B. Habitat Prioritization Modeling

In November 2010, when The Intertwine Alliance launched the effort to produce a regional conservation strategy and biodiversity guide for the greater Portland-Vancouver region, there was no data-driven map of priority areas for conservation that adequately covered both the urbanized and rural portions of the region. Previous efforts either worked on a larger regional scale that for the most part discounted the habitat value of urban areas (this was the case with the state conservation strategies and Willamette Valley Synthesis Project), focused on localized geographies and abruptly ended at jurisdictional boundaries (e.g., Title 13), or covered most of the region but were based solely on expert opinion (e.g., the Natural Features charrette process). The goal of the *Regional Conservation Strategy for the Greater Portland-Vancouver Region* and the accompanying *Biodiversity Guide* was to add a unified regional perspective to local efforts and to encourage a shared vision that could facilitate cooperation to protect remaining valuable habitat.

We aimed to develop data-driven, science-based scalable models for determining the relative conservation value of habitat in a way that would complement and support the *Regional Conservation Strategy* and accompanying *Biodiversity Guide*. We also wanted to (1) represent urban habitat in a way that makes the best fine-scale habitat within or near urban areas "competitive" with large, intact habitat blocks in the urban fringe, (2) cooperate with stakeholders to ensure their buy-in on the resulting product, and (3) create a foundation of work that others throughout the region could use for future conservation efforts, such as wildlife connectivity mapping and conservation and restoration prioritization.

Overall Approach

The modeling effort was overseen by the GIS Subcommittee of the Regional Conservation Strategy (RCS) Steering Committee, which included representatives of federal, state, and local jurisdictions and nonprofit organizations. The Institute for Natural Resources (INR) conducted the primary data development and modeling with input from the GIS Subcommittee. INR provided multiple drafts and iterations for review by the GIS Subcommittee and RCS Steering Committee. In establishing the criteria, methods, and threshold values for the models, the modeling team took into consideration the results of extensive stakeholder consultation and basic conservation science principles and incorporated scientific expertise.

The modeling effort produced two regional map outputs (with accompanying GIS data): a high-value habitat map (Figure B-1) and a riparian habitat map (Figure B-2). Each map was based on a distinct set of criteria for relative habitat value.

We used a raster-based analysis format to map and analyze the region as square pixels in a rectangular grid. Each pixel was scored uniquely based on the science-based criteria. A high-resolution (5-meter) regional land cover map that INR created for The Intertwine Alliance (Figure A-4) served as a foundational data set for several criteria, but the models also required regional data on wetlands, bodies of water, floodplains, soil types, and roads. In several cases, we faced a tradeoff between using the best available local data and creating or using a regionally consistent data set. In general, we used or created data sets that provided consistent spatial information across the region. In limited cases, such as with wetlands, we integrated local and regional data sets to produce a composite that we thought was more accurate while still reasonably consistent. Compiling data from numerous sources can cause variable results. For example, the density of mapped wetlands in Clark County is higher than in the rest of the region in part because of the mapping methods used to compile this data set.

Two Habitat Models, Two Sets of Criteria

The approach used to determine the conservation value of habitats consisted of developing two separate models—one for the entire region (the high-value habitat model) and one for riparian areas (the riparian habitat model). For each model, the modeling team developed spatial data sets that represented criteria for calculating the value of habitat.

High-value Habitat Model

The high-value habitat model covered the entire region (see Figure B-1). Every pixel received a score from 0 (lowest priority) to 100 (highest priority), yielding a multi-scale habitat prioritization for the entire greater Portland-Vancouver region (1,829,500 acres, or 2,812 square miles).

Pixel scores for the high-value habitat model were assigned by considering the following criteria:

- **Habitat interior.** Interior forest patches typically are more valuable than edge habitat because they have better three-dimensional structure, contain proportionately more native plant and animal species, and are further away from disturbances. Interior habitat was defined as areas more than 50 meters from the forested patch edge. Pixels located within interior habitat received higher scores. Pixels within the 50-meter buffer received progressively smaller scores as distance from the interior increased, with the increase dropping to zero at 50 meters.
- **Influence of roads.** Roads harm wildlife through direct mortality, loss of connectivity, and disturbance. To create a measure of habitat disruption, pixels adjacent to roads were assigned lower scores for habitat value.
- **Total patch area.** Larger habitat patches better support natural processes and provide more habitat value than small patches. Accordingly, pixels located within the largest patches (larger than 30 acres) received a relatively high score. Pixels in patches between 10 and 30 acres in size received somewhat lower scores.
- **Relative patch area.** Because the region has a widely diverse set of land uses and patch sizes, we also scored habitat patches according to their size and abundance relative to surrounding patches. This contextual approach accounts for the difference in conservation value between a 30-acre patch within a dense urban area and an identical 30-acre patch surrounded by wildlands.
- **Habitat friction.** In general, this criterion estimates how difficult it is for organisms to move from one pixel to the next across the landscape. To represent habitat friction, land cover values were reclassified with values that were cross-walked with professional input from previous studies.
- **Wetlands.** Wetlands were not mapped as a land cover type in our 5-meter RCS land cover. However, wetlands and their immediate surroundings provide very valuable habitat resources and support water quality and groundwater recharge. Pixels that fell within wetlands received higher scores than similar pixels that were not within wetlands. Pixels within 100 feet of a wetland were scored progressively based on proximity.
- **Hydric-rating soils.** Hydric soils are strongly associated with wetlands. Pixels within hydric soil areas received slightly higher scores than similar pixels outside hydric soil areas. This metric was helpful in differentiating habitat within agricultural areas and other areas with incompletely mapped wetland features.

Criteria layers were combined by adding assigned values or varying weights of the criteria to create a high-value habitat metric for each pixel. Throughout the process, we regularly evaluated model results for consistency with known areas of high-value habitat and used these comparisons to adjust the model.

Because of a lack of region-wide data, the model is limited in accounting for certain high-value habitats or habitat attributes, including:

- Oak savanna and woodlands
- Prairies and grasslands
- Old-growth forests
- Habitat composed of native species versus non-native species

The Intertwine Alliance intends to address these shortcomings over time, but for the near term, consideration of these habitat types in conservation planning will continue to require local expert knowledge.

Riparian Habitat Model

The extent of the riparian habitat model was determined by the location of the region's water features and an appropriate buffer around them. Buffers for major streams and water bodies were calculated using a variable model that assigned buffer widths to stream reaches by considering each reach's attributes, such as stream flow, stream volume, surrounding land cover, and the presence of salmonids. All perennial streams mapped in the U.S. Geological Society's National Hydrography Dataset—even those lacking stream reach attributes—received a minimum buffer and thus were included in the analysis. All Federal Emergency Management Agency (FEMA) floodplains and all

wetlands (buffered by 30 meters) within 200 feet of streams were included. Altogether, nearly 464,000 acres received scores in the riparian habitat model. This figure accounts for nearly 25 percent of the greater Portland-Vancouver region (Figure B-2). Within urban areas alone, 80,000 acres were evaluated; this accounts for 21 percent of the urban areas in the region. As with the high-priority habitat model, the fine-scaled raster-based nature of this approach provides for a high level of local detail.

Pixel scores for the riparian habitat model were assigned by considering the following criteria:

- **Curve value-surface runoff (i.e., infiltration potential) of an area based on its land cover type.** In urban and agricultural areas, high volumes of water entering streams at high velocity can wreak havoc on stream function. Vegetation, particularly trees and shrubs, slow the flow, stabilize banks, and promote healthy channel structure. We derived surface runoff for each pixel by reclassifying our 5-meter land cover using previously published research on soil and land cover absorption rates.
- **Cost distance from various bodies of water, including wetlands, target stream, floodplains, and other streams and river edges.** Riparian areas vary in width, depending largely on elevation changes. Cost distance is a combination of linear distance and topography and is a measure of how closely a particular pixel is associated with a stream. This criterion helps capture the strength of the influence that the surrounding land form and condition have on the water body.

Features and buffered areas were then weighted and combined in a similar manner as the high-value habitat metric to create a riparian habitat metric for each pixel.

Results

The models can depict areas of significant conservation value across the region (Figure B-1), or only within a specified geography e.g., only within urban areas (Figure B-3). At a regional scale, the results align with those of previous efforts, such as the Willamette Valley Synthesis Project. As one zooms in, the models have much richer detail than any previous regional maps for the region. Preliminary comparisons with local conservation mapping efforts and expert knowledge have validated the overall modeling approach.

Although we initially intended to create polygonal conservation opportunity areas, as in the *Oregon Conservation Strategy* and Willamette Valley Synthesis Project, we decided to publish the model results in raster format. Publishing in this format allows the raster data sets to provide useful maps and data at a range of scales (Figure B-4) for a wide variety of users and applications. End users can generate their own polygons based on their specific area of interest, conservation strategy, or criteria. For example, an Intertwine partner working in a subset of the region can create maps showing the top-priority habitat within a particular boundary (e.g., Clark County, the Tualatin River watershed, or the city of Gresham). However, drawbacks to this decision are that the data sets are large, analysis may require GIS skills or custom software, and some practitioners and decision makers prefer to use polygon data.

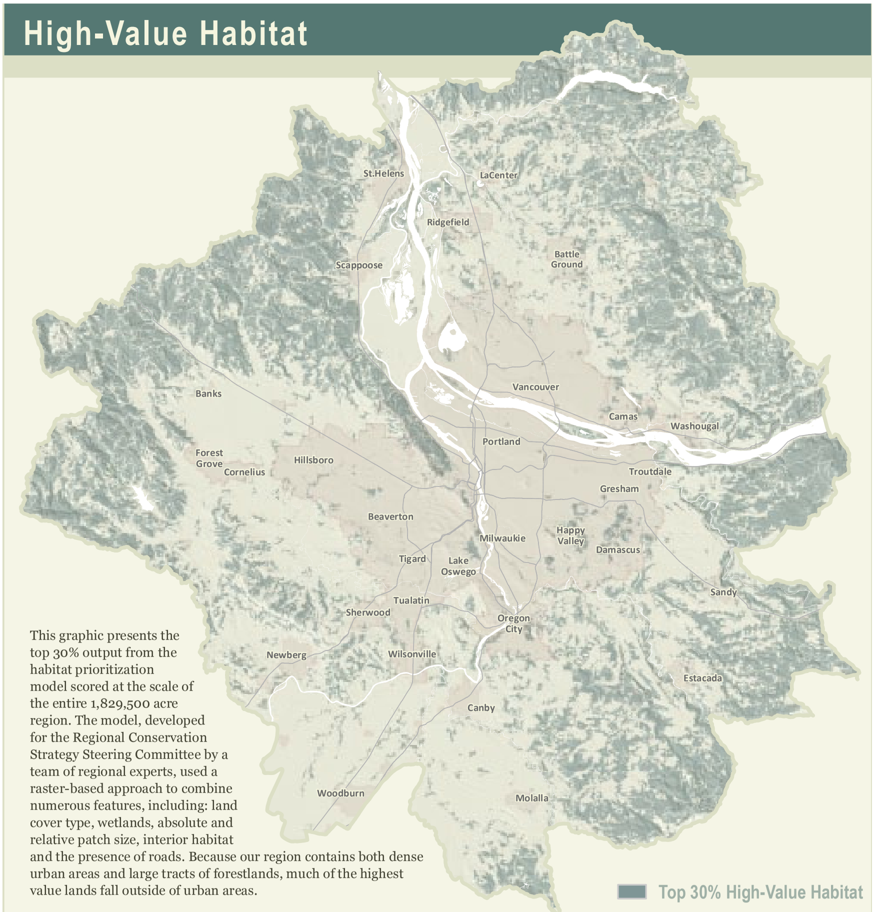
Conclusions and Next Steps

This data-driven approach is meant to complement rather than replace local knowledge by validating and challenging what we know and informing us about areas we know less well. Our intent was to provide a common metric for diverse stakeholders across the region. With limited funding available for conservation activities and a diverse set of stakeholders, there is a need for regional priority setting that can assist jurisdictions, agencies, and nonprofits in making more efficient and effective conservation decisions. Moving forward, we hope that this modeling effort will continue to undergo refinement and analysis as partners begin to apply the results to their particular geography and approaches. The following are some immediate potential uses for the model results:

- Helping nominate urban additions to the Willamette Valley Synthesis Project
- Identifying conservation opportunity areas (i.e., focal areas) for subregions where partners may have funding
- Helping to create potential biodiversity corridors
- Helping regional partners create programmatic priorities for investment
- Linking particular strategies for conservation or restoration to specific areas identified by the models

FIGURE B-1

High-Value Habitat



This graphic presents the top 30% output from the habitat prioritization model scored at the scale of the entire 1,829,500 acre region. The model, developed for the Regional Conservation Strategy Steering Committee by a team of regional experts, used a raster-based approach to combine numerous features, including: land cover type, wetlands, absolute and relative patch size, interior habitat and the presence of roads. Because our region contains both dense urban areas and large tracts of forestlands, much of the highest value lands fall outside of urban areas.

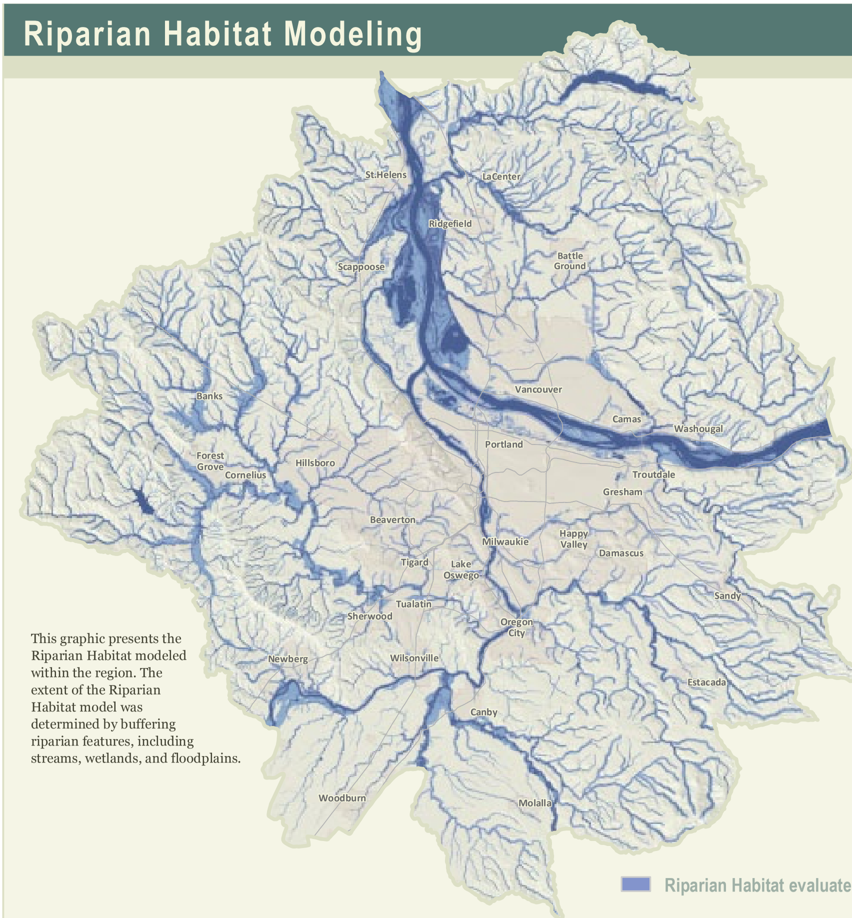
High-Value Habitat - Top 30% of the RCS region, based on modeled output

Of the 552,000 acres in the top 30%:

- 381,000 acres are in Oregon (28.5% of Oregon RCS extent; 20.8% of total RCS)
- 171,000 acres are in Washington (34.6% of Washington extent; 9.3% of total RCS)
- 19,400 acres are in RCS urban areas (5.2% of urban areas; 1.1% of total RCS)

FIGURE B-2

Riparian Habitat Modeling



This graphic presents the Riparian Habitat modeled within the region. The extent of the Riparian Habitat model was determined by buffering riparian features, including streams, wetlands, and floodplains.

Extent analyzed by the Riparian Model

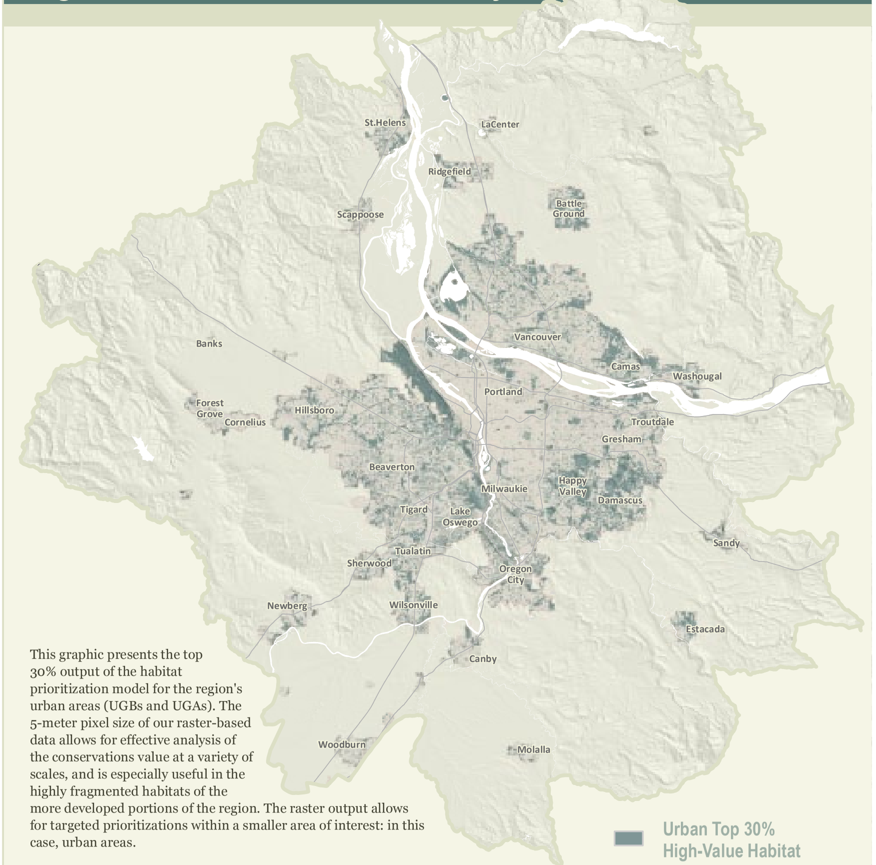
numbers below include water features

The area analyzed by the riparian model includes:

- 463,500 acres total (25.3 of RCS extent)
- 323,000 acres in Oregon (24.2% of Oregon RCS extent)
- 140,000 acres in Washington (28.3% of Washington RCS extent)
- 79,500 acres in urban areas (21.3% of RCS areas)

FIGURE B-3

High-Value Habitat - Urban only



This graphic presents the top 30% output of the habitat prioritization model for the region's urban areas (UGBs and UGAs). The 5-meter pixel size of our raster-based data allows for effective analysis of the conservations value at a variety of scales, and is especially useful in the highly fragmented habitats of the more developed portions of the region. The raster output allows for targeted prioritizations within a smaller area of interest: in this case, urban areas.

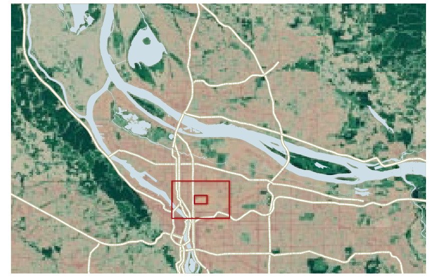
High-Value Habitat - Top 30% of urban areas, based on modeled output

Of the 114,000 acres in the urban top 30%:

- 85,400 acres are in Oregon (30.1% of Oregon RCS urban areas; 4.7% of total RCS)
- 28,600 acres are in Washington (32.3% of Washington RCS urban areas; 1.6% of total RCS)

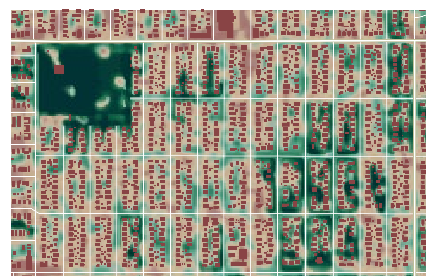
FIGURE B-4

Understanding Conditions at Multiple Scales



Regional 1"=6.3 MILES, OR 33,333 FEET

Local 1"=0.85 MILES, OR 4,500 FEET



Neighborhood 1"=0.19 MILES, OR 1,000 FEET

Highest Value
High Value
Medium-High Value
Medium-Low Value
Low Value
Least Value

An important benefit of our approach is the flexibility to analyze data at any scale, from the 3,000-square-mile region to the local neighborhood. The following examples represent patterns of land cover and relative conservation value as one zooms in from the regional to the neighborhood scale.

Regional

At the regional geographic scale, most small, local habitats are not apparent. Only the most prominent features stand out, such as rivers and large forest blocks. The highest scoring areas reflect habitats that have significant conservation value within the 3,000-square-mile region. Most highly fragmented urban habitats are not represented at this scale even though these areas are critical to regional biodiversity.

Local

At this intermediate scale, finer habitat patterns are more apparent while regional elements are still prominent. In this example, blocks of habitat barely visible at the regional scale become more dominant. For example, patterns of street tree density within east Portland become recognizable as a potential regional planning element. Opportunities to create ecological connections between regional sites are suggested. Only the highest scoring areas at this scale are likely to have regional significance.

Neighborhood

At the local scale, the neighborhood, features that appear less significant at the regional scale are apparent. Habitats barely or not recognizable at larger scales, such as local parks, creeks, vegetated hillsides, or tree patches can be woven into a meaningful framework and incorporated into local habitat conservation planning, neighborhood by neighborhood.