Measuring Habitat Outcomes of State Acquisitions and Regulations

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Executive summary

Overview

The objective of this study is to compare the relative protection afforded terrestrial and aquatic habitat by land-use regulations enforced by the State of Washington to that provided by state land acquisitions between the state fiscal years of 1990 and 2015 in Asotin, Clark, Jefferson, King, Kittitas, and Okanogan counties.

Approach

The approach to comparing the relative protection of fish and wildlife habitat by land-use regulations to protection by land acquisitions can be broken down into two parts: assessing the protection of *terrestrial habitat* and the protection of *aquatic habitat*.

To assess the protection of terrestrial habitats, we

- mapped the spatial footprints of land-use regulations,
- mapped land acquisitions made between fiscal years 1990 and 2015, and
- compared the overlap of selected species habitats with the regulation footprints to the overlap of those habitats with the acquisitions.

To assess the protection of aquatic habitats, we

- computed the length of stream network protected by land-use regulations and
- compared that to the length of the stream network that is protected by adjacent land acquisitions.

To assess the impacts of acquisitions on terrestrial habitat, we estimated the probability that the purchased land would have been converted to another land-use or timber on the land harvested over the coming 50 years.

Findings

1. First, it is critical to realize that the regulations and the acquisitions we examined were designed to accomplish very different goals. Most of the land-use regulations are designed to protect water quality and/or aquatic habitat or to protect people from natural hazards such as flooding and landslides. Most of the state land acquisitions made from 1990 to 2015 were designed to protect terrestrial wildlife or, in some cases, aquatic habitat. Thus, one would not necessarily expect the current land-use regulations to provide protection for terrestrial wildlife habitat or the state acquisitions to protect water quality and aquatic habitat.

2. Regulations cover an order of magnitude more land than acquisition made from 1990- 2015. The Growth Management Act covers the largest areas, generally—with the exception of in King and Clark counties—followed by Forest Practices and then the Shoreline Management Act.

3. Acquisitions are unevenly distributed across the counties. Okanogan County has the most acquisitions but Kittitas County has most of the large acquisitions.

4. Although the regulations cover more land, and more land that has the appropriate types of vegetation, the dendritic and fragmented patterns of the protection provided by the regulations makes that land less appropriate for habitat for many edge sensitive species and species requiring larger areas. For example, the regulations provide almost no protection for edge sensitive species when an ecologically relevant edge distance of 86m is taken into account.
5. Regulations provide little if any habitat for species with larger area requirements like the Great Gray Owl and the Columbian Sharp-tailed Grouse.
6. Regulations, which were in many cases designed to protect aquatic habitat, provide protection for at least one order of magnitude more stream miles than do acquisitions.

Objectives & Constraints

Objectives

The overall objective of this study is to compare the relative protection afforded terrestrial and aquatic habitat by land-use regulations to that provided by land acquisitions made between the state fiscal years of 1990 and 2015 in Asotin, Clark, Jefferson, King, Kittitas, and Okanogan counties. More specific objectives include:

1. comparing the overlap of selected species habitats with the lands protected by land-use regulations to the overlap of those habitats with land acquisitions;
2. comparing the length of stream protected by the Forest Practices Act, the Growth Management Act, and the Shorelines Protection Act to the length of streams protected through acquisitions.

Constraints

Our ability to fully address the main objective as outlined above was limited by the availability of data and the scope of the project. Perhaps most importantly, it was not possible to truly assess the positive impacts of regulations and acquisitions on aquatic habitat. For example, the Clean Water Act and the Hydraulic Project Approval Program both result in permitted activities, structures, and facilities. The permitting process is designed to reduce the impacts that such activities and facilities have on water quality and aquatic habitat. However, without knowledge of both the effects of the permitted action on water quality and aquatic habitat (data that in some--but few--cases might be available) *and* the effects of activities or facilities that *would have occurred or been built without the Act or the Program*, it is not possible to assess the benefit provided by the two regulations.

Likewise, it was not possible to fully assess the impacts of land acquisitions on the protection of water quality and aquatic habitat. Although it is possible to model the impact of the protection any parcel of land in a watershed has on sediment and nutrient loads to the stream network downslope of the parcel, that modeling process was beyond the scope of the study. Our analyses required us to make several assumptions about the protections afforded by regulations and acquisitions. First, we assumed that acquired parcels were protected from habitat degradation including harvest, land conversion, and other activities that are incompatible with the persistence of the species inhabiting the acquisition. Given that the acquisitions we analyzed were primarily purchased and managed for species habitat, this assumption is not unreasonable. However, we also assumed that the buffers resulting from the regulations provided protection for species occurring within their boundaries. This assumption is less sound. Selective harvest is allowed within the outer Forest Practices buffers and buffers resulting from the Growth Management Act do not always prevent development or other land modifications. It is also less clear to what degree some of the regulations are enforced from county to county. Thus, there is likely a basic disparity in the quality of habitat protection provided by the regulations and the acquisitions.

Finally, even for the analyses we did conduct, we were limited in what we could model and assess given the quality and the availability of data. For example, we used habitat associations and suspected in-state range boundaries to define what areas were likely to serve as habitat for each species in the study. The range boundaries are merely estimates and the habitat associations are often rather coarse in nature. Some species have very specific habitat needs that were not captured by these coarse relationships. We provide recommendations for more comprehensive analyses that could be conducted in the future and the types of data that would be required to conduct them.

Approach

General Approach

Regulations and acquisitions coverage of terrestrial habitat

Our general approach to assessing the degree to which regulations and acquisitions overlapped terrestrial habitat involved several steps.

1. First, we mapped the spatial footprint of the different regulations and the locations of the acquisitions. Mapping the regulations required both translating the regulations into map-able areas within each of the six counties and identifying the parts of the landscape to which the regulations applied.
2. Next, we defined potential habitat for each of the species using a combination of estimated species ranges and basic habitat associations.
3. We then overlaid the habitat maps on the spatial footprints of the regulations and the acquisitions to calculate the number of acres of habitat covered by the regulations and the acquisitions. To address the potential impact of edge, we calculated the area of habitat that qualified as forest-interior for each edge-sensitive species.
4. To assess the degree to which acquisitions prevented impacts to habitat, we performed a counterfactual analysis in which we estimated the proportion of habitat that would have been lost to land-use change or forest harvest in the absence of protection by acquisition.

Length of stream buffered by regulations and acquisitions

To assess the degree to which regulations and acquisitions protect aquatic habitat, we calculated the number of stream miles buffered by natural vegetation as a result of the regulations and compared this to the number of stream miles within the boundaries of acquisitions.

Mapping the spatial footprint of land-use regulations

We built spatial data layers associated the following regulations.

DNR Forest Practices

The Forest Practices Rules have been administered by the Washington Department of Natural Resources since 1974. The Forest Practices Rules (Title 222 WAC) establish standards for forest practices on private and state-owned land, such as timber harvest, pre-commercial thinning, road construction, fertilization, and forest chemical application. Landowners must get a Forest Practices Permit before conducting these activities. The rules set performance standards for water quality, buffers, wetlands, logging roads, remaining "leave" trees and down logs, harvesting systems, and reforestation. Our analyses focus on the stream and wetland buffers required by these rules.

The purpose of the Forest Practices Rules is to protect water quality and aquatic and riparian-dependent species on non-federal forestlands. The rules apply to any private or state land where forest practices are taking place. The only exception is if a landowner is cutting or removing less than 5,000 board feet for personal use during any 12-month period.

DNR Forest Practices Stream and Wetland Buffers

The forest practices regulations require buffers on all shorelines, fish-bearing streams, non-fish-bearing perennial streams, and some wetlands. The width of the buffer is complex and varies based on factors including stream type and width, site class, wetland type and size, and which side of Cascade Mountains the stream lies on. Although Luke Rogers at the University of Washington created a comprehensive spatial dataset of these buffers in 2010, we unfortunately had to recreate this layer. We did this for two reasons. First, because more recent spatial data are now available from the DNR GIS website (http://data-wadnr.opendata.arcgis.com) and second, because the Rogers dataset buffered all streams, including those identified as "unknown" This included all non-fish-bearing streams, even though non-fish-bearing streams that are seasonal do not require buffers.

Buffer widths vary significantly by stream type and location (Table 1). Generally, the larger the stream the bigger the buffer. DNR Forest Practices stream buffer widths used for this study assumed the "thinning from below canopy" option to harvest in the inner zone (Title 222 WAC). Because there is no spatial data on the average width of streams, inner and outer buffer distances represent an average across (a) streams with a bankfull width less than or equal to 10 feet and (b) streams with a bankfull width greater than 10 feet (Table 1).

Streams

The DNR maintains two types of hydrology datasets in Washington State—one composed of polylines (WChydro) and one composed of polygons (WBhydro). The polylines dataset delineates all observed (and sometimes modeled) stream types across the state whereas the polygons delineate water bodies (i.e., lakes, ponds, reservoirs, etc.) and large, double-banked streams. We used both of these datasets when calculating our streams and water body buffers.

First, we extracted each relevant stream type from the polyline dataset (WChydro) as defined by the Department of Natural Resources stream determination rating (e.g., type "S" (shorelines), type "F" (fish-bearing streams), and "NP" (non-fish-bearing perennial streams). Then for Np-type streams, we applied a 50-ft buffer. For S and F-type streams, we split them up by which side of the state they were located in, as defined in Chapter 222-16-010 of the Washington Administrative Code (WAC). Asotin, Kittitas, and Okanogan counties are in eastern Washington, whereas Clark, Jefferson, and King counties are in western Washington. Westside S and F-type streams were first buffered by a 50-ft core buffer as per the Forest Practices Rules (Title 222 WAC). Eastside S and F-type streams were buffered by a 30-ft core buffer. We then intersected DNR site class data (where it was available) with the stream data and applied the buffers identified in Table 1. In locations where there was no site class information available we averaged all of the buffers for each of the site classes. Specifically, for Westside S and F-type streams we assumed a 50-ft core buffer, 50.6-ft inner zone buffer, and a 41.5-ft outer zone buffer, totaling 142.1-ft buffer width. For Eastside S and F-type streams, we assumed a 30-ft core buffer, 57.5-ft inner zone buffer, and a 14.5-ft outer zone buffer, totaling 102-ft buffer width.

Next, we extracted each relevant stream and waterbody type (e.g., S, F, Np) from the polygon dataset (WBhydro). For Np-type waterbodies we applied a 50-ft buffer across the entire state. For S and F-type streams and waterbodies we split them up by which side of the state they were located in, as above. Westside S and F-type streams and waterbodies were buffered by a 50-ft core buffer and Eastside S and F-type streams and waterbodies were buffered by a 30-ft core buffer. We then intersected DNR site class data with the data and applied the buffers identified in Table 1. When there was no site class information available in a certain area we averaged all of the buffers for each of the site classes. We assumed a 142.1-ft buffer width for Westside S and F-type streams and waterbodies and a 102-ft buffer width for Eastside S and F-type streams and waterbodies.

We then merged and dissolved all of the stream buffers above and clipped them by the six counties.

Wetlands

We used the DNR's spatial dataset on wetlands, downloaded from the WA DNR website on May 31st. From this dataset we extracted wetland types A and B where buffers apply (see WAC 222- 16-035 for definitions). We further categorized wetland types A and B by size and buffered them according to Table 2 below.

We considered using the National Wetland Inventory (NWI) dataset in addition to the DNR wetland dataset, by examining all relevant PEM* and PSS* classes of wetlands (see https://www.fws.gov/wetlands/data/metadata/FWS_Wetlands.xml). However, not only do the two datasets differ in how they classify wetlands, but the WA DNR appeared to capture all of NWI wetlands.

DNR Forest Practices do not apply on lands owned by federal and tribal governments, therefore we clipped layers with a spatial data layer that serves as a proxy for non-federal forested lands (“JLARC6_All_Regs_ERASE_Dissolved.shp”). The end result is a spatial data layer (“FP_buffers_nofed.shp”) that best approximates stream and wetland buffers for the six counties in this analysis.

Table 1. DNR Forest Practices stream buffer widths using the “thinning from below canopy” option to harvest in the inner zone. Average inner and outer buffer distances represent an average across streams with a bankfull width less than or equal to 10 feet and streams with a bankfull width greater than 10 feet.

STREAM TYPE	SITE CLASS	CORE BUFFER DISTANCE (FEET)	AVERAGE INNER BUFFER DISTANCE (FEET)	AVERAGE OUTER BUFFER DISTANCE (FEET)	LOCATION
S or F	1	50	91.5	58.5	West
S or F	2	50	70.5	49.5	West
S or F	3	50	49	41	West
S or F	4	50	28	32	West
S or F	5	50	14	26	West
S or F	1	30	57.5	42.5	East
S or F	2	30	57.5	22.5	East
S or F	3	30	57.5	7.5	East
S or F	4	30	57.5	0	East
S or F	5	30	57.5	0	East
Np	N/A	50	N/A	N/A	West/East

Table 2. DNR Forest Practices wetland buffer widths.

SIZE	CLASSIFICATION	BUFFER WIDTH
> 5 acres	A	100 ft
<= 5 acres	A	50 ft
> 5 acres	B	50 ft
<= 5 acres and > 0.5 acres	B	25 ft

Growth Management Act

The Washington Growth Management Act (RCW 36.70A) requires counties to prepare comprehensive plans to accommodate urban growth while protecting critical areas of ecological importance. The law was set in place in response to rapid urban growth and development infringing on natural and agricultural areas outside of city limits. The law centers on county-level local designation of critical areas that are to be protected from development or developed with specific standards. Critical areas include aquifer recharge areas, wetlands, habitat conservation areas, and geological hazard areas. The purpose of these standards is twofold: 1) to protect natural habitat and ecosystems and 2) to protect urban populations from hazards and water depletion. Our analyses focus on wildlife habitat conservation areas (e.g., streams and wetlands) and geologically hazardous areas.

Habitat Conservation Areas

Habitat Conservation Areas (HCAs) are designated for the purpose of protecting threatened species of state and local importance. When designating habitat conservation areas, many counties designate HCAs to protect species of local, state, and federal importance that are of concern. HCAs are generally composed of stream and wetland riparian areas and areas of unique ecological significance. Streams are defined as above by the DNR (e.g., types S, F, and N).

Wetlands are defined by Department of Ecology's (ECY) wetland rating system, which classifies wetlands into four categories. Although the ECY's system rates wetlands in relation to their function, value, proximity to development, and surrounding habitat, maps of wetland locations are not available for the entire state. In fact, reliable spatial data for wetlands is not readily available, although researchers at the University of Washington and WA Natural Heritage Program are in the process of developing better spatial wetland data (Meghan Halabisky, personal communication). Consequently, we decided to combine two spatial wetland datasets for WA State: the DNR wetland map (“fpwet”) and the National Wetland Inventory (USFW, 2016[1]).

GMA Stream Buffers

To identify GMA stream riparian areas, we used the DNR stream dataset (WChydro) and split it up by stream type (i.e., types S, F, and N). We then clipped each stream type by the six counties because each county has different size buffers for each stream type (see Table 3). Next, we created three buffer layers for each stream type for each county (Table 3) and merged the results. Because GMA regulations do not apply on lands owned by federal, state, and tribal governments we intersected this merged GMA stream buffer layer with a spatial layer identifying all lands that are currently owned by either the federal, state, and tribal governments. This layer was created using the Protected Areas Database and selecting Federal, Designation (also federal), State, Tribal, and federally managed “unknown” ownerships (“PAD1_4_WA_FEDStateTribUnk”) to produce a layer of buffers on private lands (“Merged_AlltypesBuff_NoFedState”). The resulting spatial data layer best represents stream riparian areas that are regulated by the Growth Management Act in the six counties.

[1] https://www.fws.gov/wetlands/

Table 3. GMA stream buffer widths (in feet) by county and stream type.

County	**Stream Type S**	**Stream Type F**	**Stream Type Np**
Asotin	250	200	150
Clark	250	200	100
Jefferson	150	150	75
King	250	200	150
Kittitas	200	100	50
Okanogan	200	200	150

GMA Wetland Buffers

We delineated GMA wetland buffers using three scenarios: low impact development (i.e., smallest possible buffers), moderate impact development (i.e., average size buffers), and high impact development (largest possible buffers surrounding wetlands). Due to the lack of spatial data for Department of Ecology wetlands, it was not possible to identify the habitat rating of each wetland. Therefore, we averaged the wetland buffer widths across all wetland habitat ratings (I-IV) for each scenario (low, moderate, and high impact). We then merged the three scenarios with the GMA stream buffer layer and removed all federal, state, and tribal lands as above.

Table 4. GMA wetland buffer widths (in feet) by county and impact of development.

County	Low Impact (smallest buffer size)	Moderate Impact (average buffer size)	High Impact (largest buffer size)
Asotin	100	163	250
Clark	25	62	300
Jefferson	60	95	240
King	50	88	125
Kittitas	25	66	200
Okanogan	50	125	300

GMA Geologically Hazardous Area Buffers

Geologically hazardous areas (GHAs) are a class of critical area under Washington State's Growth Management Plan and are defined in RCW 36.70A.030. Washington State counties and cities are required to protect these critical areas. However, spatial data on the locations of these critical areas are generally lacking. The DNR does provide statewide maps of “potentially” hazardous areas, however, these areas often overlap areas of development, bringing into question whether they are actually geologically hazardous areas.

Therefore, we defined geologically hazardous areas as locations with slopes greater than 40%. Some counties do not explicitly identify what constitutes a steep slope or what size buffer should be applied. Therefore, we calculated average steep slopes buffer as identified in Table 5. To map steep areas, we used 10-m digital elevation models (DEMs) downloaded from the USGS. We stitched these DEMs together by relevant county and calculated the slope using ArcMap’s slope tool. We then removed areas that are located on federal, tribal, and state lands.

Table 5. Growth Management Act Hazardous Areas Buffers

County	**Steep Slope Identified in Regulations**	**Average Steep Slope Buffer (in feet)**
Asotin	Not identified (assumed 40%)	27.5’
Clark	40% or greater	27.5' + 8' setback
Jefferson	Not identified (assumed 40%)	Not identified (assumed 35’ - same as landslides)
King	40% or greater	50' + 15' setback
Kittitas	Not identified (assumed 40%)	10’ (Ellensburg)
Okanogan	Not identified (assumed 40%)	34.6'

Shoreline Management Act

In 1971, the Shoreline Management Act (SMA) was passed by the Washington State Legislature and enacted the following year to “prevent the inherent harm in an uncoordinated and piecemeal development of the state’s shorelines." It is regulated through Washington State Code RCW 90.58, which governs the 39 counties within Washington State.

The SMA applies to the following shorelines of the state [RCW 90.58.030]:

- All marine waters.
- Segments of streams where the mean annual flow is more than 20 cubic feet per second.
- Lakes and reservoirs 20 acres and greater in area.
- Associated wetlands.
- Shorelands adjacent to these water bodies. This is typically the land area within 200 feet of the water body, although there are exceptions.

Specific larger water bodies are classified as shorelines of statewide significance [RCW 90.58.030(2)(e)].

Local governments have the option to include all or portions of the 100-year floodplain. Please see the WA Department of Ecology[2] for more information.

The SMA focuses on three policy objectives for the shorelines outlined in (RCW 90.58.020): (1) use, (2) environmental protection, and (3) public access. Shorelines can be used for commercial, residential, recreational, industrial or other purposes so long as they do not degrade or pollute the natural environment. Shorelines of state significance are to be protected, with decreasing priority, for statewide interest, preservation of natural character, long term over short-term benefit, protection of resources and ecology of the shoreline, increase in public access, and lastly increase in recreational opportunities. The SMA also requires that state shorelines protect water quality, wildlife, vegetation, land, and aquatic life from adverse environmental effects and must try to mitigate any environmental impacts to the shorelines. Lastly, the SMA focuses on a public access element that allows provisions to be made to increase recreational opportunities on the shore.

Under the SMA, each county and city must adopt a Shoreline Master Program that follows state rules and regulations yet is tailored to each county's economic, geographic, and environmental needs. The Washington State Department of Ecology provides technical assistance and review of SMP's but leaves authority to counties and cities to regulate the shorelines within their boundaries. After being passed by the legislature in 1971 and affirmed by voters in in 1972, most counties created countywide SMP's between 1974 and 1978, however, these SMPs are largely unavailable. All counties have updated their SMPs in recent years to adjust to new environmental, economic, and public use goals. Older versions of the SMPs were not immediately available for this report and therefore we only consider the most recent versions of SMP regulations for each county. '

Using these most recent versions of SMPs, we calculated the buffer widths associated with a "high impact" development scenario for the various water bodies covered by the SMA. We calculated these buffer widths by identifying the relevant water bodies and their associate buffer widths in each of the county SMPs. For the purposes of this report, high, medium, and low-impact development represents the intensity of land uses proposed on development sites. High-impact development could lead to greatly reduced forest cover, many roads crossing aquatic areas and wetlands, significant amounts of impervious surfaces, and extensive amount of armoring and structures along shorelines). However, we recognize that buffer widths often vary depending on the underlying shoreline designation, buffer averaging, and common line setbacks and wetlands. We also acknowledge that not the entire buffer area will be fully protected and may be used for vegetation management and shoreline setbacks. Lastly, some counties have different buffers inside and outside Urban Growth Areas.

[2] http://www.ecy.wa.gov/programs/sea/sma/st_guide/jurisdiction/SSWS.html

Table 6. The largest average Shoreline Management Act buffer widths (in feet) for the six counties under "high" impact development.

County	Marine shorelines	Streams	Lakes
Asotin (2016)	NA	105	NA
Clark (2012)	250	200	250
Jefferson (2014)	150	150	100
King (2015)	165	165	165
Kittitas (2016)	NA	100	150
*Okanogan (2015)	NA	150	75

* *Okanogan County's SMP has been locally adopted but is still under review and has not been approved by the WA Department of Ecology.*

The spatial data that we used for SMA regulations were produced by the WA Department of Ecology (ECY) and includes bodies of water that fall under the SMA jurisdiction, including streams, rivers, lakes, wetlands, and marine areas designated "Shorelines of the State" or "Shorelines of Statewide Significance" by local governments and published in their shoreline master program and adopted by ECY. Although these data represent the current shoreline Management Act jurisdiction as of February 2017, each county has their own spatial data that is sometimes updated based on more current information. Nevertheless, we were not able to acquire this data from each of the six counties in time for this analysis. Furthermore, SMA-regulated wetlands for each of the six counties were not available at the time of this report and therefore were not included in our analysis. Although maps of SMA wetlands are available for some counties, such as Asotin, we decided against including wetlands for some counties and not for others. Additionally, ECY rate wetlands not only on size but also function, which complicated our ability to spatially map them accurately.

The SMA spatial data were clipped by each of the six counties for processing. We then created buffers for each of the SMA regulated bodies of water (marine shorelines, streams, lakes) according to Table 6, merged all of the buffers, and removed federal, state, and tribal lands.

Combined Regulations

We combined buffer layers from Forest Practices, Shoreline Management Act, and each of the three versions of the Growth Management Act (low, moderate, and high impact) to produce three combined layers.

State Funded Acquisitions

Creating a complete inventory of lands acquired is a complex endeavor because no central land- transaction database exists and state agencies and other entities that acquire land document this information differently. Therefore, we used a number of spatial datasets assembled by JLARC for the time period from FY1990 to FY2015. These acquisitions were associated with the Salmon Recovery Funding Board, Puget Sound Acquisition and Restoration program, Puget Sound Estuary and Restoration Program, Washington Wildlife and Recreation Program, State Parks and Recreation Commission, Trust Land Transfer program, and the Natural Areas Program. These data originated from WA DNR, WDFW, and the WA

Recreation and Conservation Office (RCO).

The acquisition data consists of the following:

RCO_PublicLandsInventory_StateParks: State Parks acquisitions made between FY1990 and FY2015. Extracted from RCO's 2014 Public Lands Inventory

DNR_acquisitions: Provided by DNR. Natural Areas acquisitions and easements. The PRCLACQDT (parcel acquisition date) field in the attribute table corresponds to the year a parcel was originally acquired by the state. State trust lands that were redesignated as natural areas during the study period (1990-2015) retain the original acquisition date.

WDFW_acquisitions: Provided by WDFW. Parcels for WDFW acquisitions from FY1990-FY2015 in six counties where funding is WWRP, SRFB, or Trust Land Transfer.

Asotin_RCOWorksiteParcels: Tax parcels that contain a work site for an RCO-funded project.

Clark_RCOWorksiteParcels: Tax parcels that contain a work site for an RCO-funded project.

Jefferson_RCOWorksiteParcels: Tax parcels that contain a work site for an RCO-funded project.

King_RCOWorksiteParcels: Tax parcels that contain a work site for an RCO-funded project.

Kittitas_RCOWorksiteParcels: Tax parcels that contain a work site for an RCO-funded project.

Okanogan_RCOWorksiteParcels: Tax parcels that contain a work site for an RCO-funded project.

RCOWorksite_Locations: point data for locations of RCO-funded project work sites.

All data were identified and collated by JLARC staff. We then merged the files into a master shapefile of all acquisitions and then intersected this master acquisition layer with species' observed ranges to identify areas of protected habitat.

Non-acquisition protected lands

Building the data set

We built a composite data layer of existing public lands and protected areas using three different datasets: 1) the Protected Areas Database of the United States (PADUS v1.4 - USGS Gap Analysis Project of GAP), 2) Washington DNR Managed Land Parcels (WA DNR: http://data-wadnr.opendata.arcgis.com/datasets/wa-dnr-managed-land-parcels), and 3) Non-DNR Major Public Lands (WA DNR: http://data-wadnr.opendata.arcgis.com/datasets/non-dnr-major-public-lands). We used all three datasets because each was missing important protected areas contained the others. We assigned each parcel in the composite protected areas layer a land ownership type (i.e. Federal, Tribal, State, Local, and Private) and a GAP conservation status code. GAP conservation status codes indicate what types of land management and uses are allowed on each land parcel. We included all GAP 1 and 2 lands as protected because these meet the IUCN definition of a protected area. Specifically, GAP status 1lands define areas having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management. GAP status 2 lands are those having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance (https://gapanalysis.usgs.gov/blog/iucn-definitions/).

We used the PADUS data as our primary dataset because it contained information about the GAP conservation status of each protected area. Parcels from the Washington DNR Managed Land Parcels (hereafter DNR parcels) and the Non-DNR Major Public Lands (hereafter Non-DNR lands) that were not already included in the PADUS layer were added to the PADUS data. To do this, we erased the PADUS data from both layers (the DNR parcels and Non-DNR lands). We then added the remaining parcels to the PADUS layer using the Union command in ArcGIS allowing us to retain the original data attributes from all layers. Finally, we removed any acquisition parcels from the data set using the erase function in ArcGIS. In all cases, we used a 50-m tolerance to avoid creating polygon slivers based on slight differences in boundary locations.

We then assigned GAP status to each of the additional lands that were added to the PADUS data. For the purposes of this analysis, we did not distinguish between GAP 1 and 2. We classified DNR managed parcels based on their easement type. The vast majority of parcels are managed as trust lands and allow resource extraction. A few parcels in the study area had more restrictive easements. These were classified as GAP 1-2 (see Table 7).

Table 7. GAP status assignments for DNR managed parcels. Parcels with GAP status 1-2 are considered protected habitat, those with GAP status 3 are not.

DNR easement type code	Easement type	GAP Status
2	Conservation forest legacy	3
5	Conservation riparian	1-2
6	Conservation ESA	1-2
8	Conservation other	1-2
All others	N/A	3

For Non-DNR lands, we assigned GAP status based on either the recorded management or the manager (see Table 8). Management type took precedence over manager. In other words, if a particular area was being managed for wilderness held more weight than who was managing that area. For example, an area that is managed for wilderness was assigned a GAP status 1, which took precedence over who was managing that area, such as the US Bureau of Land Management.

Table 8. GAP status assignments for Non-DNR Major Public Lands.

Field	Type	GAP status
Management	Medical Facility	4
Management	Public School	4
Management	Fish Hatchery	4
Management	Other	4
Management	Wilderness	1
Management	Watershed	2
Management	Wildlife	1
Manager	National Park Service	1
Manager	US Fish and Wildlife Service	1
Manager	WA Dept. of Fish and Wildlife	1
Manager	WA State Parks and Recreation Commission	3
Manager	US Bureau of Land Management	3
Manager	US Bureau of Reclamation	3
Manager	US Dept. of Defense	3
Manager	Army Corps of Engineers	3
Manager	City or Municipality	3
Manager	County	3
Manager	US Forest Service	3

Uses

We used the composite protected areas data to identify Federal and Tribal lands and removed these from all the regulatory buffer layers, as state regulations do not apply on Federal and Tribal lands. In addition, we removed any State lands from the GMA and SMA regulatory buffers layers because these regulations do not apply on State lands.

Species Habitats

We defined terrestrial habitats using the observed species ranges mapped by the Washington Department of Fish and Wildlife for 83 species of interest in the state (Table 9). Seventeen of these species had no habitat within the spatial footprint of the regulations or the acquisitions in the six counties.

Table 9. Species of interest in Washington State that were included in analyses. “*” denotes species that had no habitat within the spatial footprint of the regulations or the acquisitions in the six counties.

Common name	Latin name
Western pond turtle	*Actinemys marmorata*
* Clark's grebe	*Aechmophorus clarkii*
Western grebe	*Aechmophorus occidentalis*
Sagebrush sparrow	*Artemisiospiza nevadensis*
Tiger salamander	*Ambystoma tigrinum*
Western toad (boreal toad)	*Anaxyrus boreas*

Woodhouse's toad	*Anaxyrus woodhousii*
Golden eagle	*Aquila chrysaetos*
Rocky Mountain tailed-frog	*Ascaphus montanus*
Burrowing owl	*Athene cunicularia*
Pygmy rabbit	*Brachylagus idahoensis*
Marbled murrelet	*Brachyramphus marmoratus*
Ferruginous hawk	*Buteo regalis*
Gray wolf	*Canis lupus*
Greater sage-grouse	*Centrocercus urophasianus*
* Western snowy plover	*Charadrius alexandriunus*
Yellow-billed cuckoo	*Coccyzus americanus*
Sharp-Tailed Snake	*Contia tenuis*
Townsends big-eared bat	*Corynorhinus townsendii*
Cope's giant salamander	*Dicamptodon copei*
Ringneck snake	*Diadophis punctatus*
Streaked horned lark	*Eremophila alpestris strigata*
Taylor's checkerspot	*Euphydryas editha taylori*
Spotted bat	*Euderma maculatum*
Peregrine falcon	*Falco peregrinus*
Common loon	*Gavia immer*
* Sandhill crane	*Grus canadensis*
Wolverine	*Gulo gulo*
Bald eagle	*Haliaeetus leucocephalus*
Night snake	*Hypsiglena torquata*
Hoary bat	*Lasiurus cinereus*
Loggerhead shrike	*Lanius ludovicianus*

Silver-haired bat	*Lasionycteris noctivagans*
Black-tailed jackrabbit	*Lepus californicus*
White-tailed jackrabbit	*Lepus townsendii*
Canada lynx	*Lynx canadensis*
Marten	*Martes americana*
Olympic marmot	*Marmota olympus*
Fisher	*Martes pennanti*
Striped whipsnake	*Masticophis taeniatus*
Lewis's woodpecker	*Melanerpes lewis*
* Kincaids meadow vole	*Microtus pennsylvanicus kincaidi*
* Shaw Island Townsend's vole	*Microtus townsendii pugeti*
America pika	*Ochotona princeps*
Columbian white-tailed deer	*Odocoileus virginianus leucurus*
Sage thrasher	*Oreoscoptes montanus*
Flammulated owl	*Otus flammeolus*
Western screech owl	*Megascops kennicottii*
American white pelican	*Pelecanus erythrorhynchos*
Pygmy horned lizard	*Phrynosoma douglasii*
White-headed woodpecker	*Picoides albolarvatus*
* Dunn's salamander	*Plethodon dunni*
Larch mountain salamander	*Plethodon larselli*
Van Dykes salamander	*Plethodon vandykei*
* Rednecked grebe	*Podiceps grisegena*
Oregon vesper sparrow	*Pooecetes gramineus affinis*
* Mardon skipper	*Polites mardon*
Purple martin	*Progne subis*

Columbia spotted frog	*Rana luteiventris*
* Northern leopard frog	*Rana pipiens*
Oregon spotted frog	*Rana pretiosa*
* Woodland caribou	*Rangifer tarandus*
* Cascade torrent salamander	*Rhyacotriton kezeri*
Cascades frog	*Rhyacotriton cascadae*
Olympic torrent salamander	*Rhyacotriton olympicus*
Sagebrush lizard	*Sceloporus graciosus*
Western gray squirrel	*Sciurus griseus*
Slender-billed white-breasted nuthatch	*Sitta carolinensis aculeata*
Western bluebird	*Sialia mexicana*
Pygmy nuthatch	*Sitta pygmaea*
* Oregon silverspot butterfly	*Speyeria zerene hippolyta*
Valley silverspot	*Speyeria zerene bremnerii*
Great gray owl	*Strix nebulosa*
Northern spotted owl	*Strix occidentalis*
American badger	*Taxidea taxus*
* Mazama (Western) pocket gopher	*Thomomys mazama*
Brush prairie pocket gopher	*Thomomys talpoides douglasii*
Columbia sharp-tailed grouse	*Tympanuchus phasianellus*
Grizzly bear	*Ursus arctos*
Townsend's ground squirrel	*Urocitellus townsendii townsendii*
* Washington ground squirrel	*Urocitellus washingtoni*
Side blotched lizard	*Uta stansburiana*
Cascade red fox	*Vulpes vulpes cascadensis*

Habitat and range data

Potential range maps

According to WDFW these maps are referred to as "potential" habitat distribution maps because they depict range as areas with documented occurrences, as well as areas with suspected or possible occupancy based on the availability of suitable habitat and the proximity of that suitable habitat to occupied areas. These areas of potential occurrence are defined using relatively large watersheds (HUC10s).

Observed range maps

These maps represent smaller watersheds (HUC 12s) that a known occurrence has been recorded for a particular species. These are nested within the larger watersheds that define potential ranges. However, WDFW acknowledges that not every area in the state has been surveyed for all species and, therefore, only using occupied watersheds would likely underestimate the range of a species.

Ecological systems and habitat suitability maps

WDFW defines habitat distribution as the spatial arrangement of ecological systems (a component of the National Vegetation Classification Scheme) suitable for a species within its predefined range. Ecological systems are a classification unit developed by NatureServe and are defined as a group of existing plant community types that tend to co-occur within landscapes sharing similar ecological processes, substrates, and/or environmental gradients (Rocchio and Crawford 2008). WDFW defines two levels of habitat, that which is "closely associated" and that which is "generally associated." We defined habitat using both of these classes combined.

Species area requirements

We searched the literature for home range sizes of each species to use to estimate for how many individuals of each species the acquisitions could potentially provide habitat (Appendix A).

When home-range data were not available for a given species, we extracted information for a congener or other related species. It was beyond the scope of this study to assess the degree to which the density of habitat resulting from the regulations was able to support individuals or populations. Because the regulations largely resulted in linear strips of protected habitat, assessing their ability to provide an adequate area of habitat for an individual or population is less straightforward. We determined how much of the area covered by the spatial footprint of a regulation would actually provide a high enough density of habitat to support a breeding pair.

Habitat interior calculations

Although total habitat area provides some indication of wildlife benefits, the shape and distribution of that habitat has a significant impact on its ability to support wildlife. For example, some forest dwelling species actively avoid forest edges. Studies have documented physical changes to moisture, air flow, and temperature as well as ecological changes in decomposition rates, wind and fire disturbance, nest predation, prevalence of invasive and pest species at forest edges (Chen et al. 1992, Chen et al. 1999, Muricia 1995, Beatley et al. 2003). As a result, ecological planners have long recommended that protected areas that are closer to a round shape are better for wildlife than protected areas with a more linear shape because the former has a lower edge: interior ratio than the latter (Soulé 1991, Beatley et al. 2003).

To account for the impact of these edge effects, we ran a separate habitat calculation using only interior forest habitat. The extent to which edge effects penetrate into the forest differ depending on the edge impact (i.e. moisture versus nest predation). Several authors have reviewed and summarized the edge effects literature in an effort to identify a common distance from the forest edge that reasonably captures most edge impacts (Muricia 1995, Beatley et al. 2003). From these reviews, we identified three distances, 16 meters, 82 meters, and 230 meters, which were the minimum, median, and 75th percentile distances from forest edges for which edge effects have been documented. Beatley and others (2003) recommend that land use planners use a buffer of 100 meters to approximate edge impacts and the State of Maryland defines edges as being within 300 feet (~90 meter) of the forest edge. The 82-m edge distance most closely approximates these other recommended edge measures. The 23-m distance captured most (i.e.75%) of the documented edge impacts.

To identify forest interior, we took the composite regulatory protections layers and the state acquisitions layer and added any additional existing protected areas. These existing protected areas included any federal, state, private or locally protected lands that met the GAP status 1 or 2 thresholds (i.e. are designated for habitat protection purposes) and that were not already included in the state acquisitions data layer. We added existing protected areas because any acquisition or regulatory buffer edges that are adjacent to these protected areas are not true habitat edges, but rather are an extension of other protected habitat. The GAP 1 and 2 lands added to either the regulatory layers or the acquisitions layer are identical. As a result, any difference in interior habitat availability is due to the difference between the habitat protections provided by regulations versus acquisitions. We then removed any open water from each of the four protected areas layers (i.e. three regulatory layers and one acquisitions layer). Finally, we removed habitat edges from each regulatory and acquisitions protected area layer up to each specified edge distance. This resulted in a total of 12 interior habitat layers.

Habitat Area Requirements

For four case study species, selected to represent a range of habitat area needs and edge sensitivities, we ran an analysis designed to take home range size requirements into account when assessing habitat availability within the footprint of the regulations and acquisitions. We used a moving window equal in area to the median home range size of each species. Within each window, we tallied the number of grid cells of habitat and recorded that number for the focal cell. We then selected only the grid cells with a specified minimum amount of habitat. For this analysis, we specified that to be the median home range size. Thus, we were identifying focal cells whose moving window was filled with habitat. This is a relatively conservative assessment given that some species will likely have home ranges that are a mixture of habitat and non-habitat. We then buffered the selected grid cells using a radius equivalent to the median range sizes, merged the buffers, and calculated the total area of the merged buffers.

This analysis identified the area of habitat available that could support home ranges of individuals of the species in question. We included all other Gap 1 and 2 protected lands in the moving window analysis, but subtracted out those other protected lands from the buffered grid cells in the final step of the analysis. Thus, acquisition or regulated lands that abutted an existing protected area could be counted as providing home-range sized habitat patches even if the acquisitions were too small to do so themselves.

Counterfactuals

Projected land-use changes

To explore the relative impact of acquisitions on protection in the face of land-use change, we used projections from an econometric model designed to forecast economically driven changes in land-use (Radeloff et al. 2012, Lawler et al. 2014). The econometric model produced county-level probabilities of land-use change over a 50-year period. For each county, we applied the transition probabilities to the area of a species range that was contained within the acquisition lands. We calculated the probability that the land would be converted to another--human dominated--land use within the next 50 years. We applied those probabilities to the area of protected land base on the types of habitat a species occupied (e.g., for a forest dwelling species, we determined what proportion of land would likely transition out of forest and into some other land use over the next 50 years. As a result, we were able to assess the area of land that, if it had not been protected, would have been converted to a human dominated land use and would then cease to serve as habitat for many species.

Timber harvest

To explore the degree to which acquisitions will protect lands from timber harvest, we assumed two rotation lengths for the counties in our study. For the west side of the Cascades, we assumed that the majority of stands would be Douglas fir plantations and would have a rotation length of approximately 50 years. This would mean that regardless of the current age of a stand, it would be harvested sometime in the next 50 years. We assumed forest stands on the west side of the Cascades would have rotation lengths of 80-100 years for Douglas fir and grand fir stands and 120-160 for ponderosa pine and more montane species. Therefore, we assumed a rotation length of 120 years. We assumed an even distribution of stand ages between 0 and 120 years resulting in a probability of a given parcel being harvested over the next 50 year of 0.417.

There are clearly many simplifying assumptions associated with this analysis. For example, not all west-side forests have 50-year rotation lengths. Small family forest operations are likely to cut on less regular schedules with potentially longer rotations. Our assumption that stands are equally distributed across ages of 1-120 years east of the Cascades is also clearly incorrect. However, in the absence of better data on stand ages, we chose to use this simple assumption. Perhaps our biggest simplifying assumption is that if a parcel is harvested, it no longer serves as habitat. This is clearly not true. Even recently harvested areas are likely to be habitat for some species and forests that are harvested will likely serve as habitat through some portion of their lives even for species that require more mature forest stands.

Results

Land Area

Regulations

The footprint of all regulations combined ranged from roughly 30,000 acres in Asotin County to approximately 254,000 acres in King County (Fig. 1). In all counties, the Growth Management Act regulations had the largest footprint. The Shoreline Management Act regulations had the smallest footprint in all counties. When the footprints of all regulations were combined, they covered an area only slightly larger than the area covered by the Growth Management Act regulations indicating that the land covered by the other regulations is largely a subset of the land covered by the Growth Management Act.

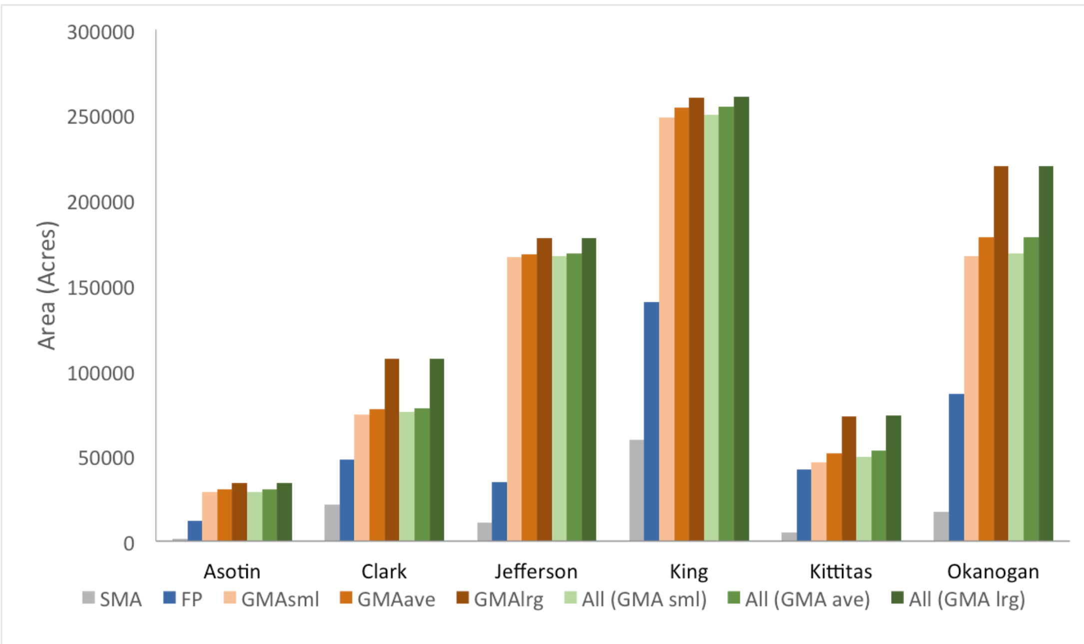
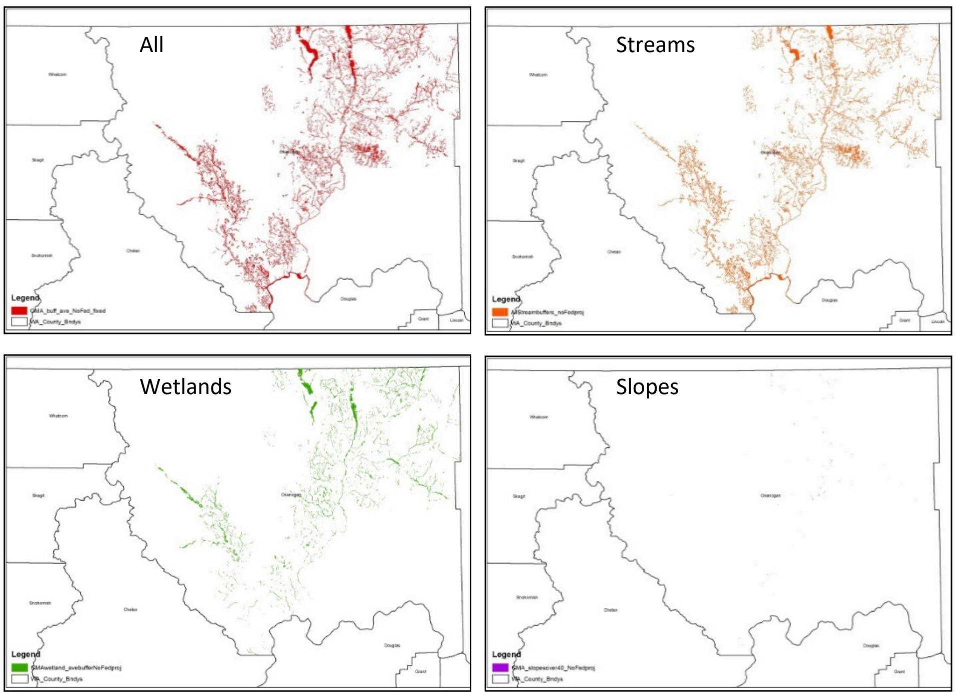


Figure 1. Acres of land covered by the Shoreline Management Act, DNR Forest Practices, the Growth Management Act (with small, average, and large buffers), and all three regulations combined.

A closer look at the spa.al footprint of the GMA regulations in Okanogan County

Here, we report the contribution that individual components of the Growth Management Act (GMA) have on the total buffered area for Okanogan. These individual components consist of streams, wetlands, and steep slope areas. Streams compose about two thirds of the total GMA buffered area, wetlands about one third, and steep slopes less than 1%. Each of the individual elements is mapped b e l o w .



Acquisitions

Okanogan County had the most (964) and Clark County had the fewest (84) acquisitions between 1990 and 2015 for which spatial data was available (Fig. 2 and 3). With the exception of one large acquisition of roughly 1,400 acres in King County, the largest acquisitions tended to be in Kittitas County (Fig. 2).

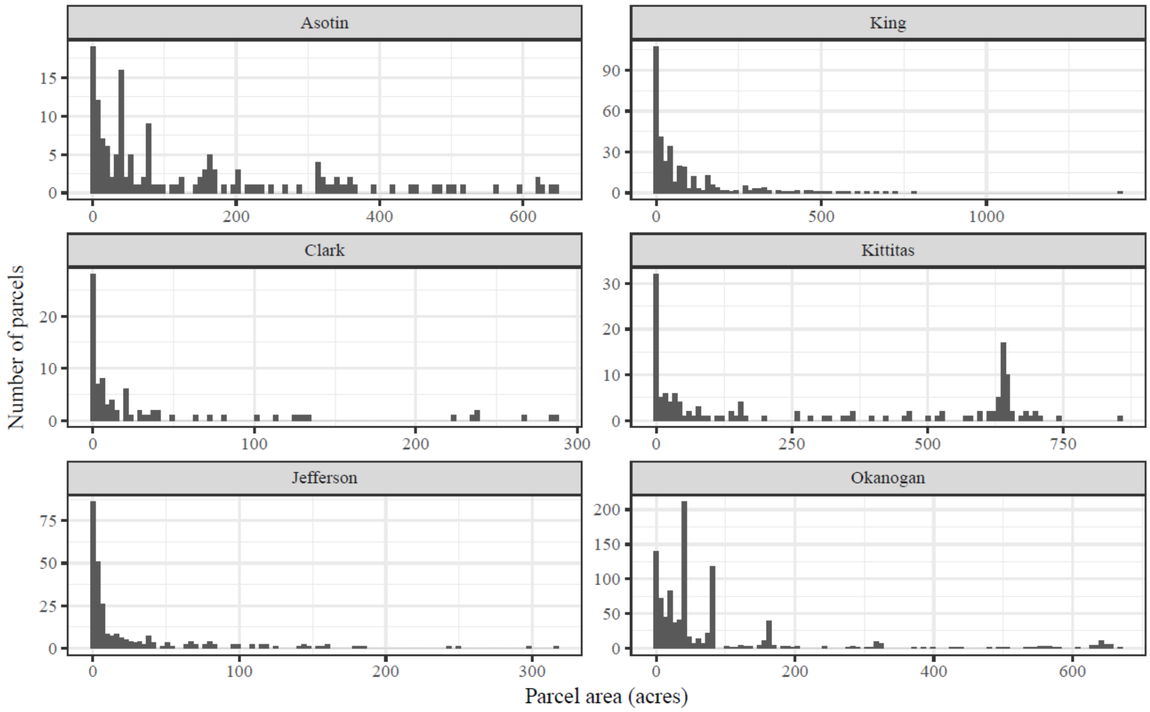


Figure 2. Distributions of sizes of acquisitions across six counties from 1990-2015.

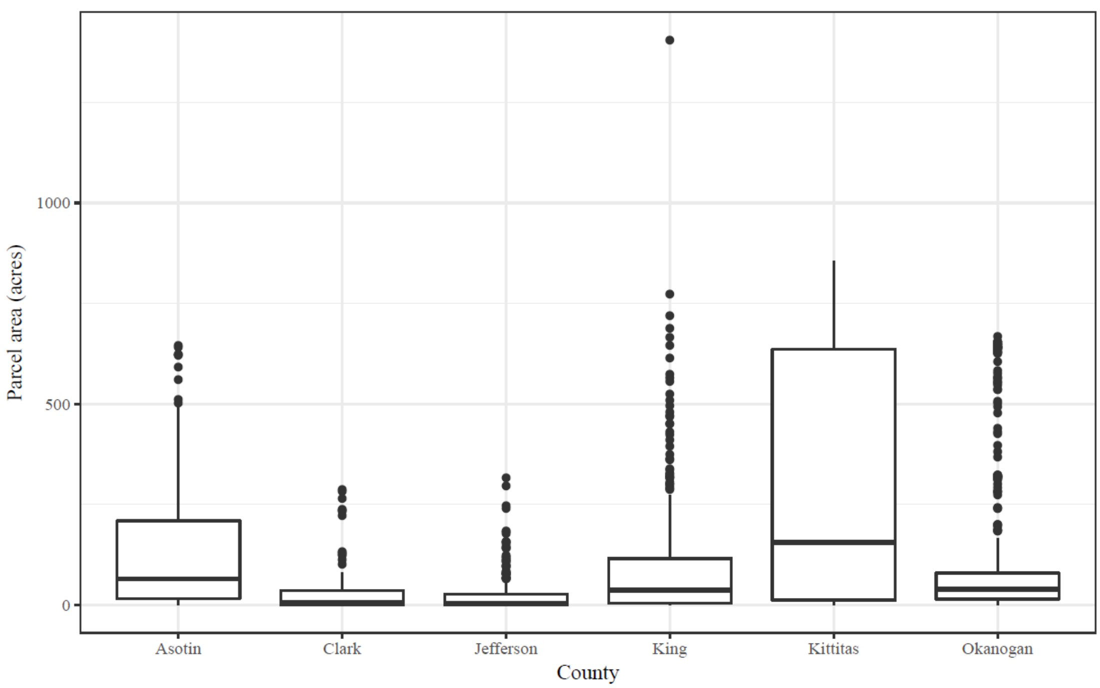


Figure 3. Box plots of acquisition parcel sizes across six counties from 1990-2015.

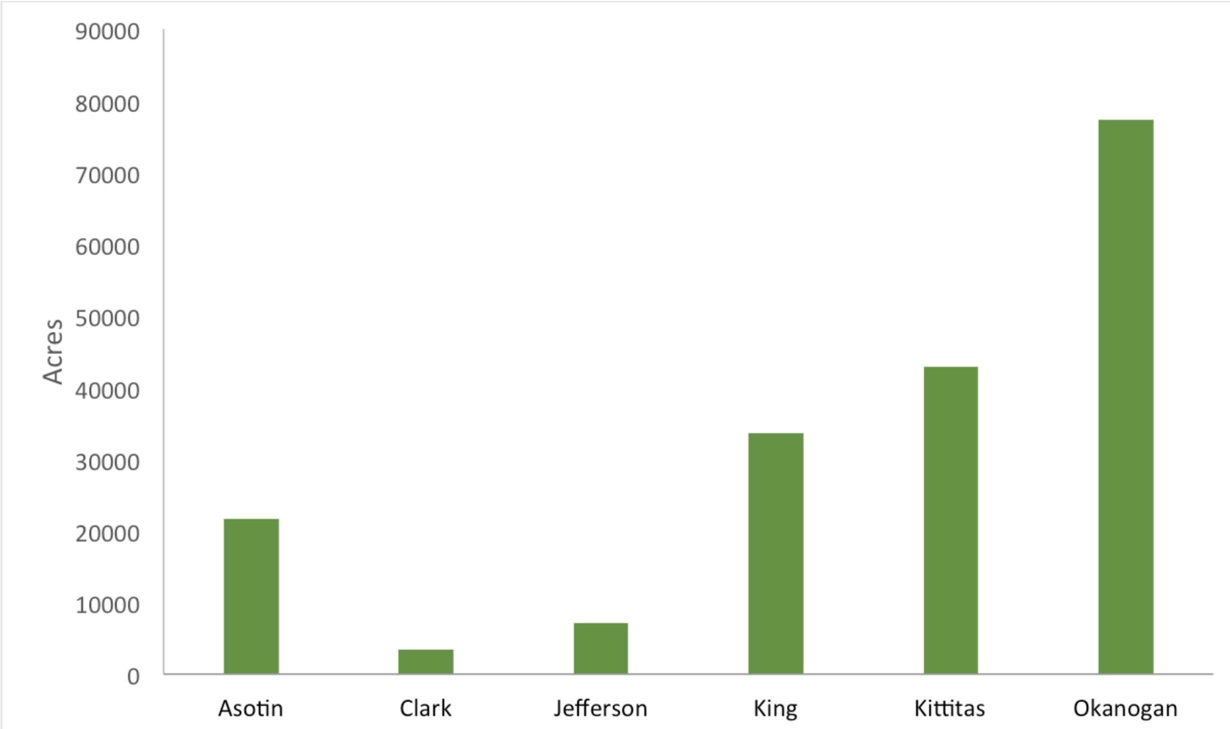


Figure 4. Total area of acquisitions across six counties from 1990-2015.

Terrestrial Habitat

Potential Habitat

The combined buffer footprints (from all regulations) covered between 278,648 and 2,482,544 acres of the mapped ranges of 83 species—in Asotin County and Okanogan County, respectively (Fig. 5). Many species' ranges were not covered in a given county—in part because not all species occur in all six counties. For individual species with at least some coverage of their range within a county, that coverage ranged roughly 3 acres for the sagebrush lizard in Asotin County to 259,819 acres for Townsend's big-eared bat in King County (Appendix B).

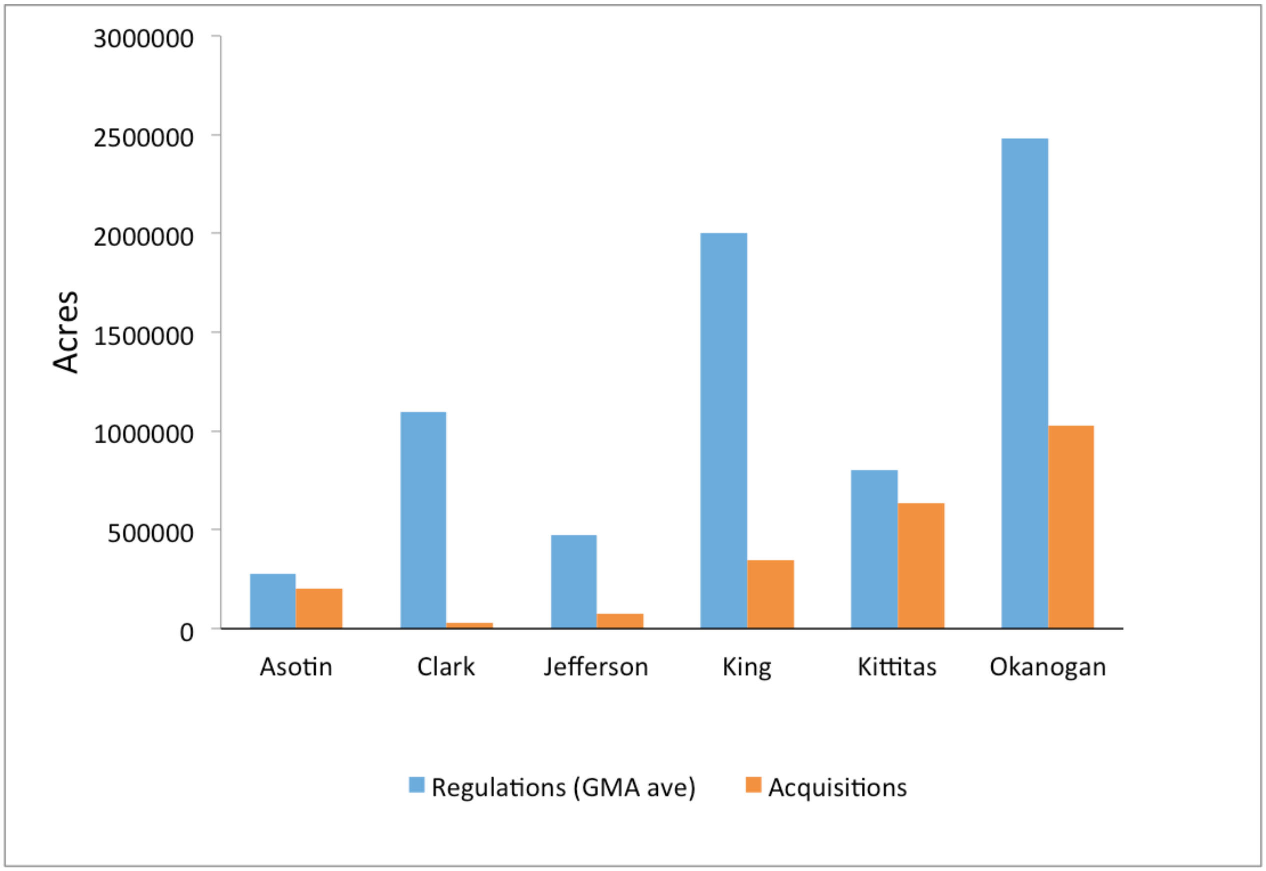


Figure 5. Acres of potential habitat (summed across all species) covered by all three regulations combined (assuming average sized buffers for the Growth Management Act).

Observed habitat

Although observed habitat necessarily covered a smaller area than did potential habitat, the pattern of relative coverage of regulations versus acquisitions remained the same when summed across all species (Fig. 6). Results for individual species can be found in Appendix B.

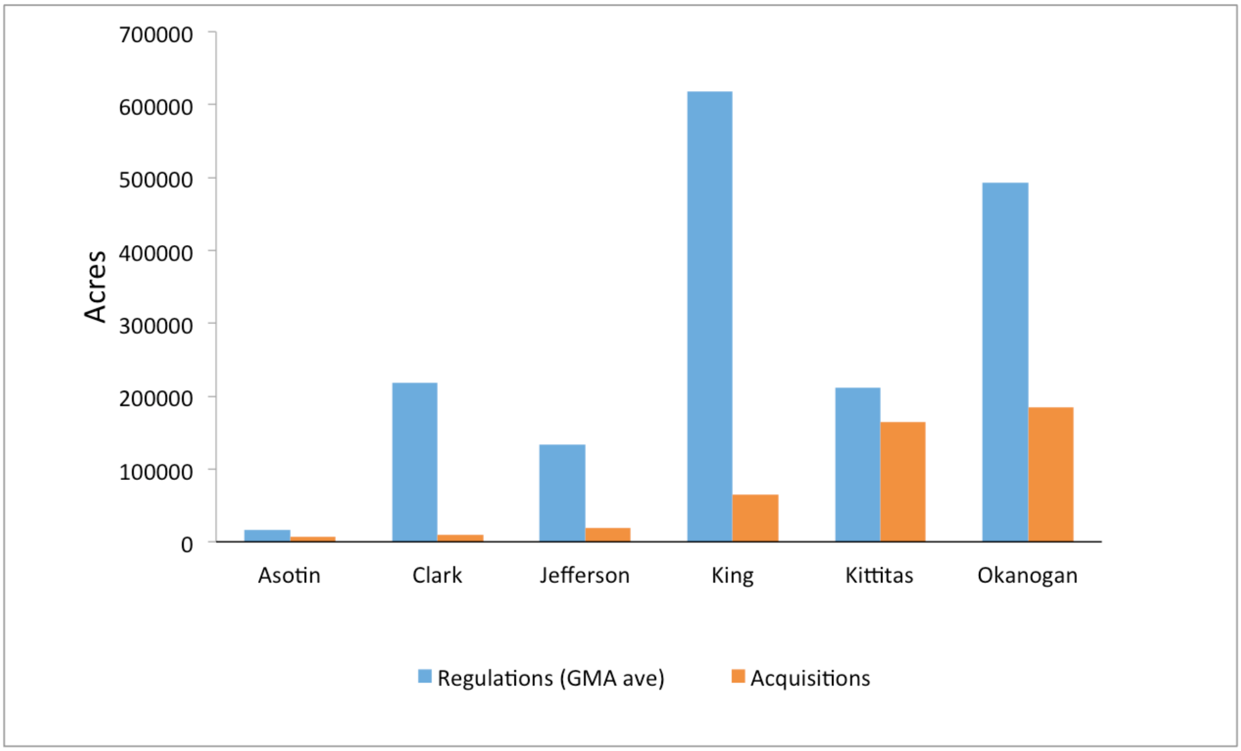


Figure 6. Acres of observed habitat (summed across all species) covered by all three regulations combined (assuming average sized buffers for the Growth Management Act) and acquisitions made between 1990 and 2015.

Counterfactual Analysis

Our counterfactual analyses for both economically driven land-use change (from more natural land covers, e.g., forest and rangeland to human dominated ones, e.g., urban and agriculture) and for timber harvest revealed differences in potential habitat protection across the six counties.

We projected greater protections for habitats in the face of timber harvest in the counties west of the Cascades (Fig. 7). On the east side, where rotation lengths are longer, it was feasible that some of the acquisitions would not be cut in the 50-year counterfactual period that we explored and thus they did not protect the species on those parcels from a loss of habitat. It is important to note that the fact that because rotations on the west side of the Cascades were assumed to be 50 years, all forest that was not protected by acquisition was assumed to be cut. Thus, both the harvest counterfactual and the combined counterfactual (the combined effects of both forest harvest and land-use change) indicated that all acres of acquired land in Clark, Jefferson, and King counties were effective at protecting habitat for the 50-year period in question. More general economically driven land-use change was projected to some degree across all counties over the 50-year period. In counties with relatively little land-use change projected (e.g., Okanogan County), acquisitions protected less land from habitat conversion. The most interesting result of the counterfactual analysis is that when considering only projected land-usechange, Okanogan County goes from having the most land protected by acquisitions to having the second most protection—being surpassed by Kittitas County, which is projected to be more heavily impacted by land-use change.

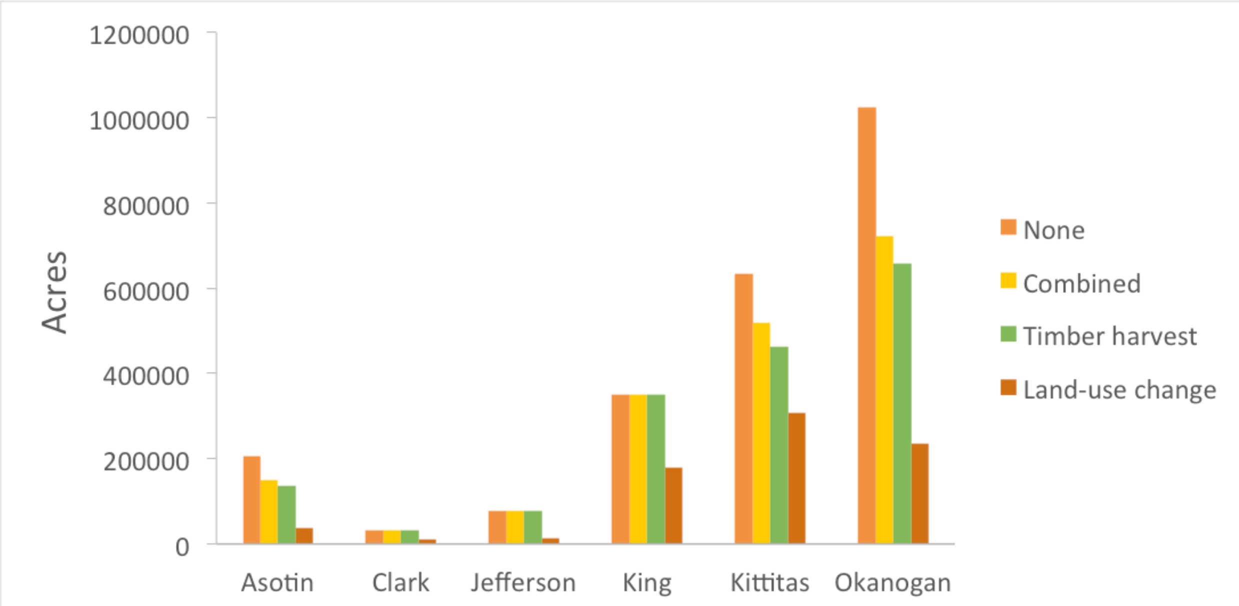


Figure 7. Acres of potential habitat (summed across all species) protected by state acquisitions between 1990 and 2015. The dark orange bars are the result of an analysis that assumes that, had they not been purchased, all acquisitions would have been converted to some other land use. The yellow bars represent the area of habitat across which logging was likely prevented by the acquisitions. The green bars represent the area of species habitat that would be protected by the acquisitions from land-use changes projected to take place by 2050.

Edge Effects

Although the footprints of the multiple regulations together cover at least three times more land than do the acquisitions made from 1990 to 2015, the pattern of the regulation footprints is strikingly different than that of the acquisitions (Fig. 8). The regulatory buffers associated with streams, wetlands, and other water bodies result in a dendritic and fragmented pattern whereas the acquisitions are more compact chunks of land. Not surprisingly, when edge effects are considered, the area of land covered by the regulation buffers that is suitable for edge sensitive species, drops dramatically (Fig. 9). The regulations provide almost no habitat interior (area far enough from an edge to qualify as habitat for an edge sensitive species) for edge distances of 82 m or greater. Results for individual species can be found in Appendix C.

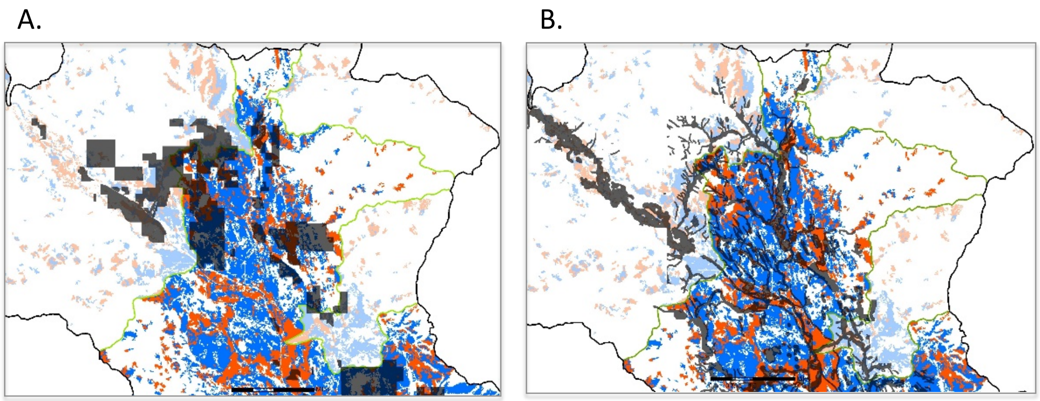


Figure 8. Example of the spatial pattern of acquisitions (A., gray polygons) and the footprint of regulation buffers (B., grey polygons). Red and blue areas denote habitat quality and the green line represents a species range boundary (for the Columbia Sharp-tailed Grouse).

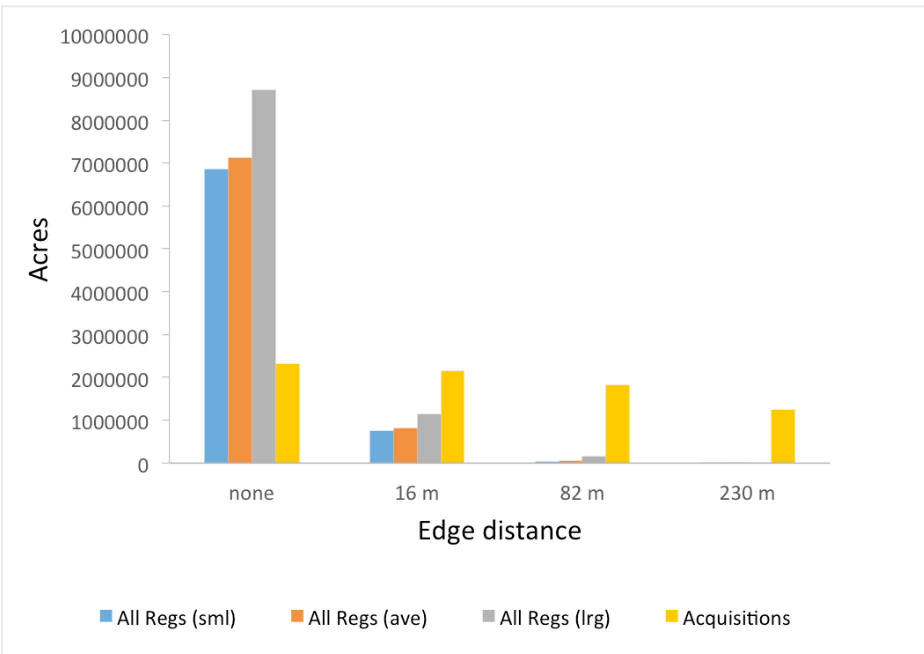


Figure 9. Acres of land protected by regulations and by state acquisitions between 1990 and 2015. The four sets of four bars each represent acres of land that is a given distance from an edge.

Aquatic habitat protection

The regulations, which are largely in part designed to protect stream quality, cover many more stream miles than do acquisitions, which were implemented to protect terrestrial habitat, or for recreational purposes (Fig. 10).

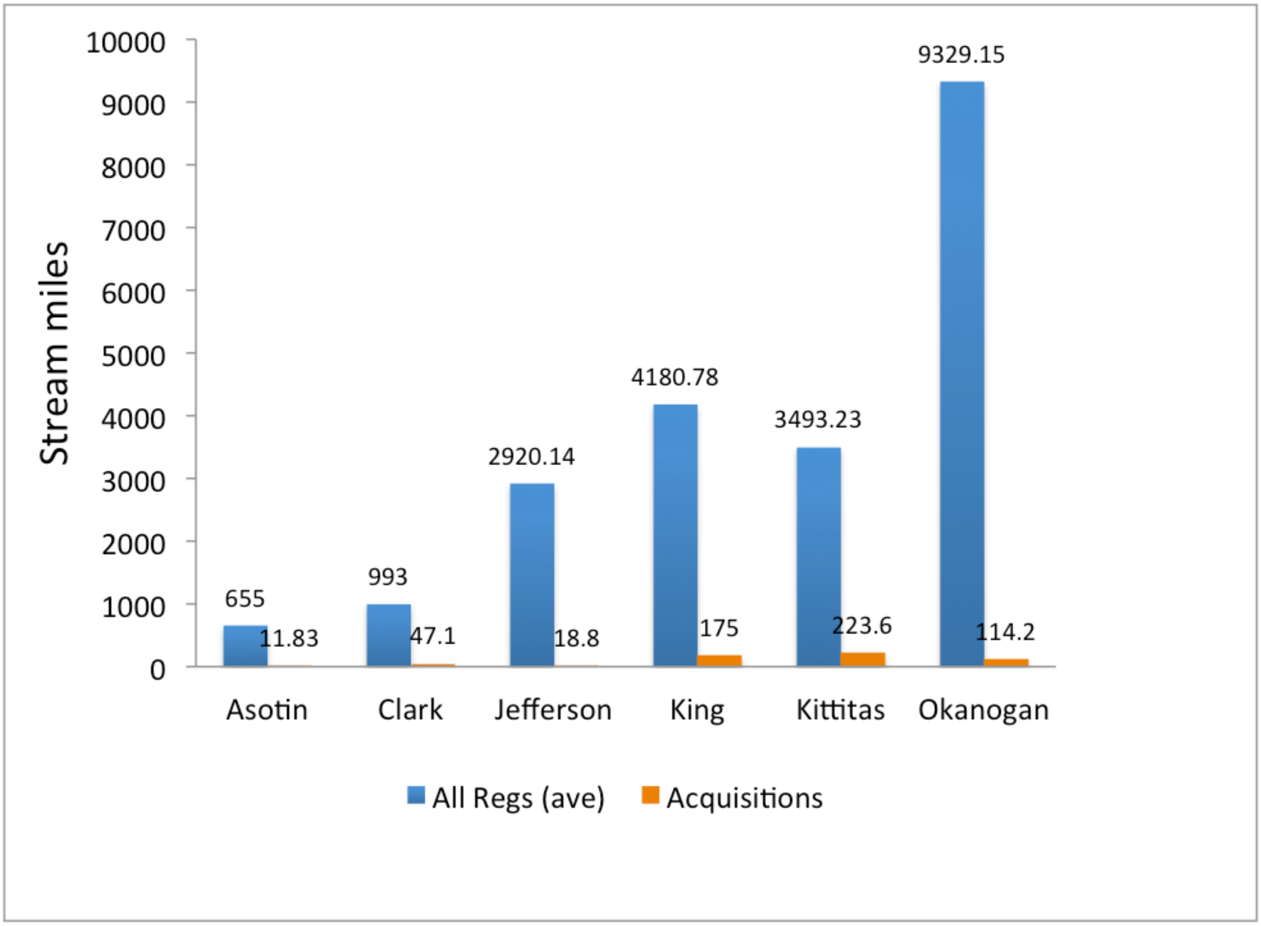


Figure 10. Miles of streams protected by regulations and land acquisitions made between 1990 and 2015.

Case studies

Case studies for four species follow. We selected these species to demonstrate potential nuances of the results for individual species that are either sensitive to edges or have larger or smaller home-range requirements.

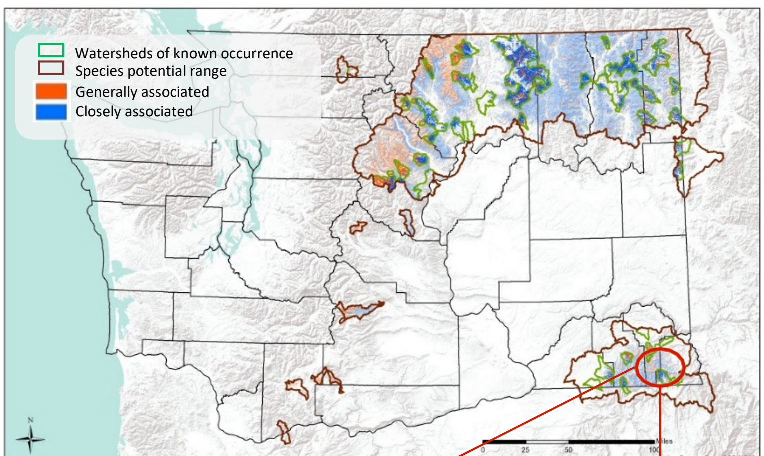
Case Study: Great Gray Owl

(*Strix nebulosa*)

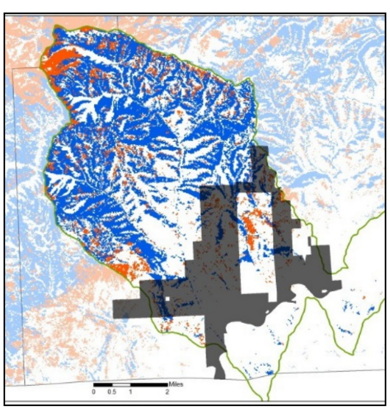
Life History

Great gray owls (*Strix nebulosa*) are large and tend to avoid areas with people. Their preferred habitat is generally dense evergreen pine and fir forests with small openings or meadows nearby but are somewhat common in mixed oak woodlands in Oregon and California. Great gray owls require live and dead large-diameter trees used for nesting, leaning trees used by juveniles for roosting before they can fly, and dense canopy closures in stands used by juveniles for cover and protection. These birds are likely to be moderately sensitive to edges and have relatively large (mean=67.3 km^2) home ranges.

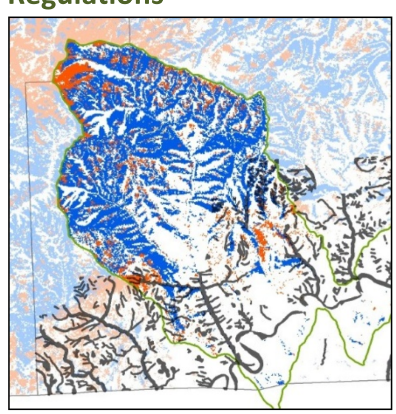
Habitat & Occurrence Maps



Acquisitions

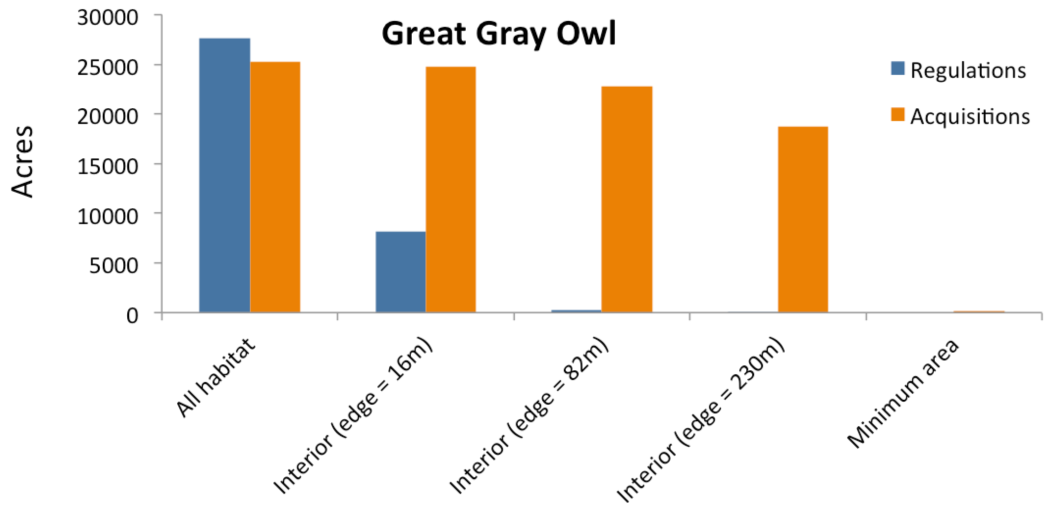


Regulations



Case Study: Great Gray Owl continued

Habitat Analyses



The spatial footprint of the regulations covered slightly more habitat than did the acquisitions. However, when edges of 82m and 230m were considered, the regulations provided almost no habitat. When area requirements were considered, acquisitions provided about 167 acres of habitat, compared to no habitat provided by the regulations. The Great Gray Owl is an example of a species that is likely to benefit more from acquisitions than from regulations, due to its need for larger tract of habitat and its moderate sensitivity to edges.

Other Considerations

It is important to note that the Great Gray Owl requires older, larger trees for nesting. The habitat maps we used are based solely on basic vegetation associations (i.e., the composition of vegetation), not the structure of the vegetation. Thus, not all areas identified as habitat are likely to be suitable for these owls. In addition, as with other species requiring large areas of habitat, our analyses that include area requirements may have underestimated the area of habitat provided by acquisitions, and to a lesser degree, by regulations.

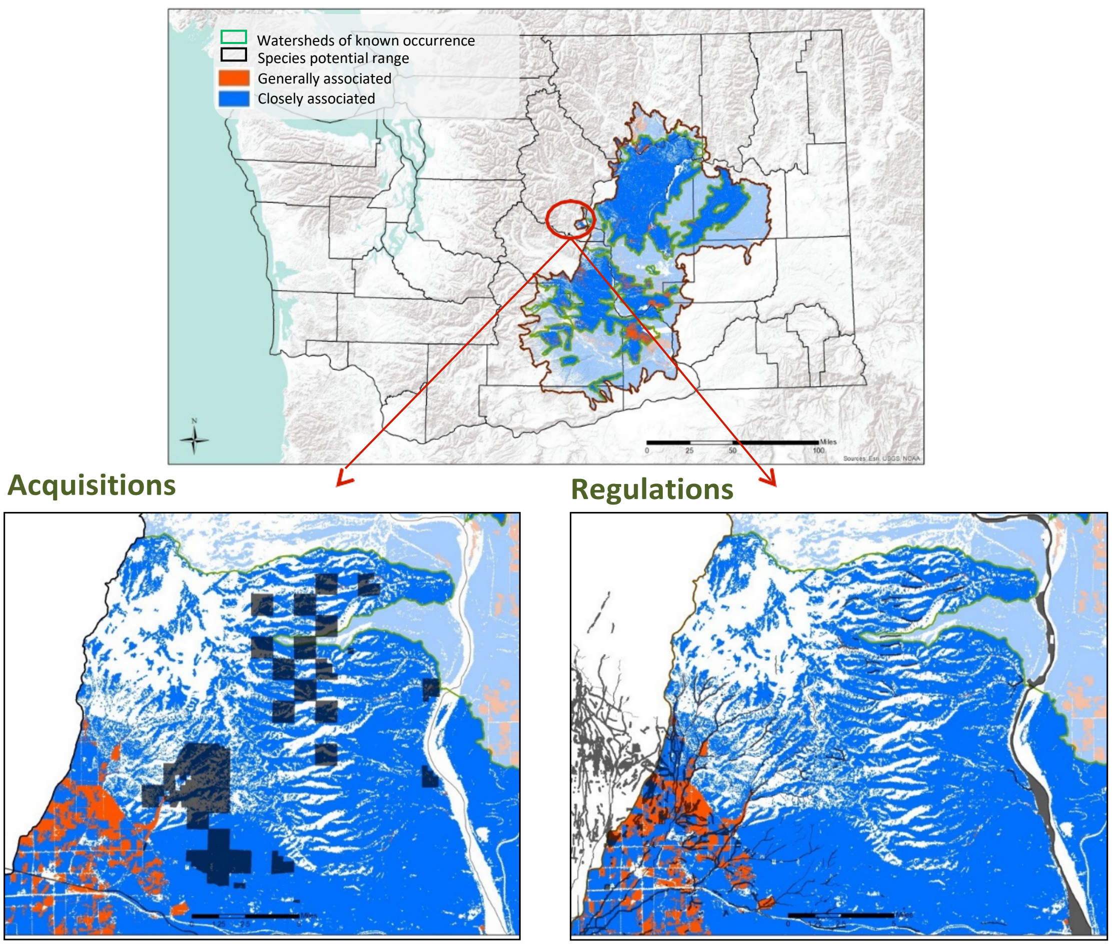
Case Study: Greater Sage Grouse

(*Centrocercus urophasianus*)

Life History

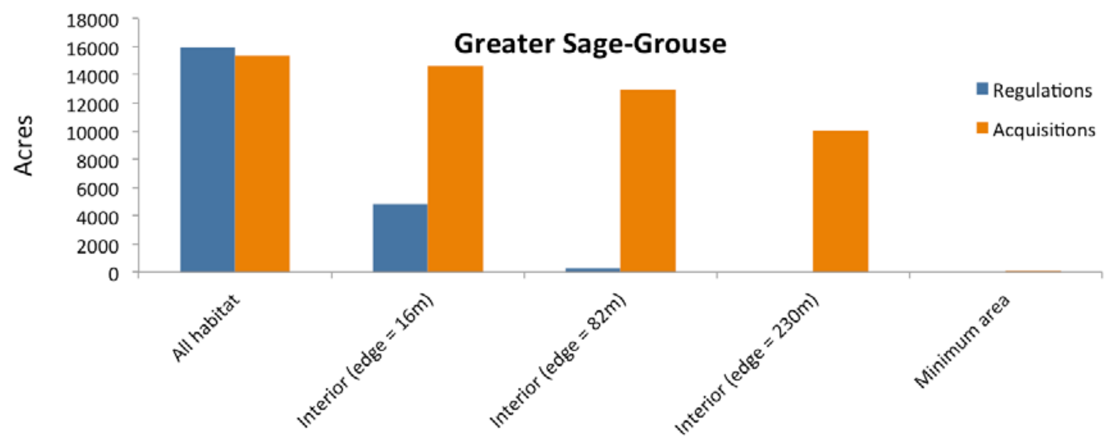
The largest species of grouse, the greater sage grouse (*Centrocercus urophasianus*) depends on sagebrush steppe of the intermountain West. Although their historical range covered a large portion of North America, human caused land-use change and development is largely responsible for much of their population decline. This species is especially sensitive to disturbances such as urban and energy development.

Habitat & Occurrence Maps



Case Study: Greater Sage Grouse continued

Habitat Analyses



The spatial footprint of the regulations covered slightly more Greater Sage-Grouse habitat than did the acquisitions. However, the utility of the areas protected by regulations dropped dramatically when even 16m edges were considered. Given that the sage grouse is highly sensitive to edges, edges of 82 m and greater will likely keep all but a few patches of land protected by regulations from serving as habitat. When area requirements were considered, the acquisitions provided only nominal amounts of habitat and the regulations provided no habitat.

Other Considerations

Our findings for the Sage Grouse need to be tempered by at least two factors. First, although our analysis that took into account area requirements found no habitat, it is critical to note that these analyses do not include a more informed counterfactual. That is, they assume that any land that is not currently protected will be developed or otherwise made unsuitable for habitat. Because this is not likely to be the case, at least not in the next 50 years, some of the acquisitions at least, might provide habitat in the absence of extensive land conversion. It is also important to note that Sage Grouse require a mixture of drier areas and more mesic areas. The habitat maps we used do not account for this distinction.

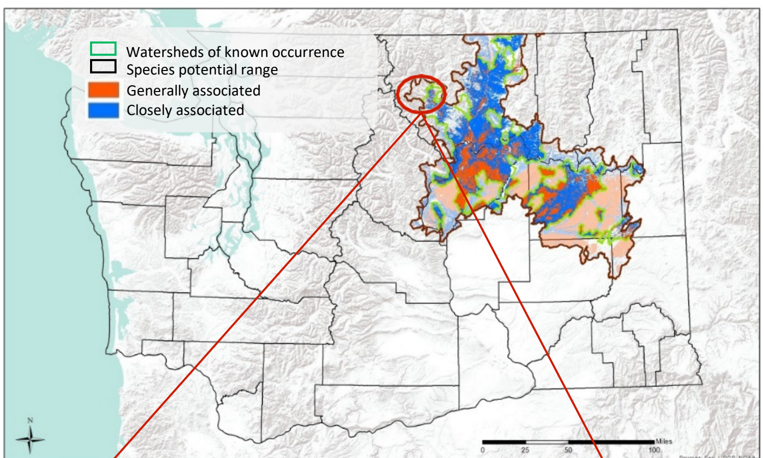
Case Study: Columbian Sharp-Tailed Grouse

(*Tympanuchus phasianellus*)

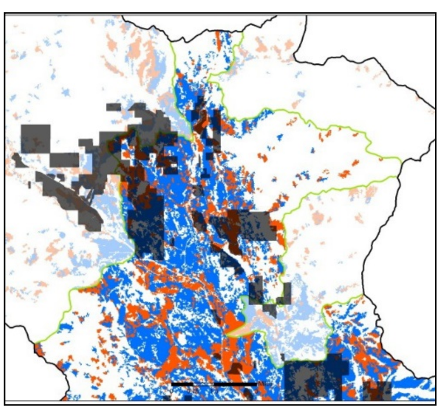
Life History

Sharp-tailed grouse, also known as fire bird by Native Americans depend on prairie ecosystems ranging from pine savannahs of the eastern upper Midwest to grass and shrub steppe ecosystems. The sharp-tailed grouse is a lekking bird species, which display their mating patterns in open areas known as leks. Although males can share their leks with other males, this species requires sometimes different patches of habitat for food resources, breeding, summer and winter habitats.

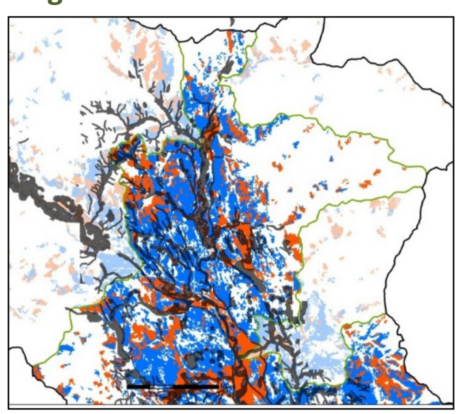
Habitat & Occurrence Maps



Acquisitions

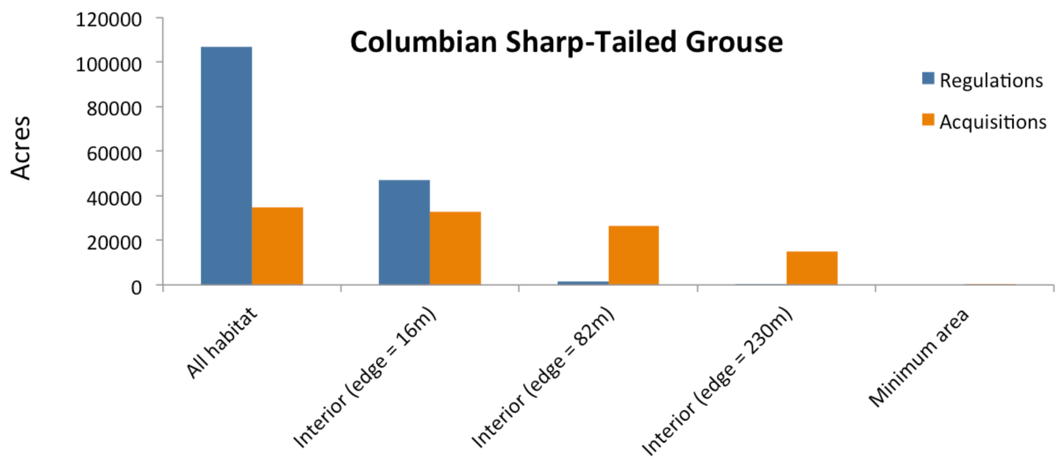


Regulations



Case Study: Columbian Sharp-Tailed Grouse continued

Habitat Analyses



Without any consideration of habitat configuration, the regulations appear to provide about four times as much habitat for the Columbian Sharp-tailed than do the acquisitions. However, when edges of at least 82 m and home range areas are taken into account for this species with moderate edge sensitivity and average home range size of 5.80 km^2, the regulations provide little if any habitat. When the strict home range requirement was used in the analysis, the acquisitions provided 137 acres of habitat compared to no habitat provided by the regulations.

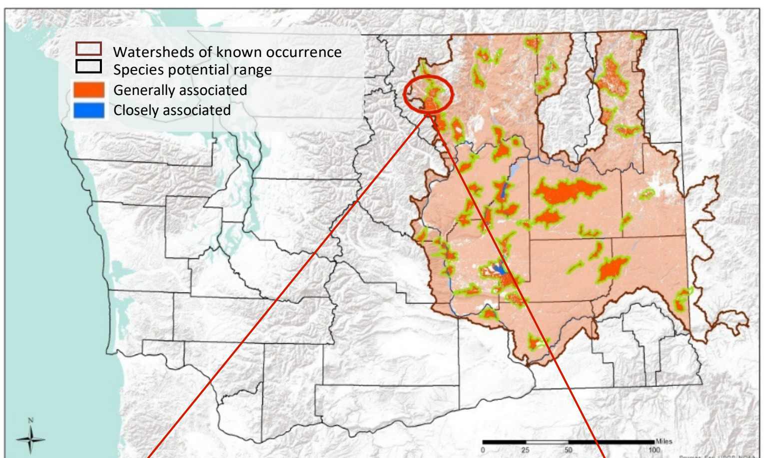
Case Study: Tiger Salamander

(*Ambystoma tigrinum*)

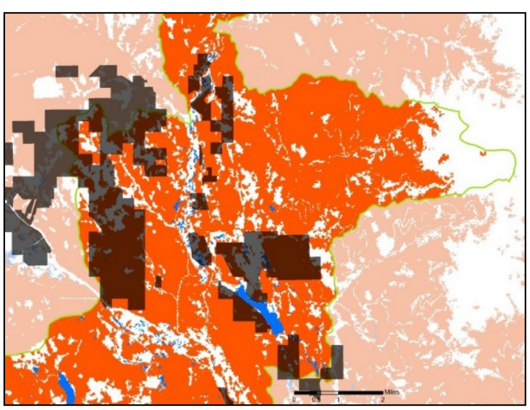
Life History

One of the largest and longest living terrestrial salamanders, the tiger salamander (*Ambystoma tigrinum*) requires both terrestrial and aquatic environments. Specifically, they prefer moist habitats with close proximity to fresh water and suitable substrate for burrowing. Tiger salamander occurrence is primarily in arid areas that support shrub-steppe vegetation but can also be found in dry ponderosa pine/Douglas-fir forests. Breeding usually takes place in perennial ponds but sometimes occurs in seasonal water bodies as well.

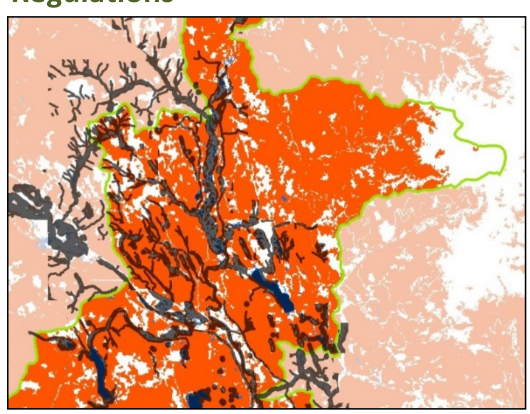
Habitat & Occurrence Maps



Acquisitions

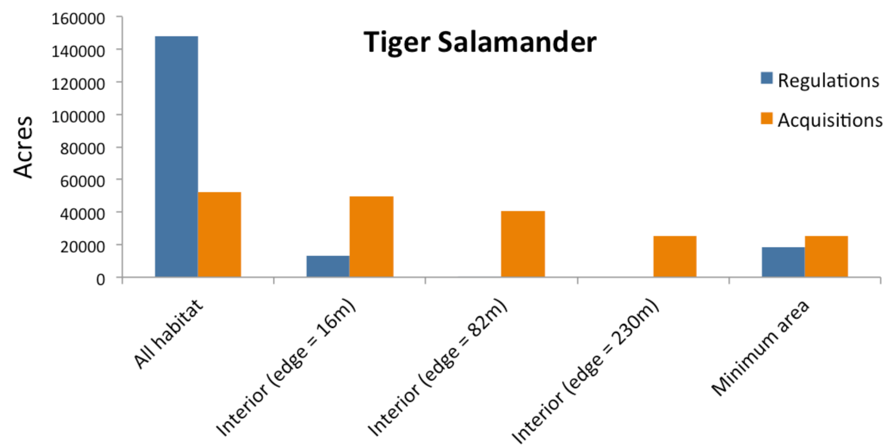


Regulations



Case Study: Tiger Salamander continued

Habitat Analyses



Because the tiger salamander is moderately sensitive to edges, like the other case study species, the high density of edges associated with the spatial footprint of the regulations reduces the utility of these areas as habitat when edges are considered to be 16 m wide and all but eliminates it when it when they are 82m or larger. Unlike the other case study species, however, the tiger salamander has a relatively small home range and thus even when area requirements are considered, the regulations may still have enough habitat to be of use to the salamander.

Other Considerations

Although many of the regulation buffers are around streams and wetlands, not all areas delineated by the regulation or the acquisitions will likely have the combination of upland and aquatic habitat needed by the salamander for breeding and other aspects of its natural history.

Potential additional analyses and associated data needs

As noted in the Objectives and Constraints section, the analyses performed here were limited by the availability of data and the scope of the project. Given more time, funding, and data, the objectives could have been better met. Below, we provide some examples of additional analyses that could be performed in the future and the data that would be required to carry them out.

Hypothetical watershed analysis

Quantifying the miles of stream protected by either regulations or acquisitions only provides a very limited understanding of potential aquatic habitat benefits from these land protections. Land cover composition and habitat protection within any given watershed significantly affect the quality of in-stream habitat for fish and other aquatic species. However, the relationship between land cover and in-stream habitat quality is complex and as a result, we did not have the time or resources to conduct a full investigation into these benefits for this report. However, here we provide a general overview of the type of analysis that would be needed to better compare the habitat benefits provided by regulatory buffers versus general land acquisition.

Research has documented that land-cover composition of a watershed significantly impacts in-stream water quality. Specifically, in Western Washington, basins with more forest cover and lower levels of impervious surface tend to have higher quality aquatic habitat as measured by macro-invertebrate diversity and composition and hydrologic characteristics (Booth et al. 2002). However, the location and distribution of forest and impervious cover, as well as the number of roads crossing a stream also has a significant impact on habitat quality (Alberti et al. 2007). Booth and others (2002) recommend that any given watershed remain at least 65% forested. The following list provides some examples of analysis steps that could be used to evaluate aquatic habitat benefits:

1. Delineate hydrologic watershed or basin boundaries to identify all lands that drain to any given point in the stream or waterbody of interest.
2. Simple threshold-based evaluation:
    a. Evaluate total land-cover composition within the watershed including quantifying at a minimum: % impervious surface, % forest cover, % agriculture, and % non-forest natural vegetation.
    b. Evaluate whether existing protected areas (not including regulations or acquisitions) protect enough forested land to meet the 65% forested threshold.
    c. Evaluate what percentage of the watershed would be protected forestland with and without the regulatory protections or acquisitions, using the counterfactual land conversion estimates from previous analyses.
3. Moderately complex hydrologic distance analysis:
4. Calculate hydrologic distance (i.e. the distance over which water would flow) from each location (cell) within each watershed to the stream.
    a. Develop a weighting system by distance to stream so land-cover types for locations closer to the stream have a higher impact on in-stream water quality.

    b. Calculate the benefit of protected areas as a function of their distance to the stream.

5. More complex hydrologic model evaluation: Use a hydrologic model, such as InVest (https://www.naturalcapitalproject.org/invest/), to evaluate changes to in-stream habitat with and without the regulatory protections or acquisitions, using the counterfactual land conversion estimates from previous analyses.

Hypothetical Hydraulic Project and Clean Water Act permit impact analysis

To assess the potential positive impacts of the Hydraulic Project Approvals Act and Clean Water Act permitting on freshwater habitat in Washington, it would be necessary to have data on the negative impacts of approved projects and permitted actions as well as the avoided negative impacts of projects and actions that were not permitted and thus not undertaken *and* the avoided negative impacts of permitted projects and actions that would have been undertaken in a different way without the act in question. Although is possible to find data on the potential impacts of some of the projects and actions that have been permitted, determining the avoided impacts is difficult. The following actions would allow one to start to build a database to enable such an analysis.

- Tracking all projects and actions that were denied permits and hence were not undertaken (this applies to the Clean Water Act permitting process, but not the HPA because, to the best of our knowledge, those projects are all permitted)
- Tracking the proposed or intended actions that would have been undertaken in the absence of the two acts. This would likely be a combination of data collection and modeling to predict foregone actions.
- Determining the impact of projects and actions both taken and not taken. This would likely require literature searches, experiments, monitoring, and modeling.

Hypothetical population-level analyses

The degree to which the spatial footprint of regulations and acquisitions overlap potential habitat for each of the analyzed species is a relatively coarse estimate of the degree to which these two policy tools affect wildlife. As demonstrated in the case studies, these basic analyses may provide a sufficient estimate for some species but are unlikely to provide robust estimates for species with complex habitat needs or life histories. For these latter species, a more robust assessment would involve the use of spatially explicit, individual-based population models built for each species. Such an effort is only possible for species with, at a minimum, data on demographics and movement behavior.

More refined counterfactual analyses

Our counterfactual land-use analysis was based on a single projected land-use change based one econometric model projection. This is projection was based on land-use returns and land-use change patterns from one historical time period and thus may not reflect future land-use trends. A more robust analysis would include multiple land-use change projections and would likely yield a range of results. It is also important to note that they projections are more realistic for shorter time periods. We projected out 50 years, yet acquisitions will likely protect land beyond

50 years. To assess the benefits of doing so, one would need land-use change models that were less uncertain when used to project further into the future. Such models may or may not exist.

Similarly, our counterfactual analysis for timber harvest was based on several simplifying assumptions. Our estimated harvest rates are merely estimates and will vary by landowner and tree species. But perhaps more importantly, we assumed that if a forest was cut in our 50-year assessment period, then the acquisition in question had prevented habitat loss. In reality, that piece of land would have served as habitat for some species for some of the time period and for other species during other parts of the time period. A more accurate assessment of the benefit provided by acquisitions would require a dynamic model that took into account forest age and forest age based habitat requirements.

Summary of data needs for more robust assessments of the benefits for aquatic and terrestrial habitat of acquisitions and regulations

1. Data on the impacts of permitted HPAs and on the hypothetical impacts of the same projects if they had not been required to go through the HPA process
2. Data on the impacts of activities and facilities permitted though the Clean Water Act and hypothetical impacts of these activities and facilities in the absence of the Clean Water Act.
3. More comprehensive species distribution data
4. Data on minimum usable habitat densities
5. Estimated species-specific edge effects
6. Sub-county level land-use change projections
7. Better maps of wetlands. It has come to our attention that a spatial data layer of wetlands exists for Asotin County that is likely better than the one we used in our analyses. Building a better spatial dataset of wetlands would benefit analyses like these as well as many other assessments and planning activities.
8. A better understanding of the way that regulations are interpreted in different counties and the degree to which regulations are differentially enforced

Future planning

The analyses provided here are retrospective in nature. Although these analyses provide an assessment of the relative benefits of regulations and recent acquisitions, they do not provide guidance on the degree to which future acquisitions could benefit fish and wildlife and how those acquisitions could be sited to maximize benefits while minimizing costs. Using existing spatial data layers and conservation planning tools, it would be quite possible to provide such guidance.

Conclusions

Regulations and acquisitions serve different purposes.

It was clear from our analyses that acquisitions cannot provide nearly as much protection for streams as can the regulations designed to reduce impacts to riparian areas. Similarly, our analyses of the ability of acquisitions and regulations to protect terrestrial habitat demonstrated that the linear, fragmented pattern of the spatial footprints of the regulations largely rendered these lands unsuitable for species that are sensitive to and/or avoid edges or have larger home ranges. Regulations may provide habitat for species that are not sensitive to edges and that have relatively small home ranges. Thus, for at-risk species, which are often, but not always, sensitive to habitat edges and have larger home ranges, the regulations are not likely to provide much usable habitat.

Our counterfactual analysis revealed that when one considers avoided habitat loss due to both land conversion and timber harvest, the majority of the acquired land is likely protecting habitat over the 50-year period we considered. If one were to take an even longer-term view (e.g., a 100-year period) even more of the acquired land would prevent land-use change or timber harvest.

Nonetheless, there were clear differences across the counties. In counties with higher rates of land conversion (e.g., King and Kittitas) and shorter rotation lengths (counties on the west side of the Cascades), all else being equal, acquisitions can be seen as more effective investments because they are countering more immediate threats of habitat loss. All else is, of course, not equal. For example, it is impossible to protect sage grouse habitat by acquiring land on the west side of the Cascades. Thus, to provide protection for all species at risk, investments may need to be made in places where the threat of land conversion is lower. Furthermore, just because a species might be in a county that is experiencing lower land conversion rates in general, the particular land that serves as habitat may be more threatened than that in the rest of the county.

Thus, it is important to note that much more goes into selecting which land parcels to purchase than the threat of land conversion or timber harvest.

Results of this study need to be understood in the context of the limitations of the analyses and data.

To our knowledge, this study made use of the best available data. Nonetheless, the results need to be considered in light of the limitation of those data. For example, our analyses considered habitat composition but not structure. The structure of the vegetation is often as important if not more important for species than is the composition. Thus, the habitat maps we used likely overestimate habitat availability. In addition, we assumed that the regulations and acquisitions will protect habitat within their spatial footprints. This assumption is likely to be more valid for acquisitions than for regulations. For example, some harvest is allowed in the Forest Practices buffers and development is not always prevented within the Growth Management Act buffers. Nonetheless, the basic conclusions that we have drawn from our results are likely valid given that they are based on coarse and clear patterns.

Literature Cited

Alberti M, Booth D, Hill K, Coburn B, Avolio C, Coe S, and Spirandeli D. 2007. The impact of urban patterns on aquatic ecosystems: An empirical Analysis in Puget lowland sub-basins. *Landscape and Urban Planning* 80:345-361.

Beatley T. 2000. Preserving biodiversity -- challenges for planners. *Journal of the American Planning Association* 66:5.

Booth DB, Hartley D, Jackson R. 2002. Forest cover, impervious-surface area, and the mitigation of stormwater impacts. *Journal of the American Water Resources Association* 33:835-845.

Chen J, Franklin JF, Spies TA. 1992. Vegetation responses to edge environments in old-growth Douglas-fir forests. *Ecological Applications* 2:387–396.

Chen J, Saunders SC, Crow TR, Naiman RJ, Brosofske KD, Mroz GD, Brookshire BL, Franklin JF. 1999. Microclimate in Forest Ecosystem and Landscape Ecology: Variations in local climate can be used to monitor and compare the effects of different management regimes. *BioScience* 49:288–297.

Lawler JJ, Lewis DJ, Plantinga AJ, Polasky S, Withey J, Helmers D, Martinuzzi S, and Radeloff V. 2014. Projected land-use change impacts on ecosystem services in the U.S. *Proceedings of the National Academy of Sciences* 111:7492–7497.

Murcia C. 1995. Edge effects in fragmented forests: implications for conservation. *Trends in Ecology & Evolution* 10:58–62.

Radeloff VC, Nelson E, Plantinga AJ, Lewis DJ, Helmers D, Lawler JJ, Withey JC, Beaudry F, Martinuzzi S, Butsic V, Lonsdorf E, White D, and Polasky S. 2012. Economic-based projections of future land use in the conterminous United States under alternative policy scenarios. *Ecological Applications* 22:1036–1049.

Soulé ME. 1991. Land Use Planning and Wildlife Maintenance: Guidelines for Conserving Wildlife in an Urban Landscape. *Journal of the American Planning Association* 57:313.

Appendix A.
Edge sensitivities and area requirements

Common name	edge sensitivity	confidence in habitat / confidence in sensitivity	med range estimate (km2)	high range estimate (km2)	range confidence
American Badger	MOD	MOD/HIGH	0.556333333		MOD
American pika	MOD	HIGH/LOW	0.0035		HIGH
bald eagle	HIGH	HIGH/MOD	22	47	MOD
black-tailed jackrabbit	MOD	HIGH/LOW	1.4555		HIGH
Brush Prairie pocket gopher	MOD	HIGH/LOW	0.0003	0.000572	MOD
burrowing owl	MOD	HIGH/MOD	2.41		MOD
Canada lynx	HIGH	HIGH/HIGH	52.5		HIGH
Cascade red fox	HIGH	HIGH/MOD	11.865	19.76	MOD
Cascade Torrent Salamander	HIGH	HIGH/MOD	0.0029		LOW
Columbia Spotted Frog	MOD	HIGH/LOW	2.975		LOW
common loon	MOD	HIGH/LOW	1.25	2	LOW
Cope's giant salamander	HIGH	HIGH/LOW	0.4325		LOW
ferruginous hawk	HIGH	HIGH/HIGH	2.061		LOW
fisher	HIGH	HIGH/HIGH	20.96	40	HIGH
golden eagle	LOW	HIGH/MOD	22	47	LOW
gray wolf	HIGH	HIGH/HIGH	133.5		HIGH
Great Gray Owl	MOD	HIGH/LOW	67.3	129	MOD
greater sage-grouse	HIGH	HIGH/HIGH	309.5	615	HIGH
grizzly bear	HIGH	HIGH/MOD	503.15	773.8	HIGH
hoary bat	MOD	HIGH/LOW	25.5		LOW
Kincaid's meadow vole	MOD	MOD/HIGH	0.0012		LOW
Larch Mountain Salamander	HIGH	HIGH/HIGH	0.0029		LOW
Lewis woodpecker	MOD	HIGH/MOD	0.676		LOW
loggerhead shrike	MOD	HIGH/LOW	0.0175	0.03	LOW
marbled murrelet	HIGH	HIGH/HIGH	0.08		MOD
marten	HIGH	HIGH/HIGH	10.58	20.57	MOD
night snake	MOD	MOD/MOD	0.2065		LOW
Northern Spotted Owl	HIGH	HIGH/HIGH	24.178		MOD
Olympic marmot	MOD	HIGH/LOW	0.003		LOW
Olympic Torrent Salamander	HIGH	HIGH/HIGH	0.0029		LOW
Oregon Spotted Frog	MOD	HIGH/LOW	0.022		HIGH
Oregon Vesper Sparrow	HIGH	HIGH/HIGH	0.0175	0.03	LOW
peregrine falcon	LOW	HIGH/MOD	71.5	340.5	LOW
Purple Martin	MOD	HIGH/MOD	0.0175	0.03	LOW
Pygmy Horned Lizard	MOD	HIGH/LOW	1.517		LOW
Pygmy Nuthatch	MOD	HIGH/MOD	0.0175	0.03	LOW
pygmy rabbit	HIGH	HIGH/HIGH	0.052		HIGH
Rednecked Grebe	MOD	HIGH/LOW	1.25	2	LOW
ringneck snake	MOD	HIGH/LOW	0.003848		MOD

Appendix A.
Edge sensitivities and area requirements

Rocky Mountain tailed frog	HIGH	MOD/LOW	0.022		MOD
Sagebrush Lizard	MOD	HIGH/LOW	0.271		MOD
sagebrush sparrow	HIGH	HIGH/HIGH	0.0175	0.03	LOW
Sharp Tailed Grouse	MOD	HIGH	5.89	7.77	HIGH
sharp-tailed snake	LOW	HIGH/MOD		65.95	LOW
Side Blotched Lizard	MOD	HIGH/LOW	0.428714286		HIGH
silver-haired bat	MOD	HIGH/LOW	20.5		LOW
Slender Billed White Breasted Nuthatch	MOD	HIGH/MOD	0.0175	0.03	LOW
spotted bat	MOD	HIGH/LOW	297		MOD
streaked horned lark	LOW	HIGH/MOD	0.0175	0.03	LOW
striped whipsnake	HIGH	HIGH/MOD	0.2065		MOD
Taylor's checkerspot	HIGH	HIGH/MOD	0.19		LOW
tiger salamander	MOD	HIGH/MOD		0.173	LOW
Townsend's big-eared bat	HIGH	HIGH/HIGH	12.4	24	LOW
Townsend's ground squirrel	MOD	HIGH/LOW	0.54975	0.902	LOW
Valley Silverspot	HIGH	HIGH/MOD	0.19		LOW
Van Dykes Salamander	HIGH	HIGH/HIGH	0.0029		LOW
Washington ground squirrel	MOD	HIGH/LOW	0.54975	0.902	LOW
Western Bluebird	LOW	HIGH/MOD	0.0175	0.03	LOW
Western Gray Squirrel	HIGH	HIGH/MOD	0.003		LOW
western grebe	MOD	HIGH/LOW	1.25	2	LOW
western pond turtle	MOD	MOD/HIGH	0.5		LOW
western toad (boreal toad)	MOD	MOD/LOW	0.4825		HIGH
White Headed Woodpecker	MOD	HIGH/MOD	0.676		LOW
white-tailed jackrabbit	MOD	HIGH/LOW	1.4555		LOW
wolverine	HIGH	HIGH/HIGH	40		HIGH
Woodhouse's toad	MOD	MOD/LOW	0.4825		LOW
yellow-billed cuckoo	MOD	HIGH/LOW	0.1		LOW

Appendix B

Table 1: Amount of observed species habitat area (in acres) protected by acquisitions.

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
ACMA	Spotted sandpiper	0.0	0.0	0.0	6.0	0.0	0.0
AECL	Clark's grebe	0.0	0.0	0.0	0.0	0.0	0.0
AMNE	sagebrush sparrow	0.0	0.0	0.0	0.0	11247.8	16.5
AMTI	tiger salamander	0.0	0.0	0.0	0.0	260.0	11071.9
ANBO	western toad (boreal toad)	131.0	77.6	3716.7	9920.1	3990.7	7492.5
ANWO	Woodhouse's toad	0.0	0.0	0.0	0.0	0.0	0.0
AQCH	golden eagle	0.0	0.0	0.0	0.0	0.0	0.0
ASMO	Rocky Mountain tailed frog	67.2	0.0	0.0	0.0	0.0	0.0
ATCU	burrowing owl	0.0	0.0	0.0	0.0	11284.1	2515.7
BRID	pygmy rabbit	0.0	0.0	0.0	0.0	0.0	0.0
BRMA	marbled murrelet	0.0	0.0	5049.0	1064.4	100.5	0.0
BURE	ferruginous hawk	0.0	0.0	0.0	0.0	0.0	0.0
CALU	gray wolf	0.0	0.0	0.0	0.0	0.0	0.0
CEUR	greater sage-grouse	0.0	0.0	0.0	0.0	1541.2	0.0
COAM	yellow-billed cuckoo	11.1	0.0	0.0	2.0	0.0	96.5
CONTE	sharp-tailed snake	0.0	0.0	0.0	0.0	2804.4	0.0
COTO	Townsend's big-eared bat	0.0	0.0	0.0	4676.5	9531.0	17048.1
DICO	Cope's giant salamander	0.0	64.7	279.3	0.0	0.0	0.0
DIPU	ringneck snake	0.0	0.0	0.0	0.0	0.0	0.0
ERALS	streaked horned lark	0.0	0.0	0.0	0.0	0.0	0.0
EUED	Taylor's checkerspot	0.0	0.0	0.0	0.0	0.0	0.0
EUMA	spotted bat	0.0	0.0	0.0	0.0	4676.5	5049.7
FAPE	peregrine falcon	980.3	1986.7	773.7	21861.9	11343.0	13936.1
GAIM	common loon	0.0	0.0	0.0	50.3	0.0	39.6
GUGU	wolverine	0.0	0.0	0.0	0.0	0.0	0.0
HALE	bald eagle	3254.3	3317.2	6457.2	6458.4	6661.6	18202.1
HYTO	night snake	0.0	0.0	0.0	0.0	0.0	197.9
LACI	hoary bat	0.0	0.0	0.0	233.7	9412.6	664.7
LALU	loggerhead shrike	0.0	0.0	0.0	0.0	14879.3	4920.0
LANO	silver-haired bat	0.0	0.0	127.7	0.0	18004.6	5679.5
LECA	black-tailed jackrabbit	0.0	0.0	0.0	0.0	909.6	0.0
LETO	white-tailed jackrabbit	0.0	0.0	0.0	0.0	11345.9	720.8
LYCA	Canada lynx	0.0	0.0	0.0	0.0	0.0	0.0
MAAM	marten	0.0	0.0	0.0	0.0	0.0	0.0
MAPE	fisher	0.0	0.0	0.0	0.0	0.0	0.0
MATA	striped whipsnake	0.0	0.0	0.0	0.0	0.0	0.0
MELE	Lewis woodpecker	555.8	0.0	0.0	0.0	5314.6	6544.0
OCPR	American pika	0.0	0.0	0.0	366.5	145.2	755.7
ODVIL	Columbian white-tailed deer	0.0	1746.0	0.0	0.0	0.0	0.0
ORMO	Sage thrasher	1.3	0.0	0.0	0.0	12755.2	5180.0
OTFL	Flammulated owl	178.8	0.0	0.0	0.0	7624.1	8493.7
OTKE	Western screech-owl	0.0	193.5	167.5	17916.8	0.0	0.0
PEER	American white pelican	0.0	0.0	0.0	0.0	0.0	0.0
PHDO	Pygmy Horned Lizard	0.0	0.0	0.0	0.0	3920.6	7044.8
PIAL	White Headed Woodpecker	215.5	0.0	0.0	0.0	9017.7	5449.3
PLLA	Larch Mountain Salamander	0.0	0.0	0.0	0.0	691.0	0.0
PLVA	Van Dykes Salamander	0.0	0.0	18.7	0.0	0.0	0.0
POGR	Rednecked Grebe	0.0	0.0	0.0	0.0	0.0	37.8
PRSU	Purple Martin	0.0	26.7	75.0	143.9	0.0	0.0
RALU	Columbia Spotted Frog	0.0	0.0	0.0	0.0	521.3	12055.6
RAPR	Oregon Spotted Frog	0.0	0.0	0.0	0.0	0.0	0.0
RHCAS	Cascade Torrent Salamander	0.0	522.2	0.0	0.0	0.0	0.0
RHOL	Olympic Torrent Salamander	0.0	0.0	1045.7	0.0	0.0	0.0
SCGRA	Sagebrush Lizard	0.0	0.0	0.0	0.0	101.2	1212.0
SCGRI	Western Gray Squirrel	0.0	0.0	0.0	0.0	991.4	6035.8
SICARA	Slender Billed White Breasted Nuthatch	0.0	455.9	0.0	0.0	0.0	0.0
SIME	Western Bluebird	0.0	1680.2	618.5	1501.8	12.2	0.0
SIPY	Pygmy Nuthatch	518.0	0.0	0.0	0.0	2807.1	12648.7

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
SPZEBR	Valley Silverspot	0.0	0.0	4.5	0.0	0.0	0.0
STNE	Great Gray Owl	842.2	0.0	0.0	0.0	0.0	4243.3
STOC	Northern Spotted Owl	0.0	0.0	0.0	0.0	0.0	364.9
TATA	American Badger	0.0	0.0	0.0	0.0	0.0	0.0
THTAD	Brush Prairie pocket gopher	0.0	0.0	0.0	0.0	0.0	0.0
TYPH	Sharp Tailed Grouse	0.0	0.0	0.0	0.0	0.0	26169.4
URAR	grizzly bear	0.0	0.0	0.0	0.0	0.0	0.0
URTON	Townsend's ground squirrel	0.0	0.0	0.0	0.0	10.9	0.0
UTST	Side Blotched Lizard	0.0	0.0	0.0	0.0	1919.3	0.0
VUVUC	Cascade red fox	0.0	0.0	0.0	0.0	0.0	61.2
Total		6755.5	10070.7	18333.3	64202.3	163824.7	183948.1

Table 2: Amount of potential species habitat area (in acres) protected by acquisitions.

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
ACMA	Spotted sandpiper	0.0	537.8	739.5	625.4	0.0	0.0
AECL	Clark's grebe	0.0	0.0	0.0	0.0	0.0	0.0
AMNE	sagebrush sparrow	0.0	0.0	0.0	0.0	15831.9	518.0
AMTI	tiger salamander	0.0	0.0	0.0	0.0	9519.8	42894.4
ANBO	western toad (boreal toad)	15257.6	244.0	5672.0	27650.1	6699.6	55206.4
ANWO	Woodhouse's toad	0.0	0.0	0.0	0.0	0.0	0.0
AQCH	golden eagle	21473.1	72.3	1950.4	4771.7	33690.6	73455.7
ASMO	Rocky Mountain tailed frog	99.0	0.0	0.0	0.0	0.0	0.0
ATCU	burrowing owl	0.0	0.0	0.0	0.0	21496.2	4936.5
BRID	pygmy rabbit	0.0	0.0	0.0	0.0	1073.3	0.0
BRMA	marbled murrelet	0.0	103.9	5154.2	27225.6	109.0	0.0
BURE	ferruginous hawk	0.0	0.0	0.0	0.0	3793.4	0.0
CALU	gray wolf	5327.7	0.0	0.0	0.0	7526.7	9195.6
CEUR	greater sage-grouse	0.0	0.0	0.0	0.0	15081.3	272.2
COAM	yellow-billed cuckoo	287.6	0.0	0.0	7.6	0.0	367.6
CONTE	sharp-tailed snake	0.0	0.0	0.0	0.0	10525.7	0.0
COTO	Townsend's big-eared bat	21671.7	3082.2	6846.0	33445.3	42832.6	76694.6
DICO	Cope's giant salamander	0.0	842.2	2863.8	0.0	0.0	0.0
DIPU	ringneck snake	4077.2	234.4	0.0	0.0	14410.3	0.0
ERALS	streaked horned lark	0.0	64.7	0.0	0.0	0.0	0.0
EUED	Taylor's checkerspot	0.0	0.0	0.0	0.0	0.0	0.0
EUMA	spotted bat	0.0	0.0	0.0	0.0	11746.0	29621.0
FAPE	peregrine falcon	20142.8	3021.2	6421.4	29627.9	34464.3	59929.0
GAIM	common loon	0.0	0.0	0.0	90.3	0.0	60.5
GUGU	wolverine	2051.4	0.0	0.0	287.6	5313.5	28488.1
HALE	bald eagle	6061.4	3317.2	6648.3	28870.4	24840.4	31451.1
HYTO	night snake	9496.0	0.0	0.0	0.0	10669.4	17797.8
LACI	hoary bat	21036.5	3119.5	6847.8	33421.9	42610.0	76336.8
LALU	loggerhead shrike	0.0	0.0	0.0	0.0	23468.9	4920.0
LANO	silver-haired bat	21036.5	3120.4	6847.8	33427.1	42610.0	76336.8
LECA	black-tailed jackrabbit	0.0	0.0	0.0	0.0	16866.0	302.5
LETO	white-tailed jackrabbit	15912.4	0.0	0.0	0.0	23387.5	31320.5
LYCA	Canada lynx	0.0	0.0	0.0	0.0	0.0	25317.4
MAAM	marten	0.0	0.0	93.4	0.0	0.0	0.0
MAPE	fisher	0.0	788.6	6070.1	24059.8	14747.2	28263.7
MATA	striped whipsnake	0.0	0.0	0.0	0.0	1534.8	0.0
MELE	Lewis woodpecker	6743.5	0.0	0.0	0.0	10664.1	12213.9
OCPR	American pika	0.0	492.2	0.0	22934.0	9836.8	35129.9
ODVIL	Columbian white-tailed deer	0.0	1807.2	0.0	0.0	0.0	0.0
ORMO	Sage thrasher	203.3	0.0	0.0	0.0	15913.7	12142.8
OTFL	Flammulated owl	1106.2	0.0	0.0	0.0	11087.7	12452.1
OTKE	Western screech-owl	0.0	921.6	5363.9	28389.2	0.2	0.0
PEER	American white pelican	0.0	25.6	0.0	0.0	0.0	0.0
PHDO	Pygmy Horned Lizard	0.0	0.0	0.0	0.0	19881.7	27609.4
PIAL	White Headed Woodpecker	2843.1	0.0	0.0	0.0	13956.2	11795.4
PLLA	Larch Mountain Salamander	0.0	524.0	0.0	0.0	1259.4	0.0
PLVA	Van Dykes Salamander	0.0	0.0	2322.0	43.6	0.0	0.0

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
POGR	Rednecked Grebe	0.0	0.0	0.0	0.0	0.0	179.5
PRSU	Purple Martin	0.0	26.7	223.1	154.1	0.0	0.0
RALU	Columbia Spotted Frog	5596.3	0.0	0.0	0.0	19727.5	57017.2
RAPR	Oregon Spotted Frog	0.0	2453.5	1044.6	5725.6	0.0	0.0
RHCAS	Cascade Torrent Salamander	0.0	846.4	0.0	0.0	0.0	0.0
RHOL	Olympic Torrent Salamander	0.0	0.0	2344.5	0.0	0.0	0.0
SCGRA	Sagebrush Lizard	0.0	0.0	0.0	0.0	10133.4	6993.4
SCGRI	Western Gray Squirrel	0.0	218.6	0.0	0.0	8597.3	10180.6
SICARA	Slender Billed White Breasted Nuthatch	0.0	640.5	0.0	0.0	0.0	0.0
SIME	Western Bluebird	0.0	2757.2	3292.6	23108.8	12.2	0.0
SIPY	Pygmy Nuthatch	3929.5	0.0	0.0	0.0	10566.4	26911.1
SPZEBR	Valley Silverspot	0.0	0.0	1052.8	0.0	0.0	0.0
STNE	Great Gray Owl	2104.5	0.0	0.0	0.0	0.0	23182.4
STOC	Northern Spotted Owl	0.0	588.2	4849.8	25690.2	13704.4	2403.2
TATA	American Badger	18679.8	0.0	0.0	0.0	27377.9	45565.4
THTAD	Brush Prairie pocket gopher	0.0	1390.9	0.0	0.0	0.0	0.0
TYPH	Sharp Tailed Grouse	0.0	0.0	0.0	0.0	0.0	34620.7
URAR	grizzly bear	0.0	0.0	0.0	0.0	0.0	30553.0
URTON	Townsend's ground squirrel	0.0	0.0	0.0	0.0	16827.5	0.0
UTST	Side Blotched Lizard	0.0	0.0	0.0	0.0	8550.6	0.0
VUVUC	Cascade red fox	0.0	0.0	0.0	0.0	40.9	2229.5
Total		205137.0	31240.9	76647.7	349556.0	632986.3	1024865.8

Table 3: Amount of observed species habitat area (in acres) protected by regulations (Forest Practices, Shoreline Management Act, and Growth Management Act (average sized buffers).

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
ACMA	Spotted sandpiper	0.0	0.0	0.0	24993.2	0.0	0.0
AECL	Clark's grebe	0.0	0.0	0.0	0.0	0.0	0.0
AMNE	sagebrush sparrow	0.0	0.0	0.0	0.0	2953.0	764.1
AMTI	tiger salamander	0.0	0.0	0.0	0.0	2545.8	24836.6
ANBO	western toad (boreal toad)	0.0	2358.1	13825.0	28896.2	7022.8	24235.5
ANWO	Woodhouse's toad	0.0	0.0	0.0	0.0	0.0	0.0
AQCH	golden eagle	0.0	0.0	0.0	0.0	556.2	0.0
ASMO	Rocky Mountain tailed frog	332.5	0.0	0.0	0.0	0.0	0.0
ATCU	burrowing owl	0.0	0.0	0.0	0.0	3633.7	12453.9
BRID	pygmy rabbit	0.0	0.0	0.0	0.0	0.0	0.0
BRMA	marbled murrelet	0.0	0.0	24785.9	4182.8	234.6	0.0
BURE	ferruginous hawk	0.0	0.0	0.0	0.0	0.0	0.0
CALU	gray wolf	0.0	0.0	0.0	0.0	11.8	225.3
CEUR	greater sage-grouse	0.0	0.0	0.0	0.0	3038.1	0.0
COAM	yellow-billed cuckoo	303.6	0.0	0.0	730.8	0.0	1349.5
CONTE	sharp-tailed snake	0.0	0.0	0.0	0.0	1515.6	0.0
COTO	Townsend's big-eared bat	0.0	230.2	0.0	13415.8	2103.0	29048.3
DICO	Cope's giant salamander	0.0	1591.0	4582.9	0.0	0.0	0.0
DIPU	ringneck snake	0.0	0.0	0.0	0.0	0.0	0.0
ERALS	streaked horned lark	0.0	0.0	0.0	0.0	0.0	0.0
EUED	Taylor's checkerspot	0.0	0.0	0.0	0.0	0.0	0.0
EUMA	spotted bat	0.0	0.0	0.0	0.0	5820.5	16356.5
FAPE	peregrine falcon	2793.7	37268.9	19114.6	129094.4	33592.7	20906.5
GAIM	common loon	0.0	0.0	0.0	3409.1	0.0	5927.7
GUGU	wolverine	0.0	0.0	0.0	0.0	0.0	1.8
HALE	bald eagle	7278.1	129593.3	43904.1	223781.7	38556.8	78783.4
HYTO	night snake	0.0	0.0	0.0	0.0	0.0	2288.7
LACI	hoary bat	0.0	0.0	0.0	36354.9	13215.4	336.5
LALU	loggerhead shrike	0.0	0.0	0.0	0.0	23802.5	12643.8
LANO	silver-haired bat	0.0	0.0	3457.8	1228.3	8635.8	9162.0
LECA	black-tailed jackrabbit	0.0	0.0	0.0	0.0	371.8	0.0
LETO	white-tailed jackrabbit	0.0	0.0	0.0	0.0	6223.9	6153.2
LYCA	Canada lynx	0.0	0.0	0.0	0.0	0.0	0.0
MAAM	marten	0.0	0.0	0.0	0.0	0.0	0.0
MAPE	fisher	0.0	0.0	0.0	0.0	0.0	0.0

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
MATA	striped whipsnake	0.0	0.0	0.0	0.0	0.0	0.0
MELE	Lewis woodpecker	2424.3	0.0	0.0	0.0	16620.0	23373.0
OCPR	American pika	0.0	20.7	0.0	2560.9	469.0	800.2
ODVIL	Columbian white-tailed deer	0.0	8813.1	0.0	0.0	0.0	0.0
ORMO	Sage thrasher	245.3	0.0	0.0	0.0	7014.8	9852.8
OTFL	Flammulated owl	60.3	0.0	0.0	0.0	5482.0	14501.7
OTKE	Western screech-owl	0.0	4023.6	2657.4	85582.9	0.0	0.0
PEER	American white pelican	0.0	0.0	0.0	0.0	0.0	0.0
PHDO	Pygmy Horned Lizard	0.0	0.0	0.0	0.0	2641.4	11849.9
PIAL	White Headed Woodpecker	1457.3	0.0	0.0	0.0	4603.6	14145.4
PLLA	Larch Mountain Salamander	0.0	667.2	0.0	635.4	3246.7	0.0
PLVA	Van Dykes Salamander	0.0	37.8	2743.5	0.0	0.0	0.0
POGR	Rednecked Grebe	0.0	0.0	0.0	0.0	0.0	5659.3
PRSU	Purple Martin	0.0	4331.1	1576.8	31256.5	0.0	0.0
RALU	Columbia Spotted Frog	0.0	0.0	0.0	0.0	5028.8	24737.2
RAPR	Oregon Spotted Frog	0.0	0.0	0.0	0.0	0.0	0.0
RHCAS	Cascade Torrent Salamander	0.0	6786.6	0.0	0.0	0.0	0.0
RHOL	Olympic Torrent Salamander	0.0	0.0	7522.1	0.0	0.0	0.0
SCGRA	Sagebrush Lizard	0.0	0.0	0.0	0.0	86.7	3316.6
SCGRI	Western Gray Squirrel	0.0	3714.9	0.0	0.0	190.4	16574.0
SICARA	Slender Billed White Breasted Nuthatch	0.0	5798.5	0.0	0.0	0.0	0.0
SIME	Western Bluebird	0.0	10225.3	7392.9	32000.8	2535.8	0.0
SIPY	Pygmy Nuthatch	1302.1	0.0	0.0	0.0	9257.2	24930.2
SPZEBR	Valley Silverspot	0.0	0.0	1167.6	0.0	0.0	0.0
STNE	Great Gray Owl	469.9	0.0	0.0	0.0	0.0	12065.6
STOC	Northern Spotted Owl	0.0	0.0	0.0	0.0	0.0	369.8
TATA	American Badger	29.6	0.0	0.0	0.0	0.0	7482.9
THTAD	Brush Prairie pocket gopher	0.0	2268.0	0.0	0.0	0.0	0.0
TYPH	Sharp Tailed Grouse	0.0	0.0	0.0	0.0	0.0	76969.5
URAR	grizzly bear	0.0	0.0	0.0	0.0	0.0	0.0
URTON	Townsend's ground squirrel	0.0	0.0	0.0	0.0	0.0	0.0
UTST	Side Blotched Lizard	0.0	0.0	0.0	0.0	301.1	0.0
VUVUC	Cascade red fox	0.0	0.0	0.0	0.0	10.9	306.9
Total		16696.7	217728.1	132730.4	618123.6	211322.5	492408.2

Table 4: Amount of potential species habitat area (in acres) protected by regulations (Forest Practices, Shoreline Management Act, and Growth Management Act (average sized buffers)

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
ACMA	Spotted sandpiper	0.0	9311.5	4968.5	41170.6	0.0	0.0
AECL	Clark's grebe	0.0	0.0	0.0	0.0	0.0	0.0
AMNE	sagebrush sparrow	0.0	0.0	0.0	0.0	5055.3	9493.1
AMTI	tiger salamander	0.0	0.0	0.0	0.0	8595.6	139326.6
ANBO	western toad (boreal toad)	17060.1	13788.0	33390.8	79218.8	12682.1	99606.4
ANWO	Woodhouse's toad	3.1	0.0	0.0	0.0	649.0	0.0
AQCH	golden eagle	26737.2	8582.9	6697.9	10015.5	35779.1	162230.8
ASMO	Rocky Mountain tailed frog	794.8	0.0	0.0	0.0	0.0	0.0
ATCU	burrowing owl	0.0	0.0	0.0	0.0	17444.0	52711.1
BRID	pygmy rabbit	0.0	0.0	0.0	0.0	250.9	0.0
BRMA	marbled murrelet	0.0	5274.1	29076.6	91681.8	518.6	0.0
BURE	ferruginous hawk	0.0	0.0	0.0	0.0	715.0	0.0
CALU	gray wolf	7952.2	0.0	0.0	0.0	17344.6	21574.3
CEUR	greater sage-grouse	0.0	0.0	0.0	0.0	9045.5	6909.6
COAM	yellow-billed cuckoo	1545.2	0.0	0.0	3430.4	0.0	4938.9
CONTE	sharp-tailed snake	0.0	0.0	0.0	0.0	16045.8	0.0
COTO	Townsend's big-eared bat	30224.8	142027.1	44416.9	259818.8	68038.4	188102.0
DICO	Cope's giant salamander	0.0	29192.7	19982.2	0.0	0.0	0.0
DIPU	ringneck snake	9231.4	4293.6	0.0	0.0	9005.9	0.0
ERALS	streaked horned lark	0.0	537.5	0.0	0.0	0.0	0.0
EUED	Taylor's checkerspot	0.0	0.0	0.0	0.0	0.0	0.0
EUMA	spotted bat	0.0	0.0	0.0	0.0	9446.4	113216.1
FAPE	peregrine falcon	25840.5	117880.4	42732.9	202768.5	57634.3	163525.4

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
GAIM	common loon	0.0	0.0	96.7	4236.4	0.0	6697.2
GUGU	wolverine	2822.2	0.0	0.0	395.0	7008.8	25495.6
HALE	bald eagle	10645.8	145295.5	45675.5	252804.2	60813.0	105732.3
HYTO	night snake	9749.4	0.0	0.0	0.0	1454.0	82308.1
LACI	hoary bat	29372.4	140687.0	44449.8	259654.9	67454.1	185707.3
LALU	loggerhead shrike	0.0	0.0	0.0	0.0	28318.0	12649.1
LANO	silver-haired bat	29372.4	140795.3	44450.5	259678.2	67461.7	185707.3
LECA	black-tailed jackrabbit	15.8	0.0	0.0	0.0	29713.7	9041.7
LETO	white-tailed jackrabbit	16667.2	0.0	0.0	0.0	30708.1	101403.8
LYCA	Canada lynx	0.0	0.0	0.0	0.0	0.0	11154.2
MAAM	marten	0.0	0.0	675.0	0.0	0.0	0.0
MAPE	fisher	0.0	29366.8	37790.4	48953.8	14892.7	14474.8
MATA	striped whipsnake	0.0	0.0	0.0	0.0	897.6	0.0
MELE	Lewis woodpecker	9493.1	0.0	0.0	0.0	21910.3	41363.9
OCPR	American pika	0.0	11256.7	0.0	41711.9	11557.6	22714.7
ODVIL	Columbian white-tailed deer	0.0	11605.9	0.0	0.0	0.0	0.0
ORMO	Sage thrasher	658.3	0.0	0.0	0.0	7988.2	43703.7
OTFL	Flammulated owl	2259.8	0.0	0.0	0.0	10957.4	37283.4
OTKE	Western screech-owl	0.0	51114.6	25729.8	156319.6	0.9	0.0
PEER	American white pelican	0.0	3848.3	0.0	0.0	5871.0	0.0
PHDO	Pygmy Horned Lizard	18.9	0.0	0.0	0.0	20904.9	75785.5
PIAL	White Headed Woodpecker	4883.6	0.0	0.0	0.0	12494.4	35381.7
PLLA	Larch Mountain Salamander	0.0	12562.9	0.0	1220.5	5713.6	0.0
PLVA	Van Dykes Salamander	0.0	932.5	11933.5	4259.3	0.0	0.0
POGR	Rednecked Grebe	0.0	0.0	0.0	0.0	0.0	9335.0
PRSU	Purple Martin	0.0	4442.3	3772.3	33917.4	0.0	0.0
RALU	Columbia Spotted Frog	13377.3	0.0	0.0	0.0	22893.8	123605.7
RAPR	Oregon Spotted Frog	0.0	34048.9	10477.0	82674.8	0.0	0.0
RHCAS	Cascade Torrent Salamander	0.0	30288.8	0.0	0.0	0.0	0.0
RHOL	Olympic Torrent Salamander	0.0	0.0	14845.5	0.0	0.0	0.0
SCGRA	Sagebrush Lizard	2.9	0.0	0.0	0.0	3720.9	19744.7
SCGRI	Western Gray Squirrel	0.0	6974.5	0.0	0.0	6117.0	25128.8
SICARA	Slender Billed White Breasted Nuthatch	0.0	18611.1	0.0	0.0	0.0	0.0
SIME	Western Bluebird	0.0	95861.5	22747.0	119886.4	2535.8	0.0
SIPY	Pygmy Nuthatch	5661.7	0.0	0.0	0.0	13377.5	49199.3
SPZEBR	Valley Silverspot	0.0	0.0	7891.0	0.0	0.0	0.0
STNE	Great Gray Owl	3391.3	0.0	0.0	0.0	13.6	24204.3
STOC	Northern Spotted Owl	0.0	15374.8	20519.9	46165.8	12658.5	2294.2
TATA	American Badger	20866.9	0.0	0.0	0.0	35395.0	138258.4
THTAD	Brush Prairie pocket gopher	0.0	14559.1	0.0	0.0	0.0	0.0
TYPH	Sharp Tailed Grouse	0.0	0.0	0.0	0.0	0.0	106652.4
URAR	grizzly bear	0.0	0.0	0.0	0.0	0.0	23550.3
URTON	Townsend's ground squirrel	0.0	0.0	0.0	0.0	30640.7	0.0
UTST	Side Blotched Lizard	0.0	0.0	0.0	0.0	713.9	0.0
VUVUC	Cascade red fox	0.0	0.0	0.0	0.0	271.1	2332.5
Total		278648.1	1098514.3	472319.8	1999982.9	802707.8	2482544.5

Appendix C

Table 1: Amount of potential species habitat area (in acres) protected by regulations (Forest Practices, Shoreline Management Act, and Growth Management Act (average sized buffers)) that remains after removing 16 meters of habitat from the regulatory boundary to account for the ecological impacts found along habitat edges.

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
ACMA	Spotted sandpiper	0.0	0.0	0.0	632.0	0.0	0.0
AMNE	sagebrush sparrow	0.0	0.0	0.0	0.0	762.4	495.3
AMTI	tiger salamander	0.0	0.0	0.0	0.0	22.0	13270.2
ANBO	western toad (boreal toad)	0.0	1005.6	7795.0	11208.7	2449.4	13982.8
AQCH	golden eagle	15034.0	15.6	1687.9	1089.0	9320.1	85916.6
ASMO	Rocky Mountain tailed frog	322.7	0.0	0.0	0.0	0.0	0.0
ATCU	burrowing owl	0.0	0.0	0.0	0.0	1330.6	7623.8
BRMA	marbled murrelet	0.0	0.0	13355.0	619.1	85.0	0.0
BURE	ferruginous hawk	0.0	0.0	0.0	0.0	1.3	0.0
CALU	gray wolf	1998.4	0.0	0.0	0.0	1178.9	7878.8
CEUR	greater sage-grouse	0.0	0.0	0.0	0.0	3032.7	1815.4
COAM	yellow-billed cuckoo	223.5	0.0	0.0	415.0	0.0	631.6
CONTE	sharp-tailed snake	0.0	0.0	0.0	0.0	1339.2	0.0
COTO	Townsend's big-eared bat	0.0	12.5	0.0	6911.0	336.0	14992.9
DICO	Cope's giant salamander	0.0	952.5	2458.7	0.0	0.0	0.0
DIPU	ringneck snake	436.1	640.5	0.0	0.0	817.3	0.0
EUMA	spotted bat	0.0	0.0	0.0	0.0	151.2	8766.8
FAPE	peregrine falcon	1357.5	15732.8	10753.4	41761.5	8094.6	10934.5
GAIM	common loon	0.0	0.0	0.0	4.0	0.0	145.9
GUGU	wolverine	471.0	0.0	0.0	4.0	195.9	1314.1
HALE	bald eagle	4234.5	31305.6	23192.8	65417.6	10153.2	38318.9
HYTO	night snake	0.0	0.0	0.0	0.0	78.1	4990.2
LACI	hoary bat	0.0	0.0	0.0	6449.8	2676.9	165.7
LALU	loggerhead shrike	0.0	0.0	0.0	0.0	8522.4	8095.0
LANO	silver-haired bat	0.0	0.0	2065.8	678.7	2738.5	5788.6
LECA	black-tailed jackrabbit	0.0	0.0	0.0	0.0	76.9	0.0
LETO	white-tailed jackrabbit	0.0	0.0	0.0	0.0	2296.6	3848.5
LYCA	Canada lynx	0.0	0.0	0.0	0.0	0.0	2464.1
MAPE	fisher	0.0	0.0	28.7	0.0	0.0	0.0
MATA	striped whipsnake	0.0	0.0	0.0	0.0	16.2	0.0
MELE	Lewis woodpecker	1736.0	0.0	0.0	0.0	5900.2	13222.9
OCPR	American pika	0.0	8.7	0.0	283.8	116.8	388.3
ODVIL	Columbian white-tailed deer	0.0	5419.2	0.0	0.0	0.0	0.0
ORMO	Sage thrasher	159.9	0.0	0.0	0.0	1873.6	5913.8
OTFL	Flammulated owl	40.0	0.0	0.0	0.0	1389.7	9396.4
PHDO	Pygmy Horned Lizard	0.0	0.0	0.0	0.0	815.1	6430.9
PIAL	White Headed Woodpecker	944.0	0.0	0.0	0.0	1347.0	8783.3
PLLA	Larch Mountain Salamander	0.0	358.9	0.0	225.3	1585.2	0.0
PLVA	Van Dykes Salamander	0.0	9.1	1373.0	0.0	0.0	0.0
PRSU	Purple Martin	0.0	594.7	522.8	1626.1	0.0	0.0
RALU	Columbia Spotted Frog	0.0	0.0	0.0	0.0	1723.5	15529.0
RHCAS	Cascade Torrent Salamander	0.0	3870.7	0.0	0.0	0.0	0.0
RHOL	Olympic Torrent Salamander	0.0	0.0	4092.4	0.0	0.0	0.0
SCGRA	Sagebrush Lizard	0.0	0.0	0.0	0.0	22.5	2114.3
SCGRI	Western Gray Squirrel	0.0	2774.3	0.0	0.0	85.2	9607.7
SICARA	Slender Billed White Breasted Nuthatch	0.0	3853.1	0.0	0.0	0.0	0.0
SIME	Western Bluebird	0.0	6542.9	4045.5	18025.4	350.9	0.0
SIPY	Pygmy Nuthatch	855.1	0.0	0.0	0.0	2639.5	15101.8
SPZEBR	Valley Silverspot	0.0	0.0	751.2	0.0	0.0	0.0
STNE	Great Gray Owl	306.9	0.0	0.0	0.0	0.0	7817.2
STOC	Northern Spotted Owl	0.0	1309.0	8400.8	9535.6	2590.2	794.6
TATA	American Badger	20.9	0.0	0.0	0.0	0.0	4241.9
THTAD	Brush Prairie pocket gopher	0.0	1492.0	0.0	0.0	0.0	0.0
TYPH	Sharp Tailed Grouse	0.0	0.0	0.0	0.0	0.0	47101.3
URAR	grizzly bear	0.0	0.0	0.0	0.0	0.0	2541.9

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
URTON	Townsend's ground squirrel	0.0	0.0	0.0	0.0	2328.4	0.0
UTST	Side Blotched Lizard	0.0	0.0	0.0	0.0	68.3	0.0
VUVUC	Cascade red fox	0.0	0.0	0.0	0.0	3.1	191.5
Total		28140.5	75897.7	80523.0	164886.6	78514.6	380616.5

Table 2: Amount of potential species habitat area (in acres) protected by regulations (Forest Practices, Shoreline Management Act, and Growth Management Act (average sized buffers)) that remains after removing 82 meters of habitat from the regulatory boundary to account for the ecological impacts found along habitat edges.

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
ACMA	Spotted sandpiper	0.0	0.0	0.0	23.6	0.0	0.0
AMNE	sagebrush sparrow	0.0	0.0	0.0	0.0	0.4	5.1
AMTI	tiger salamander	0.0	0.0	0.0	0.0	0.0	203.3
ANBO	western toad (boreal toad)	0.0	101.9	1078.4	650.5	354.7	1134.4
AQCH	golden eagle	97.6	0.0	14.5	25.6	685.6	4859.9
ASMO	Rocky Mountain tailed frog	0.4	0.0	0.0	0.0	0.0	0.0
ATCU	burrowing owl	0.0	0.0	0.0	0.0	8.9	76.3
BRMA	marbled murrelet	0.0	0.0	688.3	1.1	0.0	0.0
CALU	gray wolf	9.8	0.0	0.0	0.0	3.1	495.9
CEUR	greater sage-grouse	0.0	0.0	0.0	0.0	155.0	85.8
COAM	yellow-billed cuckoo	1.1	0.0	0.0	11.6	0.0	35.8
CONTE	sharp-tailed snake	0.0	0.0	0.0	0.0	54.9	0.0
COTO	Townsend's big-eared bat	0.0	0.0	0.0	268.2	0.0	1450.6
DICO	Cope's giant salamander	0.0	68.5	106.5	0.0	0.0	0.0
DIPU	ringneck snake	0.2	3.1	0.0	0.0	61.4	0.0
EUMA	spotted bat	0.0	0.0	0.0	0.0	0.0	640.7
FAPE	peregrine falcon	7.8	1198.9	1591.4	3500.0	554.9	371.4
GAIM	common loon	0.0	0.0	0.0	0.0	0.0	4.9
GUGU	wolverine	2.4	0.0	0.0	0.0	2.7	99.6
HALE	bald eagle	11.8	2114.7	2030.4	5051.6	751.9	3500.4
HYTO	night snake	0.0	0.0	0.0	0.0	0.0	627.8
LACI	hoary bat	0.0	0.0	0.0	88.1	175.5	0.2
LALU	loggerhead shrike	0.0	0.0	0.0	0.0	739.7	301.6
LANO	silver-haired bat	0.0	0.0	105.2	2.2	175.5	382.7
LETO	white-tailed jackrabbit	0.0	0.0	0.0	0.0	220.8	95.2
LYCA	Canada lynx	0.0	0.0	0.0	0.0	0.0	5.8
MAPE	fisher	0.0	0.0	1.1	0.0	0.0	0.0
MELE	Lewis woodpecker	40.0	0.0	0.0	0.0	373.2	1442.4
OCPR	American pika	0.0	0.0	0.0	0.7	0.0	8.9
ODVIL	Columbian white-tailed deer	0.0	627.6	0.0	0.0	0.0	0.0
ORMO	Sage thrasher	3.6	0.0	0.0	0.0	20.7	75.6
OTFL	Flammulated owl	0.0	0.0	0.0	0.0	30.7	468.1
PHDO	Pygmy Horned Lizard	0.0	0.0	0.0	0.0	2.0	109.0
PIAL	White Headed Woodpecker	4.0	0.0	0.0	0.0	20.5	75.2
PLLA	Larch Mountain Salamander	0.0	1.3	0.0	3.1	340.7	0.0
PLVA	Van Dykes Salamander	0.0	0.0	97.2	0.0	0.0	0.0
PRSU	Purple Martin	0.0	70.9	67.6	401.2	0.0	0.0
RALU	Columbia Spotted Frog	0.0	0.0	0.0	0.0	48.7	1202.9
RHCAS	Cascade Torrent Salamander	0.0	92.7	0.0	0.0	0.0	0.0
RHOL	Olympic Torrent Salamander	0.0	0.0	216.6	0.0	0.0	0.0
SCGRA	Sagebrush Lizard	0.0	0.0	0.0	0.0	0.0	18.7
SCGRI	Western Gray Squirrel	0.0	128.5	0.0	0.0	0.7	300.9
SICARA	Slender Billed White Breasted Nuthatch	0.0	332.3	0.0	0.0	0.0	0.0
SIME	Western Bluebird	0.0	412.1	796.6	1169.5	16.2	0.0
SIPY	Pygmy Nuthatch	4.4	0.0	0.0	0.0	84.5	394.1
SPZEBR	Valley Silverspot	0.0	0.0	18.0	0.0	0.0	0.0
STNE	Great Gray Owl	4.4	0.0	0.0	0.0	0.0	232.2
STOC	Northern Spotted Owl	0.0	4.4	34.9	112.8	39.1	20.9
TATA	American Badger	0.0	0.0	0.0	0.0	0.0	798.2
THTAD	Brush Prairie pocket gopher	0.0	66.0	0.0	0.0	0.0	0.0
TYPH	Sharp Tailed Grouse	0.0	0.0	0.0	0.0	0.0	1428.4

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
URAR	grizzly bear	0.0	0.0	0.0	0.0	0.0	240.2
URTON	Townsend's ground squirrel	0.0	0.0	0.0	0.0	121.2	0.0
VUVUC	Cascade red fox	0.0	0.0	0.0	0.0	0.0	2.2
Total		187.5	5222.9	6846.7	11309.8	5043.2	21195.3

Table 3: Amount of potential species habitat area (in acres) protected by regulations (Forest Practices, Shoreline Management Act, and Growth Management Act (average sized buffers)) that remains after removing 230 meters of habitat from the regulatory boundary to account for the ecological impacts found along habitat edges.

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
ANBO	western toad (boreal toad)	0	8.5	108.1	20.2	12.9	76.3
AQCH	golden eagle	0	0.0	0.0	0.0	8.9	573.1
BRMA	marbled murrelet	0	0.0	23.1	0.0	0.0	0.0
COAM	yellow-billed cuckoo	0	0.0	0.0	0.0	0.0	0.9
COTO	Townsend's big-eared bat	0	0.0	0.0	5.6	0.0	56.7
DICO	Cope's giant salamander	0	4.4	0.0	0.0	0.0	0.0
EUMA	spotted bat	0	0.0	0.0	0.0	0.0	51.6
FAPE	peregrine falcon	0	97.2	207.9	383.0	8.9	0.2
HALE	bald eagle	0	160.6	209.0	459.2	14.2	527.1
HYTO	night snake	0	0.0	0.0	0.0	0.0	51.6
LACI	hoary bat	0	0.0	0.0	0.0	12.7	0.0
LALU	loggerhead shrike	0	0.0	0.0	0.0	10.0	0.0
LANO	silver-haired bat	0	0.0	0.0	0.0	12.7	0.0
LETO	white-tailed jackrabbit	0	0.0	0.0	0.0	1.1	0.0
MELE	Lewis woodpecker	0	0.0	0.0	0.0	0.2	217.7
ODVIL	Columbian white-tailed deer	0	20.2	0.0	0.0	0.0	0.0
ORMO	Sage thrasher	0	0.0	0.0	0.0	0.0	1.3
OTFL	Flammulated owl	0	0.0	0.0	0.0	0.0	11.6
PLLA	Larch Mountain Salamander	0	0.0	0.0	0.0	12.7	0.0
PRSU	Purple Martin	0	0.0	0.0	75.6	0.0	0.0
RALU	Columbia Spotted Frog	0	0.0	0.0	0.0	0.0	50.0
RHCAS	Cascade Torrent Salamander	0	4.4	0.0	0.0	0.0	0.0
RHOL	Olympic Torrent Salamander	0	0.0	0.2	0.0	0.0	0.0
SCGRI	Western Gray Squirrel	0	0.0	0.0	0.0	0.0	22.9
SICARA	Slender Billed White Breasted Nuthatch	0	4.4	0.0	0.0	0.0	0.0
SIME	Western Bluebird	0	3.8	122.5	165.2	0.0	0.0
SIPY	Pygmy Nuthatch	0	0.0	0.0	0.0	0.0	15.3
STNE	Great Gray Owl	0	0.0	0.0	0.0	0.0	2.4
STOC	Northern Spotted Owl	0	0.0	0.0	0.7	0.0	0.0
TATA	American Badger	0	0.0	0.0	0.0	0.0	70.5
TYPH	Sharp Tailed Grouse	0	0.0	0.0	0.0	0.0	14.7
URTON	Townsend's ground squirrel	0	0.0	0.0	0.0	1.3	0.0
Total		0	303.5	670.8	1109.5	95.6	1743.9

Table 4: Amount of potential species habitat area (in acres) protected by acquisitions that remains after removing 16 meters of habitat from the acquisition boundary to account for the ecological impacts found along habitat edges.

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
ACMA	Spotted sandpiper	0.0	409.0	599.6	468.4	0.0	0.0
AMNE	sagebrush sparrow	0.0	0.0	0.0	0.0	15208.6	434.6
AMTI	tiger salamander	0.0	0.0	0.0	0.0	9174.7	40274.2
ANBO	western toad (boreal toad)	14730.7	146.3	4596.4	26104.6	6024.3	52765.1
AQCH	golden eagle	20723.6	49.4	1520.7	4573.7	32491.8	70202.5
ASMO	Rocky Mountain tailed frog	94.5	0.0	0.0	0.0	0.0	0.0
ATCU	burrowing owl	0.0	0.0	0.0	0.0	20660.9	4539.2
BRID	pygmy rabbit	0.0	0.0	0.0	0.0	1002.8	0.0
BRMA	marbled murrelet	0.0	22.9	4211.2	25694.1	47.8	0.0

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
BURE	ferruginous hawk	0.0	0.0	0.0	0.0	3471.1	0.0
CALU	gray wolf	5147.0	0.0	0.0	0.0	6879.2	8554.5
CEUR	greater sage-grouse	0.0	0.0	0.0	0.0	14422.0	180.6
COAM	yellow-billed cuckoo	273.1	0.0	0.0	4.0	0.0	287.3
CONTE	sharp-tailed snake	0.0	0.0	0.0	0.0	9860.6	0.0
COTO	Townsend's big-eared bat	20901.3	2527.9	5598.2	31385.7	40657.3	72841.8
DICO	Cope's giant salamander	0.0	677.4	2258.4	0.0	0.0	0.0
DIPU	ringneck snake	3946.8	213.7	0.0	0.0	13946.3	0.0
ERALS	streaked horned lark	0.0	51.6	0.0	0.0	0.0	0.0
EUMA	spotted bat	0.0	0.0	0.0	0.0	11347.0	27660.2
FAPE	peregrine falcon	19429.3	2473.6	5271.1	27807.9	32798.7	56734.4
GAIM	common loon	0.0	0.0	0.0	4.7	0.0	22.5
GUGU	wolverine	1969.3	0.0	0.0	272.4	4809.6	27649.5
HALE	bald eagle	5831.7	2720.7	5393.0	27178.1	23413.0	29613.0
HYTO	night snake	9169.1	0.0	0.0	0.0	10305.6	16729.7
LACI	hoary bat	20288.9	2564.2	5598.2	31364.8	40442.7	72537.4
LALU	loggerhead shrike	0.0	0.0	0.0	0.0	22548.8	4658.2
LANO	silver-haired bat	20288.9	2564.6	5598.2	31369.9	40442.7	72537.4
LECA	black-tailed jackrabbit	0.0	0.0	0.0	0.0	16057.7	219.3
LETO	white-tailed jackrabbit	15354.7	0.0	0.0	0.0	22449.2	29424.9
LYCA	Canada lynx	0.0	0.0	0.0	0.0	0.0	24899.9
MAAM	marten	0.0	0.0	71.8	0.0	0.0	0.0
MAPE	fisher	0.0	613.8	4978.4	22990.0	13752.4	27541.0
MATA	striped whipsnake	0.0	0.0	0.0	0.0	1299.0	0.0
MELE	Lewis woodpecker	6492.0	0.0	0.0	0.0	9980.6	11470.9
OCPR	American pika	0.0	404.1	0.0	21934.1	9084.0	34088.6
ODVIL	Columbian white-tailed deer	0.0	1522.9	0.0	0.0	0.0	0.0
ORMO	Sage thrasher	195.0	0.0	0.0	0.0	15224.4	11534.7
OTFL	Flammulated owl	1067.5	0.0	0.0	0.0	10369.8	11592.5
PEER	American white pelican	0.0	8.7	0.0	0.0	0.0	0.0
PHDO	Pygmy Horned Lizard	0.0	0.0	0.0	0.0	19039.0	25999.6
PIAL	White Headed Woodpecker	2729.4	0.0	0.0	0.0	13175.7	11105.0
PLLA	Larch Mountain Salamander	0.0	392.3	0.0	0.0	948.7	0.0
PLVA	Van Dykes Salamander	0.0	0.0	1801.6	35.4	0.0	0.0
POGR	Rednecked Grebe	0.0	0.0	0.0	0.0	0.0	27.6
PRSU	Purple Martin	0.0	9.8	145.0	6.7	0.0	0.0
RALU	Columbia Spotted Frog	5394.7	0.0	0.0	0.0	18540.0	54373.5
RAPR	Oregon Spotted Frog	0.0	2007.5	848.9	5184.1	0.0	0.0
RHCAS	Cascade Torrent Salamander	0.0	678.7	0.0	0.0	0.0	0.0
RHOL	Olympic Torrent Salamander	0.0	0.0	1815.1	0.0	0.0	0.0
SCGRA	Sagebrush Lizard	0.0	0.0	0.0	0.0	9744.7	6690.8
SCGRI	Western Gray Squirrel	0.0	180.4	0.0	0.0	8165.5	9583.7
SICARA	Slender Billed White Breasted Nuthatch	0.0	490.4	0.0	0.0	0.0	0.0
SIME	Western Bluebird	0.0	2308.4	2857.0	21833.6	7.3	0.0
SIPY	Pygmy Nuthatch	3789.7	0.0	0.0	0.0	9875.7	25867.5
SPZEBR	Valley Silverspot	0.0	0.0	920.7	0.0	0.0	0.0
STNE	Great Gray Owl	2022.2	0.0	0.0	0.0	0.0	22687.3
STOC	Northern Spotted Owl	0.0	470.6	4132.5	24594.1	12872.4	2252.8
TATA	American Badger	18040.3	0.0	0.0	0.0	26284.9	42915.3
THTAD	Brush Prairie pocket gopher	0.0	1211.1	0.0	0.0	0.0	0.0
TYPH	Sharp Tailed Grouse	0.0	0.0	0.0	0.0	0.0	32625.1
URAR	grizzly bear	0.0	0.0	0.0	0.0	0.0	29541.2
URTON	Townsend's ground squirrel	0.0	0.0	0.0	0.0	15983.4	0.0
UTST	Side Blotched Lizard	0.0	0.0	0.0	0.0	8216.4	0.0
VUVUC	Cascade red fox	0.0	0.0	0.0	0.0	36.2	2066.4
Total		197879.7	24720.0	58216.0	302806.3	601062.5	974729.7

Table 5: Amount of potential species habitat area (in acres) protected by acquisitions that remains after removing 82 meters of habitat from the acquisition boundary to account for the ecological impacts found along habitat edges.

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
ACMA	Spotted sandpiper	0.0	244.2	318.0	395.2	0.0	0.0

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
AMNE	sagebrush sparrow	0.0	0.0	0.0	0.0	13626.7	269.1
AMTI	tiger salamander	0.0	0.0	0.0	0.0	8340.3	32544.1
ANBO	western toad (boreal toad)	12710.5	59.8	2285.1	22286.6	4584.8	45214.3
AQCH	golden eagle	17763.2	8.9	481.5	3878.5	28890.0	60255.0
ASMO	Rocky Mountain tailed frog	84.5	0.0	0.0	0.0	0.0	0.0
ATCU	burrowing owl	0.0	0.0	0.0	0.0	18567.8	3703.2
BRID	pygmy rabbit	0.0	0.0	0.0	0.0	851.1	0.0
BRMA	marbled murrelet	0.0	1.3	2071.8	21850.5	0.0	0.0
BURE	ferruginous hawk	0.0	0.0	0.0	0.0	2893.5	0.0
CALU	gray wolf	4370.4	0.0	0.0	0.0	5538.2	6812.9
CEUR	greater sage-grouse	0.0	0.0	0.0	0.0	12864.8	98.5
COAM	yellow-billed cuckoo	220.6	0.0	0.0	2.2	0.0	197.7
CONTE	sharp-tailed snake	0.0	0.0	0.0	0.0	8343.4	0.0
COTO	Townsend’s big-eared bat	17907.3	1481.6	2830.6	26362.1	35184.8	62213.4
DICO	Cope’s giant salamander	0.0	378.5	804.8	0.0	0.0	0.0
DIPU	ringneck snake	3395.2	151.2	0.0	0.0	12495.4	0.0
ERALS	streaked horned lark	0.0	47.1	0.0	0.0	0.0	0.0
EUMA	spotted bat	0.0	0.0	0.0	0.0	10296.4	22661.3
FAPE	peregrine falcon	16654.3	1466.9	2663.1	23433.2	28476.1	47472.0
GAIM	common loon	0.0	0.0	0.0	0.9	0.0	2.7
GUGU	wolverine	1595.9	0.0	0.0	224.2	3695.9	25419.6
HALE	bald eagle	4897.9	1601.9	2696.3	23026.7	19867.7	25266.0
HYTO	night snake	7968.7	0.0	0.0	0.0	9333.5	13796.9
LACI	hoary bat	17360.9	1515.1	2830.6	26344.1	34991.7	61967.4
LALU	loggerhead shrike	0.0	0.0	0.0	0.0	20246.4	3994.8
LANO	silver-haired bat	17360.9	1515.1	2830.6	26345.9	34991.7	61967.4
LECA	black-tailed jackrabbit	0.0	0.0	0.0	0.0	14286.6	120.8
LETO	white-tailed jackrabbit	13209.5	0.0	0.0	0.0	20135.4	23640.1
LYCA	Canada lynx	0.0	0.0	0.0	0.0	0.0	23614.3
MAAM	marten	0.0	0.0	33.1	0.0	0.0	0.0
MAPE	fisher	0.0	356.0	2509.4	19813.2	11151.5	25383.1
MATA	striped whipsnake	0.0	0.0	0.0	0.0	938.9	0.0
MELE	Lewis woodpecker	5521.9	0.0	0.0	0.0	8366.5	9607.0
OCPR	American pika	0.0	277.8	0.0	18920.9	7381.1	30783.7
ODVIL	Columbian white-tailed deer	0.0	955.4	0.0	0.0	0.0	0.0
ORMO	Sage thrasher	162.3	0.0	0.0	0.0	13614.3	9551.4
OTFL	Flammulated owl	898.9	0.0	0.0	0.0	8567.8	9060.4
PEER	American white pelican	0.0	1.3	0.0	0.0	0.0	0.0
PHDO	Pygmy Horned Lizard	0.0	0.0	0.0	0.0	16985.5	20883.8
PIAL	White Headed Woodpecker	2246.8	0.0	0.0	0.0	11054.1	8958.3
PLLA	Larch Mountain Salamander	0.0	195.9	0.0	0.0	521.9	0.0
PLVA	Van Dykes Salamander	0.0	0.0	561.5	9.1	0.0	0.0
POGR	Rednecked Grebe	0.0	0.0	0.0	0.0	0.0	2.7
PRSU	Purple Martin	0.0	1.8	62.3	0.2	0.0	0.0
RALU	Columbia Spotted Frog	4571.2	0.0	0.0	0.0	15600.7	47247.9
RAPR	Oregon Spotted Frog	0.0	1196.9	439.7	4419.6	0.0	0.0
RHCAS	Cascade Torrent Salamander	0.0	378.7	0.0	0.0	0.0	0.0
RHOL	Olympic Torrent Salamander	0.0	0.0	566.2	0.0	0.0	0.0
SCGRA	Sagebrush Lizard	0.0	0.0	0.0	0.0	8751.5	5685.4
SCGRI	Western Gray Squirrel	0.0	90.3	0.0	0.0	6919.2	7642.0
SICARA	Slender Billed White Breasted Nuthatch	0.0	202.8	0.0	0.0	0.0	0.0
SIME	Western Bluebird	0.0	1377.9	1784.5	18194.2	0.0	0.0
SIPY	Pygmy Nuthatch	3172.4	0.0	0.0	0.0	8174.8	22725.8
SPZEBR	Valley Silverspot	0.0	0.0	543.3	0.0	0.0	0.0
STNE	Great Gray Owl	1671.0	0.0	0.0	0.0	0.0	21075.9
STOC	Northern Spotted Owl	0.0	303.8	2113.6	21105.0	10736.5	1789.6
TATA	American Badger	15549.7	0.0	0.0	0.0	23579.8	34909.0
THTAD	Brush Prairie pocket gopher	0.0	803.5	0.0	0.0	0.0	0.0
TYPH	Sharp Tailed Grouse	0.0	0.0	0.0	0.0	0.0	26317.4
URAR	grizzly bear	0.0	0.0	0.0	0.0	0.0	26602.5
URTON	Townsend’s ground squirrel	0.0	0.0	0.0	0.0	14200.7	0.0
UTST	Side Blotched Lizard	0.0	0.0	0.0	0.0	7444.5	0.0
VUVUC	Cascade red fox	0.0	0.0	0.0	0.0	24.9	1575.2
Total		169294.0	14613.7	28426.0	256612.3	522516.4	831032.6

Table 6: Amount of potential species habitat area (in acres) protected by acquisitions that remains after removing 230 meters of habitat from the acquisition boundary to account for the ecological impacts found along habitat edges.

Species code	Common name	Asotin	Clark	Jefferson	King	Kittitas	Okanogan
ACMA	Spotted sandpiper	0.0	58.5	94.1	299.1	0.0	0.0
AMNE	sagebrush sparrow	0.0	0.0	0.0	0.0	10673.4	56.3
AMTI	tiger salamander	0.0	0.0	0.0	0.0	7009.1	18556.0
ANBO	western toad (boreal toad)	8602.9	3.1	612.0	15618.9	2455.0	31701.5
AQCH	golden eagle	11749.5	0.0	44.9	2487.7	21468.6	41699.5
ASMO	Rocky Mountain tailed frog	63.8	0.0	0.0	0.0	0.0	0.0
ATCU	burrowing owl	0.0	0.0	0.0	0.0	14314.6	2283.3
BRID	pygmy rabbit	0.0	0.0	0.0	0.0	666.9	0.0
BRMA	marbled murrelet	0.0	0.0	582.0	15237.5	0.0	0.0
BURE	ferruginous hawk	0.0	0.0	0.0	0.0	1965.9	0.0
CALU	gray wolf	2711.4	0.0	0.0	0.0	3617.4	3900.3
CEUR	greater sage-grouse	0.0	0.0	0.0	0.0	10007.8	4.0
COAM	yellow-billed cuckoo	148.1	0.0	0.0	0.0	0.0	115.0
CONTE	sharp-tailed snake	0.0	0.0	0.0	0.0	5804.2	0.0
COTO	Townsend's big-eared bat	11840.9	429.7	763.7	18177.9	25118.7	42996.2
DICO	Cope's giant salamander	0.0	105.0	117.9	0.0	0.0	0.0
DIPU	ringneck snake	2203.2	49.8	0.0	0.0	9231.9	0.0
ERALS	streaked horned lark	0.0	38.3	0.0	0.0	0.0	0.0
EUMA	spotted bat	0.0	0.0	0.0	0.0	8275.1	13465.0
FAPE	peregrine falcon	11024.5	445.2	750.3	16332.1	20287.8	30658.5
GAIM	common loon	0.0	0.0	0.0	0.7	0.0	0.9
GUGU	wolverine	849.3	0.0	0.0	101.4	1947.9	21360.6
HALE	bald eagle	2969.4	467.7	751.2	16244.7	13332.1	17959.5
HYTO	night snake	5700.1	0.0	0.0	0.0	7531.5	8258.7
LACI	hoary bat	11484.2	429.7	763.7	18161.5	24989.5	42804.3
LALU	loggerhead shrike	0.0	0.0	0.0	0.0	15654.5	2560.4
LANO	silver-haired bat	11484.2	429.7	763.7	18161.5	24989.5	42804.3
LECA	black-tailed jackrabbit	0.0	0.0	0.0	0.0	11111.0	8.2
LETO	white-tailed jackrabbit	8929.2	0.0	0.0	0.0	15535.3	13386.5
LYCA	Canada lynx	0.0	0.0	0.0	0.0	0.0	20666.0
MAPE	fisher	0.0	107.6	722.1	13851.6	6657.2	21394.6
MATA	striped whipsnake	0.0	0.0	0.0	0.0	533.1	0.0
MELE	Lewis woodpecker	3464.2	0.0	0.0	0.0	5473.2	6251.8
OCPR	American pika	0.0	103.6	0.0	13299.6	4623.0	24326.1
ODVIL	Columbian white-tailed deer	0.0	317.1	0.0	0.0	0.0	0.0
ORMO	Sage thrasher	103.2	0.0	0.0	0.0	10642.5	5747.4
OTFL	Flammulated owl	531.5	0.0	0.0	0.0	5489.7	4784.9
PHDO	Pygmy Horned Lizard	0.0	0.0	0.0	0.0	13236.2	11495.6
PIAL	White Headed Woodpecker	1211.1	0.0	0.0	0.0	7159.0	5013.6
PLLA	Larch Mountain Salamander	0.0	54.5	0.0	0.0	163.0	0.0
PLVA	Van Dykes Salamander	0.0	0.0	44.9	0.0	0.0	0.0
POGR	Rednecked Grebe	0.0	0.0	0.0	0.0	0.0	0.9
PRSU	Purple Martin	0.0	0.0	16.7	0.0	0.0	0.0
RALU	Columbia Spotted Frog	2839.5	0.0	0.0	0.0	10473.2	34049.2
RAPR	Oregon Spotted Frog	0.0	376.7	113.6	3359.0	0.0	0.0
RHCAS	Cascade Torrent Salamander	0.0	105.0	0.0	0.0	0.0	0.0
RHOL	Olympic Torrent Salamander	0.0	0.0	44.9	0.0	0.0	0.0
SCGRA	Sagebrush Lizard	0.0	0.0	0.0	0.0	6949.7	3639.6
SCGRI	Western Gray Squirrel	0.0	0.7	0.0	0.0	4559.4	4086.6
SICARA	Slender Billed White Breasted Nuthatch	0.0	4.0	0.0	0.0	0.0	0.0
SIME	Western Bluebird	0.0	410.1	615.6	12537.7	0.0	0.0
SIPY	Pygmy Nuthatch	1849.8	0.0	0.0	0.0	5265.3	16652.6
SPZEBR	Valley Silverspot	0.0	0.0	154.1	0.0	0.0	0.0
STNE	Great Gray Owl	902.7	0.0	0.0	0.0	0.0	17846.8
STOC	Northern Spotted Owl	0.0	103.6	603.3	14817.0	6903.9	924.5
TATA	American Badger	10497.3	0.0	0.0	0.0	18211.5	20310.4
THTAD	Brush Prairie pocket gopher	0.0	299.8	0.0	0.0	0.0	0.0
TYPH	Sharp Tailed Grouse	0.0	0.0	0.0	0.0	0.0	14809.6
URAR	grizzly bear	0.0	0.0	0.0	0.0	0.0	21008.7
URTON	Townsend's ground squirrel	0.0	0.0	0.0	0.0	11022.5	0.0
UTST	Side Blotched Lizard	0.0	0.0	0.0	0.0	6238.9	0.0
VUVUC	Cascade red fox	0.0	0.0	0.0	0.0	0.2	791.9
Species code	**Common name**	**Asotin**	**Clark**	**Jefferson**	**King**	**Kittitas**	**Okanogan**
Total		111160.0	4339.4	7558.7	178687.9	379589.2	568379.8