

# Ecoroof Avian Monitoring Report

## Spring 2013



ENVIRONMENTAL SERVICES  
CITY OF PORTLAND  
working for clean rivers



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### **Background**

Ecoroofs are an alternative to conventional roofing practices. In addition to keeping water out of buildings, ecoroofs are rooftops that provide multiple benefits. They manage stormwater, save money by extending the life of the roofing membrane, cool and clean the air, save energy, and provide habitat. Portland is taking a closer look at the habitat benefits of ecoroofs for macroinvertebrates and birds. This ongoing study compares ecoroofs with conventional roofs and ground-level greenspaces to find patterns of presence and use by birds. Birds are used as an indicator of the broader biodiversity value of a site and are cost-effective to monitor. Sampling began in spring 2012 and is planned to continue through fall 2014, for a total of six seasons of data. Mornings were chosen during migration periods for data collection because this is a critical time in many species life-cycles and the time when birds are most abundant in our area. Future ecoroof designs to maximize habitat value may be compared to the baseline data collected in this study.

### **Protocol**

- Nine sites were monitored, all in highly urbanized areas near or in downtown Portland, Oregon. They include three greenroofs (two ecoroofs, one roof garden), three conventional roofs (“control” roofs), and three ground-level landscaped areas (open parks or parking lots with non-native trees and shrubs or lawn).
- Birds heard and seen on or flying directly above the sites were recorded, along with observed behavior. The charts and numbers in this report only represent birds that landed on the sites.
- All roofs are flat and on commercial buildings.
- Monitoring occurred from 7-9 AM or 8-10 AM, on nine mornings in spring between April and May, and 12 mornings in fall between August and October.
- Each site is sampled three times in spring for a total of six hours of monitoring per season; and four times in fall for a total of eight hours per season.
- On each date, avian monitoring occurs simultaneously at one ecoroof, one nearby conventional roof, and one nearby ground-level landscaped area.
- 11 trained Audubon volunteers, one Audubon staff and one City staff have contributed to bird monitoring shifts.

## Site Descriptions



### Central Wine Warehouse Sites

An area of approximately 20,000 square feet was monitored for each of the following sites:

- **Central Wine Warehouse ecoroof:**  
*Ecoroof Constructed:* 2008  
*Number of Stories:* 2  
*Distance from Willamette River:* 3 blocks  
*Design:* Mix of all native sedum, grasses and forbs in extensive greenroof soil blend with red cinder drainage channels. Soil depth averages about 5".
- **American Medical Response conventional roof:**  
*Number of Stories:* 2  
*Distance from Willamette River:* 1 block, with the interstate and railroad running between and the Burnside bridge adjacent to the north.  
*Roofing Type:* Asphalt membrane with a light-colored granular coating.
- **Tazo parking lot:**  
*Distance from Willamette River:* 2 blocks, with the interstate and railroad running between.

*Vegetation:* Site is 65% paved with narrow landscape strips with medium-size non-native trees providing about 40% canopy.

### **Hamilton West Apartments Sites**

An area of approximately 4000 square feet was monitored for each of the following:

- ***Hamilton West Apartments ecoroof:***  
*Ecoroof Constructed:* 1999  
*Number of Stories:* 10  
*Distance from Willamette River:* 14 blocks  
*Design:* Dominated by non-native sedum and volunteer grasses, with some forbs. Includes a geotextile drainage membrane beneath two different soil blends between 3 and 5" deep.
- ***12<sup>th</sup> Avenue Terrace Apartments conventional roof:***  
*Number of Stories:* 6  
*Distance from Willamette River:* 14 blocks  
*Roofing Type:* Covered in 1/2" depth pea gravel.
- ***PSU park block (SW 12<sup>th</sup> Ave. and Market St.):***  
*Distance from Willamette River:* 13 blocks  
*Vegetation:* Open lawn with large non-native street trees around two sides providing about 50% canopy.

### **Louisa Apartments Sites**

An area of approximately 8700 square feet was monitored for each of the following sites:

- ***Louisa Apartments roof garden:***  
*Ecoroof Constructed:* 2005  
*Number of Stories:* 2  
*Distance from Willamette River:* 14 blocks  
*Design:* Soil depth undulates between 6 and 18". Planted with various non-native ornamental grasses, shrubs and small trees in pots. Accessible to residents and their dogs.
- ***Crystal Ballroom conventional roof:***  
*Number of Stories:* 4  
*Distance from Willamette River:* 15 blocks.  
*Roofing Type:* Asphalt membrane with a light-colored granular coating.
- ***North Park Block (NW Couch St. and Park Ave.):***  
*Distance from Willamette River:* 9 blocks.  
*Vegetation:* Lawn with large non-native street trees. 80% tree canopy (deciduous).

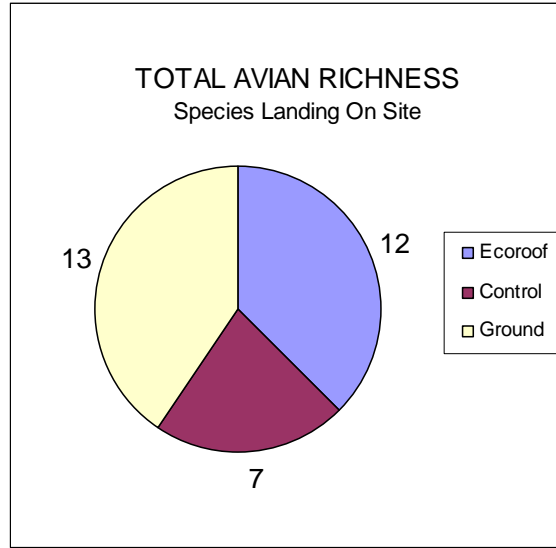
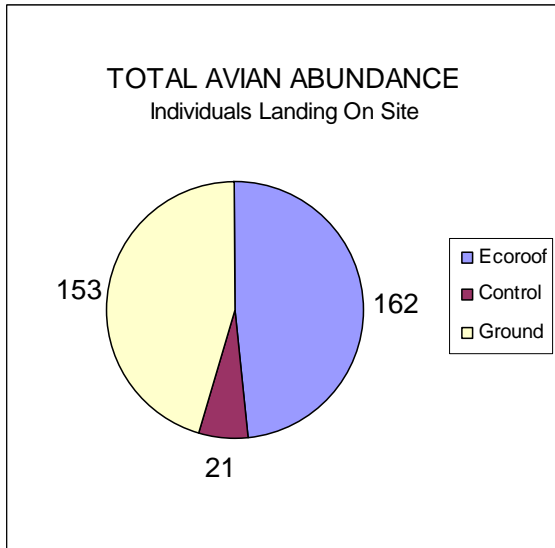
## **Results**

This data should be considered preliminary and more sampling days are needed before the results can be considered statistically significant. The vast amount of

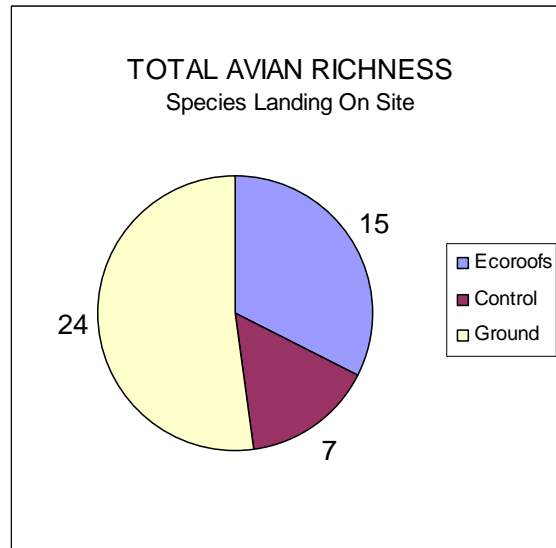
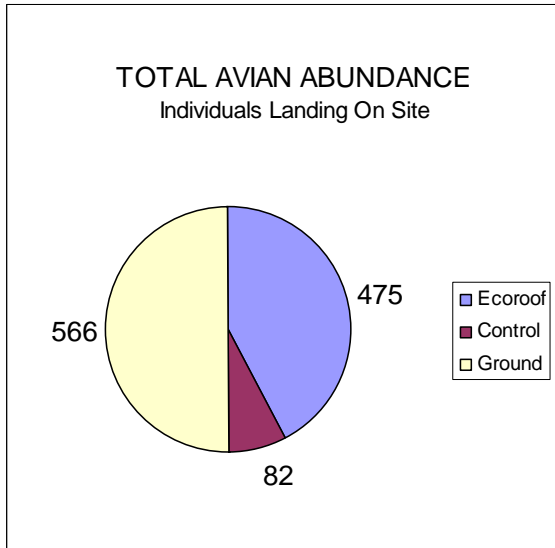
variables inherent to a study like this should be kept in mind as well when analyzing the results. Each site has a unique location, context, age, plant palette, soil, and elevation. Despite this amount of variability, we are identifying early patterns in the data.

It is easier to miss birds in ground-level greenspaces because of tree canopy and other visual barriers, resulting in these sites potentially having less accurate results than the rooftops. Charts that are related to species only include high-confidence identifications. Low-confidence or unidentified birds are included in data relative to abundance.

**Spring 2013 Results**



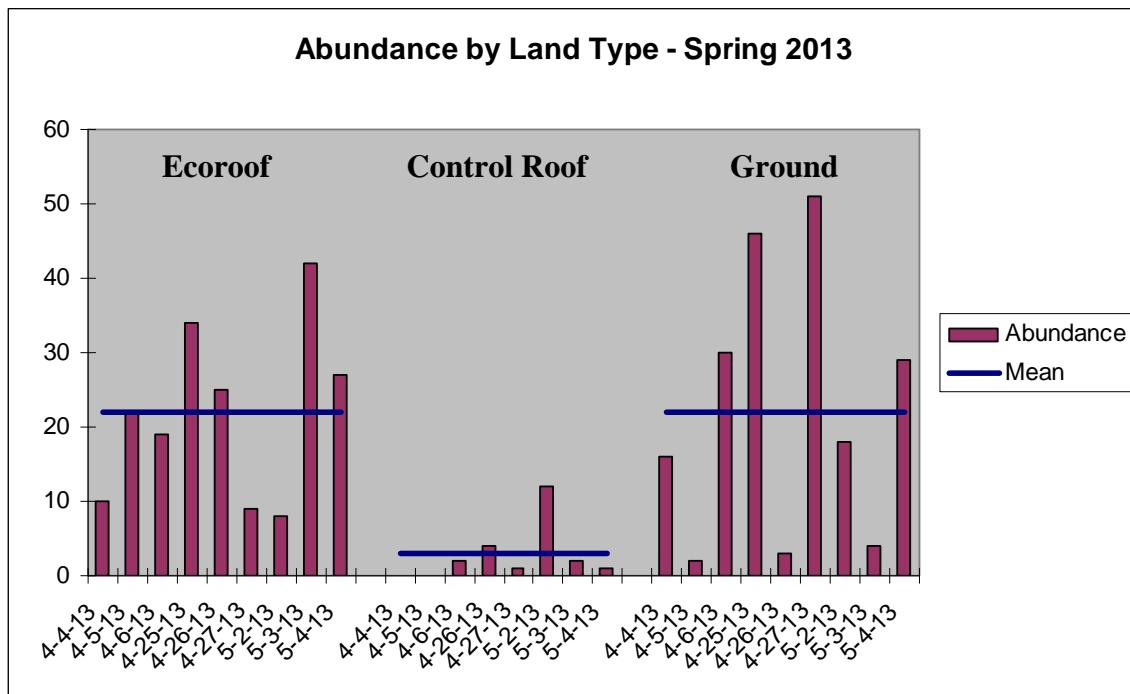
**Cumulative Results: Spring 2012, Fall 2012 and Spring 2013**





This spring's results found nearly eight times the number of birds landing on greenroofs than on control roofs. As might be expected, species richness was highest on the ground sites and lowest on the control roofs.

Abundance ranged on the Hamilton ecoroof from eight landing birds in a two-hour monitoring period to 34 in another. The Central Wine Warehouse ecoroof varied between 22 and 42 landing birds; and nine to 27 landed on the Louisa roof garden. This is roughly consistent with the different sizes of the greenroofs being monitored. In fall 2012, there was one morning where no birds landing on the Louisa roof during the study period, which compared with this season's high of 27, shows the need for a large data set due to daily variability. The Louisa roof garden had notably less bird activity than other sites last fall which was attributed to its accessibility to tenants and proximity to a busy street, but this season it had more activity recorded than the Hamilton ecoroof. This is likely a result of the small data set and other harder to pinpoint variables. The table below of abundance by land type by day shows the variable nature of a small data set and highly mobile, live data.



Central Wine's corresponding conventional roof and ground-level greenspace were the same area as the Central Wine ecoroof, i.e. larger than the other sites monitored, but they didn't show a corresponding increase in abundance. This suggests the larger the greenroof, the higher the bird activity, while larger conventional roofs do not appear to result in increases in bird activity. Also the Central Wine ecoroof is the only study site utilizing predominantly native plants, which may contribute to its higher observed avian activity. The Tazo parking lot

had much lower abundance than the other ground sites, perhaps related to the mostly impervious hardscape beneath the tree canopy.

Foraging was the most frequently observed behavior on all sites. As can be seen in the table below, the ecoroof provides a site to forage where there typically would not be one; on conventional roofs the foraging observed was relegated to within the pea gravel ballast or in the cracks beneath objects sitting on the roof. Foraging on the ground sites mostly consists of flocks of birds foraging in tree canopies, with some ground foraging. Birds observed on the greenroofs are primarily granivores (pigeons, finch, sparrows) and omnivores (crows, jays, starlings) observed feeding on the soil surface among the low plants. Insectivores (chickadees, warblers, woodpeckers) are mostly seen on the ground sites gleaning through the tree canopy. Swallows are an insectivore seen feeding in the air over all sites. Hummingbirds, a nectavore, were seen perched or flying over all sites. When looking at abundance by dietary preferences, generalist omnivores were most frequently observed on both roof types while in the ground-level greenspaces insectivorous species were most abundant. It should be noted that these dietary classifications are only averages, as most species eat some combination of plant and animal matter, with ratios often changing with the season.

*Observed Behavior – Spring 2013*

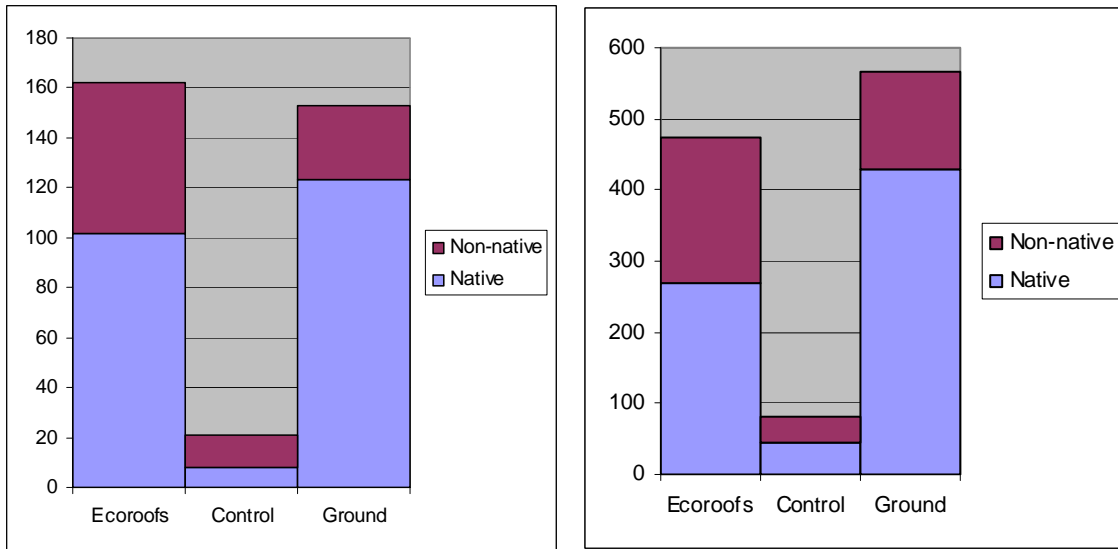
	GREENROOF	CONTROL ROOF	GROUND
Foraging	106	11	92
Gathering nest materials	13	2	1
Displaying	17	-	10
Singing	12	-	3
Nesting	-	-	2

Multiple species used parapets and other objects on both roof types for perching, sometimes in small flocks. This is the primary avian use of conventional roofs. More singing, visual displays and nest material collection was recorded on the greenroofs than on the ground sites. This could be a result of better visibility in the more open sites, or a sign that greenroofs make suitable habitat. In fall, behavior observed is reduced to foraging and perching.

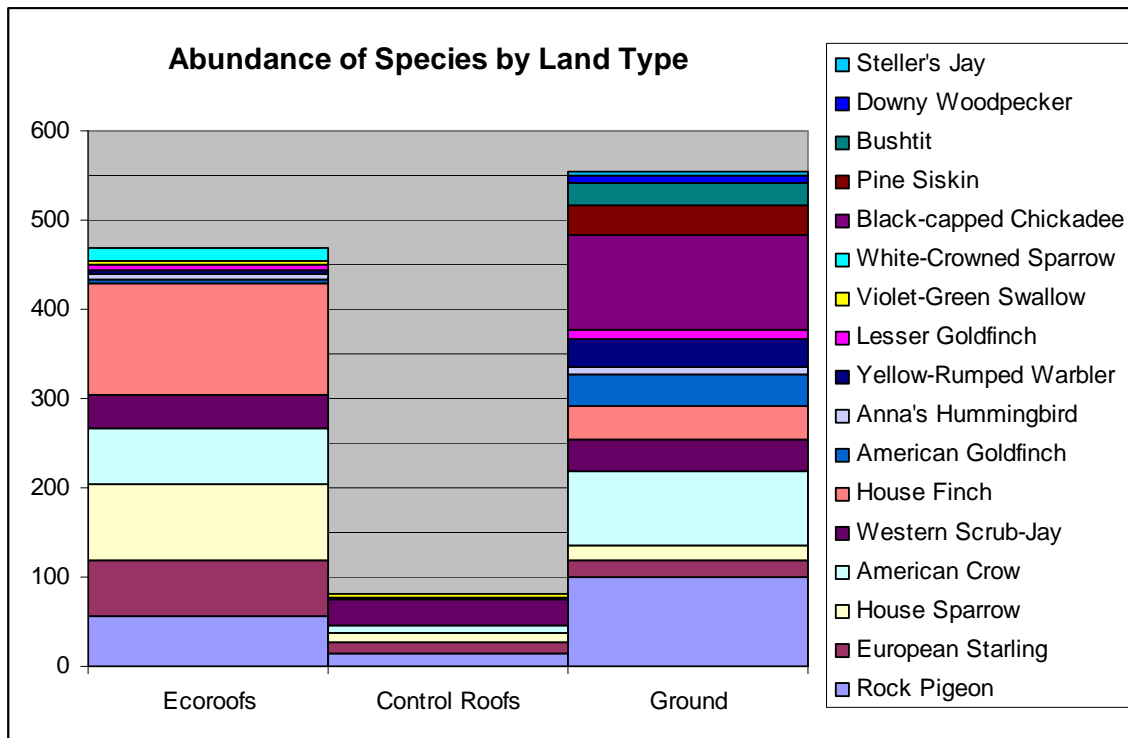
The spring data again show a relatively high proportion of non-native birds on the ecoroof but at a lower ratio than the conventional roof. Three species made up all non-native species recorded: Rock Pigeon, European Starling and House Sparrow.

Spring 2013 Results:

Cumulative Results:



The following chart shows the number of individuals by species that have been recorded landing on the three different land types. It is cumulative of the first three seasons of data collection and only includes species recorded five or more times.



A few long-distance migratory individuals have been observed so far, the most commonly observed being Violet-Green Swallows and Yellow-rumped Warblers, at times recorded on or near all sites. The ground sites have had greater diversity of migrants as might be expected, including Wilson's, Yellow, and



Nashville Warblers, House Wren and Western Tanager. A Savannah Sparrow was observed on the Central Wine Ecoroof, a species of open grasslands which an ecoroof emulates, and it was likely a migrant. Possibly if the study occurred earlier in the morning when there is typically more bird activity, more would be found.

Several Portland Special Status Species were observed on ground-level sites: Bushtit, Downy Woodpecker and House Wren, as well as Yellow, Nashville and Wilson's Warblers. Special Status Species are considered rare, declining or of special interest because of associations with important habitat attributes or conditions that support functioning ecosystems.

Common among all land types is the introduced Rock Pigeon. This species is however likely the primary prey species for urban raptors including Red-Tailed and Cooper's Hawks, and Peregrine Falcons. Regular on most roofs were Western Scrub-Jay, American Crow, European Starling, House Sparrow and House Finch.

Birds flying high over sites are recorded but not included in result data because they are not interacting with the sites and are likely in commute. These include Osprey, Great Blue Heron, Vaux' Swift, Bald Eagle, Turkey Vulture, Red-tailed Hawk, California Gull, Glaucous-winged Gull, Canada Goose, Cackling Goose, Double-crested cormorant and Mallard. Cooper's Hawks have been observed on ground-sites just outside of count areas.

## **Conclusions**

- There is a pattern of more avian abundance and species diversity on greenroofs than on conventional roofs, but not as much as on ground-level landscaped sites.
- Greenroofs appear to function as an extension of urban habitats such as ground-level parks. A diversity of native species, including several species of concern, are being recorded in the ground-level sites and could therefore access and benefit from ecoroofs if they were designed for that purpose. The absence of ground-level predators may make them particularly beneficial to migratory aerial wildlife.
- Ground sites have more insectivorous specialist species utilizing the greater plant diversity, size and associated cover, while greenroofs tended toward more generalists species. Exceptions to this are the Savannah Sparrow and Killdeer, two species associated with low-vegetated, open areas which were observed on ecoroofs.
- Two native species were observed nesting on or just over the Louisa roof garden during the study: White-crowned Sparrow and House Finch.

- More plant size diversity (on ground sites, and on the Louisa roof garden) appears linked to more avian diversity, suggesting ecoroofs could be designed for increased habitat value.
- Spring data show more species and more behaviors than in fall. Again more data is needed to see if this pattern holds up.
- More sampling dates are needed to identify patterns in data as variable as this.

## **Caveats for Future Studies**

- Associated flyovers (under 50 feet) are no longer included in these results as they are common at all sites and difficult to determine a degree of association.
- An earlier start would likely capture more bird activity; however new sites would likely need to be found as access to roofs is more difficult the earlier the hour. Current timing of study is based on arrival times of building staff.
- Obtaining rooftop access is always an issue and occasionally a site is missed. Getting keys from the building owner or manager is ideal. Staff turnover is often high and frequent communication and reminders are recommended.
- The more sampling days the better. With a small number of sampling days, the number of variables inherent to this type of study, or any atypical events make the broader statistical patterns difficult to read.
- Disturbances are frequent on ground sites, including construction, dogs, maintenance and removal of vegetation and organized events in parks. These clearly impact the results but are included as indicative of urban landscaped spaces.
- Similarly, resident accessibility on a condominium greenroof may play a large role in bird presence and use. The Louisa roof garden had extremely low (zero) numbers of birds on some days. A future study could separate data into extensive (minimally accessible) ecoroofs, and intensive roof gardens in order to see patterns more clearly.
- Each season brings different birds and though this study focuses on migration, when a high number of species are active in the area, it would be worthwhile to monitor in winter as well when many of our ground-foraging species are present.

## **Acknowledgements**

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