original design intent can be continued over time. Portland examples include Laurelhurst Park, Peninsula Park, and Chapman and Lownsdale Squares.

Establishing ecologically sustainable landscapes is a long-term adaptive process. This includes establishing and refining best management practices from turf to natural areas. Ecological resiliency allows our park system to adapt to ecological disturbances and climate change, while retaining ecosystem functions, and contributing to watershed health and wildlife habitat. As more people move to Portland, the pressures of urbanization and population density will increase. To reduce the population impacts on ecosystem functions, PP&R's acquisition, planning, design, construction, operations and maintenance, and public involvement staff need to work collaboratively to identify opportunities to restore ecological processes and functions in new and existing parks.

Ecologically sustainable landscapes will be maintained primarily by PP&R staff. They will also provide opportunities to develop partnerships with residents, stewardship organizations, and neighborhood associations who are committed to making a long-term investment in our community and to leave a positive legacy for future generations.

Based on these PP&R Guiding Principles, three overall goals were developed for the Ecologically Sustainable Landscape Initiative:

1. Continue to use and refine best management practices to increase soil and plant health, and to reduce inputs (consumption of water resources, fertilizers, herbicides, maintenance, machinery, and labor).

2. Maintain and create diverse park landscapes by converting underutilized park spaces to habitat patches, adding groundcover and maintaining solar penetration for healthy turf.

3. Plan, design, and manage landscapes through collaboration among PP&R staff and community members.

Designing and maintaining for landscape change in parks is financially, socially, and economically sustainable and provides a new, intentional legacy for future generations. Building public awareness and acceptance through education and stewardship will allow PP&R to reach its goals.

Ecologically Sustainable Landscapes

Goal One: Continue to use and refine best management practices to increase soil and plant health, and to reduce inputs (consumption of water resources, fertilizers, herbicides, machinery, and labor).

PP&R developed and implemented numerous best management practices (BMP) to reduce water, fertilizers, and pesticide use; enrich soil and maintain plant health. These are key components in developing and maintaining ecological processes and functions. Healthy soil and planting the right plant in the right place increase nutrient recycling and reduce maintenance costs, herbicide use, and operation expenses. Continued updating BMP will support ecologically sustainable landscapes. BMP supporting soil and plant health are listed below. For each BMP there is a premise, objective, and a list of actions.

A. Soil Health

Premise: Soil health is the "ability of a soil to perform the functions for its intended use." Soil functions include[3]:

- Sustaining biological diversity, activity, and productivity.
- Regulating water and solute flow.
- Filtering, buffering, and degrading organic and inorganic materials.
- Storing and cycling nutrients and carbon.
- Providing physical stability and support.

Healthy soil increases the productivity of landscapes by promoting germination, growth rate, size, and reproduction of plants. Soils with excessive nitrogen or other problems tend to benefit undesirable weed species, require replanting and more maintenance.

Objective: Maintain and increase soil quality by increasing nutrient cycling as measured by the presence of healthy soil organisms and organic matter.

Actions

1. Complete soil testing before planting or amending planting beds and turf areas. Test soil fertility including pH, N-P-K, iron, calcium, organic material percentage, particle gradation, infiltration rates, salinity, and groundwater elevation.
2. Evaluate the cost of significantly improving or replacing existing soils when they are in poor condition or fill material based on testing.

[3] USDA NRCS Soil Quality Indicators Fact Sheet, September 2009

3. Locate the equipment that converts green waste to mulch or compost in a central location and assign a staff person to properly maintain the mulch grind and temperature to produce high quality compost that is weed seed free.
4. Employ mulch-mowing (leaf and lawn clippings left on the ground surface) on passive open space areas.
5. Continue to allow the decomposition of leaves and small branches in plant beds and along trail edges.
6. Add seed-free compost to the top 12 inches of existing soil prior to planting or as needed based on soil testing data.
7. Place wood chips on habitat patch sites or in planting beds for one year prior to planting for weed and grass suppression.
8. Apply medium or fine grind bark or mulch to planting beds and over newly planted areas.

Volunteers spreading wood chips

9. Utilize organic sources for all soil additives and use organic nitrogen fertilizer applications to benefit the slower uptake for native plants. For example, balance pH through organic means such as the addition of lime to increase nutrient uptake by plants.
10. Plant an abundance of nitrogen-fixing plants, such as alder (Alnus sp.), myrtle (Myrica sp.), and lupine (Lupine sp.) at sites with poor soils.
11. Reduce soil compaction by not allowing heavy machinery or driving on wet soils.

Newly planted perennial bed

B. Right Plant, Right Place

Premise: Match plants to specific site conditions and microtopography to increase their vigor and reduce replacement.

Objective: Select and locate plants to match the differing micro-climate and soil conditions for the site. Ensure aesthetic and functional objectives are met by using compatible plants.

Actions

1. Coordinate plant selection and location directly with the PP&R staff most familiar with the site conditions, maintenance of the site and public use.
2. Cluster plants with the same watering requirements and sun exposure, planning for only three (3) years of supplemental irrigation or until established.

3. For each park have only three to five water regimes – amount, timing, seasonality – for all planting beds.
4. Include, with the original design, a vegetation management plan that addresses plant maintenance practices and replacement species if site conditions change (increased shading or sunlight) or plants die due to natural causes and human activities.
5. Develop an associate and compatible plant list – assemblages of plant species that are compatible and are able to occupy noncompetitive spaces, soil, and mineral resources. For specific parks, review and modify the plant list when necessary.
6. Ensure plants are selected and planting beds designed to allow for appropriate visual access and safety in parks.
7. Use high quality planting stock and ensure plants are properly planted.

C. Species Selection Hierarchy

Butterfly Park

Premise: Native plant species and Northwest hardy plants (non-invasive) are better matched to the life cycle requirements of native wildlife and are more ecologically desirable.

Objective: Favoring native species and northwest hardy, non-invasive cultivated varieties of trees, shrubs and herbaceous species can accomplish the aesthetic or functional objectives of the design such as seasonal interest and drought tolerant. Apply a hierarchical approach to plant selection that prioritizes the use of species based on their historic range. Cultivars of native and Northwest hardy species are equally acceptable in landscaped areas where some native plants may be unruly and need to be pruned for safety and aesthetics. Plant hierarchy from desirable to less desirable:

1. Willamette Valley
2. Northwest: northern California to Vancouver, British Columbia
3. Intermountain West
4. Other locations

Actions

1. Establish a reference/guidance plant list, including climate change-adapted species, for staff and consultants. Examples include the Portland Plant List, the website Great Plant Picks[4], Sunset Plant Finder[5], and Plants for USDA Hardiness Oregon Zone 8a and 8b.

[4] www.greatplantpicks.org; Elisabeth C. Miller Botanical Garden
[5] www.plantfinder.sunset.com

2. Prioritize plants that:
    - Outcompete common invasive species and weeds.
    - Offer value to a diversity of wildlife.
    - Serve as hosts for birds, pollinators, butterflies, and moths.
    - Require no supplemental irrigation after initial establishment period.
    - Offer evergreen cover and winter fruit.
    - Are long-lived.
    - Are susceptible to few pests or diseases.
    - Will require infrequent trimming or pruning to fit in identified space.
3. Seek to design and maintain a wide diversity of plant families, genera, and species for sites based on PP&R institutional knowledge of plants that thrive throughout the park system.

D. Plant Establishment and Regeneration

Premise: Plant, including ground covers, and mulch the entire planting area during the initial establishing or when renovated planting areas to inhibit weed growth and reduce the need for future mulching. As desirable plants mature, allow them to reproduce in the landscape to create a multi-age landscape.

Objective: Install and allow for the colonization and regeneration of desirable plants. Initial plantings should cover 100% of the ground surface within three years.

Actions

1. Select native and hardy species that are adapted to the Pacific Northwest, resistant to pests and diseases, and need limited water after establishment from the guidance list.
2. Use cover crops, mulch, and other temporary plantings to cover bare soil.
3. Install slower growing species in early phases on the planting plan. Plan for additional plants in subsequent phases and replacement based on the life cycle of the dominant vegetation.
4. Reduce risk of weather-related failure by planting or seeding over several seasons or years.
5. Allow for existing plants to regenerate via seed, sprouts or other method.
6. Create habitat for native seed-eating birds so they disperse seeds of native plants.

7. Install logs, boulders, berms, and manipulate micro-topography to increase seed establishment, where appropriate.
8. Communicate the condition and strategies for ecologically sustainable landscapes to staff, visitors, and the public to increase social acceptance.

E. Plant Diversity

Premise: Landscapes with multiple layers of healthy vegetation provide for a larger diversity of habitats than a single layer of plants. A variety of plants increases the biological diversity, is more likely to be disease resistant, and provides a variety of life cycle resources for native pollinators and wildlife. Landscape diversity can be composed in one community type (e.g., Douglas fir forest) or a matrix of smaller communities combined into a larger system such as a mixed deciduous forest with a herbaceous understory.

Objective: Create a biologically diverse, multi-layer landscape that includes a variety of vegetation types (e.g., groundcover; low, medium, and large shrubs; and trees) with no single species making up more than 30% of the plantings.

Actions

1. Cluster shrubs and trees to create varying solar and moisture levels.
2. Create micro-climates to support a variety of plants by installing features such as berms, furrows, logs or boulders.
3. Protect the interactions between wet and dry landscapes.
4. Test regionally uncommon plants at a small scale (a test garden) to evaluate if their requirements can be met in larger or restored landscapes.
5. Select plants that will mature into a multi-layer landscape.

South Waterfront Park

Fine tuning the irrigation system

F. Supplemental Irrigation

Premise: Supplemental irrigation for newly planted landscapes should be limited to the establishment period and only used in established perennial beds to preserve the plants during drought conditions.

Objective: Conserve water used for irrigating turf, sports fields, planting beds, and establishing park landscapes.

Actions

1. Select plant species adapted to dry summer conditions and that can be established with three (3) years of supplemental irrigation.
2. Control grasses and weeds before planting; however, allow native grasses to remain.
3. Water plants deeply and infrequently to encourage deep roots.
4. Install smaller size plant material where appropriate to reduce initial water demand. In heavily used areas, install larger plant materials that have a better chance of not being trampled.
5. Plant and transplant in the early spring or fall to give plants time to establish over winter months so they will require less irrigation their first years and be better adapted to hot, dry summers.
6. Seed and plant in late fall, if possible.
7. Mulch or add organic matter to newly planted sites to retain water.
8. Continue to add parks to the central irrigation management system until all parks are included.

Practicing IPM in Forest Park

G. Integrated Pest Management (IPM)

Premise: Invasive species, both flora and fauna, will continue to reduce watershed and ecological health unless properly controlled. Integrated pest management means a coordinated decision-making and action process that uses the most appropriate pest control methods and strategies in an environmentally and economically sound manner to meet pest management objectives. PP&R has a regionally recognized IPM program that has been in place since the late 1980s. The IPM policies and practices direct every aspect of pest management throughout the park system. Policies and training are updated on a regular basis to respond to new information and challenges.

Objective: Continue to develop and improve the IPM program to manage invasive species to maintain and enhance watershed, human, vegetation, and animal health.

Actions

1. Continue to focus on eradicating invasive species that are disrupting ecosystem processes or impeding the long-term succession in ecosystems.
2. Continue to improve soil health through mulching and other methods to reduce the need for herbicide use.
3. Develop a list of plant species to use as native cover crops to control invasive species.
4. Plant appropriate groundcover and shrubs under trees to reduce herbicide spraying.
5. Continue to expand scientific knowledge of chemicals and best management practices, and monitor results of various applications.

H. Staff Training

Premise: As BMPs are refined and developed, it is important to continue to update staff skills through trainings and opportunities to work together.

Objective: Continue to train and refresh seasonal, new, and current staff in BMPs to maintain and enhance planting beds, park landscapes (especially for pruning), habitat patch planting and maintenance, irrigation systems, public safety (CPTED), and use of herbicides.

Actions

1. Establish and maintain written BMPs for reference and trainings.
2. Review and revise standards every five (5) years.
3. Provide yearly staff trainings and refresher opportunities.
4. Develop unified trainings for City Nature and Services staff to share expertise.
5. Improve access to technology (computer and other electronic devices) to field staff to record horticultural, irrigation practices, and landscape changes to the park or natural area.
6. Form partnerships with ecology, landscape, and horticultural programs at Oregon universities to further develop the BMP body of knowledge and track effectiveness of various actions.

Westmoreland Park

Maximizing Ecological Effectiveness

Goal Two: Maintain and create diverse park landscapes by converting underutilized park spaces to habitat patches, adding groundcover and/or maintaining solar penetration for healthy turf.

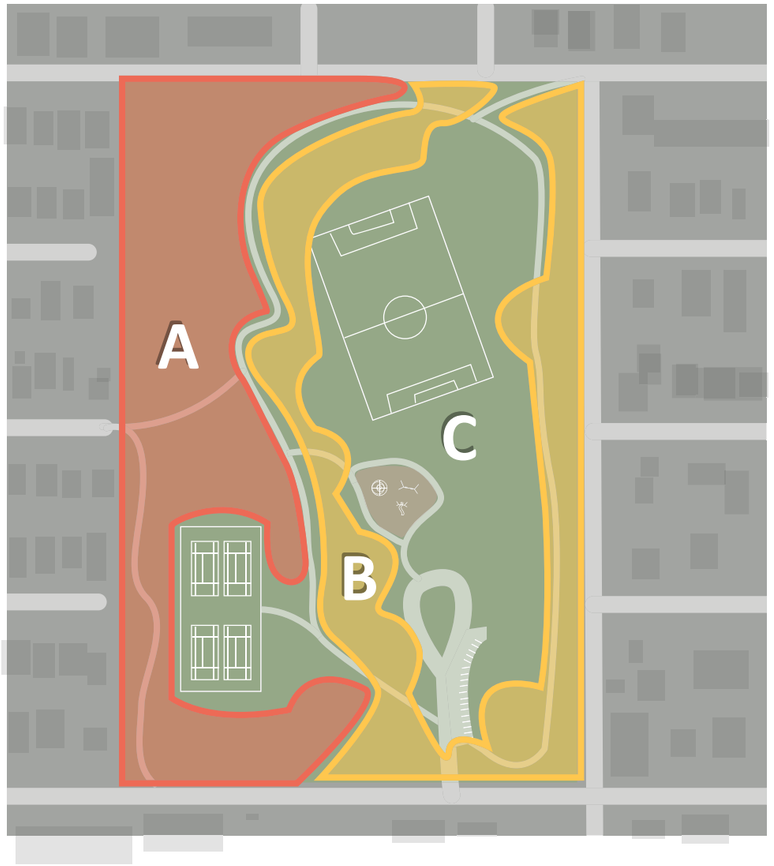
Extending ecologically diverse landscapes throughout the park system requires a series of actions within a park that range from conversion of underused turf to a habitat patch, planting understory plants or groundcover, and/or renovating turf by removing small trees to allow solar penetration (see graphics). Areas that have low recreational, gardening, and social value are candidate sites for conversion. By reintroducing ecological functions and process there is the opportunity to provide a full range of life cycle needs for wildlife, while improving watershed health within the city and our region. This goal also includes expansion of unique landscapes such as community gardens, the urban canopy, and specialty gardens.

The following are examples of landscape conversions that enhance diverse and unique landscapes that build resiliency and enhance ecological functions throughout the system.

Tall grasses grace Tanner Springs

Existing Condition - Neighborhood Park

Mix of used and unused passive open space, homogeneous landscape with scattered trees and turf areas.

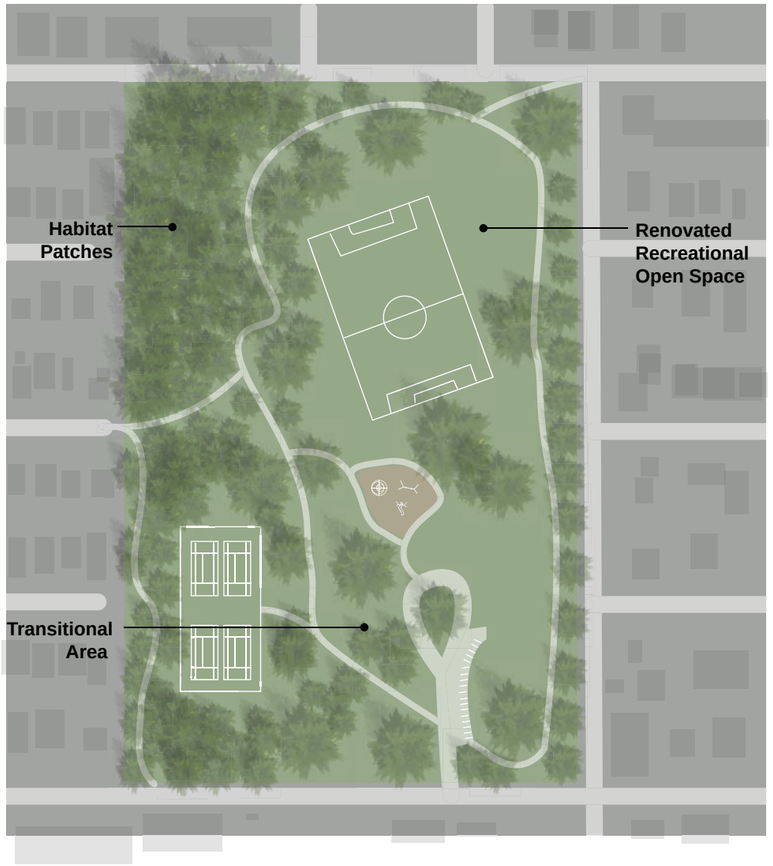


Diverse Landscapes - Gradient Planting Diagram

A. Habitat Patch: Multi-story planting at park edge w/ trail; planting with predominately native plants and deciduous trees limbed up to 7 feet.

B. Transitional Area: Remove turf areas and smaller trees. Plant ground covers (18” max height).

C. Renovated Recreational Open Space: Renovate turf areas by removing small trees for additional sun light. Use best management practices to renovate the turf area including any needed updates to the irrigation system. Large trees to remain. Additional tree planting where appropriate.



Future Condition - Neighborhood Park

Diversity of ecologically sustainable landscapes from habitat patches to renovated recreational open spaces

Tanner Springs Park

A. Underutilized Lawns and Known Problem Lawns

Premise: Converting steep hillsides, soggy lawns, and areas that do not provide opportunities for passive recreation to sustainable landscapes enhances the ecological functions of the system.

Objective: Increase ecological functions and process by enhancing or creating diverse habitats and changing best management practices.

Actions

1. Tall Grass Meadow: A tall grass meadow can provide beneficial insects for pest management, plant pollination, and increase plant diversity.
    - Develop a list of meadow plants and, over time, plant or encourage the colonization of beneficial insect plants at a recommended minimum density of 1 plant per 5 square feet.
    - Allow the beneficial plants to flower and seed before mowing.
    - Vary color, scents, textures, plant height, and flowering season. Select plants to attract at least four different families of insects, e.g., solider beetles, big eyed bug, and hoverflies using the Xerces Society's Pollinator Plants Maritime Northwest .
    - Include at least three different bunchgrasses.
    - Ideal locations include adjacent to riparian areas to enhance food and nesting material.
    - Ensure the meadow is mowed before becoming a fire hazard.
2. Pollinator Garden: A pollinator garden requires two essential components – a place to nest and flowers to gather nectar and pollen for a variety of pollinators.
    - Use the Xerces Society's Pollinator Plants Maritime Northwest list to select pollinator plants.
    - Gardens can vary in size and optimal would be at a maximum 1 mile from an existing pollinator habitat.
    - The ideal plantings are to have at least three different forage (food) plants within each of the three blooming periods (early spring, spring, and summer) for a total of at least nine different forage plants and at least six different caterpillar host plants (including one native bunchgrass) for a grand total of 15 plants.

Pollinator bee on flower

- Ideal locations include those adjacent to community gardens, perennial flower beds, and natural areas.

3. Habitat Patch: Plant a diverse, native vegetation, multi-layer landscape such as an ash woodland, oak woodland or Douglas-fir forest.
   - There is no minimum patch size; however the larger the patch the more ecological functions it provides.
   - Create a wide spectrum of tree ages and a multi-storied layer, including snags and wood piles for wildlife where appropriate and manage for regeneration of native plants.
   - Ideal location are hill slopes, wet areas, hard to mow locations, and adjacent to natural areas.
   - In large areas, recommend planting at least 20 containerized trees and shrubs per acre (average 50 feet on-center for trees) to establish the structure of the habitat patch and an understory with layers of vegetation. To fill in the patch spaces, plant approximately 1,500 bare-root trees and shrubs per acre with the understanding that some plants may die and thinning may be needed.

Multi-layer habitat patch

B. Existing Forest or Scattered Large Trees with No Understory

Premise: Managing the landscape understory for a variety of functions increase the overall health and use of the park.

Objective: Select areas under the existing canopy to increase the vegetation diversity, and other areas to re-invigorate the turf.

Actions

1. Interplant with native species and/or cultivated varieties of trees, shrubs and herbaceous species under existing forest canopy to create a multi-layered forests. Manage for forest regeneration and create a wide spectrum of tree ages, including dead trees and bush piles.
2. Replace turf with hardy, low growing groundcover to outcompete weeds. Groundcover provides soil nutrients as a "living" mulch and habitat for beneficial insects. It often needs to be managed so it does not become overrun with undesirable plants.
3. Remove small trees to increase the vigor of the remaining trees and provide the needed sunshine to improve remaining turf. Tree removal will need to be permitted and mitigated. One option for mitigation is planting a habitat patch.

Scattered Trees with no understory

4. Expand existing forest on slopes that are steeper than 5 to 1 or greater than 14 degrees. Over time install or encourage the colonization of at least 20 trees per acre (average 50 feet on-center) and a diverse multi-layer understory. Manage for forest regeneration and create a wide spectrum of tree ages, including dead trees that increase the biodiversity, reduce water runoff, and provide habitat for native animals.

C. Existing Riparian Forest

Premise: A diverse native, multistory riparian forest provides a wide variety of functions including shading the stream, wildlife habitat, and connectivity.

Objective: Increase the functions and processes of riparian areas by increasing the width, removing invasive species, and enhancing wildlife habitat.

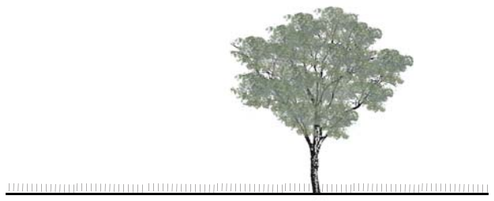
Riparian area along Johnson Creek

Actions

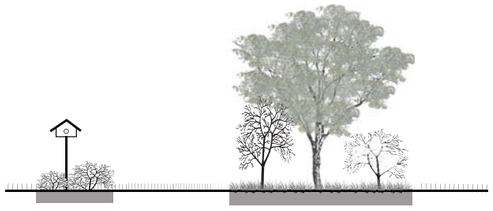
1. Install or encouraging a diverse and layered matrix of native shrubs and trees.
2. Where possible, continue planting 90% of the area within the 100-year floodplain, assuming that the remaining 10% will be paths, facilities, and compatible amenities.

April Hill Park

Example Ecological Landscapes in Sequence



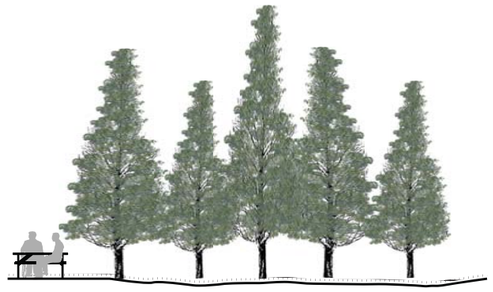
Revitalize underutilized lawn and problem areas



- Eradicate sun-tolerant weeds.
- Install shrubs under bird houses.
- Seed annually-mowed grasses under tree grove.

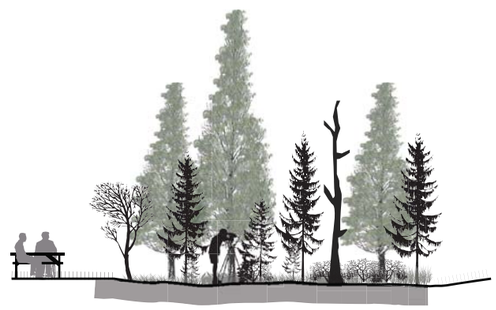
- Allow volunteer native plants.
- Install a fence & gate for seasonal closure.
- Mow the perimeter of the rehabilitation area.

- Establish a pollinator garden along a pathway.
- Maintain snags & allow for new trees to emerge.
- Coordinate stormwater retrofits with pollinator goals.

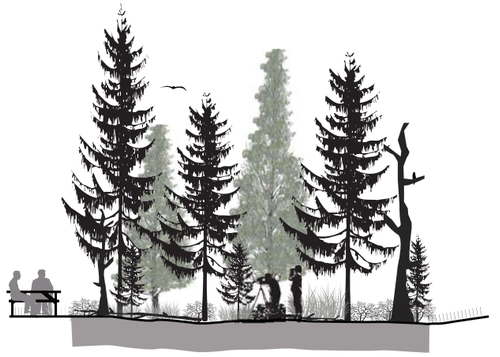


Regenerate conifer forest

- Place nurse logs.
- Open gaps in canopy for lupine to fix nitrogen.
- Plant a new generation of trees.

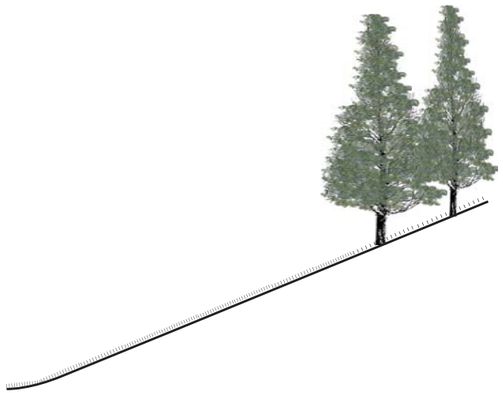


- Plant layers of shade tolerant shrub & trees.
- Build soil with leaf litter and compost.
- Maintain snags for habitat.

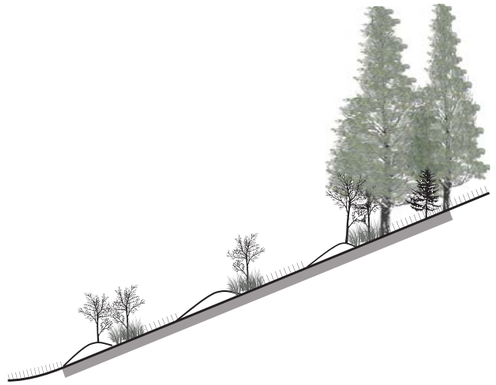


- Reduce watering, weeding & fertilizer.
- Monitor for plant diversity.
- Incorporate nature-play opportunities.

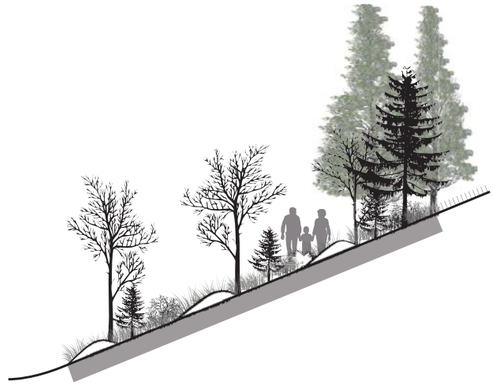
Example Ecological Landsapes in Sequence



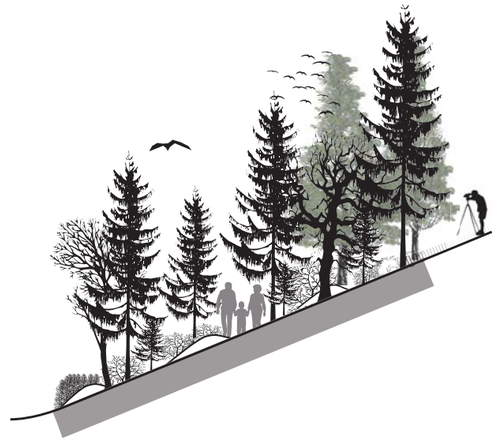
Expand conifer forest
on slopes



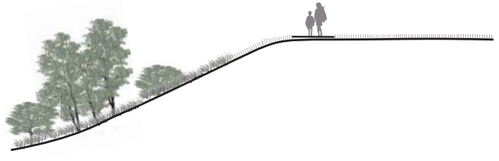
- Locate the rehabitliation area on a steep soggy slope.
- Create berms for seedling establishment.
- Plant red alder trees for nitrogen fixing.



- Seed a diversity of natives.
- Interplant shrubs to support IPM.
- Mow pathways.

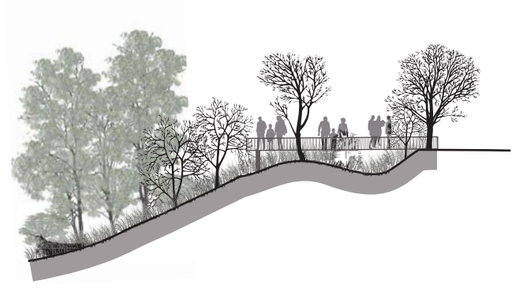


- Leave decaying trees in place.
- Eradicate shade tolerant weeds.
- Selectively prune shrub along pathways.



Expand riparian zone

- Coordinate the location with greenstreets system.
- Eradicate shade-tolerant weeds.
- Build an overlook for a diverse river experience.



- Select plants adapted to urban fill soils.
- Expand on existing riparian vegetation.
- Revise strategies based on pattern of volunteer vegetation.

- Evaluate success.
- Perform annual bird counts.
- Host annual planting day.

D. Unique Landscapes

Premise: Unique landscapes add diversity and beauty to Portland and our park system. They are managed for specific objectives using many of the same BMPs employed in other parks and natural areas.

Objective: Maintain, enhance, and develop sustainability practices used in these unique landscapes by continuing to work with managers and the public.

Actions

1. Community Gardens – Community gardens provide numerous ecological services such as a diversity of fruits and vegetables for use by a variety of pollinators, water infiltration, and soil enrichment through composting that supports necessary microbes and soil fauna. Access to fresh, healthy, organic food promotes sustainable urban ecology through promotion of organic practices, conserves resources related to food transport and reduces the use of pesticides and herbicides in the environment. They also create community by bringing people together – neighbors, newcomers to Portland, and connect cultures and generations through gardening.

Rhubarb from a community garden

   - Plant borders for pollinators.
   - Expand existing gardens and develop partnerships with public land managers and private landowners to locate gardens in deficient areas and low income neighborhood to meet the current and future demand.

The value of one urban tree

2. Urban Canopy – Portland's urban forest consists of approximately 236,000 street trees, 1.2 million City property trees, including parks, and innumerable private property trees. In 2010, the urban canopy covered 30% of the city. A healthy urban forest:
   - Improves air quality through pollutant absorption, releasing oxygen.
   - Reduces urban heat island effect by lowering air temperatures and reducing energy demands helping to offset climate change.
   - Provides shade for streams needed for improved fish habitat.
   - Provides wildlife habitat for birds, insects, and mammals, increasing biodiversity.
   - Helps manage stormwater by reducing soil erosion, intercepting rain, and increasing infiltration.
   - Reduces atmospheric carbon dioxide by sequestering carbon and reducing the heating and air conditioning demands of nearby buildings.

- Improves mental and physical health.

PP&R and partners strive to protect and enhance the health of the urban forest through tree maintenance and planting. Future actions include:

- Plant understory shrubs and groundcover to enhance watershed health, biodiversity, and ecological function.
- Increase the variety of tree species citywide to build resiliency and proactively maintain the City's forest assets and trees as our climate changes.
- The City continues to refine citywide tree canopy targets and canopy targets by zone (open space, residential, commercial, and industrial) classes.

5. Speciality Gardens – There are a variety of specialty gardens throughout the park system. They include:
    - Rose Gardens – International Rose Test Garden at Washington Park, Ladd Rose Gardens and Peninsula Park Rose Garden
    - Botanical Gardens –Crystal Springs Rhododendron Garden, Hoyt Arboretum, Leach Botanical Garden, Lan Su Chinese Garden, Duniway Park Lilac Garden and Japanese Garden

These gardens are managed to display their specialty plants and trees. PP&R staff manage the rose gardens, Crystal Springs Rhododendron Garden, and Hoyt Arboretum. The other gardens are managed by nonprofit groups with PP&R input.

Best management practices used to maintain PP&R-managed specialty gardens and the arboretum highlight the plant collections. Many of these practices are common to other parks. Mulch and wood chips are used to manage weeds where feasible, and IPM policies and protocols are followed. In some instances, plant diversity is being introduced to build resiliency into the collection. All rely on volunteers to assist with the maintenance. There are also unique practices for each garden and the arboretum.

Washington Park International Rose Test Garden

The rose garden is one of the top 10 urban gardens in the world, and top 10 public garden and free places to visit in the nation. The curator and a very large volunteer cadre maintain this worldclass garden. Volunteers and service crews pull weeds by hand nine times per year, deadhead roses, top roses, and replant beds. The rose beds are occasionally mulched, and soil amendments are added when the beds are replanted. Irrigation is done by the curator as there are 74 zones. The curator works with the IPM coordinator on all aspects of weed and pest management needed to maintain the garden. A diversity of Northwest hardy perennials have been planted adjacent and throughout the garden to add resiliency and diversity and provide pollinator habitat.

The International Rose Test Garden

Peninsula Park Rose Garden

This garden is included in the portfolio of a horticulturist in the Northeast Zone. The International Rose Test Garden curator provides technical assistance in selecting and maintaining the roses. BMPs are similar to most developed parks. The weeds are mainly controlled through spraying and when possible bark mulch is blown on the beds. A growing group of volunteers help deadhead and replant the roses. The rose beds are on the computer controlled irrigation system and the hedges are manually watered. Here, too, a strict IPM program is followed to maintain the roses.

Rose Garden at Peninsula Park

Crystal Springs Rhododendron Garden

This garden is included in the portfolio of a horticulturist in the Southeast Zone. The Friends of Crystal Springs Rhododendron Garden make the majority of the design and plant decisions, prune, and plant. They raise money for the garden through plant sales and events. The horticulturist spends most of his time controlling weeds and the manual irrigation system. Weed control is done by spraying and mulching with wood chips. Presently the Azalea Lacy Bug is a large problem. The IPM coordinator and horticulturist are working to control it through chemical treatment and installing companion plants. The horticulturist is also focusing on diversifying the plantings to add resiliency in this speciality garden.

Crystal Springs Rhododendron Garden

Hoyt Arboretum

The curator manages the arboretum and the natural area in Washington Park. At the arboretum, the curator manages the collection and the volunteers. The global tree collection contains approximately 2,000 species that are hardy and non-invasive. Volunteers help maintain the arboretum. They do the majority of mulching, weed removal, supplemental irrigation for the first two years for new trees, trail work, and general clean-up. Once a year professional arborists volunteer for one day of pruning, and some firms volunteer on an as-needed basis.

Volunteer arborists maintaining trees

For the past eight years, the curators have been evaluating warmer climate adapted trees to monitor their adaptation and survival during an occasional harsh winter. They have also been evaluating higher elevation trees for genetic variability. This information is recorded in a database and shared with Urban Forestry. This information should be shared with a wider audience within the City as maintaining and enhancing the health of the urban canopy is an important objective of the Climate Action Plan.

A variety of ecologically sustainable practices are implemented at Hoyt Arboretum:

- Shrub beds are mulched on a three-year rotation using mulch from the equipment that converts green waste to mulch. The curator stated that the grind has improved in the past two years. The arboretum uses around 2,000-3,000 cubic yards per year.
- Tall grass mowing is done according to the Migratory Bird Guidelines and observation. The curator has received very few complaints about the tall grass.
- Irrigation of the magnolia and maple collections is done through an automated system. These collections are the priority for the garden.
- Native shrub beds have been added where appropriate to provide habitat for pollinators and birds.

Public art along the Peninsula Crossing Trail

Internal Processes and Collaboration

Goal Three: Plan, design, and manage landscapes through collaboration among PP&R staff and community members.

The previous two goals are about best management practices and landscape conversions to enhance ecologically sustainable landscapes. This goal provides the process for continuing and improving collaboration within PP&R and with others. To successfully meet this goal, teams work together to make decisions across multiple disciplines for new park development or sustainable landscape modifications. This effort would be led by a planner for master and management plan development, a landscape architect for design and construction of new parks, and a supervisor or landscape architect for conversion of areas within a developed park. Though the project would be led by these individuals, technical input from a variety of other PP&R work groups is essential. The level of effort required to ensure successful collaboration will need to be included in the scope, schedule, and budget for a project.

To implement this goal, the following actions are need:

1. Form a technical advisory committee (TAC) – appropriately sized multidisciplinary team based on the scope and size of the project. Team members may include the following disciplines: planning, landscape architecture, ecology, operations and maintenance, horticulture, urban forestry, community gardens, turf and irrigation, public involvement or community partners such as neighborhood associations. The role of the TAC is to work with the project manager to integrate all project components from planning to maintenance.
2. Strive to meet Sustainable Sites Prerequisite 2.2 Use an integrated site development process (Appendix D).
3. The team shall continue to work together to evaluate and make modifications to the best management practices and landscape diversity success with team check-ins at years 1, 2, 3, 5, and 10.
4. Allocate the necessary resources, money, and staff to allow full participation in the process.

The steps to collaboratively design, adapt, and manage a new park or landscape conversion that includes habitat patches are:

A. Site Selection – Identify locations in new parks and use the site selection matrix (Table 1) for selecting conversion locations in existing parks.

B. Site Analysis and Inventory – Conduct a pre-design assessment and explore opportunities for site sustainability (Sustainable Sites Prerequisite 2.1 Conduct a pre-design site assessment and explore opportunities for site sustainability, modified for PP&R; Site Inventory Guidelines from NYC High Performance Landscape Guidelines).

C. Engage users and stakeholders – use PP&R Public Involvement Matrix to determine the level of public involvement.

D. Design of overall park or landscape conversion area – complete design and specifications.

E. Develop a vegetation management plan that is submitted with any permitting applications to guide future site maintenance. This should identify areas where succession is desired, trees that may need to be removed as canopies grow, and areas where establishment irrigation can be shut off.

F. Construct a new park or make the landscape conversions – meet ecological goals and objectives.

G. Implement the maintenance plan for the next 1-3, 5, 10, and 25 years to meet the ecological goals of the site and estimate the short- and long-term funding needed to implement the plan.

H. Feedback Loop/Lessons Learned – Continue to work with the team to evaluate if the goals and objectives for the park or landscape conversions are met or if modifications need to be made. Take corrective action and incorporate changes into the maintenance plan and in future design processes.

A. Site Selection for Landscape Conversions

Premise: Selection of park areas for a diversity of landscapes should be based on a set of criteria that includes present use and connectivity to natural areas. Where possible, restoring habitat and wildlife corridors builds resiliency and increases functions and effectiveness for maintenance.

Objective: Select underused, passive open space for conversion that are in close proximity to each other or enhance wildlife corridors using a specific criteria landscape scale and site specific criteria.

Actions

1. Inventory the extent and conditions of passive open space, shrub beds, woodlands, and forests and, based on the inventory, prioritize habitat patch placement and other landscape conversions throughout the system.
2. Select habitat patch location by using Table 1: Site Selection Criteria for habitat patches.

TABLE 1: SITE SELECTION CRITERIA FOR HABITAT PATCHES.

Habitat Patch Selection Criteria	High Desirability		Low Desirability
1. Proximity to existing natural areas	connected	<1/2 mile	>1/2 mile
2. Proximity to already restored areas	connected	<1/2 mile	>1/2 mile
3. Adjacent to or infill within existing native vegetation	infill	adjacent	no
4. Physical extent of habitat patch	>1 ac	0.25-1ac	<.25 acres
5. Underutilized or problematic area	yes	n/a	no
6. Connected to existing natural areas corridors	2+	1	0
7. Linked to green street or greenway	yes	in future	no possibility
8. Cost of installation, maintenance and monitoring	low	medium	high
9. Stream and wetlands	Within park	adjacent	Not connected
10. Restoration/enhancement method	Natural succession	Managed succession	restoration
11. Ability of project to be applied across park system	high	medium	low
12. Public/stakeholder support	high	medium	low
13. Stewardship plan	yes	in future	no possibility
14. Visibility	high	medium	low
15. Education and research program	yes	in future	no possibility
16. Recreation use	None/Low	3 to 4 months	More than 4 months
17. Community Garden Site	None/Not planned	Will not shade garden	Creates shade/sunnny, flat area
18. Equity	Habitat deficient area	Limited access to nature	Natural areas within 1/2 mile

For example, a GIS analysis using Criteria 1: Proximity to existing natural areas and sorted by watershed shows existing parks closest to natural areas that have potential habitat patch locations:

Distance	Columbia Slough Watershed	Willamette River Watershed	Johnson Creek Watershed	Fanno/Tryon Creeks Watersheds
1/8 mile	Northgate, Pier	Fulton, Spring Garden, Joseph Wood Hill, Kingsley, Cathedral, Council Crest, Madrona, Mt Tabor	Eastridge, Johnson Creek	Dickinson, Albert Kelly, Gabriel
¼ mile	Arbor Lodge, Argay, Columbia, Thomas Cully, PIR, East Delta Park, Chimney			
	Custer, Hillsdale, Gov. Tom McCall Waterfront, Hancock	Gilbert Primary, Hazeltine, PlayHaven, Ed Benedict, Bloomington, Glenwood		
½ mile	Gammans, George, Portsmouth	Cherry, Couch, Wallace	Earl Boyles	

B. Site Analysis and Inventory

Premise: Site analysis and inventory are fundamental for developing design/conversion, and establishing best management practices and ecologically sustainable components. The majority of designs will modify the ground and it is essential to understand the present conditions.

Objective: Determine the opportunities and constraints of the site to inform the design or landscape conversion.

Actions

1. For new parks and landscape conversions, complete an assessment to document the site's history, context, current uses, conditions, and analysis.
2. Modify the NYC site analysis checklist for our park system and use the evaluation to identify challenges and opportunities for sustainable landscape conversions.
3. Use the PP&R Salmon Safe Checklist for design and the modified checklist for more detailed information to plan and design ecological resiliency and function.

4. Perform the initial site analysis and review and synthesize site analysis information.
5. Use existing inventories where available.

C. Engage users and stakeholders

Premise: Public involvement activities offer park staff, park users, and stakeholders the opportunity to positively interact and develop relationships that will serve PP&R for years to come. Users and stakeholders bring ideas that strengthen the process and inspire design innovation, as well as resources and support for stewardship activities. They will gain an understanding and appreciation of park functions.

Objective: Develop a strong and supportive partnership with the community for the landscape changes and stewards.

Actions

1. Use PP&R's Public Involvement Matrix to determine the level of public involvement.
2. Outreach and include underrepresented communities for specific design elements.
3. Form a Friends group to sustain input and stewardship.

D. Design of overall Park or landscape conversion area

Premise: Sustainable design requires that the project establishes and meets goals and objectives for protecting and enhancing the ecological and recreational functions of the site. The landscape architect and team members work together to design the park or conversation areas to meet the goals and objectives in context of the information gained through the site analysis. Each member of the team brings their expertise to the design to strengthen the overall design and create ownership in the implementation.

Objective: Design an ecologically sustainable park that implements best management practices for soil health, water requirements, plants, and turf.

Actions

1. Establish goals and objectives for ecologically sustainable landscapes, including habitat patches and conversions with the project team.
2. Work as a team to set schedules and evaluate design iterations for a successional, long-term landscape.
3. Select and/or develop ecological landscape strategies illustrating and describing ecological succession.

4. Prioritize goals and strategies to anticipate staffing and funding needs to implement and maintain the landscape.
5. Complete design, including contract documents that articulate contractor's performance requirements for soils, plants, and irrigation.

E. Develop a vegetation management plan

Premise: Integrating a vegetation management plan into the design process produces designs that show landscape succession and resiliency, allow for change over time, sets the maintenance trajectory, and estimate maintenance costs. The vegetation management plan helps inform design and material decision. It also gives the design team an estimate of life cycle, not just construction, costs. Also, it increases the probability that the design intent will be maintained over time as horticulturists and field staff are invested in the project.

Objective: Develop immediate and long-term planting and maintenance actions to be achieve at specific milestones that establish the ecological trajectory for the site (1-3, 5, 10, and 25 years), include a capital budget and maintenance budget for years 1, 3, 5, and 10.

Actions

1. Landscape architect/project manager and horticulture staff collaborate on developing the plan. This allows for institutional knowledge to be shared and incorporated in the plan.
2. Budget additional design time to allow for the development of the plan.
3. Agree on an acceptable level of maintenance for each area – habitat patch, groundcover plantings, healthy turf, and planting beds – and develop a detailed cost estimate for meeting each landscape type
4. Determine staffing requirements to meet the agreed upon level of maintenance.
5. Incorporate maintenance needs into the design and submit with permitting applications to guide future site maintenance. This should identify areas where succession is desired, trees that may need to be removed as canopies grow, and areas where establishment irrigation can be removed or shut off.
6. Develop a vegetation management plan template for future park design projects.

F. Construct a new park or make the landscape conversions

Premise: During construction continue to communicate with the project team and public on installation methods and changes that are made to the design and materials. It is essential the team stay involved. This requires coordination and clear communication from the construction manager. Change orders, requests for information, substitutions, and field orders can create knowledge gaps between the final design and the constructed landscape for operations staff that will be maintaining the park. Ensuring that specifications are met for soils, planting, and watering will mean fewer field changes in the future.

There is also an opportunity for staff and volunteer development when converting landscapes and adding habitat patches. Smaller scale projects may be a good venue for site staff to design and manage the project often partnering with volunteers. There are many benefits of working with community volunteers including acceptance of these changes, positive public perception of the bureau, ownership, and maintenance.

Objective: Construct the park or make the landscape conversion to meet the goals and objectives of the design and vegetation management plan with as few minor modifications as possible

Actions for new parks

1. Obtain all necessary permits, including Urban Forestry permit for trees.
2. Define roles for construction, maintenance, monitoring, and stewardship to install and maintain the desired ecological functions and processes in the landscape.
3. Ensure contractors follow construction, staging, and sequencing plans to protect soils, existing vegetation, and water resources on the site.
4. Team attendance at the pre-construction meeting to meet the contractor(s).
5. When feasible, review addenda, change orders, field orders, and changes to plant selection, soil amendments, and/or irrigation regime prior to construction manager's on-site meeting with contractors.
6. Team attends the final punch list site visit.

7. Review as-built drawings and gather contactors' operational information and warranties.

Actions for habitat patches/small landscape conversions – staff led

1. Obtain all necessary permits, including Urban Forestry permit for trees.
2. Attend on-site field meeting to review proposed changes.
3. Project lead send out updates on progress.
4. Attend periodic construction meetings and final installation review.

G. Implement Vegetation Management Plan

Premise: Implementing the vegetation management plan assures the integrity of the design and that goals and objectives are met as the landscape matures. It is a road map for field staff to follow and, when there are staff changes, implementation allows for maintenance continuity.

Objective: Maintain the park to meet ecologically sustainable landscape goals and objectives by properly implementing the vegetation management plan, including irrigation, thinning, pruning, additional plantings, mulching, and controlling diseases and pests.

Actions

1. Allocated resources, both staff and capital, for purchasing plants and soil amendments according to the vegetation management plan and site inspection.
2. Supplement irrigation, if needed, according to the plan. For most projects irrigation should only be up to three (3) years.
3. Implement the interplanting plan on schedule to continue to meet the ecological trajectory.
4. Thin and prune to maintain the ecological structure and safety; set schedule based on plant growth and ecosystem function.
5. Mulch new plantings and maintain to meet plant replacements.
6. Work with park stewards and other partners to maintain the landscape.
7. Revise plan and best management practices as additional knowledge is gained about site conditions and plant requirements.
8. Specify the training and best management practices needed to maintain the park.

H. Feedback Loop/Lessons Learned

Premise: Feedback allows the project team and others to learn from and adapt policies and practices for design, installation, and maintenance. This phase emphasizes long-term participation by the project team in monitoring, evaluating progress, modifying practices, and planning for future actions. The systematic recording of changes to the landscape and the necessity to change practices in response are at the core of managing ecological landscapes. Unforeseen challenges are certain to occur and team members should collaborate on these issues as well.

Objective: Through a series of early action projects PP&R staff would refine and develop best management practices and standards that could be used across the system and modified to account for site-specific characteristics. These practices and standards will help understand actions and costs associated with creating and maintaining converted landscapes and habitat patches at existing and new parks to improve ecological function and managing for succession.

Actions

1. Develop a feedback/lesson learned form to be used by the project team.
2. Make modifications to best management practices to meet the design intent and balance with other park needs.
3. Record practices and changes in a database to achieve the ecological functions.
4. Review and modify policies and design criteria.
5. Plan for the implementation of future design and installation.
6. Evaluation/Measurement – survey participants at the end of design and construction, and 2 and 5 years after project installation.

EVALUATION AND MEASUREMENT

In order to meet the three goals outlined (Ecologically Sustainable Landscapes, Maximizing Ecological Effectiveness, and Internal Processes and Collaboration) progress must be measured over time. The following targets or performance measures will be used to measure progress:

Collaboration/Teamwork
Use SITES Prerequisite 2.2 Use an integrated site development process (Appendix D) for evaluating the team integration from planning through maintenance. Develop a project team survey to be completed after the design, construction, and 5-year installation stages to determine level of satisfaction with the process including staff understanding the status of their input.

Performance Measure: Staff rate each stage of the process as satisfactory or above.

Create habitat patches from underutilized lawns and known problem lawns

The estimated cost of converting an acre of turf to a diverse landscape dominated by native plants is $1,500/acre using bare root stock and adding 10% (150 one gallon) container trees, shrubs, and planting costs for additional $850 for a total of approximately $2,350/ acre for planting (2014 estimates). Larger trees and shrubs are added to create a sense of scale and anchor the rehabilitation site. There are additional costs for site preparation, split-rail fence and establishing the planting.

In general it is a five-year process when starting with turf to the establishment of a functional habitat patch:

- Site preparation for two years – placement of wood chips over the site to build soils.
- Planting in year three by volunteers, contractor or staff from Horticultural Services.
- Monitoring, invasive species control, and replanting if necessary in the next two years.
- Maintenance costs are typically higher during the plant establishment period and become less over time. Site preparation and installation are peak costs. As the canopy develops, invasive species are reduced and costs go down.

Performance Measure: Acres or square feet planted in habitat patches – a minimum of two (2) acres per year for 2015-2020 to evaluate total costs, staff time, and acceptance by the public and PP&R personnel. Set new targets for conversion based on information gathered during the previous five years for the following ten years. Evaluate the location of habitat patches based on the criteria listed in Table 1 and measure connectivity to other natural areas and the creation of habitat corridors.

Healthy turf

Maintaining and enhancing turf used for passive open spaces requires good cultural practices throughout the year. The Draft PP&R Maintenance Standards (2013) and Policy 16: Turf Broadleaf Weed Management in the Integrated Pest Management Program gives examples of turf health practices currently proposed by PP&R. The Maintenance Standards also defines four classification of maintenance based on number of features, major program areas, and use. A few examples of best management practices include proper siting, site and

soil preparation, pruning adjacent plants for increased sunlight penetration, and mulch-mowing to leave clippings on site. The policy in the IPM program states: "When an area has been determined to be maintained as turf, it is the policy of PP&R to do so primarily through the implementation of proper planning, cultural, and mechanical practices." The Draft Maintenance Standards for turf care includes mowing regime, aeration, reseeding or sodding, and weed control based on level classification. For example, the proposed maintenance for Level 1 Parks Turf Care includes: Grass height maintained according to species and variety of grass. Mowed at least once every 5 working days but may be as often as once every 3 working days. Aeration as required but not less than 4 times per year. Reseeding or sodding as needed. Weed control to practice so that no more than 1% of the surface has weeds present.

Measures of turf health include acceptable level of broadleaf weeds and no bare spots. Tolerance of weeds is based on the park classification in the Draft Maintenance Standards. Bare spots trigger reseeding or sodding. Turf health is also dependent on sunlight. As observed in numerous parks, as the trees mature, the turf underneath because harder to maintain and is often unhealthy. Removal of small trees and pruning are mechanical methods to increase solar penetration.

Performance Measure: Identify park areas to maintain as passive open spaces and continue to follow the current practices as detailed in the Draft Maintenance Standards. In identified areas for passive open space where turf is degraded, determine the cause(s) for degradation. If lack of solar penetration is the problem, work with Urban Forestry to prune or remove trees, and then remove small trees that start to grow in the turf. Select one park in 2015 to improve the turf health as a demonstration project and to develop a process for determining causes of degradation, making improvements, and working with Urban Forestry if necessary. Use the information gained to consider a system-wide approach.

Riparian habitat enhancement
Plant the floodway to increase riparian habitat functions where it does not interfere with programed activities. The floodway is defined as "the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot." The floodway is depicted on Flood Insurance Rate Maps. For unidentified watercourses, the floodway should be a minimum of 15 feet. Where possible, plant the mapped floodplain as defined by the channel of watercourse and adjacent land areas which are subject to inundation by the base flood. In our system, the majority of floodways are in natural area parks. These areas are protected and enhanced for their riparian values.

There are only a handful of developed parks and park properties with floodways:

- Portland International Raceway (Columbia Slough)
- Kelley Point Park (Columbia Slough)
- Heron Lakes Golf Course (Columbia Slough)
- East Delta Park (Columbia Slough)
- Colwood Golf Course (Columbia Slough)
- Eastmoreland Golf Course (Crystal Springs)
- Leach Botanical Garden (Johnson Creek)
- Cathedral Park (Willamette River)
- Sellwood Riverfront Park (Willamette River)
- Willamette Park (Willamette River) – the master plan shows improvements to the riparian area

Performance Measure: In 2015 measure linear feet of riparian habitat that possibly could be planted and then establish a planting goal by year based on the mapped floodway and priorities both within parks property and the watershed. Coordinate selection within park properties with other City agencies to identify high priority, multi-agency targets for 2016-2021.

Tall grass meadows
Allowing grass to grow and seed provides food, nesting material, and habitat for a variety of bird and small mammal species. In 2005 the Turf Maintenance Group identified approximately 135 acres to mow once per month (meadow mowing) after budget cuts reduced staff. The identified sites are not irrigated, heavily treed, on steep slopes, and/or wet – making these areas difficult to mow. The Turf Maintenance Group also has a few acres where they mow two or three times per year (tall grass meadow

mowing). A tractor with a flail mower attached is used instead of mower. Examples of tall grass meadow mowing are areas at Columbia Children's Arboretum, Peninsula Crossing Trail, and areas within Forest Park.

The ideal locations for tall grass meadows are adjacent to riparian areas to increase the habitat functions for wildlife. Public outreach and education to park users will be important for acceptance of this habitat type.

Performance Measure: Identify five parks to introduce tall grass meadows over the period from 2015-2020. Select these from lists of areas already identified for once a month mowing and if possible within the floodplain, adjacent to riparian or natural areas. Only mow the tall grass in August or September except where there is the possibility of fire.

Pollinator gardens

Pollinator plants are being planted in grasslands managed by City Nature at Powell Butte Nature Park and Oaks Bottom Wildlife Refuge, and in perennial beds in developed parks. There are opportunities to introduce pollinator gardens in specific areas that enhance habitat functions and not adversely impact adjacent activities. Opportunities include specialty gardens, Hoyt Arboretum, planting beds, adjacent to community gardens, natural areas, and stormwater facilities. For example, pollinator plants bordering community gardens are compatible uses. There is interest in installing pollinator plantings at Adams, Gabriel, and Johns community gardens. A location and condition inventory of planting beds needs to be completed. Then horticulture staff could identify beds to be planted and maintained as pollinator gardens.

Performance Measure: Plant five pollinator gardens in 2015-2018. Work with stewards and Xerces Society to plan, plant, and monitor the gardens for key pollinators. If successful, continue to plant two pollinator gardens per year from 2018-2028.

Community gardens

PP&R added over 1,000 new community garden plots in 2010-2014. Currently we use 21 acres of land to grow local food in 50 gardens and over 2,200 plots. Most gardens have two ADA accessible areas that include raised beds and crushed rock. Other sections of the gardens have wood chip pathways and in-ground garden beds. Despite recent growth, garden plots are in high demand; there are over 1,400 people waiting for a plot. PP&R's Community Garden program is looking to fill the gaps in the city to ensure equitable access to gardening. The first step is to identify garden deficient areas, high density areas, and areas with high demand, then plan for building new gardens. The program is also working on ensuring that plots are actively gardened and productive. The program is targeting adding one new garden each year, if resources are available, so that there is more equitable access to land for growing locally produced food.

Performance Measure: Add a minimum of one garden per year from 2015-2025 to continue to provide opportunities within the urban environment for people to organically grow their own food or food for others on publically and privately owned lands.

Urban canopy cover

The protection and enhancement of the urban forest requires continual maintenance, replanting, and shared stewardship along with increased resources. Documenting the health and condition of the forest over time reveals trends and provides consistent measurements to evaluate program effectiveness. An important measure of urban forest health is canopy cover. PP&R developed a monitoring protocol for measuring urban canopy change in 2012. Using point interpretation of aerial photos (http://www.portlandoregon.gov/parks/article/403426), PP&R measured the canopy cover as 27.3% in 2000, 28% in 2005, and 29.9% in 2010. Citywide canopy cover increased by 2.6% which translates into 2,384 acres of canopy from 2000-2010. The next measurement will be in 2015. In fiscal year 2013-2014 (July 1 through June 30) the following trees were planted throughout the city:

- Urban Forestry issued 2,840 street tree planting permits and 385 private tree planting permits to property owners and developers.
- During FY14, the Bureau of Environmental Services Tree Program planted 4,269 street trees with planting partners Cascadian Landscapers, Inc., Friends of Trees, and Verde.
- On PP&R property, 111 large-caliper trees were planted, predominately as replacements for trees lost.
- A total of 7,696 planting permits were issued for street trees, private property trees, and City trees.

- 2,920 trees were permitted to be removed for development or the tree was dead/dying.
- There was a ratio of 2.6 of street trees planted to removals.

Performance Measure

1. Establish yearly, 5-year, and 10-year planting targets for street and park trees. Set up a tracking database.
2. Reach the urban canopy target of 33% by 2030 (Climate Action Plan). Set interim goals based on stocking rates.
3. Establish tree health monitoring program that measures health every ten years to ensure the canopy remains healthy.
4. Diversify street tree species to build resiliency and plan for climate change. Coordinate with Hoyt Arboretum on tree selection.
5. Identify areas where native shrubs can be added to create a multi-layered canopy.
6. Increase the density of native trees and shrubs throughout the park system and along the streetscape to provide habitat for native insects and birds.
7. Determine if additional public property is needed to meet canopy goals.
8. Include these Performance Measures in the update of the Urban Forestry Management Plan.

Continued reduction in supplemental irrigation

PP&R started using a centralized water measurement system (MAXICOM™) in 1993. To date, 78 parks are online so that water flow is continually measured and landscape irrigation is based on plant/crop types, soil moisture, and daily weather calculations. The MAXICOM™ system is a budget item for all new parks. However, there is not an Irrigation Service budget item to purchase additional systems for more sites. Instead, funding for adding existing parks is through grants and capital renovation projects. Irrigation Services general supplies budget does cover the cost of components repairs on a limited basis. As the system ages (the first installations are 20 years old), these systems are reaching the end of their life cycle and will need to be replaced.

With the installation of a centralized flow measurement and weather-based system, water used for irrigation on average has been reduced 30%. The goal is to continue to reduce water use another 20% for a total reduction of 50% since computerized systems were first installed. To achieve this goal, more training and time is needed for field staff to adjust sprinkler heads to optimum watering locations (ensure water is going to the target landscape), ensure plant materials with similar water needs for establishment are grouped together, additional native plants installed that have a lower water demand, and that the soil health is optimized at time of planting.

In addition to MAXICOM™, in the past five years as new parks are constructed and others renovated, irrigation flow is monitored separately from other uses such as splash pads and bathrooms. This allows the Irrigation Team to recognize equipment failures quickly and make repairs so water is not wasted. Use of groundwater is not measured. To have a more complete understanding of water use and reduction, PP&R needs to establish a system-wide method to measure and reduce all water applied to the landscape.

Performance Measure: By 2025, PP&R will have all facilities with irrigation controlled by MAXICOM™ or similar remote monitoring system(s), bringing five parks online per year with available funding. In addition, total water use for landscape maintenance will be reduced by an additional 20% of current levels.

Soil health/Mulch/Compost

There are soil indicators and numerous methods for measuring physical, chemical, and biological functions. One method that is fairly simple is measuring the bulk density of the soil. Bulk density is an indicator of soil compaction and is calculated as the dry weight of soil per unit volume of soil. Ideal bulk density depends on the soil type . NRCS recommends using the Cylindrical Core Method. Bulk density should be below 1.55 to 1.6 g/cm3 to promote root growth.

Another indicator of soil health is earthworm density. Earthworms live in the litter and top soil, burrow down to feed on plant residues, and their casts enrich the soil with nutrients. They are abundant in mulched, moist soils with a pH ranging from 5-8. NRCS recommends that earthworms be measured in numbers/foot cubed of soil. A count of 10 earthworms/meter squared in agricultural fields and native soil is considered good. This measurement is most valuable in forest habitats.

Application of mulch to planting beds and around trees improves soil health by retaining moisture, adding nutrients and suppressing weeds that deplete soil health. A central location for the equipment that turns green waste to mulch and proper management of green waste to compost/mulch would provide much needed mulch for park properties.

Performance Measure: For new parks, the bulk density and earthworm counts should be tested during the site analysis, before planting, and three years after planting. Bulk density should be below 1.55 to 1.6 g/cm3 and earthworms in the range of 10 earthworms/meter squared. Soil amendments should be added and/or aeration to bring the bulk density into the proper range for planting success. To increase earthworms, add mulch and compost.

For existing parks, by 2020 the needed amount of weed-free mulch is supplied through proper placement and management of equipment that converts green waste to mulch.

Equitable Access to Nature

The majority of PP&R's natural areas are located on the perimeter of the City where larger tracts of lands are protected and there are more opportunities for acquisition. Other natural areas are along sloughs and streams because of the importance of protecting and enhancing riparian areas for fish and wildlife. Examples include: Forest Park along the western edge of the city, Powell and Clatsop buttes along the eastern border, Johnson Creek floodplain and the Columbia Slough corridor along the City's northern edge. Natural areas are often difficult to access by public transportation.

Through this initiative, PP&R has the opportunity to enhance Portlander's access to nature by including equity as a criteria for selecting habitat patch location. A habitat patch in a local park could improve access for low income and communities of color users to enjoy nature in their backyard.

Performance Measure: Locate at least two (2) of the demonstration habitat patches in low income and/or community of color neighborhoods. As the initiative is fully implemented, through a public outreach process, set goals for number of landscape conversations and habitat patches to be completed in low income and community of color neighborhood parks.

Perennial Plant Arrangement

External Processes and Collaboration

Having a diversity of landscapes in parks provides multiple and deliberate set of experiences for users. However, in some cases these changes in landscape type and management may not meet the traditional expectation of park users. To help encourage public acceptance and support, here is a list of considerations to be incorporated in each project:

A. Orderly Frames

Premise: Creating an orderly perimeter around habitat patches and tall grass mowing areas visually frames the interior of the area and makes it more socially acceptable and underscores the intentionality of this landscape type.

Actions

1. Mow edges of pathways to frame habitat patches.
2. Create an orderly perimeter of shrubs, perhaps ones with pleasing ornamental qualities.
3. Hedge perimeter of shrub thickets, which are valuable bird habitat.
4. Incorporate some large-flowering species because they tend to appear less weedy than small-flowering plants.
5. Install split-rail fencing to frame and protect habitat patches.
6. Mow trails and use zones around picnic table and benches.

Framed habitat patch

B. Planting Arrangement

Premise: Appropriate plant spacing and clear patterns are appealing and illustrate a positive transition of passive open space to habitat patch or pollinator gardens.

Actions

1. Plant in large drifts and massings or rows to visually organize plants.
2. Install plants in grouping of three, five, seven or larger odd-numbered groups.
3. Layer smaller plants in front and larger plants in the back.
4. Install plants at appropriate spacing to ensure landscapes do not appear cluttered or sparse.
5. Maintain area over time following the vegetation management plan.

Plant arrangement at South Waterfront Garden

Overview at Oaks Bottom Wildlife Refuge

C. Boardwalks, Buffers, and Overlooks

Premise: The deliberate and careful integration of human use and habitat patches emphasizes the importance of providing access to nature.

Actions

1. Border habitat patches with passive recreation to give users visual access.
2. Build boardwalks to indicate the presence of sensitive ground and vegetation.
3. Provide overlooks into habitat patches to maintain habitat contiguity and indicate special protection.
4. Place soft surface trails, benches, and picnic areas on edges of the habitat patch.

Insects etched into a rock

D. Ecological Art & Interpretation

Premise: Ecological art and interpretation have an important role in revealing the ecological processes that are underway in parks, provoking thought and creating visual interest for park users.

Actions

1. Install art that celebrates the landscape, adds beauty or interprets the ecological value of the landscape.
2. Use interpretive signage to educate visitors about the purpose of the different types of landscapes in parks and to help develop an appreciation for them.
3. Work with RACC to develop a program that explores innovative art installations, both short- and long-term.

Bird boxes Photo: Jessica King

E. Wildlife Enhancements

Premise: Supplemental wildlife structures as appropriate in some landscape areas can provide missing life cycle needs, bring attention to the habitat value of the landscape, and function as ecological art.

Actions

1. Install bird houses and platforms.
2. Install bat houses.
3. Install lady bug houses near gardens.

Kenilworth Park

Perennial flower bed at Pittock Mansion

Conclusion and Recommendations

Implementing the actions to enhance ecologically sustainable landscapes and best management practices at developed parks, and other City-managed properties will assist the City in meeting watershed health, climate change, and PP&R Vision 2020 goals. To implement the initiative, it will require:

- Create a new position to coordinate the implementation of this initiative.
- PP&R staff working on projects across disciplines to successfully plan, design, construct, and maintain projects.
- Adding and/or modifying staff responsibilities and funding resources, including a cost analysis of current management versus new approach.
- Working with staff and park users to embrace and assist with the proposed changes through an outreach and education program.
- Continue existing and develop new partnerships with universities and scientific communities to assist with implementation and monitoring.
- Take a long view, starting with five to 10 demonstration landscape conversions that include habitat patches, groundcovers, and revitalizing turf in passive open spaces in new or existing parks.
- Track implementation in the first five years to evaluate and understand implementation costs, staff time, and ecological lift, then upscale enhancements based on the information learned from the initial projects.
- Conduct a system-wide inventory of passive open space to gain a better understanding of recreational uses and possible locations for landscape conversions and enhancing passive open spaces.
- Make modifications to NYC and SITES checklists to reflect landscape conditions in Portland.
- Working with other property managers to adopt the BMPs and include habitat patches in the properties they manage.

Intended outcomes of this initiative include two subsequent initiatives that address how new parks are developed with ecologically sustainable landscapes and how opportunity areas in existing parks are transformed over time to an enhanced ecological process and functions while still providing for recreation and programs in the next 30-50 years.


City of Portland

Appendix A

APPENDIX A: INITIATIVE PROCESS

Stakeholder Interviews

Stakeholder interviews were conducted with people who have an understanding of parks and recreation design, programming, and maintenance.

Some major themes and strategies from these interviews include:

Sustainability

- All aspects of sustainability are important and interdependent – ecological, social, and economic.
- Barriers to ecological park landscapes include budget, need for safety, and CPTED.
- Take a whole system approach.
- Consider lifetime cost of ownership.
- Suitability requires sustained efforts and funding, often with a short-term infusion of cash with sustained efforts resulting in long-term rewards.
- Frame ecological benefits through the ecological services paradigm.

Ecological Principles and Assumptions

- Soils are incredibly important. For example, Battery Park in New York City is known for its soil management.
- Parks are not wilderness; they are semi-natural and disturbed ecosystems.
- In the NW old growth forests (a likely desired future condition) are driven by aspect. NE and SW and higher and lower elevation slopes have different kinds of old growth forests. NE is wetter and coniferous, SW and higher on the ridgelines is dryer and maple, and lower SW slopes are oak.
- Ecological richness is a factor of connectivity and biodiversity at a regional scale as well at a site scale.
- Invasive plants are bad for stormwater due to shallower root systems and no layers for canopy. Soil ecology also suffers under a monoculture of invasive plants.
- Most soil is not a native soil. With non-native fungus and other introduced microbes, how can one expect native plants to perform well in non-native soils?

- New trees should be planted in groves where leaf litter can be left to regenerate the soil.

Design

- Parks are an opportunity to demonstrate green infrastructure.
- Maintenance staff needs to be involved in the design process from the beginning.
- Horticulturists need to take part in design and planning conversations early on.
- Regenerative landscapes need to be considered.
- Ask a series of ecological questions about site developments during the planning process.
    - Context – what larger system is the site connected to?
    - Water – where does it come from? What condition does it arrive in? Where does it go? What condition does it leave in?
    - Ecology – What lives here? What used to live here? What could live here now?
    - Materials – Where does it come from? What's being brought in? What are the inputs to maintain it and build it?
    - Maintenance – What efforts to keep it functioning? How many times is the park is mowed? Weeds? Fertilizers? Pesticides?
- Change requires a shift in aesthetics of the park landscape in parks and in the public.
- Address public perception issues.
- Including a diversity of species is important for urban environment.

Maintenance

- Retain biomass on site.
- Mulching is hugely beneficial.
- PPR's IPM program is incredibly successful and a useful model for addressing ecological sustainability. It is process-oriented and tailored to PP&R, and focuses on truth on the ground. The IPM process forces PP&R to question everything done in maintenance: Why are we doing this? What would happen if we didn't? Are there things that can be done instead? What is the gain?

Core Team

A core team representing different sectors of PP&R staff was established as an advisory team. The project manager and consultant led these meetings and completed the report and recommendations with the guidance of the core team. The role of the core team was also one of ambassadorship. They not only represented their work groups and departments in team discussions, but also served as ambassadors of the ecologically sustainable initiative to their work groups and departments as the process moved forward.

Many of the stakeholder meetings confirmed that one of the biggest barriers to sustainable practices is in the disconnection between maintenance and horticulture staff and the design process. The creation of this core team with representatives from both specialties was the first step in creating a realistic approach to improved ecological function throughout the entire park system.

The meeting plan was structured to allow the group to self-educate. In the first meeting the team was asked to explore the ideas of ecological landscapes in parks and the sustainable maintenance of those landscapes. In the second meeting several core group members gave short descriptions of their work and how it relates to sustainable landscapes. The team brainstormed practices that are currently working well and those that can be improved. In the third meeting the group was presented with a draft of the ecological landscape goal and performance goals and a discussion on those items followed. In the fourth meeting a draft presentation on the report was made and the groups gave their recommendations to PP&R. The group reviewed another draft and their comments were incorporated.

Research

Throughout this process research was conducted by the consultant and project manager. Those documents are listed in the Select References section in the appendix.

Appendix B

APPENDIX B: Glossary of Terms

Biodiversity
Number and distribution of species, genes, and ecosystems; enhances certain ecosystem services

Climate change
Gradual change in earth's temperatures, rainfall, and other meteorological traits due to human activities

Climax vegetation
Vegetation that has reached a stable state

Competition
The negative influence of one species on another due to the sharing of limited resources

Dispersal
The process by which an organism or its reproductive units are transferred from their place of origin to another location

Disturbance
A relatively discrete event in time and space that alters habitat structure and often involves a loss in biomass

Ecological adaptability
The capacity of people to manage for resilience in an ecological system

Ecological integrity
The degree in which an ecosystem is operating within the bounds of its historic range of variation

Ecological latitude
The maximum amount a system can be changed before losing its ability to recover (before crossing a threshold which, if breached, makes recovery difficult or impossible)

Ecological resilience
The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks

Ecological resistance
The ease or difficulty of changing the system; how "resistant" it is to being changed

Appendix B

Ecological succession
The observed process of change in the species structure of an ecological community over time

Fragmentation
The biogeographic process of dividing a landscape, as through urbanization

Functional group
Species that share physiological, morphological or behavior traits

Habitat corridor
An area of habitat connecting wildlife populations separated by human activities such as roads or development

Habitat patch
A relatively well-defined area with a predominance of native vegetation that provides habitat for species

Intermediate disturbance
The hypothesis that maximum diversity is obtained at an intermediate level of disturbance

Life cycle requirements
The environmental conditions that are required in order for a species to move through birth, growth, reproduction, and death

Mature ecosystem
A well-developed ecosystem in which the rate of biomass accumulation and of species turnover is slow

Mutualism
A biotic interaction among different species that is beneficial to both

Nutrient cycling
Process by which nutrients become available to plants. Nutrient cycling in natural environments relies upon healthy community of decomposers within the soil

Performance goals
The part of a rehabilitation project that specifies the criteria that will define success

Pioneer species
A plant that colonizes a disturbed area thereby initiating succession

Pollination vectors
Abiotic or biotic factors that transfer pollen; wind, insects, birds are the most common

Primary productivity
Production of plant biomass

Refugia
Isolated patches that escape disturbance and provide a suitable habitat for relict species

Regeneration niches
Microsites that satisfy germination and establishment requirements

Rehabilitation
To repair ecosystem processes, productivity, and service, but does not necessarily mean a return to pre-existing biotic conditions

Relict species
A species surviving in a refuge within a large, newly created landscape

Restoration
To restore a site to its original condition; returning the land to its former biological status

Safe-site
A microsite where seeds have an enhanced chance to lodge, germinate, and establish

Soil food web
The community of organisms living all or part of their lives in the soil

Stress
Any factor that limits the rate of productivity (e.g., infertility, drought, cold, heat, toxicity)

Appendix C

APPENDIX C: Selected References

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Appendix D

APPENDIX D: SITES

SITES Guidelines and Performance Benchmarks 2009
http://www.sustainablesites.org/report/Guidelines%20and%20Performance%20Benchmarks_2009.pdf

New York City High Performance Landscapes 2010
http://www.nycgovparks.org/sub_about/go_greener/design_guidelines.pdf

Appendix E

APPENDIX E: Building a new ecological landscape legacy

To build public and staff support for the Ecologically Sustainable Landscape Initiative, Portland Parks & Recreation will need to involve staff and the public to work with them to understand and initiate change throughout the park system. The following are a list of actions to involve and inform staff and the public:

1. Convene internal work sessions to refine messaging regarding purpose and benefit of the initiative.
    - Meet with staff whose work is most affected by the change to get their input on public communication.
    - Identify communities and stakeholders to assist in identifying sites for habitat patches.
    - Anticipate concerns of citizens and partner organizations.
    - Develop concise statements of purpose and benefits.
    - Develop branding for this initiative.

2. Engage in a public education campaign to communicate issues and help set priorities for parks.
    - Include neighborhood association, Friends groups, key stakeholders, and park committees in location of habitat patches and their upkeep.
    - Create a webpage and have a section for comments and input. Also, provide information in various languages and for people who do not have internet access.

3. Build a coalition of stewards to assist in planting and long-term maintenance of habitat patches.
    - Articulate the need for long-term stewardship of ecological management and maintenance.
    - Identify methods for acknowledging/rewarding the involvement of stewards and partners in parks.
    - Tailor the goals of individual projects to the goals of partner organizations.
    - Bolster PP&R staffing for stewardship coordination and implementation of these efforts.
    - Use adopt-a-park model. Focus on businesses or organizations near the park.

- Host annual "park day" to install plants, weed, and care for habitat patches.

4. Partner with scientific and management communities to perform monitoring work.
   - Coordinate monitoring goals with capabilities of citizen scientist organizations, universities, high schools, and other organizations.
   - Develop a PP&R webpage to enter monitoring information and performance standards.
   - Fund monitoring and evaluation of ecological landscapes.