



Impacts of Ivy in Portland's Forest Park: Management Considerations

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Background

A Novel Urban Forest Ecosystem

Forest Park (Fig. 1) is a 5,128-acre municipal park located in the Tualatin Mountains in northwest Portland, OR. Like most urban forests, it is highly disturbed by past land use, recreational activity (including over 80 miles of hiking, biking, and horse trails), and pressures from urbanization ranging from air pollution to invasive species. Some urban-adjacent areas of Forest Park appear to be altered to the point of being novel ecosystems, relatively stable states with unprecedented biotic communities and ecological processes.

Management of Forest Park

Portland Parks and Recreation (PP&R) is the agency responsible for the management of Forest Park. PP&R ecologists actively manage the park to conserve its flora and fauna and to restore the structure and functions of a healthy forest system.

Current restoration efforts are focused on the ~600 acres of the park located within the Balch Creek sub-watershed (Fig. 2), which was prioritized due to increasing invasive species impacts, high visibility, and heavy visitor traffic. Ivy (*Hedera* spp.) is in the late stages of invasion in Balch Creek sub-watershed area, having reached >75% coverage in some areas. While current restoration efforts have reduced ivy coverage in places, a study from 2010-2013 conducted by Dr. Marion Dresner's lab at Portland State University (PSU) on ivy invasion in Forest Park documents that ivy density increased an average of 14%, while native herb cover increased by <1% and shrubs did not change in study plots near Balch Creek.

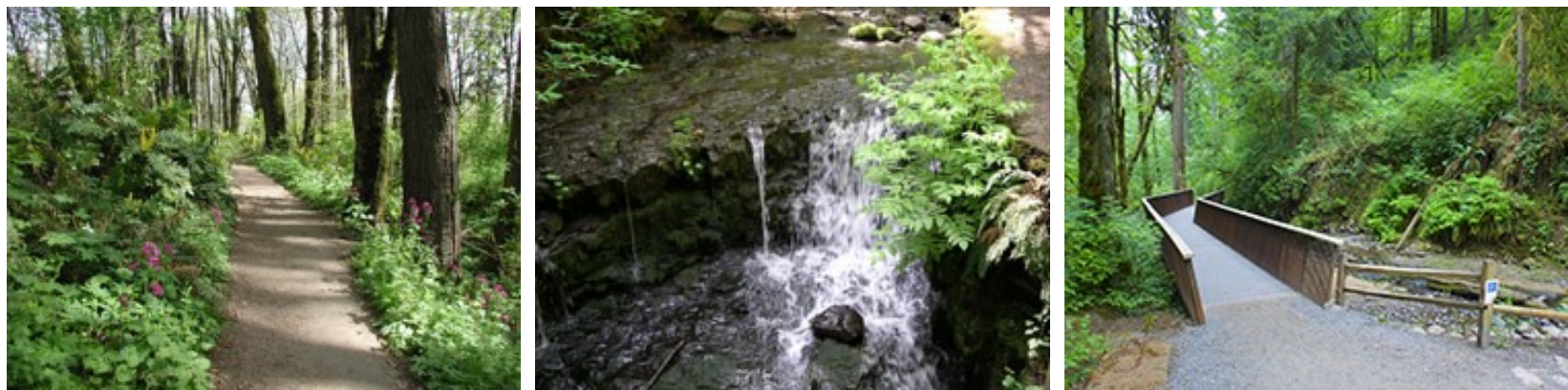


Figure 2: Images of the Balch Creek area of Forest Park (Photos: Portland Parks & Recreation)

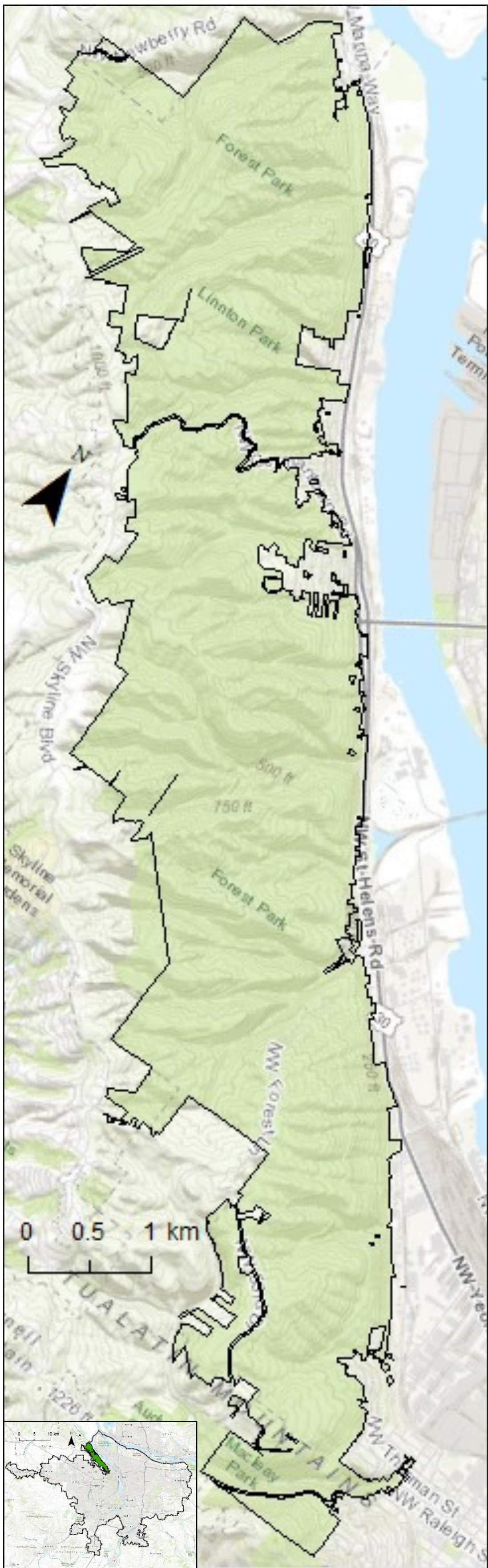


Figure 1: Forest Park.

Methods

We conducted a review (Table 1) of peer-reviewed articles, gray literature, and management documents, and interviewed several ecologists with firsthand research and/or management experience in Forest Park and other natural areas in Portland's west side. Our review focused on establishing the state of knowledge about the current and future condition of Forest Park, the invasion ecology and management of ivy, and effective strategies for replanting restoration sites.

Table 1: Summary of information sources

Peer-reviewed literature/journal articles	Management documents	Interviews
Specific to Forest Park	Greater Forest Park Conservation Initiative	PSU researchers (Dr. Jeff Gerwing, Dr. Jen Morse, Dr. Andrés Holz, Dr. Marion Dresner)
Other Pacific Northwest urban forests/greenspaces	City of Portland strategic management plans	
General invasion ecology of ivy and similar species	Research, inventory, and monitoring datasets	Dr. Nancy Broshot, Linfield College
Theories and practices of ivy and other invasive plant management	Ivy management BMPs and previous research syntheses	City of Portland ecologists (Marshall Johnson/PP&R, Toby Query/BES)
Theories and practices of restoration planting		Cody Chambers, FPC Adrienne Basey, Metro

Defining a Healthy, "Restored" Balch Creek Watershed

Conservation Goals for Forest Park

The Greater Forest Park Conservation Initiative (GFPCI) is a multi-stakeholder strategic plan developed in 2013 with the goal of protecting and restoring ecological values in Forest Park and the surrounding landscape, with multiple initiatives (Protect the Best, No Ivy League, Early Detection-Rapid Response, and habitat restoration) and areas of focus (streams, connectivity, forests, and wildlife). In addition, PP&R has defined a set of "future desired conditions" including biological and structural diversity, air quality, reduced fire risk, and ecological resiliency.

Balch Creek Restoration

The Balch Creek area (Fig. 3), at the southern end of Forest Park, is PP&R's current focus of restoration activities, since it is both the most heavily visited and most ecologically degraded section of the Park. Building upon past site-scale work, mostly volunteer-led ivy removal efforts, PP&R began employing contractors to spray ivy in this area in 2015 and is following treatments with revegetation projects. However, underlying issues ranging from high tree mortality and lack of regeneration to degraded soils, coupled with predicted future ecological changes, make restoring Balch Creek toward desired future conditions particularly challenging.

Restoration Approaches

Managers should consider managing toward a likely future forest dominated by hardwoods. Additionally, unstable slopes, weed pressure, and high levels of disturbance mean that restoration activities such as ivy removal may not be suitable in all areas; sites should be prioritized accordingly.

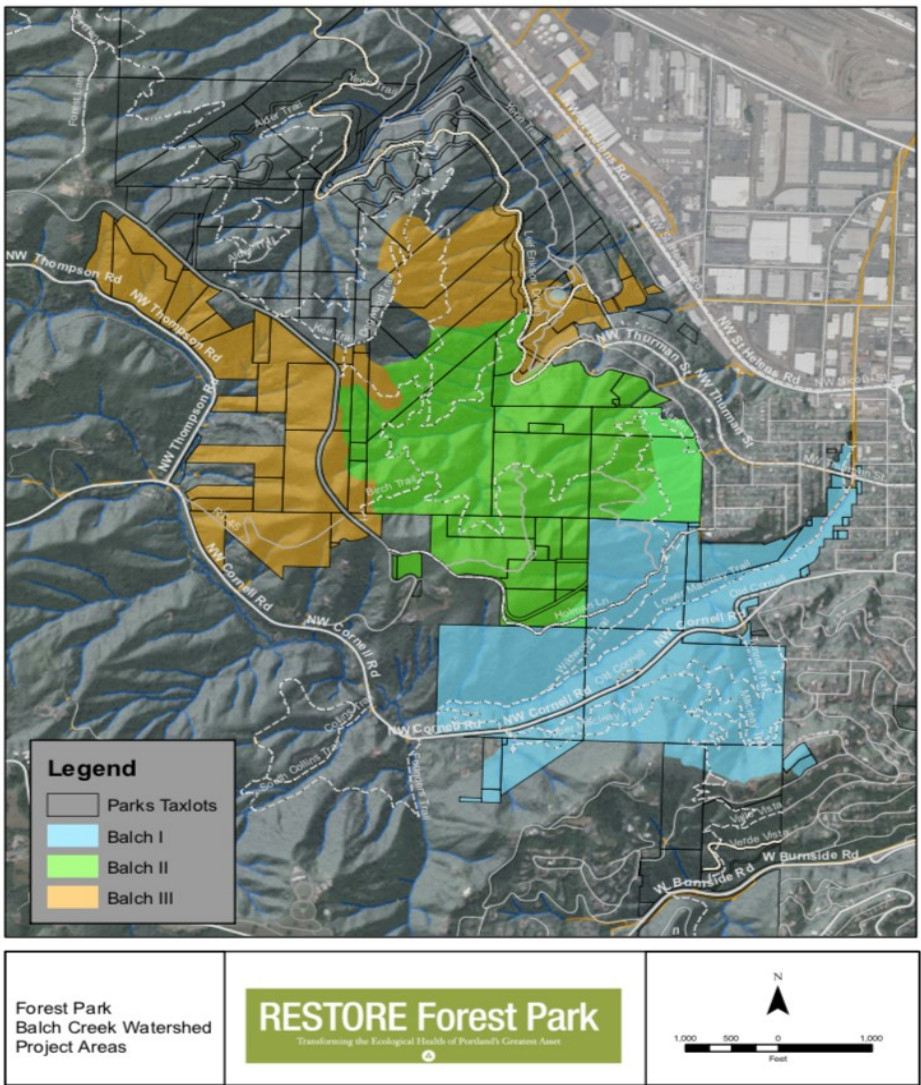


Figure 3: Balch Creek restoration plan. Phase I, in blue, began in 2015; Phase II, in green, began in 2018; and Phase III, in orange, is pending.

Invasion Ecology of Ivy and Its Impacts on Forest Function

Characteristics of Ivy

Ivy (*Hedera* spp., primarily *H. hibernica* in our region) is an evergreen liana introduced from Eurasia as an ornamental. It spreads by vegetative growth and, to a lesser extent, by bird-dispersed seeds. Ivy's vegetative form is highly shade- and drought-tolerant and puts on much of its growth during winter. It requires sunlight to produce flowers and seeds, however, leading it to climb into the forest canopy. Ivy appears quite tolerant of air pollution, and may help improve air quality.

Ivy as an Invasive Species

Ivy has been present in our region for over a century. While it favors edge habitats and disturbed sites, it can invade relatively intact areas by spreading from established patches. Once established, it can dominate forest understory and invade the canopy. In Forest Park (Fig. 4), ivy patches are estimated to increase in density by ~4.6% per year; its rate of spread and current extent have not been determined. It commonly co-occurs with other invasive plants, and is expected to thrive under a warmer, drier climate future.

Ecological Impacts of Ivy Invasion

At high densities, ivy competitively excludes native understory plants, in both the shrub and herbaceous layers. It physically weakens invaded trees and stunts their growth, though we found no research to support the common belief that it increases blowdown. It has not been found to affect tree recruitment in urban forests. Ivy foliage is unpalatable to most wildlife, but its flowers provide an early-season nectar source for pollinators, and rodents may frequent dense ivy patches. Ivy is associated with reduced soil organic matter and microbiota.

Managing Ivy Invasion

Current management recommendations are spraying or manual removal followed by intensive revegetation, which has been shown to be durably effective. Tree rescue should be prioritized where eradication is impractical. Goat browsing appears promising for removal. Monitoring and EDRR are recommended to stay ahead of ivy invasion into new areas.

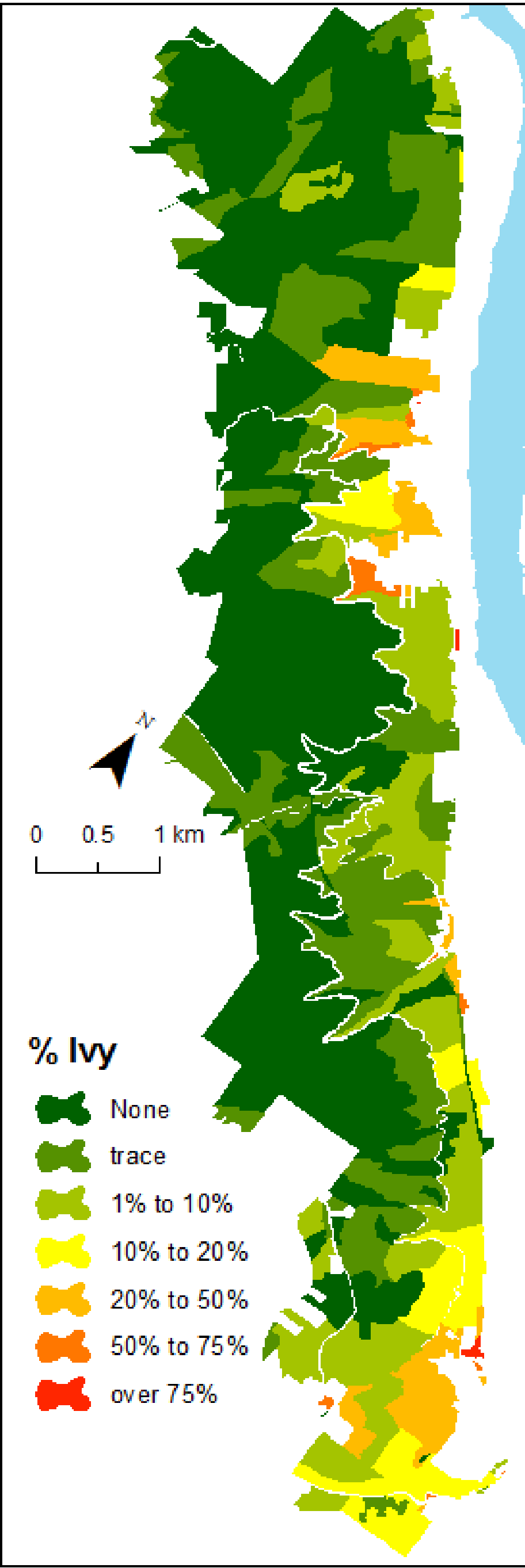


Figure 4: distribution of ivy in Forest Park based on 2004 vegetation survey data

Considerations for Replanting Strategies

Benefits of Replanting

While "passive restoration", relying on the existing seed bank and natural dispersal to revegetate a weed-treated area, can work in some circumstances, it is a slow process and leaves the site vulnerable to soil loss or secondary weed invasion. Aggressive replanting with proven species can reestablish a vigorous, diverse, and resilient understory plant community much more quickly.

Challenges to Replanting

Degraded soils and a lack of organic matter (both humus layer and coarse woody debris) result in unfavorable conditions for most understory species, including late-seral trees, shrubs, and herbaceous plants. Low success has been observed in post-treatment direct-seeding efforts in Portland's west-side natural areas; possible reasons include competition from opportunistic weeds, predation by earthworms or slugs, compacted soils, or drought stress.

Current Best Practices

Bare-root planting is more economical and effective than container stock for establishing most native shrubs. Direct seeding is superior to plugs for most herbaceous species for the same reasons. Ecologists are currently evaluating numerous herbaceous species to determine which are the easiest and most affordable to establish (Table 2). Managers should select diverse stock from around the local region to promote genetic resilience, but an assisted migration approach is not recommended at this time.

Areas for Research

Among current knowledge gaps are the best spatial and temporal patterns for revegetation; how to increase germination and survivorship in seeding efforts; and whether trait-based or reference-based plant selection leads to more effective outcomes. There also remain many understory species which have not yet been evaluated.

Table 2: Selected herbaceous species evaluated in seeding trials in west-side natural areas

Species	Common	Success
<i>Adenocaulon bicolor</i>	Pathfinder plant	N
<i>Aquilegia formosa</i>	Red columbine	N
<i>Carex leptopoda</i>	Dewey's sedge	Y
<i>Claytonia sibirica</i>	Candy-flower	Y
<i>Hydrophyllum tenuipes</i>	Pacific waterleaf	Y
<i>Osmorhiza berteroi</i>	Sweet cicely	N
<i>Tellima grandiflora</i>	Fringecup	Y



Figure 5: Forest Park remains an exceptionally valuable public resource despite the many challenges it faces (Photo: Forest Park Conservancy)

Conclusions and Recommendations

The future ecological trajectory of Forest Park remains uncertain; the landscape faces many and increasing pressures, ranging from invasive species and human impacts to air pollution and degraded soils, and at least some areas may be novel ecosystems which cannot be restored to historical or reference conditions. We recommend a diversified, long-term, adaptive-management strategy integrating research and practice, prioritizing information gaps and treating every project as an experiment to improve the state of the art. Research results, monitoring data, and management documents should be open-access and continuously updated. Through such a strategy, we have an opportunity to protect Portland's Forest Park for future generations of humans and wild species (Fig. 5). This program will require thoughtful and intentional collaboration, skilled facilitation, ample public and private financial support, and community buy-in.

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