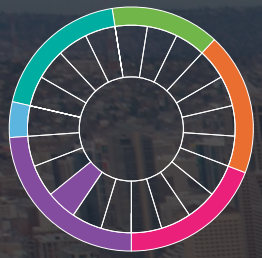
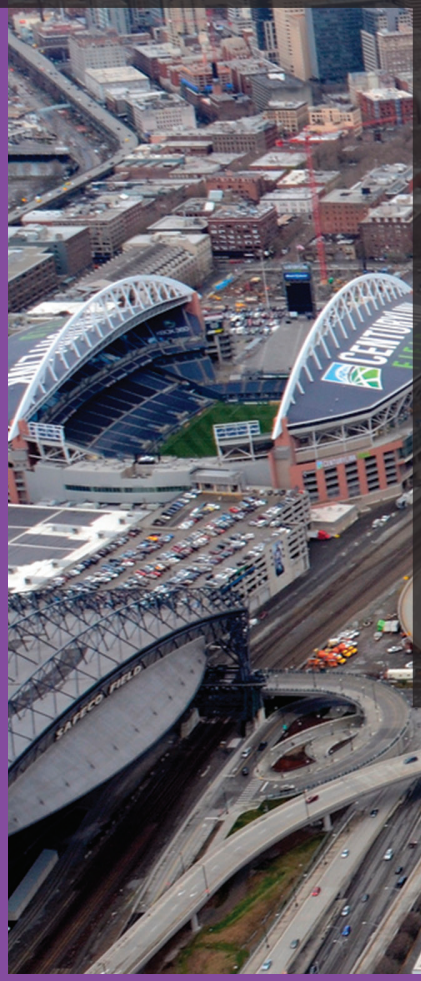


Land Development and Cover

In the Puget Sound region, we have lost at least two-thirds of our remaining old growth forests, more than 90% of our native prairies, and 80% of our marshes in the past 150 years.

The land surrounding Puget Sound is home to four million people who live, work, and play in our region. The need for homes, businesses, roads, and agriculture must be balanced with ecosystem protection. Forest and riparian areas provide important habitat for many species and reduce the rate of polluted runoff flowing into Puget Sound.

Land development and cover indicators measure how well we are directing our region's ongoing growth to protect our best remaining natural areas and working forests. In the future, with an additional Land Development Pressure indicator focused on the form and location of development, we expect to be able to determine how well we are concentrating population growth in those areas identified as most suitable for development.



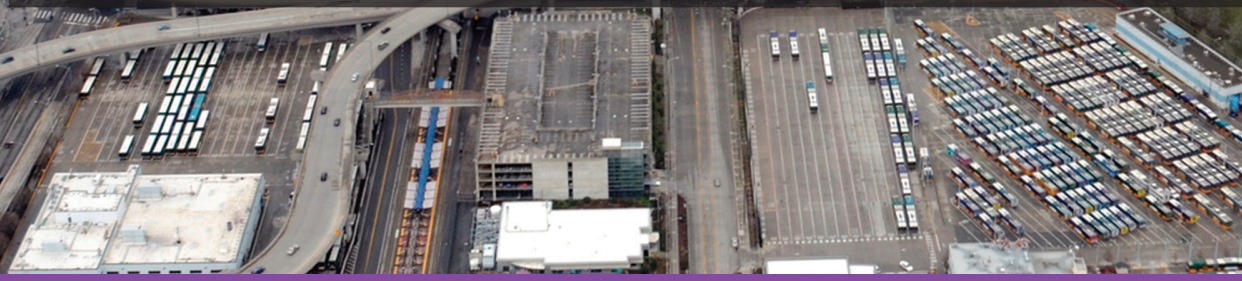


Photo Credit: Jon Bridgman, Puget Sound Partnership

Land Development and Cover

INDICATOR:

Land Cover Change: Forest to Developed

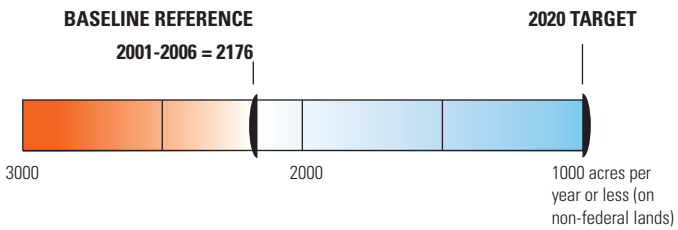
Indicator lead: Kenneth B. Pierce Jr., Washington Department of Fish and Wildlife

TARGET:

The average annual loss of forested land cover to developed land cover in non-federal lands does not exceed 1,000 acres per year, as measured with Landsat-based change detection.

PROGRESS:

IS THE TARGET MET?	NO	IS THERE PROGRESS?	UNKNOWN



Baseline conversion rates: 2001-2006 conversion of forested cover to developed cover was 2,176 acres per year. Information on the rate of conversion from 2006 to 2011 is expected to be available in 2013.

Progress Towards 2020 Target

The 2020 target has not yet been reached, and progress towards the target is unknown due to lack of data.

Non-federal Puget Sound basin forest was converted to developed cover at a rate of 2,176 acres per year for the period 2001-2006. Data needed to calculate an updated conversion rate for the period 2006-2011 were not yet available, but are expected in 2013.

Achievement of the 2020 target rate of 1,000 acres converted per year would represent a roughly 50% reduction from the 2001-2006 annual conversion rate, or an 80% reduction from the 1991-2001 conversion rate of 5,048 acres per year. 1991-2001 was a period of unprecedented regional growth that included significant expansion of the developed landscape. Limiting the conversion rate to 1,000 acres per year is an ambitious target that reflects our need to minimize loss of regional forest cover while recognizing that some conversion of forest cover for the purposes of development and infrastructure development is necessary.

What Is this Indicator?

Forest conversion measures the loss of forested land cover to developed land cover. The indicator provides a check on our regional success in maintaining forest cover throughout the Puget Sound Basin.

Forested landscapes, as measured by forest cover, provide the following: 1) habitat functions that support terrestrial species, 2) watershed functions that support freshwater systems, and 3) provisioning and cultural services for humans.

Change in forested lands is monitored using NOAA analysis of satellite imagery to track change from forested land cover, including coniferous, deciduous, and mixed forest classes, to developed land cover using four classes of development intensity, on a five-year basis. Forest cover conversion in the Puget Sound basin has been consistently measured every four to five years since 1992 with the next results expected in late 2012 for change during the period 2006-2011.

Interpretation of Data

The current trends and targets were set using land-cover change information for lands not in federal ownership as determined by the Landsat satellite imaging system. Due to image element limitations, this approach does not capture relatively small land use change, such as clearing for single homes or lot expansion, and therefore only larger events (more than two acres) are reliably captured in these values.

Land Development and Cover

INDICATOR:

Land Cover Change: Riparian Restoration

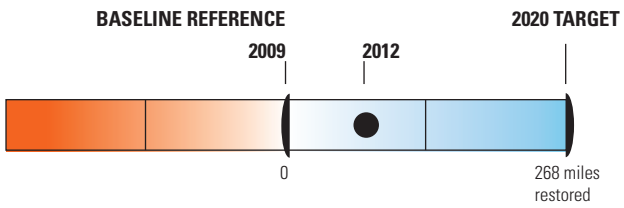
Indicator lead: Alex Mitchell, Puget Sound Partnership

TARGET:

Restore 268 miles of riparian vegetation or have an equivalent extent of restoration projects underway.

PROGRESS:

IS THE TARGET MET?	NO	IS THERE PROGRESS?	YES



At least 76 riparian miles were restored between October 2009 and September 2012. This is 28% of the 2020 target of 268 miles. Although 19 riparian restoration projects were conducted in Puget Sound, the current status has been derived from 13 projects that reported an associated mileage.

Progress Towards 2020 Target

The 2020 target has not yet been reached. Habitat data collected by the Puget Sound Partnership on behalf the Environmental Protection Agency indicate that 19 riparian restoration projects were conducted in the Puget Sound basin from October 2009 through September 2012. However, miles of restored riparian corridors were reported only for 13 projects. In total, at least 76 miles were restored during that time period, or 28% progress towards the 2020 target of 268 miles. It should be noted that riparian corridor restoration prior to October 2009, the baseline reference year, was not counted towards the target.

What Is This Indicator?

The riparian vegetation restoration indicator measures the amount of new vegetated cover delivered by restoration projects along riparian corridors. These corridors are a critical component of the Puget Sound ecosystem and the indicator evaluates the effect of direct efforts to improve them. Intact, vegetated riparian corridors are critical for the following reasons: 1) keeping fresh and marine waters clean and cool, 2) moderating variability in water volume and timing of flow (i.e. flood storage), and 3) as key habitat for myriad terrestrial, freshwater and interface (e.g. salmon) species.

The amount of riparian corridor restored to vegetated cover will be measured through collection of acreage or linear riparian shoreline restoration reported for Puget Sound restoration projects. Riparian restoration efforts are being measured instead of riparian condition due to the difficulty in assessing riparian condition Sound-wide and the length of time necessary to call

a specific location successfully restored. Although tracking total riparian condition is a much more difficult task than tracking regional forest cover, the initiation and completion of restoration activities are track table measures. Successful restoration may take many years and measuring its success will require ongoing monitoring. Recent restoration efforts in the Puget Sound basin have included 19 projects completed from October 2009 to September 2012 to restore riparian vegetation. These projects involved planting and other actions beyond treatment to remove invasive species. A project length was reported for 13 of the projects.

Interpretation of Data

The sum of the lengths reported for the 13 projects between October 2009 and September 2012 is about 76 miles, which is 28% of the 2020 target. If the median project length were applied to the six projects with no length estimate provided, we would estimate that the total mileage restored in this three-year period at 86 miles, which is 32% of the 2020 target.

Data Source

Puget Sound Partnership staff analysis of data for federal fiscal years 2010, 2011, and 2012 primarily from the Recreation and Conservation Office's PRISM database and reports of Natural Resource Conservation Service (NRCS) habitat programs.

Land Development and Cover

INDICATOR:

Land Development Pressure: conversion of ecologically important lands

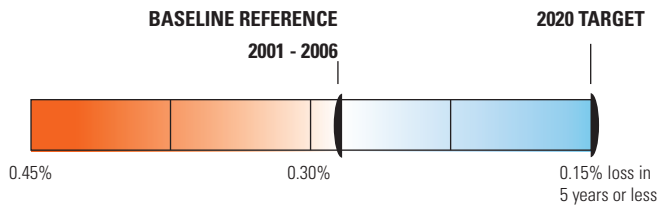
Indicator lead: Kenneth B. Pierce Jr., Washington Department of Fish and Wildlife
Kari Stiles, Puget Sound Institute

TARGET:

Basin-wide loss of vegetation cover on ecologically important lands under high pressure from development does not exceed 0.15% of the total 2011 baseline land area over a five-year period

PROGRESS:

IS THE TARGET MET?	NO	IS THERE PROGRESS?	UNKNOWN



Baseline rate of change: 0.28% loss of vegetation cover on indicator land base[1] over the period 2001-2006.

[1] Indicator land base = ecologically important lands under high pressure from development

Progress Towards 2020 Target

The 2020 target has not been met yet, and the analysis of progress towards the target is pending due to the lack of data, which will be available in 2013. However, achieving the 2020 target will require reducing the conversion of ecologically important lands to development to just over one-half the rate of conversion observed in 2001–2006.

The five-year baseline rate of land cover change on the indicator land base across all 12 counties in Puget Sound for the period 2001–2006 was 0.28%. Similar analyses will be completed every five years to track change over the periods 2006–2011, 2011–2016, and 2016–2021.

What Is This Indicator?

The indicator tracks the conversion from vegetated cover to developed cover on undeveloped lands identified as ecologically important and that are under high pressure from development for residential, commercial, and industrial uses. This indicator was developed in 2011 as part of a larger effort to define the ecological importance and development pressure for all parcels within the Puget Sound basin. Indicator lands—one of four land base types that were defined—include those parcels determined to be ecologically important and under high pressure from development. The other three land base types include 1) areas determined to be ecologically important under low pressure from development, 2) areas of lower ecologically importance and high development pressure, and 3) areas of lower ecologically importance and low development pressure.(Figure 1).

A parcel's ecological importance was determined using Ecology, WDFW, and PSNERP data identifying areas of high significance and high integrity with respect to hydrological dynamics, habitat quality, or biodiversity. Areas under high pressure from development included parcels with less than 35% impervious surfaces in private ownership with limited or no regulatory protection.

Because of the coarse scale approach to defining ecologically important lands in the indicator land base, this indicator is appropriately used to identify broad regional trends. This indicator's results are not intended for use in local decision-making, permitting, or planning.

This indicator provides a regional measure of the effectiveness of local jurisdictions' efforts to direct growth away from undeveloped ecologically functional areas. Specifically, the indicator provides a measure of the success of local governments in identifying and protecting ecologically significant and intact lands within and outside of Urban Growth Areas, a priority strategy in the Puget Sound Action Agenda.

It is also an indicator, though perhaps a weaker one, of how effectively local jurisdictions are using or incorporating landscape characterization methods, or other ecologically based information, into their land use decision-making.

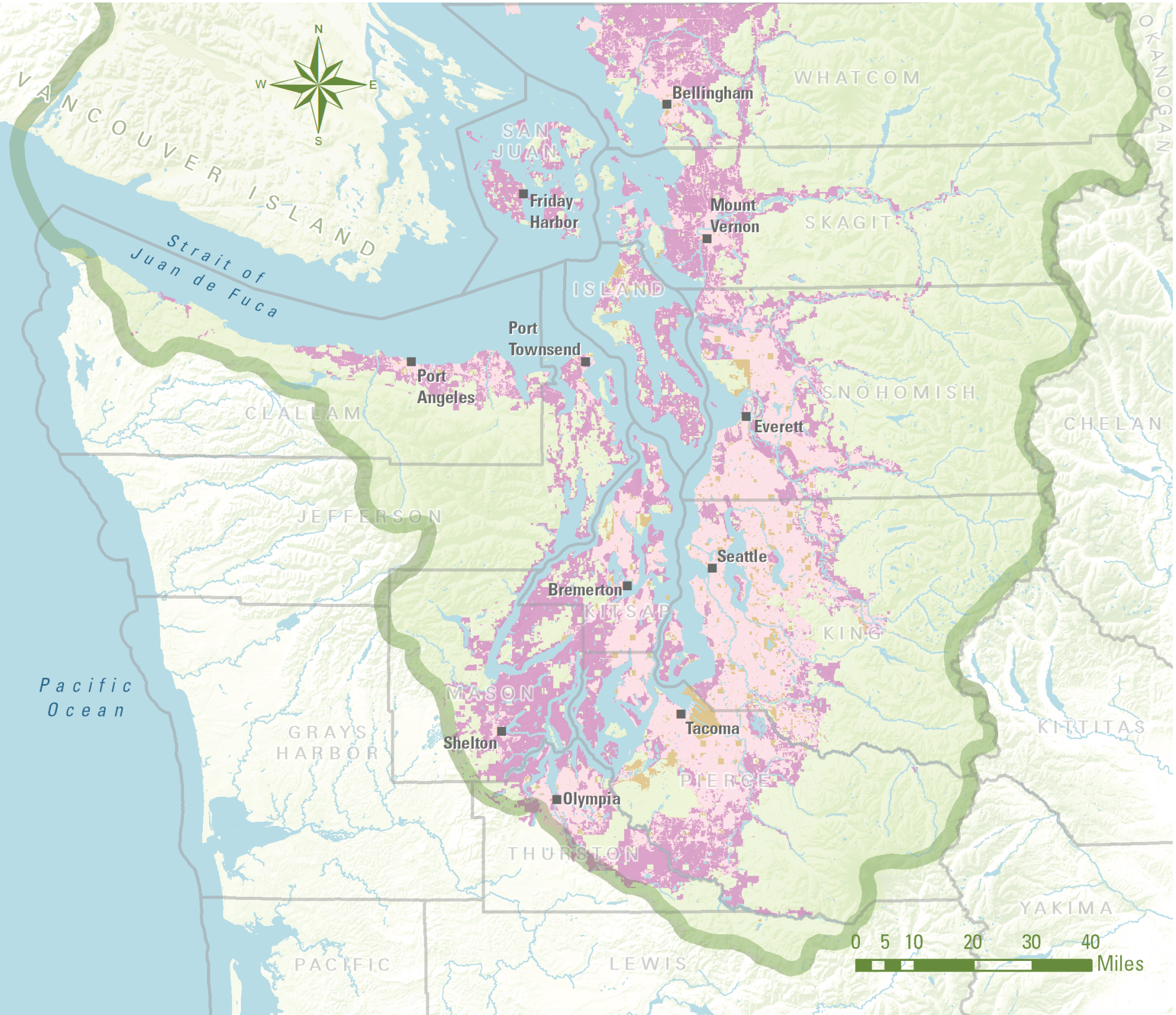
Interpretation of Data

The 2011 indicator land base represents 13% of the total Puget Sound land area (Table 1). As shown in Figure 1, most of the indicator land base lies around the urban fringe, outside of urban growth areas (UGAs) in the Puget Sound lowlands. The parcels that make up the indicator land base often fall along transportation corridors that are also important habitat and hydrological corridors, within the region's most productive farmlands (e.g. around Mount Vernon and north of Bellingham), and in lowland forested areas to the south and west of the Puget Sound. Although the parcels typically fall outside of areas identified as the highest priority and most suitable areas for growth and development (i.e. UGAs), in most cases there are no protective measures in place to direct growth away from these ecologically important areas.

Land Cover Change from Vegetated to Developed, 2001–2006

Land Base Type	Land area (proportion of total Puget Sound land area)	Area converted 2001-2006 (acres)	Proportion of area converted 2001-2006	Proportion of total Puget Sound 2001-2006 conversion
Indicator Land Base high ecological importance, high development pressure	1,084,785 (13%)	2,996	0.28%	15%
high ecological importance, low development pressure	5,737,559 (68%)	1,140	0.02%	6%
low ecological importance, high development pressure	1,101,134 (13.0%)	10,136	0.92%	50%
low ecological importance, low development pressure	558,315 (7%)	6,077	1.09%	29%
TOTAL	8,481,793	20,349	0.24%	

Table 1. Land cover change from a vegetated class to a developed class over the period 2001-2006 in twelve Puget Sound counties.
Source: Washington Department of Fish and Wildlife, Habitat program. Analysis based on many federal, state, and local data sources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Port Townsend
Port Angeles
CLALLAM
SNOHOMISH
Everett
CHELAN
JEFFERSON
Seattle
Bremerton
KITSAP
KING
MASON
GRAYS HARBOR
Shelton
Tacoma
KITTITAS
PIERCE
Olympia
THURSTON
YAKIMA
PACIFIC
LEWIS
0 5 10 20 30 40
Miles

The majority of the land area in Puget Sound (68%) is classified as high ecological importance and low pressure from development. This land base type is primarily made up of publicly owned forest and protected lands, privately owned large scale forest lands, and privately owned protected lands. The remaining 20% of the land area is classified as low ecological importance with high and low development pressure and includes significantly ecologically degraded areas.

A 2011 12-county analysis of land cover change reveals a loss of vegetative cover on 0.28 % of the indicator land base (2,996 of 1,084,785 acres) over the period 2001–2006 (Table 1). This is equivalent to 15% of total vegetation loss in Puget Sound for the period 2001-2006. In contrast, the land area classified as high ecological importance but under low pressure from development only experienced 6% of basin-wide vegetation loss. These preliminary results suggest that protective measures are influencing where development is occurring but it is not yet possible to say how much of the lower conversion rate on low pressure lands is due to protective measures versus suitability for development. The remaining 79% of vegetation loss for the five-year period 2001-2006 occurred on lands classified as low ecological importance, with 50% and 29% of vegetation loss occurring on high and low development pressure lands, respectively.

This analysis suggests that regulatory and other protective measures are directing much of the region's development away from ecologically important lands. However, with roughly 20% of vegetation loss still occurring on ecologically important lands, there is significant room to improve the degree to which we are directing and concentrating new growth in those areas that are not as critical for maintaining and recovering the health or Puget Sound species, habitats, waters, and people.

Land base types

- High Development Pressure: Higher Ecological Importance (Indicator land base)
- High Development Pressure: Lower Ecological Importance
- Low Development Pressure: Higher Ecological Importance
- Low Development Pressure: Lower Ecological Importance

- County Border
- Salish Sea Basin Boundary

Figure 1. Distribution of land base types in Puget Sound.
Source: Washington Department of Fish and Wildlife, Habitat program. Analysis based on many federal, state, and local data sources

Land Development and Cover

INDICATOR:

Land Development Pressure: Proportion of Basin-Wide Population Growth Distribution within Urban Growth Areas (UGAs)

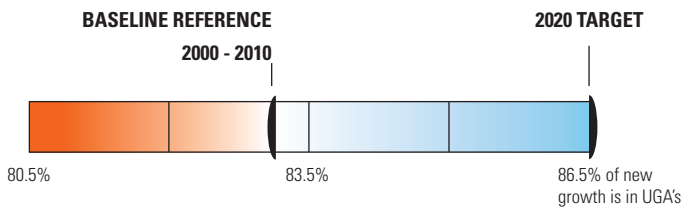
Indicator lead: Kenneth B. Pierce Jr., Washington Department of Fish and Wildlife
Kari Stiles, Puget Sound Institute

TARGET:

The proportion of basin-wide growth occurring within UGAs is at least 86.5% (equivalent to all counties exceeding their population growth goals by 3%), with all counties showing an increase over their 2000–2010 percentage.

PROGRESS:

IS THE TARGET MET?	NO	IS THERE PROGRESS?	UNKNOWN



Based on basin-wide census data from 2000 to 2010, 83% of new growth occurred in UGAs. This value serves as the baseline for future analysis of progress.

Progress Towards 2020 Target

The 2020 target has not yet been met. Based on U.S. census data from 2000 to 2010, the Puget Sound basin-wide population growth occurring within UGAs was 83% (Table 1). For counties, this indicator ranged from 28-101%. The analysis of progress towards the 2020 target is pending until new data are made available. For future analyses of progress, the value derived from the 2000 to 2010 census data will be used as a baseline reference for basin-wide (83%) and county-scale (ranging from 28-101%) population growth distribution.

The 2020 recovery target of 86.5% of population growth occurring within UGAs is equivalent to a 3% increase in the proportion of new population growth occurring within all Puget Sound UGAs. This target represents an effort to direct more growth to those areas deemed best suited for development, while also respecting that Puget Sound includes very urban as well as very rural counties with very different growth management needs and objectives. Data on the distribution of permits for new development (a proxy for population growth) within five of the 12 Puget Sound counties suggest that the target is achievable.

What Is this Indicator?

This indicator tracks the proportion of population growth occurring within UGAs. Population growth is used as a surrogate for development activity in the region. Ten-year U.S. Census data are used for this indicator and the analysis will be updated when census data are next available in 2020. In order to generate intermediate measures of population growth distribution and assess progress toward the target, the less precise U.S. Census American Community Survey will be used.

County comprehensive plans designate UGAs for high-density urbanization with the intent to guide as much growth as possible to these areas to support regional and local economies, meet residence needs for a growing population, and be concurrent with infrastructure availability. This indicator therefore provides a measure of the effectiveness of land use policies and programs. It also measures the effectiveness of development practices in directing new development activities within existing urbanized areas and reducing land development pressures on rural and resource lands outside of urbanized areas.

Interpretation of Data

Washington population data, based on 2010 U.S. Census data, was used for the baseline analysis of population growth distribution for UGAs and rural areas between 2000 and 2010 (Table 1). Basin-wide, 83% of new population growth from 2000 to 2010 occurred within UGAs. For individual counties, the proportion of growth occurring within UGAs ranged from a low of 28% for Mason and Jefferson counties to highs of 92% and 101% for Snohomish and King counties, respectively.

Data are not currently available to complete a trend analysis of population distribution patterns over the past ten years. However, the Washington Department of Commerce has been collecting data on the distribution of permits for new development and a preliminary analysis suggests that growth is increasingly occurring within UGAs. For five central Puget Sound counties, the proportion of permits for new development within UGAs increased at an average rate of 0.85% per year from 2003 to 2010. Carried out over 10 years, these permit data suggest an almost 10% increase in the proportion of growth going into UGAs in central Puget Sound. While permit activity does not correlate exactly to population increase, these reports provide an indication of progress (in a five county area) toward the 2020 recovery goal of an increasing proportion of population growth with UGAs.

Number of people within and outside UGAs from 2000-2010, by county and basin-wide

County	2010 population	2000-2010 Total new population	% New population within UGA 2010	% New Growth (2000-2010) occurring within UGA
Clallam	64,262	7,546	50.0%	47%
Island	78,506	7,878	30.9%	40%
Jefferson	28,605	3,532	41.4%	28%
King	1,931,249	195,569	93.6%	101%*
Kitsap	251,133	20,418	62.1%	65%
Mason	60,699	13,931	27.1%	28%
Pierce	795,225	95,538	82.5%	85%
San Juan	15,769	1,986	21.6%	37%
Skagit	116,901	14,608	67.6%	83%
Snohomish	713,335	107,775	83.0%	92%
Thurston	252,264	76,584	67.6%	50%
Whatcom	201,140	35,034	67.4%	78%
Basin-wide	4,509,088	580,399	81.7%	**83%**

Table 1.
Sources: Washington Department of Fish and Wildlife, Habitat Program and the U.S. Census.

* This number reflects new growth occurring within UGAs and migration of some existing population into UGAs.

Conserving the Lifeblood of Puget Sound

We Cannot Restore the Sound Without an Accurate Stream Inventory

Jamie Glasgow, Director of Science and Research, Wild Fish Conservancy

The challenges facing Puget Sound reach beyond its deep inlets and sinuous shorelines, all the way to the crests of the Cascades and Olympics and into the rivers and streams that are the Sound's lifeblood. The streams that flow into Puget Sound form an integral part of its physical, biological, and chemical integrity. When those streams are inadequately protected, the consequences affect Puget Sound as surely as water flows downhill.

State and local government agencies in Washington are charged with protecting Puget Sound's streams from negative impacts caused by adjacent land-use activities. In many cases that charge hasn't been met for a surprisingly simple reason: agencies have been relying on inaccurate maps.

In Washington, the responsible agencies depend on a process called water typing to identify as well as categorize streams, lakes, and wetlands based on their importance, both ecologically and for human uses. Water typing answers the question: "Where are the streams, and where are the fish habitats within them?" This basic inventory is the most fundamental step in conserving the health of Puget Sound and its tributaries.

Unfortunately, current water typing records and maps often underestimate the actual miles of fish-bearing waters by 50% or more. Wild Fish Conservancy has documented widespread error throughout Puget Sound in designating streams as fish-bearing or non fish-bearing. We have found that a significant number of streams in Puget Sound do not even appear on any maps. Hundreds of miles of productive Puget Sound watersheds are threatened because, when they are misidentified or unidentified on regulatory maps, they are often subjected to inappropriate land-use practices. Many streams are not receiving protection they warrant under already existing regulations.

Unless the watersheds draining into Puget Sound are accurately identified and protected, cumulative effects from the development of these watersheds will continue to contribute to the compromised health of Puget Sound. And until systematic inventories are performed, regulatory maps updated, and streams adequately protected, progress towards a healthy Puget Sound will continue to be significantly offset by the pervasive and in many cases unrecorded loss of freshwater habitat and water quality.

HOW WATER TYPING WORKS, AND DOESN'T

In 1975 the Washington Department of Natural Resources (WDNR) developed the process of water typing to regulate forest practices that impact Washington's surface waters, classifying streams into types depending on their physical, biological, and human-use characteristics. Stream reaches that can support fish are classified as Type F, and non fish-bearing streams are classified as Type N. Accurate water

Snyder Cover Creek. Photo Credit: Wild Fish Conservancy

typing is essential to protecting fish and their habitats because the type and proximity of human activities allowable in areas adjacent to streams and other surface waters is dictated by water type. For example, streamside buffer zones required on Type F streams are larger than those required on Type N streams. In some cases, Type N streams receive no protection at all.

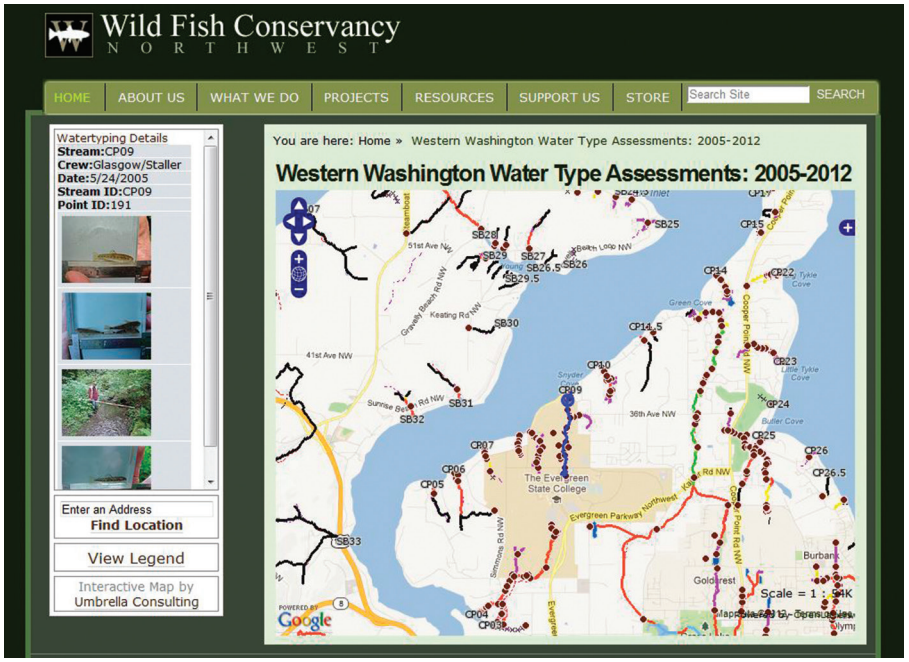
Since 1994, Wild Fish Conservancy has been physically surveying streams throughout Washington to correct their misclassification and qualify them for the protection warranted under existing laws. Funded by U.S. Fish and Wildlife Service in 1994, Wild Fish Conservancy assessed water type in a randomized subsample of watersheds between the Canadian Border and the Columbia River. Since then, using the state-sanctioned watertype survey protocol we have corrected the watertype classification of over 7000 stream reaches statewide.

A CRISIS IN REGULATING DEVELOPMENT

Though originally designed for defining stream buffer requirements for forest practices, the WDNR water typing regulatory maps have been widely adopted by city and county government agencies for regulating development activities outside the forest-practice zones. Recent Wild Fish Conservancy watertyping surveys in rural and suburban landscapes in King, Snohomish, Jefferson, Thurston, Mason, San Juan, Kitsap, and Island counties documented significant errors in the regulatory maps. Many stream reaches identified on the regulatory maps as Type N were found to support fish, and many streams did not even appear on the maps.

CASE IN POINT: Snyder Cove Creek

A small watershed located on Cooper Point in west Olympia, Snyder Cove Creek flows directly into Eld Inlet in South Puget Sound. Prior to a Wild Fish Conservancy survey, the regulatory water type maps identified 0.2 miles of stream channel where Wild Fish Conservancy documented 1.4 miles – a 600% increase in stream length. The regulatory map had identified only 14% of the actual stream network. Unfortunately, the inaccurate stream channel mapping and the underestimated extent of fish habitat exhibited in Snyder Cove Creek regulatory map is not anomalous. Without watertype assessments to correct the inaccurate regulatory maps, watersheds like Snyder Cove Creek are not likely to be afforded adequate protection—protection they warrant under existing regulations.



Wild Fish Conservancey online mapping tool