

# **Valuing Open Space in Central Puget Sound A Synthesis Paper**

## **Regional Open Space Strategy July 2016**

### **Introduction**

This paper is intended as a synthesis of the work of the Ecosystem Services Committee (ESC), one of the technical committees of the Regional Open Space Strategy (ROSS) project. It incorporates the overall conclusions from discussions of the ESC, meetings that took place over 18 months during 2013-2015. It also incorporates the findings from five papers produced by thematic Task Forces convened by the ROSS (findings as summarized by ROSS staff in April 2016) to highlight how an integrated open space strategy across the central Puget Sound region could simultaneously help address five key regional challenges: Biodiversity, Climate Change, Economic Development, Human Health, and Social Equity. Lastly, the paper incorporates findings from a report highlighting the natural asset value of open space across the four-county region addressed by the ROSS.

The resounding message that emerges from this analysis is that current open space planning, conservation, and prioritization practices are highly disjointed and collectively insufficient to sustain the open space system that supports the treasured way of life across the central Puget Sound region. The goal of connecting the region's vital open space system to these five regional challenges underscores the need for a shared vision and strategy that connects the region's growth strategy with open space protection, and aligning investments in both the built and natural infrastructure in order to sustain the health, character and economic success of the region.

### **I. Background—Why Focus on Open Space at the Regional Scale?**

The ROSS project is an innovative effort among planners, environmentalists, conservationists, and local, county, and regional governments in the central Puget Sound region of Washington state (King, Kitsap, Pierce, and Snohomish Counties) to advance the idea that a regional strategy to prioritize conservation and investment in the region's natural infrastructure, its treasured open spaces, is a more holistic and sustainable approach than current planning and conservation practices.

The ROSS team views OPEN SPACE as a term embracing a diverse spectrum of lands and waters across a rural and urban continuum, at large and small scales. Open space includes and is not limited to:

- wilderness lands;
- resource lands for agricultural and timber production;
- national, state, county, and city parks;
- water bodies and wetlands;

- local and regional recreational and “active transportation” trail systems; and
- urban green spaces like parkways, rain gardens, tree canopy, and green roofs.

Key to the ROSS conception of open space is that, ideally, open spaces function in concert as an integrated and connected system with different open spaces supporting one another to achieve multiple benefits. And, to sustain itself and support human communities, this system must remain healthy at the regional scale. If one stretch of a river is damaged, then the river’s ability to support aquatic life is diminished; trails will attract several times the number of users if they are connected regionally; and the agricultural economy depends on a critical mass of farming activity across the region in order to thrive.

Within its Preliminary Comprehensive Strategy, the ROSS further describes open space as providing a vast number of critical and life-enhancing benefits that include:

- Ecosystem services – water quality, flood control, air quality, carbon sequestration, wildlife habitat, biodiversity, etc.;
- Economic vitality – timber resources, agriculture, fisheries, recreational tourism, and the ability to attract anchor businesses due to quality of life and stunning landscapes;
- Improving human health – providing clean air and water, playing a role in supporting every day wellness and healing and reducing stress;
- Social equity – accessible and equitable distribution of open space resources and opportunities for all; and
- Regional identity – sense of place, cultural identity, natural history, and vital educational resources.

The ROSS approach is predicated on the fact that while individual agency and organization efforts to protect and preserve open space are highly valuable, those efforts are often implemented in isolated, single-benefit projects with resources that are sought in competition with others doing similar work either at the project or watershed scale. Moreover, the nature of how dollars have been invested in the protection of open space is not demonstrating or achieving the collective benefits needed to restore the health of Puget Sound, its communities and its residents.

**The ROSS calls for an alternative approach**, one that focuses on advancing a collective, multi-benefit vision for planning and investment in open space at a regional scale spanning technical areas and geo-political boundaries. It calls for planning and investments in open space to be positioned alongside traditional built infrastructure such as the transportation network, water and stormwater conveyance, and flood control systems. Furthermore, it calls for these planning and investment practices to happen at a scale that maximizes the direct benefits that open space contributes to addressing five identified regional challenges: preserving the region’s rich biodiversity, adapting to a changing climate, sustaining economic development, promoting human health and ensuring social equity. These challenges are regional by nature and thus demand an approach that looks beyond traditional planning geographical borders and

considers that by prioritizing and investing in a *regional* open space system, decision makers improve the impact of each dollar invested and thus the outcomes needed to sustain the rich, diverse and treasured quality of life across the region as well as its underlying resiliency.

## **II. Connecting Open Space and Traditional Ecosystem Services**

In March 2005 the Millennium Ecosystem Assessment (MEA) was formally launched as a result of a call by the United Nations Secretary General to better understand the consequences of ecosystem change for communities world-wide and to identify actions needed to enhance the conservation and sustainable use of those ecosystems to benefit humankind. The MEA offered the scientific and policy communities a framework for quantifying the benefits of 23 ecosystem services, and formal strategies for increasing investment in and policies to support their continued and sustainable productivity.

The MEA working groups focused on assessing the changing conditions of ecosystems and the services they provide, the causes of the changes to ecosystems, and the consequences of ecosystem change for human well-being.

The MEA found that over the past six decades, “humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth. In addition, approximately 60% (15 out of 24) of the ecosystem services it examined are being degraded or used unsustainably, including fresh water, capture fisheries, air and water purification, and the regulation of regional and local climate, natural hazards, and pests.”

The ROSS approach in the central Puget Sound region is directly inspired by the MEA findings and the framework for quantifying the value and benefits of ecosystem services to inform better policies and investments in the region’s natural infrastructure. But the ROSS effort aims to push the MEA ecosystem services framework even further, moving beyond traditional ecosystem services to those provided by, and for the benefit of, the open space system across the four-county region. This interconnected system of multiple open space types is at the heart of the quality of life in our region; one that is deeply rooted in natural beauty and abundant natural resources.

As stated earlier, the ROSS vision is that of a highly progressive and innovative regional planning effort to conserve and enhance the open space systems that provide direct inputs to the ecological, economic, social, recreational, and aesthetic vitality of our region, and at the same time a vision that will help our region address a number of key impending challenges.

The ROSS Preliminary Comprehensive Strategy concluded that there is a compelling need to more clearly communicate open space values and benefits as an underpinning

of the overall ROSS effort. With that in mind, the ROSS team adopted the approach that **open space services + benefits = quality of life for humans + habitat**. This takes inspiration from defined human rights and development goals that provide for access to basic necessities and brings in the broad embrace of ecological health and social well-being. This resulted in a re-categorization of the MEA ecosystem services into a modified list of categories of open space services and benefits:

Air	Play	Energy	Aesthetic
Food	Work	Waste	Cultural
Water	Transport	Materials	Education
Shelter	Health	Disaster Mitigation	Community

To summarize, the ROSS team and technical committees started working with a traditional definition of *Ecosystem Services*, then translated those into key *Open Space Services (OSS)* which related more directly to the environmental and human benefits provided by natural and built open spaces. With these newly articulated OSS, the work evolved to quantify these benefits in relation to the five identified regional challenges to create a compelling composite story for why and how the central Puget Sound region must invest in its natural infrastructure to ensure its sustainable development.

### III. Investing in Open Space as a Means to Addressing the Region’s Most Pressing Challenges

The accelerated growth and development in the Puget Sound region poses a constant threat to the open space system. This intense growth also illuminates the urgent need to address other pressing regional challenges as part of regular planning processes. As mentioned earlier, this includes: adapting to and mitigating for a **changing climate**, preserving the region’s rich **biodiversity**, advancing **social equity** objectives, attending to the **health and well-being** of the region’s residents and stewarding **economic development** opportunities for the benefit of people, place and economy. These challenges encapsulate a breadth of human and environmental conditions within our region in five succinct areas of concern, which can be addressed, in part, through prioritizing the protection and augmentation of the region’s open space system. Ultimately, the goal in examining open space through the lens of these regional challenges is to illustrate the overall importance of open space in preserving and protecting the continued success of the region’s economy, its communities and its people. This further underscores the need for an integrated approach to addressing the region’s open space protection as part of its overall growth management strategy.

**Image 1. Regional Challenges as Identified by ROSS**



To better understand how open space helps address these regional challenges, the ROSS team convened five expert task forces to explore how open space investments can support solutions to these challenges. Each task force produced an “overview paper” using a common template to highlight: 1) the primary challenges facing the region; 2) the relationship of each challenge to open space; and 3) the rationale for a regional approach to open space protection. Subsequently, ROSS staff together with task force experts developed a set of recommended actions where open space could contribute to addressing each of the challenges and identified sample metrics for assessing how the region can optimize benefits. These can be found in a report titled “Open Space Recommendations in Response to Regional Challenges” in Appendix 2.

Drawing from the work of the task forces and the ROSS staff, below are **common themes** from all five task force papers:

- Land conversion and either the lack of or loss of open space is a key factor impacting the health and sustainability of the region, its communities and people.
- Open space and the services it generates is of fundamental importance to addressing, mitigating, or adapting to the negative impacts on each challenge (i.e. climate change, loss of biodiversity, human health) and core to achieving sustainability across these respective challenges.
- There are significant economic or financial impacts of losing open space and/or replacing open space services with traditional engineered solutions. Conversely, there are significant cost-savings that could be realized if open space services are considered a core part of the portfolio of infrastructure investments across the region.
- Open space should be more systematically factored into current and future land-use planning processes, tools, practices, and policies underscoring the importance of accounting for benefits/impacts at the regional scale.

Table 1 below summarizes the five key regional challenges and highlights how open space helps address the challenges. It also calls out the benefits, difficulties and potential actions *unique* to each regional challenge. Appendix I contains a more comprehensive summary matrix of information extracted directly from each of the task force papers.

**Table 1. Relationship of Open Space to Regional Challenges**

Regional Challenge	How Open Space Addresses Regional Challenges	Unique Benefits, Challenges, and Key Actions
<p><b>Biodiversity:</b> The sum of all life forms and their associated biological processes. A rich diversity of species and ecosystems yields the strongest chance of maintaining the wide range of biological processes and their benefits to the region’s economy, health and culture.</p>	<p>Open space provides the critical foundation supporting the richness of our regions biodiversity. This richness depends both on actual physical area and quality of open space. This includes: 1) habitat along streams and rivers that affects the diversity of salmon species (the loss of habitat is already resulting in a steep decline of a number of salmon species across the region); 2) biodiversity in urban and suburban areas from parks and backyard green space (less green space means: fewer flowers to host pollinators, fewer tree and pervious surface to help stabilize soil and absorb and filter water).</p>	<p>A public information campaign is vital to improve what the public understands and expects of investments in the region’s biodiversity. Biodiversity principles should be widely integrated into land use planning.</p>
<p><b>Climate Change:</b> Anthropocentric activities causing an overall warming of the Earth. The result of this warming is the alteration of normal climate patterns. Impacts of such long-term change include rise in sea level, melting of snow and ice, more extreme heat events, fires and droughts and more extreme storms, rainfall and floods.</p>	<p>Open space is a key mechanism through which to implement climate mitigation and adaptation, and achieve other environmental, social, and economic benefits, by: 1) Mitigating the urban heat island effect (e.g., providing shading and cooling, increasing albedo); 2) Conserving habitat and facilitating connectivity (e.g., providing permeable migration corridors to facilitate species range shifts, identifying temporary open space areas that may facilitate climate migration); 3) Managing surface water and riverine/coastal flood risk (e.g., increasing permeable surface area, allowing for groundwater recharge, reducing rate and volume of runoff); 4) Managing surface water and riverine/coastal flood risk (e.g., increasing permeable surface area, allowing for groundwater recharge, reducing rate and volume of runoff); 5) Enhancing water quality (e.g., filtering and removing sediment and pollutants); 6) Sequestering and storing carbon in vegetation and soils (e.g., protecting and restoring forests and coastal wetlands, increasing the carbon content of soils); 7) Providing space for the siting of alternative energy sources, such as wind, hydro, and solar power; 8) Providing space for regionally-sourced food and fiber (e.g., enhancing food security, providing sustainably managed wood and natural materials to replace</p>	<p>Open space is a key feature in the climate change adaptation portfolio. Intact and abundant open space serves as a buffer while the loss of open space is expected to exacerbate the impacts of climate change such as those from flooding and landslides due to more intense storms. Therefore conservation of all manner of green infrastructure should be a key strategy as part of a front-line defense to mitigation and adaptation actions.</p>

	<p>high fossil fuel consuming materials such as steel and concrete); and 9) Reducing the need to travel by car by providing greenways for walking and bicycling, thereby decreasing greenhouse gas emissions.</p>	
<p><b>Economic Development:</b> Defined by the Economic Development Administration as an effort to "create conditions for economic growth and improved quality of life by expanding the capacity of individuals, firms and communities to maximize the use of their talents and skills to support innovation, lower transaction costs, and responsibly produce and trade valuable goods and services"</p>	<p>The region's economy has been built and thrives on the services provided by open space in both direct and indirect ways. Specifically, open space is tied to the Pacific Northwest brand with roots in its beauty and abundant natural resources. Open spaces also serve in a more direct provisioning role in providing economic inputs such as providing food, building materials, fuel and medicinal services.</p>	<p>The region's economy has been built and thrives on the services provided by open space. The loss of open space has a direct effect on the region's economy including lost dollars from tourism, loss of key businesses and talent, and more expensive investments in engineered solutions related to infrastructure. The economic values provided by the region's natural infrastructure should be incorporated into growth management planning and economic forecasting.</p>
<p><b>Human Health:</b> Defined by the World Health Organization as the state of complete physical, mental and social well-being and not merely the absence of disease.</p>	<p>In addition to the social and physical environments where people live, interaction with open space and nature is a likely determinant of personal and community level health and well-being. "Open spaces provide unique resources for promoting healthy behaviors, lifestyles and opportunities." Open space planning and management can contribute to health promotion and disease prevention through: 1) promoting physical activity that reduces risk of disease, depression and many other preventable conditions (think active transportation and biking to work); 2) promoting mental health that reduces impacts from conditions such as ADHD, anxiety, depression and dementia; 3) building social connections and strong community cohesion; 4) improving environmental factors that affect air quality, water quality (in both surface and drinking water), and exposure to toxic chemicals; 5) improving access to healthy food; 6) improving resiliency in the face of environmental disasters.</p>	<p>With an increase in health problems in the region, as well as nationally (obesity and asthma), open space provides an opportunity to add benefit to both physical and mental well-being. It is particularly important to bring open space to where people live so they benefit on a regular/daily basis. That suggests that the human health impacts associated with open space need to be routinely factored into landscape planning and design.</p>
<p><b>Social Equity:</b> Defined by Puget Sound Regional Council as the system of fairness in which "all people, regardless of where they live, have access to the resources</p>	<p>MEA states: "Everyone in the world depends on nature and ecosystem services to provide the conditions for a decent, healthy, and secure life." Access to open space is not uniform across all</p>	<p>There is a historic link between open space and community vibrancy. Planners and policy makers must factor in the importance of open space for</p>

and opportunities that improve their quality of life and let them reach their full potential."	communities and demographic groups. Open space quality, access, quantity and cultural applicability are recognized environmental justice concerns, including access by vulnerable and less mobile populations. Equitable distribution of high quality open space environments, facilities and programs can help address environmental and social justice concerns in the region.	"all people," remembering that equal access to quality open spaces is essential so that vulnerable populations can also enjoy their benefits. As such, social equity must be a key consideration Integrated into open space planning processes and the prioritization of investments.
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Despite the fact that each of the five regional challenges highlights different connections and opportunities, the findings are clear and compelling: investing in open space conservation and protection is a key mechanism through which to implement climate mitigation and adaptation actions and achieve vital biodiversity, environmental, social, economic and human health and well-being benefits. The task force overview papers uniformly called attention to the fact that the scale of the challenges is regional, and so must be the solutions. Open space can be part of the solution to address these challenges, but most effectively if open space planning and protection are considered at a similar regional scale.

There is also uniformity among the work of the task forces and the ROSS staff for how to move forward with prioritizing and investing in open space including:

- The need for more knowledge about the services that open space provides, and continuous assessment of and full accounting of open space resource impacts and benefits;
- The need for better public outreach, engagement and education on the benefits associated with open space;
- The need to incorporate open space knowledge and multi-benefit values across planning sectors, beyond conservation and parks; and
- The need for additional funding to invest in open space conservation and protection;
- The need for stronger governance and policy action to prioritize open space investment;
- The need for better mapping and prioritization tools for open space planning.
- The need to better understand the co-benefits and potential tradeoffs associated with prioritizing some open spaces over others, especially at the regional scale.

#### **IV. Open Space Values and Benefits at Multiple Scales**

In general, understanding and communicating information about ecosystem services and the focus on those services with specific connections with open space, values, and benefits is challenging. Even so, **establishing a baseline of current services provided by open space across the region** is of vital importance in order to measure changes over time. With this in mind, the ROSS team compiled a select inventory of the analytical

tools currently being used to assess ecosystem services values and benefits, summarized in the table below.

**Table 2. Summary of Baseline Analytical Tools**

Tool Name	Organizational Presenter	Tool Type
InVEST	Natural Capital Project	Scenario-based, project specific analysis of ecosystem services and tradeoffs
ARIES – Artificial Intelligence for Ecosystem Services	Earth Economics	Modeling platform, data integration, probability calculator
ENVISION Integrated Modeling Platform	Puget Sound Ecosystem Portfolio Model, USGS	Risk-assessment modeling using future scenarios
Action Agenda Strategy + Sub Strategies	Puget Sound Partnership	Multiple stakeholder prioritization process
MODA (Multi-Objective Decision Analysis)	CH2MHill, City of Seattle project	Multiple stakeholder decision-making
STAR Communities	King County	Sustainability measurement and rating system for communities

While the expectations were high for a “silver bullet” among these tools for the ROSS to adapt or adopt for its own data analysis and decision-making needs, in the end, none of these were a good fit for the ROSS approach. These are the key considerations that could not be met by any of the existing tools:

- While spatial and quantification information is needed, being able to prioritize this information is key.
- Prioritizing among services through the lens of the five regional challenges will require a unique approach to visualizing these multi-criteria across the region.
- Understanding the impact of land use and various scenarios requires a look at demographics, density, and anticipated migration trends if the ROSS is to contextualize social equity and prioritize specific open space services and/or geographies.
- All of the spatially based tools begin with land cover data, which is *but one key starting point* to understand the baseline of current services provided by the region’s open space system.

The important lesson learned in examining these existing tools is that the ROSS approach requires layering together multi-criteria open space baseline data through the lens of the five regional challenges; *such a tool does not currently exist* (see section V. below for a description of a new tool in development).

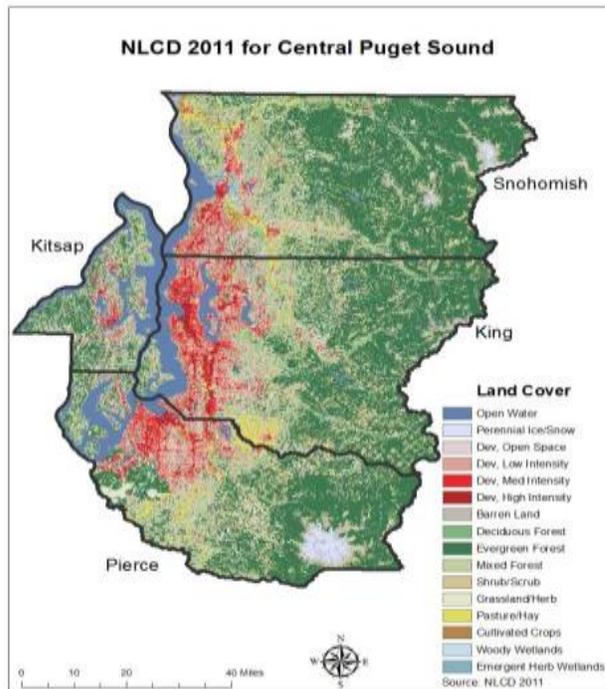
### *Establishing a Baseline of Open Space Services*

In order to articulate the business case for investing in the region’s open space system, planners and decision makers need a clear picture and understanding of the baseline value of open space services - vital data to inform decision making. Specifically, a baseline would provide a picture of the existing condition of open space land cover and the services that they provide, and thus create the potential to show losses and gains under different planning, conservation, and land-use scenarios. Additionally, it would provide the scaffolding needed for exploring tools and decision-making frameworks that could identify threats and opportunities, and inform prioritization of interventions.

The region’s existing landscapes or land cover, such as forests, grasslands, wetlands and water bodies, would spatially create a picture of the baseline condition of open space services. This is most easily represented by the National Land Cover Database (NLCD), a product of a consortium of federal agencies, which provides spatial reference and descriptive data for characteristics of the land surface such as land classification (for example, urban, agriculture, and forest), percent impervious surface, and percent tree canopy cover. NLCD supports a wide variety of government and non-governmental applications that seek to assess ecosystem status and health, understand the spatial patterns of biodiversity, predict effects of climate change, and develop land management policy -- a perfect fit for the demands of the ROSS approach.

Earth Economics, a regional NGO specializing in the valuation of ecosystem services, together with ROSS staff, used current NLCD data to roughly quantify the four-county region’s open space system, based on standard NLCD land cover classifications. The image and table below reflects these initial findings.

**Image 2. Open Space Assets Based on Land Cover**



**Table 3. Approximate Acreage of Open Space by Land Cover**

**TOTAL OPEN SPACE ACREAGE<sup>11</sup>**

Open Water	357,030
Developed, Open Space	264,364
Barren Land / Beach	121,302
Deciduous Forest	129,181
Evergreen Forest	1,805,346
Mixed Forest	376,762
Shrub / Scrub	427,020
Grassland / Herbaceous	136,752
Pasture / Hay	107,736
Cultivated	14,863
Woody Wetlands	74,337
Emergent Herbaceous Wetlands	23,526

**Source: Earth Economics**

This quick exercise offered a coarse assessment of current baseline conditions of the study area’s open space and in the process, highlighted a number of challenges with using the NLCD database, due largely to its more standard classification of land cover. For example, beaches are designated as “barren land,” and “open water” includes Puget Sound, streams, reservoirs, and lakes. Each of these types of land and waterways provide different services, and for purposes of the ROSS approach, need to be separated in more refined land classification layers that align more accurately with the ROSS’s definition of OSS. The Earth Economics research team adapted their traditional methodology, which is based on the standard NLCD land classification, to embrace a more robust baseline of ROSS-defined open space services in order to complete a monetary valuation of the central Puget Sound regions open spaces based on the ROSS definition of OSS.

*The Monetary Value of Open Space in the Central Puget Sound Region*

Using the coarse baseline of OSS provided by Earth Economics as a starting point, the ROSS team endeavored to value the region’s OSS to determine, in real dollars, how much they contribute to the region’s economy. Monetary valuation of ecosystem services or as the ROSS team asserts, OSS, is a recognized tool for illuminating the huge financial assets derived from the landscape. These assets are consistently left out of traditional economic measures and accounting methods and therefore not factored into important land-use planning processes and investment decisions. It is important to note that while a monetary valuation provides new and often compelling data on the value of nature’s assets (as is the case here), it is not a complete picture, as capturing the

benefits and values of traditional ecosystem services in dollar values continues to be an evolving science. Therefore, while the valuation findings are compelling, they are only a small part of the overall ROSS story and approach.

Working with ROSS staff, the research team at Earth Economics refined NLCD land classification data to provide more nuance to certain land cover types where valuation data is available -- for example, adding buffers to water body classifications and distinguishing lands within and outside of urban growth boundaries. In addition, Earth Economics adopted the ROSS OSS framework, and mapped the 16 ROSS OSS categories based on the individual benefits/services within each. This helped provide a clearer and more consistent connection between NLCD land classification and the ROSS approach.

Earth Economics applied Benefit Transfer Methodology to indirectly estimate the value of ecological goods and services of open spaces within the central Puget Sound region. This method generates a range of values for goods and services that have credible, peer-reviewed studies associated with them from within the study area (in this case the four-county region). When values were not available for the specific region, studies from geographically similar areas were applied. Due to the gap in primary research on a number of key open space services, this methodology does not fully reflect the total values of open space in the region, which helps explain the wide range in values from an overly conservative calculation to a more mid-range calculation. Even so, applying the methodology offers an important benchmark of the significant financial inputs provided by open spaces across the region.

The valuation study reveals that open space and its services are hugely valuable to the region, yielding an asset value ranging between \$328 and \$825 billion, even with the aforementioned limitations of this type of analysis. Table 4 below shows the low and high dollar value of the services provided **annually** to our regional economy by open space across central Puget Sound – between \$11.4 and \$25.2 billion – and Table 5 shows the values contributed by specific land cover types.

**Table 4. Estimated Annual Value of Open Space Services**

<b>Estimated Open Space Service Values (in thousands of \$\$ per year)</b>		
<b>Service</b>	<b>Low</b>	<b>High</b>
Aesthetic	\$2,293,975	\$9,509,713
Air	\$422,203	\$529,187
Food	\$12,587	\$86,472
Shelter	\$73,984	\$111,407
Water	\$62,605	\$1,925,347
Health	\$41,168	\$50,352
Play	\$2,633,343	\$4,132,675
Disaster Mitigation	\$1,860,499	\$4,194,473
Raw Materials	\$23,279	\$155,093
Waste	<u>\$4,034,301</u>	<u>\$4,568,983</u>
<b>Total</b>	<b>\$11,457,944</b>	<b>\$25,263,702</b>

**Table 5. Estimated Annual OSS Value by Land Cover**

<b>Estimated Open Space Service Values by Land Cover Type (in thousands of \$\$ per year).</b>				
<b>Land Cover</b>		<b>Acres</b>	<b>Low</b>	<b>High</b>
<b>Forest</b>	Deciduous	130,779	\$349,294	\$695,782
	Evergreen	1,797,553	\$4,594,833	\$11,280,912
	Mixed	376,893	\$970,465	\$2,052,403
	Emergent Herbaceous	23,777	\$129,607	\$1,083,597
<b>Wetlands</b>	Woody	74,377	\$474,995	\$3,507,100
	Shrub	430,052	\$188,793	\$204,296
<b>Shrub/Grassland</b>	Grassland/Herbaceous	138,109	\$134,857	\$175,296
	Pasture/Hay	106,823	\$7,326	\$53,952
	Cultivated Crops	14,839	\$1,222	\$37,326
<b>Open Water/Beach</b>	Beach	28,987	\$1,501,123	\$1,546,772
	Lakes	55,392	\$2,273	\$180,345
	Reservoirs	2,775	\$260	\$2,370
	Rivers	13,492	\$356,270	\$367,462
	Saltwater	285,069	\$2,649,788	\$3,912,022
<b>Developed</b>	Open Space (urban parks)	<u>20,795</u>	<u>\$96,836</u>	<u>\$164,067</u>
<b>Totals</b>		<b>3,499,712</b>	<b>\$11,457,942</b>	<b>\$25,263,702</b>

Source: <http://eartheconomics.org/FileLibrary/file/Reports/Earth%20Economics%20ROSS%20ESV%202015.pdf>

It is important to draw attention to the open space benefits that cannot be estimated as easily in dollars, especially given that the ROSS approach embraces a broader definition of open space and is intended to capture services that are difficult to quantify using traditional definitions and data. This includes services such as habitat corridors; bicycle and recreation trail connectivity and human health and community well-being benefits. Absent credible data to represent these services, their value could not be factored into the overall monetary valuation for the region as prepared by Earth Economics. This suggests that the range of value is conservative and will grow overtime as better information becomes available.

This valuation exercise brings to light important results that can inform prioritization of investments in the region's open space including:

- People place a high value on being proximate to beaches, water bodies and forests; this value is reflected in home prices demonstrating a willingness to pay a premium for these aesthetic services (views of open space).
- Wetlands are highly prized across a number of open space services.
- Rivers, grasslands and shrub lands carry significant value for play (recreation).
- Open space values are higher in more densely populated areas. This translates to the fact that urban parks are more highly valued than their rural counterparts

(an economic reality that will only increase as the population increases, resulting in increased density and reduced acreage of urban open space over time).

The exercise is based on data availability, which heavily influences the results. This simply means that what gets measured gets valued. Here are a number of findings that are influenced by the lack of data:

- Food values are not well represented in current valuation studies and are thus under-represented in the overall valuation of services in the central Puget Sound region.
- In contrast to saltwater beach proximity, urban lakes, such as Lakes Washington, Union and Sammamish are currently not well valued by standard ecosystem services primary studies.
- The connection between open space and human health and well-being is a growing area of interest yet few studies actually calculate the human health values provided by open space (most likely measured in terms of health expenditures or dollars saved).
- The health of any landscape directly affects the quality and quantity of services it provides but the methodology for assessing the health of open space (or an ecosystem) is not yet available when conducting a valuation study.

Monetary valuation of open space services such as this one is a leap forward in understanding the enormous importance that open space brings to a region's economy, its people, and communities. The dollar values are real and demonstrate direct inputs to the region's economy provided by forests, wetlands, parks, open water resources and prized vistas. The study provides an important baseline accounting of monetary values from which to measure change over time. For example, if forests are lost, so are the filtration benefits that the forest provides and thus its value to the economy. Those filtration benefits are of vital importance to many beneficiaries including the millions of consumers of high-quality drinking water provided by utilities such as Everett Utility Services, Tacoma and Seattle Public Utilities.

Furthermore, this analysis represents the opportunity to consider policy and institutional actions stemming from new knowledge of the fundamental value of what is being lost with every acre of open space converted to development or some other land type that is less valuable and provides fewer benefits. These conclusions lend further credence to the ROSS approach to prioritize the protection and conservation of our region's valuable open space and the services it provides. Put into action, these findings can transform how the region's policymakers incorporate the value of open space into their decision-making process, potentially leading to land-use planning processes and actions that prioritize investments in the region's open space system.

## **V. Developing an Innovative Tool for Assessing Open Space Benefits**

Throughout the work of the ROSS project, the task of quantifying, organizing, and communicating the baseline value of open space services in the central Puget Sound region has proven a complex undertaking. The findings of the monetary valuation are

both unique and compelling, yet still are an incomplete documentation of a baseline of services that landscapes provide. A more robust set of regionally-specific open space service data that can be expressed visually was identified as a vital need. The goal was that such visualization could represent the beginnings of a decision-making tool to support geographically-based, prioritized, conservation actions and investments.

Coincidental to the ROSS team's interest in creating a new, comprehensive OSS planning tool, staff learned of the work of the Trust for Public Lands (TPL), and its award-winning Conservation Visioning and GIS division with expertise in providing strategic analysis and planning of large landscapes. TPL uses its expertise to help communities prioritize conservation goals (especially those focused on open space) with spatial analysis through mapping and modeling processes.

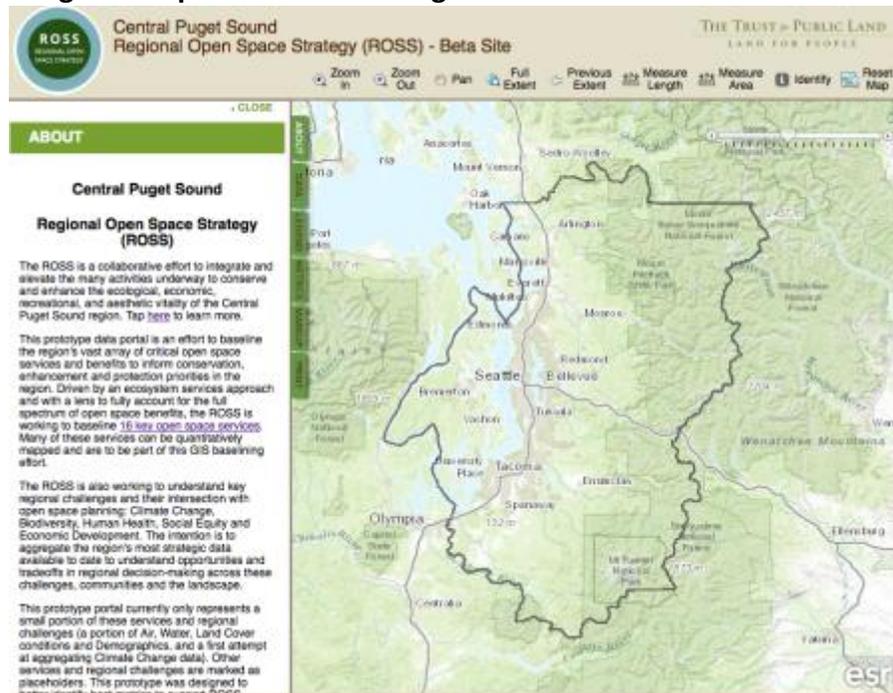
The ROSS team communicated the breadth of expectations for a new tool and TPL built an initial prototype that can be accessed via a web portal developed around two Open Space Services, air and water, and one regional challenge, climate change. The prototype was limited in scope in order to better test the approach for metrics development, and to determine the architecture, navigation, background data, and visualization options for the decision support portal. The primary goal of the tool (from hereon the "Portal") is to educate planners and policymakers about the robustness and importance of the open space system and the services it provides, and to provide an interactive platform that incorporates quantified open space service values to inform prioritization of public investment. Further, the tool is organized to enable the user to identify alternative land use cover scenarios that best address each of the five regional challenges as described above.

The ROSS team worked with the TPL team to establish the basic architecture, functionality, and accessibility of the Portal to include:

- Open space services baseline: based on available scientific data
- Regional challenges: with weighted criteria
- Open space services conditions + demographic data
- Basic data decisions + assumptions
- A query and report card function
- A zooming function to capture multiple geographic scales

The Portal was successfully launched in early 2015. Image 3 below is a snapshot of the prototype Portal showing the regional geographic scale and basic architecture.

Image 3. Snapshot of Portal Image



The prototype Portal, while limited to two services and one regional challenge, successfully demonstrated the functionality of relating multiple open space services with regional challenges and overlaying important demographic information illuminated on a particular geography at different scales. It showed brilliantly how the Portal could be used to achieve the objectives of educating planners and policymakers about the significance and importance of the open space system and the services it provides when making decisions about land-use actions and investments. Given this exciting and enormous promise, the ROSS team is continuing its partnership with TPL and is investing in the second phase of building out the tool. TPL is leading the work in close collaboration with the ROSS staff and a team of regional experts to identify additional data and studies needed to map and model information relating to a subset of the remaining OSS. The expected launch date of the phase two Portal, tentatively named the Open Space Benefits Assessment Tool, is October 2016. Ross staff and consultants are working with TPL and the Puget Sound Regional Council's (PSRC) leadership and staff to help market and demonstrate the new tool's capabilities within the network of planners and policymakers across the region. The aim of this outreach is to best position the tool to work in conjunctions with existing planning processes and landscape modeling tools to better incorporate open space into all aspects of regional growth management planning.

## VI. A Unifying Message: Action Strategies for Prioritizing Open Space through the Lenses of Five Regional Challenges

The resounding uniformity of the findings of the task force reports and the regional valuation study highlight the significant value of the region's open spaces and the services they provide, and the significant loss of value when those services are lost due

to conversion or degradation. The loss of these services is like the ripple created when a pebble falls into a pond; the enormity of the original impact continues to grow even as it moves away from the epicenter of impact. This is attributable to the multiple benefits provided by open spaces; even one lost acre has a radiating impact throughout the region. Yet, current land-use policies and practices contribute to hundreds and hundreds of acres of lost open space every year. Consider that from 2001 – 2011, the region lost more than 25% of its evergreen forest cover, largely due to development and conversion to lower value scrub cover. We now know that the ripple of a lost acre of evergreen forest means multiple lost services including: carbon sequestration, water filtration and absorption, soil stability, air filtration, recreation services, and human health benefits. The new and highly anticipated Open Space Benefits Assessment Tool will significantly improve the ability of planners and decision-makers to calculate the multiplier effect for the many layers of both benefits and lost services to the region from each acre of open space.

There were two unifying recommendations across each of the task force reports as well as from the regional valuation study: 1) the need to educate planners, policymakers and the public on the value of open spaces and their contribution to the regional economy; and 2) the need to integrate Open Space Services values into standard land-use and land conservation planning process, tools, and investment decisions. If conservation advocates and policymakers fail to institute vital changes in current planning and investment practices with regard to the region's open space services, the rippling impact will continue to be widespread, affecting the long-term health of the economy, the environment, the public, and to the very way of life that is so deeply cherished in this region.

### ***The Need for Effective Governance at the Regional Level***

The central Puget Sound region is known for progressive government policies on top of a profound love of the natural environment by its residents. In addition, there are hundreds of organizations in the region fighting to protect and conserve open space resources. So why is the region still struggling with significant loss of its natural resources and (possibly priceless) open space? One important reason: the region lacks a unifying vision for how to connect and leverage all of this activity *at the regional level*. It means that the efforts by dozens of federal and state agencies, the 900-plus municipalities and taxing authorities, and the hundreds of non-profit and volunteer organizations in the region remain largely uncoordinated and therefore inadequately funded.

Work tends to focus on a particular project area or on a specific issue, and is often driven by opportunistic considerations rather than a carefully constructed set of priorities. This *silo-ing* of efforts and money hampers the ability to maximize scarce dollars and undermines all of these efforts to protect open spaces and the benefits they provide for people, the environment and the economy.

Despite the robustness of governance institutions, there is no regional organization with a broad enough mandate or authority to keep track of the cumulative investments and outcomes of every project related to open space protection. The lack of a vision and a strategy for prioritizing the most valuable open spaces also makes it impossible to know if expenditures on natural resource protection are demonstrating positive results.

The entity that comes the closest to fulfilling this role is the Puget Sound Regional Council (PSRC), an organization with a regional purview focused primarily on transportation projects and funding. PSRC develops and implements Vision 2040, a regional growth strategy that includes language on open space planning but has not yet dedicated staff resources to focusing on open space planning as is called for by its plan.

The ROSS team has been working closely with PSRC leadership and staff to develop ways to incorporate the ROSS vision into the regional growth strategy moving forward. The thinking motivating this collaboration is with additional funding, PSRC could use its current authority to develop Multi-County Planning Policies (MPPs) and help guide the cities and counties across the region to incorporate open space prioritization through existing comprehensive plans. Combined with its authority to review and comment on the transportation elements of the comprehensive plan of every city and county in the four-county central Puget Sound region, it is a potent idea to creatively link open space planning to transportation and land use planning under this regional umbrella. The forthcoming Open Space Benefits Assessment Tool will be a powerful instrument to enable the integration of open space into PSRC traditional planning processes and practices. Coupled with some new funding to PSRC to integrate watershed planning into its planning processes, it marks an important and exciting turning point for how the region prioritizes open space.

Yet the gap in the current governance and finance system to support open space planning at the regional scale is perpetuating the loss of open space to other uses (mostly yielding fewer services). We now know that this is costing the region billions of dollars of direct inputs to the economy, all the while reducing the resiliency of the environment and reducing the health of people. It's time for a better approach!

### ***Call to Action***

With all that is now known about open spaces and the valuable benefits and services they provide, regional planners and decision makers must take immediate action to reverse the current pace of loss of open space. A vital first step is to establish a collaborative regional body whose central purpose is to prioritize open space protection and conservation work. This work will be shaped by a regional open space strategy with a unifying vision and implementation plan that includes a mechanism for leveraging funding from multiple sources across the region and beyond. Such a bold step will require equally bold leadership and political will to achieve this vital collective impact. To be clear about what is at risk: without this boldness of action, the quality of life that is cherished within the central Puget Sound region will falter. Further loss of open space translates as follows: the region cannot effectively mitigate against or adapt to climate

change; biodiversity loss will reach new heights, with more listings of species endangered to become extinct; economic development opportunities will slow and eventually stall; and human health and social equity within the region will degrade to unacceptable levels. We need open spaces, we are dependent on their services, and our economy benefits from the billions of dollars they provide on an annual basis. If the central Puget Sound region expects to continue to thrive into the future, we must take action to protect these natural assets today.

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  - Open Space Valuation of Central Puget Sound:  
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## **Appendix I. Matrix Summary of Task Force Papers**

White Papers Summary: As extracted from the five task force papers: <http://www.openspacepugetsound.org/ross-reports>

	Biodiversity	Climate Change	Social Equity	Human Health	Economic Development
What are the primary challenges facing Central Puget Sound?	<p>* Population expansion and land development</p> <p>* habitat fragmentation, housing growth, agricultural expansion, invasive species, logging, reduce in surface and groundwater, shoreline armoring and pollution = degradation of habitat</p> <p>* social and governmental management choices</p> <p>* Five primary challenges facing biodiversity protection in coming years in Central Puget Sound will be to: 1) understand and address threats to regional biodiversity with prioritized, results-driven actions; 2) apply ecological principals to land use management at multiple spatial scales; 3) plan for a future that conserves biodiversity as part of sustainable development; 4) identify indicators and create monitoring system that reveals whether strategies are protecting biodiversity or not, and if not, manage adaptively to continuously improve; and 5) develop a citizenry that values protecting a rich, regional biodiversity.</p> <p>*Open space as defined by ROSS provides the primary area for all species, habitat and ecological interactions. The richness and long-term health of our regional biodiversity depends both on the amount and quality of open space, and its spatial structure and configuration.</p>	<p>*Climate change will challenge the region with impacts such increased average temperatures, altered precipitation patterns, altered hydrology (e.g., decreased snowpack, flow patterns), altered oceanic and atmospheric circulation, sea level rise, and changes in water chemistry and quality.</p> <p>* Cascading impacts include increased disturbances (e.g., fire, insect outbreaks), inundation of low-lying coastal areas, erosion, habitat loss, infrastructure damage, heat-related illnesses, increased vector-borne diseases, and stress on water supplies and quality</p> <p>*The primary challenges facing climate mitigation and adaptation in the Central Puget Sound region are related to: 1) Understanding the risks posed by a changing climate and identifying appropriate responses; 2) Increasing capacity (financial, institutional) to implement and sustain climate responses across jurisdictions and sectors (e.g., public and private); 3) Generating and sustaining interest and political/stakeholder will over time, especially in relation to other pressing issues and priorities (e.g., economic problems, balancing the costs of inaction versus no action) 4) Alleviating the disproportionate environmental and health effects of climate change on the most vulnerable citizens (i.e., low-income families, elderly, infants); 5) Coordinating existing climate response efforts throughout the region; 6) Uncertainty of the timing, magnitude, and in some cases direction of change, and knowing what strategies to pursue and within what time frame; and 7) Monitoring the effectiveness of climate responses and adjusting activities and investments if needed.</p> <p>*Open space is a key mechanism through which to implement climate mitigation and adaptation, and achieve other environmental, social, and economic benefits.</p> <p>*mitigate UHI, conserve habitat, manage surface water</p>	<p>* In comparison to the general population, low income populations and communities of color have less access to green space, lower quality and less culturally-relevant recreational options, and higher rates of poor health and obesity that can be linked to lack of open space opportunities.</p> <p>* Unless disparities in access to quality open space services are intentionally addressed, they may become more pronounced as the Central Puget Sound Region continues to experience unprecedented growth.</p> <p>* The significant connection of open space to social equity is through the human health benefits open space provides to populations that are most at risk of decreased life expectancy. Open spaces are indicators of healthy communities where children play, families spend time together, people of all ages exercise, relax and rejuvenate, and neighborhoods are made more economically sound.</p> <p>*Access to, and benefits from, open space are critical aspects of equity.</p> <p>* Open spaces are a social equity issue because decisions must be made about where these spaces will be created or preserved. These locational decisions can impact neighboring communities in both positive and negative ways. To ensure that all people in the Central Puget Sound Region have fair access to resources and opportunities that improve their quality of life and help them reach their full potential, avoidable inequities in open space services should be eliminated.</p> <p>* Even while open space projects may be constructed at a very intimate local level, a regional approach to open space is necessary to address the current disparities in participatory decision making, the spatial disparities, and the cultural disparities across the region.</p> <p>*These challenges need regional attention because the causes are not isolated but dispersed throughout the region or beyond; or solutions may be too difficult to be carried by one local community and would be less burdensome if shouldered by the region, regardless if it is a locational strategy or a funding strategy.</p>	<p>*A combination of physical, mental and social issues has created complex public health challenges in the region and nation. Non-communicable diseases (NCDs) such as cardiovascular disease, cancer, respiratory disease and diabetes have surpassed infectious diseases as the leading causes of illness and death. People of all ages are increasingly facing health risks that lead to chronic disease and early mortality. For example, the prevalence of overweight conditions and obesity among children and adults has increased significantly in the nation and region to previously unseen levels, particularly among vulnerable populations. By 2020 mental and substance use disorders are anticipated to surpass physical diseases as a major cause of disability worldwide (Hyde, 2011).</p> <p>*The conditions in which people are born, grow, live, work, and age are recognized determinants of health (WHO, 2015). In addition to the social and physical environments where individuals live, interaction with open space and nature is likely an important influence on personal and community level health and well-being</p> <p>*Research evidence suggests that encounters with nature and open spaces can aid in alleviating the burden of disease. Additionally, recent research is examining causal pathways to health conditions (i.e. connections between physical activity and diabetes, air quality and cancer, or stress and immune response) to help understand the types of open space elements that might improve specific health outcomes.</p> <p>*A regional approach to open space in the Central Puget Sound Region can support health by enabling equitable distribution and experiences of high quality open spaces that support health promotion and disease prevention. Interconnected open spaces within a regional system can enhance and support co-benefits of human health and well-being in a variety of ways:</p> <ul style="list-style-type: none"> <li>• recognizing and connecting varying spatial scales;</li> <li>• connecting ecological and infrastructure systems;</li> <li>• uniting communities and resources</li> </ul>	<p>*the fundamental challenge to economic development for the Central Puget Sound region is identifying how to accommodate the anticipated population of 5 million people and 3 million jobs by 2040 while enhancing the environment and our overall quality of life.</p> <p>*Knowing what will cushion future shocks while allowing for growth/opportunity in new sectors;</p> <p>* Providing access to opportunities and prosperity for all the region's citizens: 1) Confronting the growing divide between the opportunities available to educated workers and those with fewer skills and less training, and 2) Ensuring success is more equally shared throughout the region's diverse populations; and</p> <p>* Ensuring the region can compete for the jobs and economy of the future.</p> <p>* retaining talent, creating a business climate that supports job creation, harnessing innovation, advancing infrastructure, ensuring high quality of life</p> <p>*open space is integral to the region's economy, both directly and indirectly</p> <p>* Pacific Northwest has a natural "place brand"</p> <p>* the area's reputation for a strong urban-nature link bolster brands and build credibility among customers and employees as indirect benefits (Wetter, 2015), but open space lands serve in a more direct provisioning role in providing food, building materials, fuel and medicinal services, all which can be brought to market for sale.</p> <p>*regional planning to support efforts to preserve important open space assets is integral to recruiting and retaining talent, maintaining the region's business climate, fostering entrepreneurship and innovation and creating solutions to address our failing infrastructure. When coordinated on a regional basis, key system-wide deficiencies such as lack of park space in a particular area or a missing link in a trail corridor, can be exposed and/or new visions put in place to connect facilities or enhance amenities.</p> <p>*Broader threats to business activity that cross jurisdictional boundaries can be addressed more efficiently than piecemeal at a local level. Analyses and investment solutions can be framed to make more compelling requests for federal, state, and local funding. *A regional approach to develop common goals also offers the potential to provide business interests with more consistency or clarity with regard to environmental policies and regulations that can be applied across multiple jurisdictions, facilitating development.</p>
What is the relationship to open space?					
Why is a regional approach to open space necessary?(Identify 3-5 key reasons, providing data as possible)	<p>*No single location can adequately protect regional biodiversity. Rather, providing a resilient landscape that can maintain biodiversity over the long-term requires protecting a network of connected open space lands as well as managing the surrounding landscape across large spatial scales</p> <p>*salmon and large carnivores, require conservation efforts not only at site, local and regional scales, but also at state, national and global scales.</p>	<p>*Climate mitigation and adaptation require a portfolio approach – utilizing a broad suite of options to help incorporate the inherent uncertainty associated with rapid climate change (e.g., what impacts will occur where and to what degree?), and allowing planners to spread risks and resources across a range of opportunities.</p> <p>*Although climate change is a global problem, the effects on natural and built systems will vary by region.</p>			

**What's at risk if we don't have the coordinated planning, governance structure and investment strategy at a regional scale to address open space?**

\*Loss of biodiversity would have reverberating, negative impacts on the region's economy, health and culture – including leaving the region with less resilience for unanticipated future environmental challenges like those resulting from climate change. \* Additionally, there could be an added burden to public resources as more species are added to the federal or state endangered species lists.

\*If open space is not preserved and prioritized in the region, there are a number of potential consequences, including:  
 • Loss/reduction of ecosystem services, including nutrient cycling, flood control, food provision, wildlife habitat, carbon sequestration, and recreational opportunities, among others, which may require increased energy and financial expenditure to provide alternatives for otherwise 'free' services;  
 • Reliance on more expensive, less flexible adaptation options, such as hard engineering solutions along shorelines to reduce flooding risk; and  
 • More intense and frequent use of open space (including the conversion of open space to other uses) as regional population and development pressures increase over time.

\*Unless disparities in access to quality open space services are intentionally addressed, those disparities may become more pronounced as the Central Puget Sound Region continues to experience unprecedented growth  
 \* Recent studies suggest that greater racial and social inclusion corresponds with more robust economic growth, while inequity hinders growth  
 \* According to the PSRC, "without intentional focus on equity and meaningful community engagement, future growth could adversely affect or displace low-income, minority, and limited-English proficient residents"

\*access to open spaces is not uniform across all communities and demographic groups. There is growing awareness that certain significant health problems (e.g., obesity, asthma) are found in higher incidence in communities that also have little open space. One open space planning challenge is to find ways to interlace open spaces within the urbanized built environment to integrate nature where people live, particularly places with fewer nature amenities.

- The region's ability to attract and retain key businesses and talent would be made more difficult;
- Loss of revenue from decreases in tourism and recreational industries;
- Reduced production of natural resources, especially food (including fish/shellfish) and timber, which impact other industries, especially shipping and construction industries ;
- Investments in engineered structures would be required to replace services provided today with marginal (monetary) cost by natural systems, such as clean drinking water;
- Costly cleanup and repair to recover from emergencies related to disasters such as floods, landslides, storm surges, wildfires, etc.
- Other less direct impacts would result in increased societal costs for:
  - o healthcare due to populations with lack of access to clean air and recreational opportunities;
  - o public safety due to increases in mental illness;
- \*Over the decades, our region's citizens have identified an explicit need to enhance the environment and protect open space and natural landscapes as key economic assets. It is after all one of the major reasons for our economic success. Open space provides direct services and materials that fuel our regional economy and help avoid long-term costs in managing waste and energy outputs.

**Summary/Persuasive Closing Statement**

\* Preserving open space for the support of biodiversity will require regional strategies for: knowledge management and goal setting; public engagement and support; policy-supported investments, and integrating biodiversity concepts widely across many public interest sectors.

\*The Central Puget Sound region is already experiencing the effects of rapid climate change, along with a suite of other challenges. Open space is a key tool to minimize, mitigate, and respond to climate change, while simultaneously achieving additional environmental, social, and economic benefits. A regional strategy for open space can complement and enhance existing local climate initiatives,

\*It is clear that in American land conservation theory and practice, setting aside open space for "all people" was historically considered paramount for maintaining national heritage, community vibrancy, and individual well-being. This makes sense, as parks, trails, and green spaces promote recreation and improve neighborhood quality. However, over time, governmental intent to attend to the open space needs of "all people" seems to have been diluted.

\*While not specific to the Central Puget Sound region, a growing body of scientific evidence indicates strong linkages between open space experiences and human health and wellness. Protecting, stabilizing and expanding an open space facilities and systems network in the Central Puget Sound Region can help mitigate the serious health issues facing the region's communities while simultaneously supporting vibrant, beautiful and ecologically resilient communities. Equitable distribution of high quality open space environments, facilities, and programs for people will enable people to experience nearby nature, and can help address environmental and social justice concerns in our region.

\* Engagement metrics: Measure Degree of Jurisdictional Interaction and Collaboration and Social Marketing for Outdoors and Health  
 \* Research metrics: construct health outcome indicators and assess health outcome indicators by jurisdiction and address social equity  
 \* Assessment metrics: set benchmarks for extent and connectivity of open space and set benchmarks for site character and quality  
 \* Planning metrics: monitor funding goals and achievement by jurisdiction and/or sector  
 \* Demonstrate metrics: monitor social media and news outlets

\* Puget Sound Regional Council's (PSRC) Regional Economic Strategy (RES) has a set of Performance Measures with associated data elements that are used to assess progress on implementation of economic development strategies targeted for the Central Puget Sound region. A full list of these measures is listed on the PSRC's Economic Development District (EDD) website: <http://www.psrc.org/econdev/res/res-performance-measures/>  
 \* white paper recommends the following metrics: for Open space jobs development - loss of natural resource-based jobs in previous 5 years, current/projected number of open space jobs  
 \* improved workforce productivity metrics - will vary based on industry  
 \* business/talent retention and recruitment metrics - benchmark of business/employee proximity / access to parks/ recreation lands and trails, travel times/catchments to key recreation assets by mode  
 \* entrepreneurship and tech innovation metrics - new technology business ventures identified to be a result of tested applications in cps open space system lands  
 \* infrastructure metrics - inventory or sample of natural green infrastructure assets that contribute to reduced energy/water consumption and air quality improvements in close proximity to employment concentrations and id opportunity sites  
 \* Maintain healthy environment to support business metrics - track visibility of mt. rainer, track ski resort open days, areas

\* The ROSS should adopt a long-term biodiversity measuring and monitoring strategy.  
 \*The Washington Biodiversity Council (2010) proposed a "Biodiversity Assessment Framework" and "Biodiversity Scorecard" as a statewide tool to measure and monitor biodiversity  
 \*There are four indicator categories: 1) elements of biodiversity, 2) key ecological processes that affect and support biodiversity, 3) key human-socioeconomic factors that affect and support biodiversity, and 4) ecosystem services. these categories have hundreds of indicators each with possible metrics. see table 1.

\* Current conditions of climate mitigation and adaptation in the Central Puget Sound region can be most accurately accounted for by examining the manifestations of climate change (e.g., changes in temperature – air and water, changes in precipitation patterns) and the responses to these changes (e.g., technical and financial resources, political and institutional will, policies and plans).  
 \* Sample metrics related to the manifestations of climate change: Changes in average annual and seasonal temperatures; Changes in precipitation patterns (e.g., timing, frequency, intensity); Sea level rise; pH, salinity, and temperature of water; Reduced snowpack; Species range shifts  
 \*Sample metrics related to climate mitigation and adaptation responses: Institutional, financial, and technical capacity (e.g., degree to which issues are mainstreamed into management and policy); Existence of mitigation/adaptation policies and plans in the region; Inventories of and reductions in regional greenhouse gas emissions; Regional and local government commitments to reduce greenhouse gas emissions  
 \*Sample metrics related to the ability of open space to contribute to climate mitigation and adaptation: Amount, type, and configuration of open space; Existing uses of open space and contribution to climate mitigation and adaptation goals; Projected uses of open space under changing climate conditions and mitigation and adaptation policies; Number of days with 0-50/"Good" Air Quality Index score; Amount and spatial distribution of pervious and impervious surfaces; Surface and groundwater holding capacity of existing open space  
 \* ROSS may consider prioritizing the following:

\* Current social equity conditions, with regard to open space in the central Puget Sound region, can be most readily assessed by examining:  
 • Inequities in open space benefits prevalent in areas where low-income, racially diverse, and culturally diverse communities are located (e.g. lack of vegetative cover, trails, recreational opportunities; and polluted air, land, and water); as well as  
 • Responses to these inequities (e.g. political and institutional will, and policies, plans, programs, projects, and funding to address the issues).  
 \* King county has determinants of equity  
 \* Process equity metrics: voter registration and voter turnout  
 \* Distributional equity metrics: life expectancy, obesity, diabetes prevalence, resident satisfaction with parks, open green space, distribution of regional trails, park accessibility, distribution of playgrounds, vegetation distribution, proximity to public transit, walk/bike transit score, transportation cost burden, and resident satisfaction with quality of life.  
 \* Cross-generational equity metrics: social cohesion and residential mobility  
 \* also provided MEA cultural services potential metrics -- could be helpful for measuring gains and losses that occur as consequences of providing open space to improve social equity:  
 • Land use and cover characteristics and change (e.g., vegetative cover; habitat fragmentation from

**Section 2: Metrics**

1) knowledge management and goal setting: centralize knowledge and develop spatial goals  
 2) Public engagement and support: Increase public will for biodiversity conservation  
 3) Policy-supported investments: strengthen governing policies with biodiversity concepts  
 4) Adopting biodiversity conservation principles widely: integrate biodiversity concepts into (non-conservation) public interest sectors

1. Survey the integration of climate change into other city open space planning efforts to document lessons learned and best practices for application by the Central Puget Sound ROSS.  
 2. Create a community engagement toolkit to support individual climate-informed actions (e.g., climate-friendly gardening, water conservation, stewardship, etc.) that can facilitate open space objectives.  
 3. Support the integration of climate change into policies and plans, such as the requirements of the state Growth Management Act and Shoreline Master Programs, city and county comprehensive plans, hazard mitigation plans, and Water Resource Inventory Areas (WRIA) plans.  
 4. Identify, map, and assess the climate change vulnerability of priority terrestrial and aquatic conservation targets for open space preservation to climate change.  
 5. Conduct/update and maintain an inventory of greenhouse gas emissions and carbon sequestration/storage potential of natural and working lands in the Central Puget Sound region (e.g., carbon sinks, blue carbon) to support the identification and conservation of open space areas.

\* Achieving social equity in the central Puget Sound region, with respect to open space access and benefits from open space services, will require:  
 1. Changing existing governance structures to be more inclusive of diverse populations;  
 2. Addressing the needs of populations with dramatically changing demographics; and  
 3. Respecting the cultural and historic resources of the past and present, while also fully providing for the needs of diverse future generations.  
 \* process equity initiatives: explore possible amendments the GMA and lower level planning frameworks; explore possible amendments to SEPA; ensure diverse populations have their own voice; explore possible funding to provide assistance to train community leaders; ensure agency leaders and staff are adequately trained to be receptive to involvement by diverse populations; provide technical assistance; encourage agencies to apply rigorous analysis of impacts to marginalized populations of proposed agency projects  
 \* distribution equity initiatives: expand detailed data analysis of social inequities as conducted by King County to other three counties; identify gaps in open space service delivery to diverse populations; identify and map open space; prioritize investments  
 \* cross-generational equity initiatives: explore mechanisms to ensure future generations of marginalized communities are afforded the same level

\*Engagement actions: 1) involve grassroots organizations, decision-makers and residents; 2) involve public health professionals and departments, and the medical and clinical communities; 3) provide education materials; 4) promote stewardship programs and activities; 5) engage with user public  
 \* Research actions: 1) build a locally referenced research repository; 2) conduct a gap analysis of research for regional studies; 3) consult the research review to identify important unanswered questions in the research and pose recommendations to fill gaps using the region as a test case; 4) conduct a full cost accounting analysis of open spaces  
 \* Assessment actions: 1) assess open space lands and health potential; 2) open space lands and health geospatial synthesis; 3) health and activity programs assessment; 4) user locations, frequencies and usage of open spaces; 5) community assessment  
 \* Planning actions: 1) create health-focused open space goals; 2) embed human health in local comprehensive planning; 3) support ongoing, policy oriented analysis; 4) prioritize open space investments  
 \* Demonstrate actions: 1) conduct pilot studies; 2) health impact assessments on open space developments

1. Establish a more precise understanding of the role open space plays in supporting economic development objectives in the region;  
 2. Exhibit values of open space as an economic tool as part of education/advocacy work;  
 3. Establish a regional governance structure and policy or regulatory revisions that can more fully incorporate these values into land use, transportation, and public works investment decisions;  
 4. Incorporate metrics for economic impact into investments in open space and leverage private sector expertise in fulfilling open space system development objectives;  
 5. Secure technical and financial support that can establish and steward open space actions based on the alignment between open space and economic development;  
 6. Leverage existing opportunities that both exhibit and enhance the contributions that open space investments yield in support of the regional economy.

**Section 3:  
 Recommendations.**

## Appendix 2

# OPEN SPACE METRICS AND RECOMMENDATIONS IN RESPONSE TO REGIONAL CHALLENGES:

## SYNTHESIS

### REGIONAL OPEN SPACE STRATEGY FOR CENTRAL PUGET SOUND

April 2016

#### 1.0 INTRODUCTION

This report summarizes the findings and conclusions of the reports prepared by each Task Force on the five regional challenges of biodiversity, climate change, economic development, human health, and social equity. The Task Forces assisted the Regional Open Space Strategy (ROSS) project better understand the extent that open space could help address the challenges faced by the region. The reports focused on each challenge individually by:

- Exploring the relationship of open space to each challenge;
- Identifying ecosystem services provided by open space for each challenge;
- Advancing objectives toward influencing positive responses to each challenges; and
- Explaining the economic value of an open space response to each of the challenges.

Common findings across each of these reports include that:

- Conversion of open space lands to more developed uses will continue to impact the region;
- Open spaces and their services are fundamentally important in addressing, mitigating, or adapting to the impacts of the challenges;
- The economic or financial impacts of losing open spaces and/or replacing their services with traditional engineered solutions will be costly. Conversely, there is potential cost-savings to be realized if open space services are considered a core part of the portfolio of infrastructure investments across the region; and
- There is a need for open spaces to be more systematically factored into local land-use planning processes, policies, practices, and tools, at multiple scales throughout the region in order that open space can affect these regional challenges.

These reports also revealed that there are enormous co-benefits to addressing these challenges through the creation of a robust regional open space network for the Central Puget Sound Region. This report recommends actions to be incorporated into the ROSS to support solutions to these regional challenges.

The major themes presented within this report include:

- There is a need to map priority areas / spatialize the inventory of open spaces. This will help to better market open space protections and help garner public and leader support for more conservation and better management;
- One way to potentially bring about positive change in the Central Puget Sound could be through regulatory/policy adjustments that prioritize open spaces. It will also be important to insert open space ideals into the next iteration of plans such as local comprehensive plans. Such actions will allow open space preservation to filter down from regional to community geographies and through the different layers of government;
- Most experts believe that additional funding sources will need to be found in order to accomplish meaningful positive changes possible with open space projects; and

- There is a need for public outreach to better engage the public about the importance of open spaces and to promote stewardship of open spaces. Such actions will work to advance conservation policies and reach a wider group of stakeholders.

## 2.0 WHY THESE FIVE REGIONAL CHALLENGES?

The ROSS is a collaborative effort based out of the University of Washington. The primary aim of this group is to integrate and elevate the open space conservation and stewardship activities already underway in the Central Puget Sound Region. The Central Puget Sound Region is comprised of King, Kitsap, Pierce, and Snohomish Counties, and the ROSS is working toward strategies to conserve and enhance the natural infrastructure of open space systems within these places. These natural assets are critical to the ecological, economic, and cultural vitality of the Central Puget Sound Region, and are intrinsic to its very identity. The underlying premise of the ROSS project is that open space systems at both a watershed and regional scale, can help to address many of the challenges facing the region. The five regional challenges that help frame ROSS's open space discussion include:

- Adapting to and mitigating against **climate change** to form a more resilient region able to weather coming climatic disturbances;
- Maintaining **biodiversity** within the region to expand our understanding of nature, ensure continued food safety, create new medicines, and retain cultural heritage;
- Creating **economic development** opportunities to increase the prosperity, quality of life, and innovation of residents and businesses;
- Improving **human health** across the region to unlock the full potential of the region's human capital; and
- Enhancing **social equity** so that all people "have access to the resources and opportunities that improve their quality of life" and the region's ability to function efficiently.<sup>i</sup>

The ROSS team coalesced around these challenges because they encapsulate the breadth of human and environmental conditions within the Central Puget Sound Region in five succinct areas of concern. Further, each of these regional challenges can be addressed in part through conservation and enhancement of open spaces.

Each challenge represents a serious and increasing threat to the region if open spaces continue to disappear. For example, the threats associated with climate change include increases in fire hazards, flood risks, sea level rise, and drought that could all negatively impact the economy, society, and environment of the region. Decreasing open spaces will further increase the severity of the issue as the region's ability to mitigate against or adapt to climate change will become limited.

The regional challenges represent stressors on our shared systems, but they also represent opportunities where open space services can play an essential role. For instance, increasing or maintaining open spaces in the region could help mitigate climate change through the sequestration of carbon dioxide, while at the same time creating a healthy and aesthetically pleasing environment that attracts new businesses. The goal in examining open spaces through these regional challenges is to illustrate the overall importance of open spaces in the health and continued success of the region.

## 3.0 RECOMMENDED ACTIONS

Based on research, analysis, and discussions with the Ecosystem Services Committee, five Task Forces, and other local experts, the ROSS team has compiled a list of recommended actions on how open spaces can help address the five regional challenges. Within each challenge's discussion of recommendations, metrics that serve as indicators for how progress could be measured over time, are also provided.

### 3.1 CLIMATE CHANGE

#### 3.1.1 Recommendations

Climate change is generally defined as a long term change to the earth's climate. Of late, this change has been radically accelerated by human activities such as the burning of fossil fuels and the conversion of forested lands to

developed uses. These actions release heightened levels of greenhouse gases (GHGs) into the atmosphere that work to trap ultraviolet rays from the sun within the earth's atmosphere. These trapped rays cause global temperatures to rise, leading to rising sea levels, melting snow packs, increased frequency and severity of flooding and drought, and more extreme urban heat islands, among other impacts. Within the Central Puget Sound Region, these effects will place an even greater strain on water quality, threatened salmon populations, drinking water supplies, urban populations, flood-prone areas, and working farms and forests, to name a few.

Forests, and the vegetation within them, are some of the most effective and efficient vehicles for carbon sequestration accessible to society. Many have tried to invent technologies that can sequester carbon, but these efforts have proven more costly and less effective than simply allowing trees to grow.<sup>ii</sup> One tree, on average, can sequester 48 pounds (lbs) of carbon dioxide (CO<sub>2</sub>) a year.<sup>iii</sup> Taking this figure further, forest land can sequester an average of 21,600 lbs of CO<sub>2</sub> per year per acre (assuming 450 trees per acre). As CO<sub>2</sub> is a GHG playing a leading role in climate change, the uptake of CO<sub>2</sub> into biomass is a crucial mechanism to mitigate the effects of climate change. Afforestation and reforestation projects are seen as methods to do just that, and can be accomplished through the protection of wilderness areas, parks, and working timber farms. The protection of old growth forest is particularly important as a recent study conducted by Oregon State University has found that old growth forests can reduce microclimates by as much as 4.5°F more than even mature tree plantations with full canopies.<sup>iv</sup>

Although, even if massive reforestation efforts were to start today, the greenhouse gases already accumulated in the atmosphere would create a lag effect, and temperatures would continue to rise. To prepare for these coming changes, the region must also find ways to adapt. Here too, open spaces can be of service in terms of their ability to provide shade, retain water to reduce the severity of floods and droughts, filter air and water to increase quality, decrease temperatures of both surface and groundwater, and provide recreational and exercise opportunities within reduced microclimate temperatures.<sup>v</sup> The more open spaces that we preserve or create, the better chance we give the region in remaining relevant, healthy, and economically viable in the coming years.

Several potential initiatives and actions<sup>vi</sup> to support the creation, enhancement, and maintenance of open space to facilitate climate mitigation and adaptation objectives include:

- 1. Survey the integration of climate change in other city open space planning efforts to document lessons learned and best practices.**

Open space is a key tool to support climate mitigation and adaptation. Understanding how open space is being used as such a tool and how well it is working in other locales can provide practical, real world examples, lessons learned, and best practices to support open space preservation in the Central Puget Sound. Learning from the successes and failures of other efforts will help the region limit investments of time and money, and maximize the likelihood of success in our region.

- 2. Create a community engagement toolkit to support individual climate-informed actions (e.g., climate-friendly gardening, water conservation, stewardship, etc.) that can facilitate open space objectives.**

Engaging communities and gaining public buy-in can facilitate open space preservation and foster a climate-informed citizenry. Education, outreach, and engagement programs focused on building climate-smart communities and citizens have been successful in other U.S. cities.<sup>vii</sup> This toolkit could include specific recommendations for climate-informed activities to facilitate mitigation and adaptation objectives, such as creating climate-friendly gardens, conserving water, advocating for the preservation and management of open space, and participating as citizen scientists in monitoring programs. Further activities might include limiting the use of synthetic fertilizer to reduce N<sub>2</sub>O emissions, purchasing locally grown produce to reduce CO<sub>2</sub> emissions related to long-distance transport, and planting vegetation and tree species with high carbon storage potential, among others.

- 3. Support the integration of climate change into policies and plans, such as the requirements of the state Growth Management Act and Shoreline Master Programs, city and county comprehensive plans, hazard mitigation plans, and Water Resource Inventory Areas (WRIA) plans.**

Integrating climate change into the policies and plans that guide decision making around development, conservation, and watershed planning throughout the state can mandate local action on mitigation and

adaptation. Existing policies and plans that affect or are affected by open space preservation include the Growth Management Act,<sup>viii</sup> city and county comprehensive plans, city and county Shoreline Master Programs,<sup>ix</sup> hazard mitigation plans,<sup>x</sup> and WRIA plans. A mechanism to help achieve this initiative is to develop a regulatory toolkit to support climate-informed actions specific to open space designed in partnership with and geared toward city and county decision makers.

**4. Identify, map, and assess the climate change vulnerability of priority terrestrial and aquatic conservation targets for open space preservation to climate change.**

In the Central Puget Sound Region, there are and will continue to be conflicts between residential, commercial, and industrial development and open space. This makes the identification and designation of resilient open space critical, especially in a changing climate. This initiative will help identify the areas with the greatest capacity to contribute to climate mitigation and adaptation objectives, assess their vulnerability to observed and projected climatic change, and prioritize the conservation and management of resilient open space – existing and not yet designated – in light of climate change and other non-climatic stressors (e.g., public/private land ownership, zoning, etc.).

**5. Conduct/update and maintain an inventory of GHG emissions and carbon sequestration/storage potential of natural and working lands in the Central Puget Sound Region (e.g., carbon sinks, blue carbon) to support the identification and conservation of open space areas.**

Open space may provide a mitigation benefit by helping to sequester and store carbon in vegetation and soils, although the overall effect in the Central Puget Sound Region will likely be minimal due to its size. Creating and maintaining inventories of GHG emissions and the carbon sequestration/storage potential of the region facilitates the creation of a baseline from which to measure relative contributions and progress towards reducing the region's carbon footprint. This initiative may include identifying the primary sources of GHG emissions in the region and the organizations working to reduce these impacts.

### **3.1.2 Metrics**

Current conditions of climate mitigation and adaptation in the Central Puget Sound Region can be most accurately accounted for by examining the manifestations of climate change (e.g., changes in temperature and precipitation patterns), and the responses to these changes (e.g., technical and financial resources, political and institutional will, policies and plans).

**1. Sample metrics related to the manifestations of climate change:**

- a) Changes in average annual and seasonal temperatures,
- b) Changes in precipitation patterns (e.g., timing, frequency, intensity),
- c) Sea level rise,
- d) pH, salinity, and temperature of water,
- e) Reduced snowpack, and
- f) Species range shifts.

**2. Sample metrics related to climate mitigation and adaptation responses:**

- a) Institutional, financial, and technical capacity (e.g., degree to which issues are mainstreamed into management and policy),
- b) Existence of mitigation/adaptation policies and plans in the region,
- c) Inventories of and reductions in regional GHG emissions, and
- d) Regional and local government commitments to reduce GHG emissions.

**3. Sample metrics related to the ability of open space to contribute to climate mitigation and adaptation:**

- a) Amount, type, and configuration of open space,
- b) Existing uses of open space and

- c) contribution to climate mitigation and adaptation goals,
- d) Projected uses of open space under changing climate conditions and mitigation and adaptation policies,
- e) Number of days with 0-50/"Good" Air Quality Index score,<sup>xi</sup>
- f) Amount and spatial distribution of pervious and impervious surfaces,
- g) Surface and groundwater holding capacity of existing open space,
- h) Extent to which habitats are connected,
- i) Prioritization and zoning of regional open space considers the *renewable portfolio standard*,<sup>xii</sup>
- j) Reduction of sprawl (e.g., enhanced public transportation opportunities in suburbs to reduce regional greenhouse gas emissions), and
- k) Capacity for carbon sequestration and storage (e.g., acreage of specific land cover types with sequestration/storage potential, such as vegetation).

Several of these sample metrics are already monitored in the Central Puget Sound Region. In order to maximize resources, ROSS suggests prioritizing the following:

- a) Amount, type, and configuration of open space,
- b) Existing uses of open space and contribution to climate mitigation and adaptation goals,
- c) Projected uses of open space under changing climate conditions and mitigation and adaptation policies,
- d) Extent to which habitats are connected, and
- e) Reduction of sprawl (e.g., enhanced public transportation opportunities in suburbs to reduce regional greenhouse gas emissions).

There are several metrics to help measure gains and/or losses related to the quality and quantity of the ecosystem services in relation to climate mitigation and adaptation, these include:

- a) Manifestations of climate change (e.g., changes in air and water temperatures),
- b) Land use and cover characteristics and change (e.g., vegetative cover; habitat fragmentation from development),
- c) Population growth or decline (e.g., population density),
- d) Pollution (e.g., pollutant concentration),
- e) Species introduction or removal (e.g., presence/absence of species),
- f) Storage capacity (e.g., nutrients, energy, water, carbon), and
- g) Biomass and net productivity (e.g., above- and below-ground biomass).

## **3.2 BIODIVERSITY**

### **3.2.1 Recommendations**

Biodiversity is the sum of all life and the inherent variety associated with this life. As such, biodiversity and open spaces are intrinsically linked because open spaces provide the primary area for all species, habitat, and ecological interactions to occur. The richness and long-term health of our regional biodiversity depends both on the amount and quality of open space, and its spatial structure and configuration.

A wide variety of open spaces can contribute to regional biodiversity if designed or managed correctly. Wildlands typically provide the best habitat for many species, but suburban yards can also support several different species of birds, for instance. Even recreational sports fields can provide habitat for plants, pollinators, and other animals. Recreational open spaces along the urban fringe in particular, can also help maintain biodiversity by slowing urban sprawl.

The five key challenges facing biodiversity protection in the Central Puget Sound are to:

1. Understand and address threats to regional biodiversity with prioritized, results-driven actions;
2. Apply ecological principals to land use management at multiple spatial scales;
3. Plan for a future that conserves biodiversity as part of sustainable development;
4. Identify indicators and create a monitoring system that reveals whether strategies are protecting biodiversity or not, and if not, manage adaptively to continuously improve; and
5. Develop a citizenry that values protecting a rich, regional biodiversity. Many of the recommendations listed below were shaped by the work of the Washington Biodiversity Council (2010) and should be consulted for additional details.

Preserving open space for the support of biodiversity must take into consideration the challenges listed above, and will require regional strategies for:

**1. Knowledge Management and Goal Setting: Centralize Knowledge and Develop Spatial Goals**

Implement an open space strategy that protects ecological functions by monitoring key metrics and adaptively managing biodiversity toward goals based on both the status (e.g. habitat quality and key species population numbers) and spatial distribution (e.g. minimizing fragmentation) of biodiversity elements.

Priority actions to this end include:

- a) Reconstitute the Washington Biodiversity Council or create a new entity with statewide focus within the Governor's office.
- b) Centralize and archive existing information on the status of biodiversity in Central Puget Sound.
- c) Through the statewide entity, develop guidance on a spatial approach that would deliberately maximize native biodiversity in the central Puget Sound, given the current status of the landscape.
- d) Produce regional base maps for critical open space areas relevant to biodiversity protection.
- e) Develop regional measures of functional diversity (e.g. spatial, taxa, structural).

**2. Public Engagement and Support: Increase Public Will for Biodiversity Conservation**

Deliver customized messages about the importance of biodiversity for Puget Sound residents that are personal enough to promote behavior change. Priority actions to this end include:

- a) Develop value proposition messaging for specific Central Puget Sound audiences, including: urban residents, rural residents, planners, foresters and farmers.
- b) Review, synergize and link current outreach campaigns for biodiversity messages.
- c) Encourage connection between ROSS-related outreach and regional citizen science projects.

**3. Policy-supported Investments: Strengthen Governing Policies with Biodiversity Concepts**

Implement biodiversity relevant policies, including financial funding legislation, to increase public incentives and government agency priorities for protecting biodiversity and ecological services. Priority actions to this end include:

- a) Identify update opportunities (PSRC, Comprehensive Plans, GMA, SMP, and PSP Action Agenda).
- b) Incorporate biodiversity goals from the WA Biodiversity Council in agency mandates.
- c) Implement additional public incentives to conserve biodiversity on private lands.
- d) Develop funding needs and financial models for regional biodiversity management.
- e) Encourage the development of a formal regional planning body/authority.

**4. Adopting Biodiversity Conservation Principles Widely: Integrate Biodiversity Concepts into (Non-Conservation) Public Interest Sectors**

Maximize opportunities of cross-pollination across public interest sectors; environmental protection needs to be considered across all public sector areas. Priority actions to this end include:

- a) Identify multi-objective planning efforts that could incorporate biodiversity information (e.g. land use, transportation, healthcare, public safety, economic development).

- b) Identify cost avoidance opportunities based on protecting biodiversity (e.g. flood control; reducing endangered species listings).
- c) Promote social equity, smart growth and urban health by creating new natural areas in cities that also protect biodiversity.

Consider new strategies that link urban development with more distant protected areas (e.g transfer of development rights).

### 3.2.2 Metrics

Recommended metrics for measuring biodiversity and ultimately the success of the recommended biodiversity strategies are listed below.

#### 1. Elements of Biodiversity (Structure and Composition)

- a) Increase plant and animal diversity (relative richness and balance/evenness, requires an abundance of data).
- b) Plant community/ecosystem diversity (Ecological Integrity Assessment):
  - o Distribution of native vegetation, and
  - o Distribution and quality of WA NHP-identified critical and/or rare systems.
- c) Landscape composition and pattern:
  - o Percent cover,
  - o Largest patch index,
  - o Landscape diversity (Shannon landscape evenness index),
  - o Contagion index (a measure of aggregation/ connectivity), and
  - o Riparian vegetation.

#### 2. Key Ecological Processes that Affect and Support Biodiversity

- a) Functional diversity (pollinators/seed dispersers, predators, etc.).

#### 3. Key Human-Socioeconomic Factors that Affect and Support Biodiversity

- a) Land base under conservation protection:
  - o Distribution and extent of public and private lands amenable to biodiversity, as well as NGO/trust lands for biodiversity.
- b) Land use/cover change:
  - o Distribution/extent of land cover transitions.
- c) Public engagement and education:
  - o Distribution/extent and content focus of efforts within a given ecosystem type.

## 3.3 ECONOMIC DEVELOPMENT

### 3.3.1 Recommendations

Open spaces and green infrastructure investments have a role in supporting many of the industries within the region, including farming, timber, tourism, and government employees. Further, the Central Puget Sound Region's economic resilience and its ability to attract and retain world class businesses and talent depends heavily on "ensuring a healthy and beautiful environment."<sup>xiii</sup> Open space investments are considered a fundamental strategy for a healthy regional economy because "the well-educated, highly talented employees from around the world that businesses need in order to be competitive will live here only if the region is an attractive, humane and creative place to live, work and raise a family."<sup>xiv</sup> Further, on a smaller block by block scale, studies have shown that individuals are often willing to spend more money on homes with parks nearby, and are willing to shop longer and spend more money along streets with planted trees.<sup>xv</sup>

Many also credit the Central Puget Sound Region's "outstanding natural beauty" as a driver of tourism, a major contributor to the region's economy. Tourism is the third largest industry cluster in the region (18.5 percent of employment among all clusters) and employment growth by 2021 for tourism is estimated to be over 10 percent - the 4th fastest growing cluster in the region. Tourism already employs more than 133,000 workers in the region and is estimated to have generated over \$10 billion in sales in 2011. Further, nearly 80 percent of the state's revenue from tourism occurs in the Puget Sound.<sup>xvi</sup>

Strategies to advance a region-wide system of open space investments will require alignment with existing objectives for the regional economy established in the Regional Economic Strategy (RES) for the Central Puget Sound. Additional economic objectives include:

1. Real estate value capture and smart growth;
2. Cost avoidance and reduced demand on existing infrastructure;
3. Improved workforce productivity associated with nearby open space;
4. A specific emphasis on expanding outdoor recreation jobs and multipliers in local economies;
5. A sustainable approach to natural resource jobs (agriculture and forestry) and mitigation for natural resource job loss with employment in parks, outdoor recreation, tourism, and ecological restoration;
6. Economic support for rural communities grounded in open space investment; and
7. Advancing a more expansive set of economic values aligned with the broader set of open space services and measures such as the Genuine Progress Indicator (GPI).

The above goals can be incorporated into a comprehensive set of strategies that advance the preservation of open spaces to support economic development at a regional scale. Specific actions to achieve these objectives include:

**1. Establish a more precise understanding of the role open space plays in supporting economic development objectives in the region.**

Priority actions to this end include:

- a) Assess potential confluence points between objectives for open space and objectives for economic development;
- b) Assess green infrastructure economic benefit/cost; and
- c) Assess how companies benefit directly from investments in open space and green infrastructure.

**2. Exhibit values of open space as an economic tool as part of education/advocacy work.**

**3. Establish a regional governance structure and policy or regulatory revisions that can more fully incorporate these values into land use, transportation, and public works investment decisions.**

Priority actions to this end include:

- a) Support a regional approach that offers the potential to provide business interests with more consistency or clarity in regard to environmental regulations that are applied among multiple jurisdictions;
- b) Apply regulations more consistently to support open space to avoid negative impacts on businesses. Similarly, improve enforcement of unmitigated or unregulated business activity and excessive or poorly managed/directed development to reduce disruptions to our natural systems that can induce natural disasters that greatly impact existing infrastructure and facilitate significant loss to business due to flooding, mudslides, and other natural disasters; and
- c) Connect to taskforce on outdoor recreation and ecotourism.

**4. Incorporate metrics for economic impact into investments in open space and leverage private sector expertise in fulfilling open space system development objectives.**

Priority actions to this end include:

- a) More precisely define how and where business activity is/is not a clear threat to the functions of our natural systems – particularly over time and in light of changing climate conditions;
- b) Identify where these objectives can be mutually reinforcing or when the tradeoffs are merited; and
- c) Reward businesses for health/climate/other cost avoidance.

**5. Secure technical and financial support that can establish and steward open space actions based on the alignment between open space and economic development.**

**6. Leverage existing opportunities that both exhibit and enhance the contributions that open space investments yield in support of the regional economy.**

Priority actions to this end include:

- a) Identify and act on open space investments that reinforce smart growth and development objectives (e.g. GTC + SR-99 corridor development opportunities); and
- b) Support rural economies and the region's tourism industry cluster by advancing on the Greater Rainier Coalition - Identify potential resources and set up the pathway for local champions to advance these proposals in the short-term.

### 3.3.2 Metrics

The Puget Sound Regional Council's (PSRC) RES has a set of Performance Measures with associated data elements that are used to assess progress on implementation of economic development strategies targeted for the Central Puget Sound Region.<sup>xvii</sup> Although, this only monitors a limited set of measures where open space connects to economic development. The metrics below represent an early attempt to better articulate where investments in open space and green infrastructure can reinforce key economic objectives identified for the region and advance a more complete accounting and monitoring of economic support associated with investments in open space and green infrastructure in the region.

**1. Education + Workforce Development Related Performance Measures** to *ensure residents have access to family wage jobs, and employers have access to world class talent:*

- a) International Talent,
- b) H-1B Visas,
- c) Net Migration,
- d) Imported Talent,
- e) Foreign Students, and
- f) Non-Resident Students.

**2. Business Climate Related Performance Measures** to foster a regional business climate that supports new high quality investment and job creation:

- a) Regional Employment Growth + Location Quotient (For 5 Clusters, including Clean Technology),
- b) Visitor Volume,
- c) Airport Passengers,
- d) Tourism + Visitors Cluster - Regional Employment Growth + Location Quotient, and
- e) International Travel Spending.

**3. Infrastructure Related Performance Measures** to advance the region's infrastructure to meet the *demands of a globally connected modern economy:*

- a) Jobs-Housing Balance,
- b) Manufacturing Industrial Center (MIC) Appropriate Employment, and

c) Net Industrial Lands.

**4. Quality of Life Related Performance Measures** to ensure a healthy and beautiful natural environment, vibrant and thriving communities and a high quality of life for the region's residents:

- a) Energy Consumption,
- b) Air Quality / Emissions,
- c) Housing + Transportation Affordability Index,
- d) Crime Rate,
- e) Arts Related Organizations, and
- f) Arts Organization revenues.

### **3.4 HUMAN HEALTH**

#### **3.4.1 Recommendations**

Human health is a wide-reaching issue in the Central Puget Sound Region. The Department of Health (DOH) in Washington State considers issues from air quality, climate change, and safe drinking water to worksite wellness, family planning, and food safety to be within their purview. Open spaces affect human health in several manners as well. Open spaces can help address environmental health issues by filtering out contaminants from different media, as well as provide opportunities for individuals to exercise and become mentally restored. Studies have shown that if individuals are provided more opportunities to recreate, they will choose to recreate more often. This is especially true if the opportunity is outside as studies have also shown that individuals prefer to recreate and/or exercise in more natural environments. Beyond physical health, open spaces are also crucial for the mental health of residents. Studies indicate that when individuals spend time in open spaces, they feel less stressed and their mental health increases. Human health and social equity are intrinsically linked because access to health care is in and of itself a social equity issue.

In general, given the spatial and temporal scales of a regional open space system, a process of coalition building is important to address human health. A broad based constituency for health promotion would include the local and state agencies that typically manage parks, recreation, and natural resource lands. Many conservation NGOs that have historically focused on landscape or ecosystem health – such as the Trust for Public Lands and The Nature Conservancy – are now more oriented on public health and bring unique resources and knowledge to the effort. Further, public health entities – including public health departments, hospitals, medical societies, and clinicians – are committed to evidence-based practice, and are increasingly interested in both risk response and salutary environmental health determinants. Finally, residents and neighborhood groups are important contributors to efforts that develop and test the relevance of new planning, policy, and program development.

Based on diverse sources and inputs the actions listed below can support the integration of outdoor spaces and human health in the Central Puget Sound Region, and contribute to coalition building.

#### **1. Engagement Actions**

Planning for the outdoors and open space for better human health outcomes is a socio-ecological activity. Given the complexity and jurisdictional range of a regional open space plan, essential actions include extensive, and comprehensive engagement with professional and governance communities, as well as open space users.

- a) *Involve Grassroots Organizations, Decision-Makers, and Residents:* Develop and encourage participatory design and visioning workshops to include grassroots organizations, local decision makers and residents in discussions about the assessments and envision how to co-design open spaces for health and well-being in the future. Organize a regional annual summit for all health stakeholders to share feedback on open space and related health projects and programs in their communities.
- b) *Involve Public Health Professionals and Departments, and the Medical and Clinical Communities:* Assess the key individuals, networks and meetings to reach out and recruit the public health communities to

interface with and inform the parks, recreation and open space professional community to explore common cause of the outdoors and human health. Consider how to 'reveal' effective innovations within the medical community (such as Parks Prescription for weight and disease control) to promote and enable broader adoption.

- c) *Provide Education Materials:* Develop and produce educational materials to inform decision makers and the public about the relationship between health and well-being and open space systems. Discover and adapt previously formulated toolkits of policies, programs and activities that encourage health in open space systems. If appropriate, provide materials in multiple
- d) *Promote Stewardship Programs and Activities:* Civic environmental stewardship programs now involve 100s of organizations and 1,000s of individuals each year. Participation in open space stewardship and management offers physical activity opportunities and other individual health benefits, and can directly provide learning about environmental and human health. Encourage organizations to highlight health benefits of participation when recruiting people to get involved in stewardship.
- e) *Engage with User Public:* Encourage crowdsourcing of health and open space projects (i.e. Falling Fruit foragers database, user experiences on Washington Trails Association). Encourage citizen science projects around health and open spaces.

## **2. Original Research Actions**

An extensive body of research has emerged in recent decades that demonstrates the linkages between experiences of nearby nature and human health and wellness. Future needs include actions to first identify the evidence that is relevant to the central Puget Sound region, and then formulate specific research needs that can be addressed by scientists.

- a) *Build a Locally Referenced Research Repository:* Assemble a task team of public health, medical experts, and open space planners to review and summarize current evidence about open space and health benefits, with a focus on spatial analysis and couched in regional terms. Formulate an easily accessible and understood repository of research or summary report for use in the Central Puget Sound Region. Generate a nature/health typology to communicate open space conditions and human health opportunities.
- b) *Conduct a Gap Analysis of Research for Regional Studies.*
- c) *Consult the research review to identify important unanswered questions* in the research (i.e. what is the optimal "dose" of nature?) and pose recommendations to fill gaps using the region as a test case. Partner with local universities and science agencies to access research funding.
- d) *Conduct a Full Cost Accounting Analysis of Open Spaces:* Assemble a task team of public health, medical, open space and economic experts to trace and document full cost accounting of select health and open space goals or programs in the region (see Section 1, Challenge 4). Analysis should articulate the health benefits provided by current open space, as well as the full costs of open spaces to help decision-makers and planners support future open space investments.

## **3. Assessment and Inventory Actions**

Inventories and assessments of both biophysical and social systems can use methods derived from research as well as applied technologies, such as GIS and census information.

- a) *Assess Open Space Lands and Health Potential:* Conduct an assessment of current open space (parks, gardens, significant tree stands, green belts etc.) in the Central Puget Sound region using remote sensing and agency GIS layers. Generate a spatial summary product (i.e. GIS layers) to visualize the regional open space system using the constructed nature/health typology.
- b) *Open Space Lands and Health Geospatial Synthesis:* Conduct secondary analyses using the products(s). Create a mappable classification of open space elements that specifically contribute to health. Explore not only the distribution of open space in the region, but also its connectivity (in a landscape ecology approach) as many health benefits are supported by having open space networks. Conduct a gap analysis (using GIS buffering and attribute analysis) to identify regional needs.

- c) *Health and Activity Programs Assessment*: Programs (such as hiking or cycling events, or parks prescription) encourage access and use of open spaces by diverse and nontraditional users. Using community outreach and web review survey the region and compile a list of programs, followed by a survey of program goals, successes, and audiences served.
- d) *User Locations, Frequencies and Usage of Open Spaces*: Open spaces can be evaluated in terms of their use. Assessments can include user counts, frequencies, and observed activities in the open spaces. User surveys could gather information such as where users are coming from geographically, how often they visit the open space, types of activities while in the open space, if they are using the open space in connection to other open spaces etc. Methods that are now be used nationally by the Robert Wood Johnson Foundation and the RAND Corporation could be applied in the Central Puget Sound region.
- e) *Community Assessment*: Conduct community participatory workshops or other forms of listening assessments with key communities (such as those having little or no green space, vulnerable populations, tribes etc.) to identify top priorities for health and the outdoors in their communities, with careful consideration for getting input from diverse populations. Acknowledge and address environmental disservices (see Section 3) and connect to Community Health Needs Assessments being done in the region.

#### **4. Planning and Policy Actions**

Aligning open space acquisitions, management, and programs to achieve human health and wellness goals is a complex pursuit. Planning and policy that specifies goals and outcomes, and spans the many jurisdictions that make up the central Puget Sound region is important activity.

- a) *Create Health-Focused Open Space Goals*: Based on the regional landscape assessment, open space classifications, and gap analysis, assemble a multi-disciplinary and multijurisdictional task team to draft open space goals for the region. These would include lands conservation and acquisition, site design, and best management practices. Prioritization would be determined by co-benefits opportunities, and community needs (including environmental justice concerns).
- b) *Embed Human Health in Local Comprehensive Planning*: Support integration of health and well-being into local comprehensive planning efforts and policy changes, with a specific focus on open space planning and impacts. Support local dialogue and collaboration around health in all open space related planning (e.g. transportation, public utilities, parks and recreation etc.). Provide example policies, plans and language for local review and use.
- c) *Support Ongoing, Policy Oriented Analysis*: Support Health Impact Assessments and similar frameworks and processes that directly inform open space policies and projects in comprehensive plans, with particular attention to cross-jurisdiction impacts. Support and promote policies that are demonstrated to lead to improved health while protecting the environment (i.e. transportation policies, initiatives such as the Shoreline Street Ends program).
- d) *Prioritize Open Space Investments*: Understand community level health conditions using health data (i.e. BRFF, Communities Counts), health spatial data analysis (i.e. R Studio), and full cost accounting to prioritize locations of open space investment and policies to address poor health areas.

#### **5. Demonstrate Actions**

There can be efficiencies and a shared sense of purpose for all those engaged in outdoors and human health efforts if each can learn from all. Good examples and success stories need to be shared.

- a) *Showcase Innovations*: Across all the activities mentioned above, some communities will activate particularly innovative and accessible programs. An example is 'Hike It Baby!'. A clearinghouse, or periodic outreach meetings can help local jurisdictions, communities, and concerned citizens to access and initiate ideas that are suited to local interests.
- b) *Conduct Pilot Studies*: Assemble multidisciplinary teams of health and open space designers to conduct pilot studies or demonstration projects of open spaces pairing open space design with research on health outcomes.

- c) *Health Impact Assessments on Open Space Developments*: Utilize Health Impact Assessments or similar tools when implementing regional open space development. Conduct post occupancy health evaluations for new parks, public lands, and nearby nature projects (such as green stormwater infrastructure installations).

### 3.4.2 Metrics

Metrics are useful as stakeholders within a coalition seek to better understand both baseline conditions and to monitor open space and public health accomplishments. Well-designed metrics can improve efforts to track success in two ways. First, they can be used to understand the degree that regional entities and organizations are working together for collective impact. They can also be used to better understand the degree of user access to green space, and suggest ongoing improvements to open spaces that promote human health.

#### 1. Engagement Metrics

- a) *Measure Degree of Jurisdictional Interaction and Collaboration*: Use periodic assessment of spatial as well as administrative collaboration and interactions between jurisdictions to document ongoing regional efforts and identify potential links and challenges.
- b) *Social Marketing for Outdoors and Health*: Using social marketing principles, including benefits and barriers analysis, periodically evaluate the institutional activity and organizational support of open space and health initiatives.
- c) *Conduct Regional Stewardship Monitoring*: Current monitoring activities focus on landscape or ecological restoration outcomes. A social assessment can facilitate a comprehensive understanding of stewardship activity and programs across the region. The Stewardship Mapping (Stew-Map) project, sponsored by the USDA Forest Service, is a platform for geographic and organizational monitoring.

#### 2. Research Metrics

- a) *Construct Health Outcome Indicators*: Draft a set of health outcomes metrics and measurements tools derived from research findings that can be implemented through data collection by trained staff and volunteers in the region. Assemble a task force of public health, medical experts, and open space planners to implement health performance metrics that are appropriate for different communities and geographic scales, and specifically addresses open space contributions.
- b) *Assess Health Outcome Indicators by Jurisdiction and Address Social Equity*: Assemble indicators for outdoor experience and activity determinants that include demographics and socioeconomic spatial analysis using census data mapping. Consider use of more global evaluators such as the National/Seattle Area Happiness Index. Indicators should be mapped by jurisdiction to compare and contrast regional implementation progress and health statuses across the region.

#### 3. Assessment Metrics

- a) *Set Benchmarks for Extent and Connectivity of Open Space*: Guidelines could also include accessibility (e.g. walkability radius) to determine where open spaces (and different open space types) are lacking in the region, as well as calculating the green space quotient per capita. Determine the appropriate expression or mosaic of open space for health along the entire urban to rural landscape gradient. Efforts could build off of the Centers for Disease Control access to green space recommendations.
- b) *Set Benchmarks for Site Character and Quality*: The mere presence of open spaces does not necessarily indicate positive health potential. Additional indicators would be open space activity facilities and elements, and programs. Efforts could build off of the Trust for Public Lands Parks Score sheet. Additional markers of quality could include aesthetic appreciation, cultural appropriateness, and ecological value.

#### 4. Planning Metrics

- a) *Monitor Funding Goals and Achievement by Jurisdiction and/or Sector*: Assess and set economic performance guidelines for local investment in green spaces that promote human health. This could

include a sector breakout, such as local government, NGO, private sector (such as hospitals and clinics), and special land uses (such as school districts and ports).

## **5. Demonstrate Metrics**

- a) *Monitor Social Media and News Outlets*: Use content analysis approaches to search media and periodically report catalogs of projects, innovations, and major programs concerning open space and health achievements. Such products can be indicators of goal oriented activity, highlight interesting activity across the region, and support celebration of successes.

## **3.5 SOCIAL EQUITY**

### **3.5.1 Recommendations**

Generally speaking, the goal of social equity is to ensure that all people regardless of race, ethnicity, gender, age, religion, economic status, disability, or geographic location “have access to the resources and opportunities that improve their quality of life.” “Access” and “resources” in this case can be interpreted as anything from the ability to vote or take part in the political process, to living within walking distance to a neighborhood park. Social equity further includes matters such the ability of small towns and rural areas to access major transportation networks during disasters, or the ability of visitors to reach these rural areas to spend tourist dollars.

Open spaces can help advance social equity efforts by providing minority or low-income populations, for instance, access to the recreation and health benefits that local parks can provide. Community parks and larger open spaces also provide residents and visitors with opportunities to participate in a wide variety of outdoor activities, environmental education, and encourage communal and social activities. Social equity can be advanced if open spaces are equally distributed in terms of size and quality throughout the region. Although distributional equity is not the only component of social equity.

To fully address the three key dimensions of equity – process equity, distributional equity, and cross-generational equity – strategic open space efforts will be needed from governance at multiple scales (e.g. watershed, municipality, county, region, state, and federal). As actions are implemented at various scales, investments that yield multiple benefits should be prioritized (i.e. open space projects should be planned that help address other high-priority needs and challenges). To gauge results of open space initiatives, input/feedback from diverse populations should be coordinated and shared among governing entities, to avoid strain on the time and energy of stakeholder groups.

Achieving social equity in the Central Puget Sound Region, with respect to open space access and benefits from open space services, will require:

1. Changing existing governance structures to be more inclusive of diverse populations;
2. Addressing the needs of populations with dramatically changing demographics; and
3. Respecting the cultural and historic resources of the past and present, while also fully providing for the needs of diverse future generations.

Given these general requirements, the text below presents some preliminary recommendations for how the region might advance social equity through open space initiatives. The recommendations are organized according to the key dimensions of equity.

#### **1. Process Equity Initiatives**

- a) Explore possible amendments to GMA and lower level planning frameworks to strengthen language to include social equity policies in multi-county, countywide, and city comprehensive planning, including capital facility planning;
- b) Explore possible amendments to SEPA to include Environmental Justice analysis, similar to NEPA;
- c) Ensure diverse populations have their own voice in developing watershed open space strategies by seeking funding to compensate and/or provide incentives for individuals from diverse populations to participate in comprehensive and watershed planning processes;

- d) Explore possible funding to provide assistance to train community leaders and trainers in civic engagement and decision making;
- e) Ensure agency leaders and staff are adequately trained to be receptive to involvement by diverse populations;
- f) Provide technical assistance such as Tacoma Pierce County Health Department's Healthy Community Planning Toolbox; and
- g) Encourage agencies to apply rigorous analysis of impacts to marginalized populations of proposed agency projects, programs, and procedures, e.g. City of Seattle Racial Equity Toolkit; King County Equity Impact Review.

2. **Distribution Equity Initiatives**

- a) Expand detailed data analysis of social inequities as conducted by King County to other three counties;
- b) Identify gaps in open space service delivery to diverse populations;
- c) Identify and map open space, cultural & historic resources that are of particular importance to diverse populations; and
- d) Prioritize investments in areas especially lacking in open space and access to open space.

3. **Cross-Generational Equity Initiatives**

- a) Explore mechanisms to ensure future generations of marginalized communities are afforded the same level of open space services as those in more affluent communities.

### 3.5.2 Metrics

Social equity conditions, with regard to open space in the Central Puget Sound region, can be most readily assessed by examining:

- Inequities in open space benefits prevalent in areas where low-income, racially diverse, and culturally diverse communities are located (e.g. lack of vegetative cover, trails, recreational opportunities; and polluted air, land, and water); and
- Responses to these inequities (e.g. political and institutional will, and policies, plans, programs, projects, and funding to address the issues).

However, measuring inequity is still an emerging field of analysis, and quantifying inequities is a new way of looking at community conditions. Consequently, the collection and usage of pertinent data (such as distributional equity information) has not been standardized. There is also a wide range of community conditions to include in analysis. Navigating these challenges requires analytical expertise and broad engagement with an array of civic, public, and private organizations as well as affected community members.

The following sections present preliminary ideas regarding potential metrics to assess the status and progress of social equity conditions as they relate to open space more specifically. The process of identifying suitable metrics, and aligning with interested public, civic and private sector partners to establish equity baseline and progress monitoring data, will be crucial to regional progress toward social equity.

#### King County Indicators for Determinants of Equity

Within the Central Puget Sound Region, King County has likely conducted the most intensive exploration into measurement of equity conditions. In their 2015 study, "The Determinants of Equity - Identifying Indicators to Establish a Baseline of Equity in King County," the County examined 13 determinants of equity, and 67 related community-level equity and social justice indicators as an initial step at capturing the baseline equity conditions across King County and later benchmarking progress.

1. **Process Equity Metrics**

- a) Voter Registration, and

- b) Voter Turnout.

## **2. Distributional Equity Metrics**

- a) Life Expectancy (Number of years a person can expect to live if the current death rates stay the same for his/her life),
- b) Obesity (Body Mass Index score over 30),
- c) Diabetes Prevalence (Adults that have been diagnosed for diabetes by a doctor),
- d) Resident Satisfaction with Parks (Percent of survey respondents who said they were satisfied or very satisfied with regional parks and trails),
- e) Open Green Space (Less developed parks, greenbelts, open space, undeveloped areas, natural areas, ecological land, and developed parks that are within a geography),
- f) Distribution of Regional Trails (Proximity of regional trails by ESJ score),
- g) Park Accessibility (Travel distance to a park),
- h) Distribution of Playgrounds (Distribution of playgrounds by median household income),
- i) Vegetation Distribution (Normalized Difference Vegetation Index – NDVI),
- j) Proximity to public transit(Percent of housing units per census tract that are located within a quarter mile of a transit stop or a two mile drive to a park-and-ride),
- k) Walk, Bike, Transit Score,
- l) Transportation Cost Burden (Proportion of total income spent on auto ownership costs, auto use costs, and public transit costs), and
- m) Resident Satisfaction with Quality of Life (Likert scale rating of resident satisfaction with quality of life).

## **3. Cross-Generational Equity Metrics**

- a) Social Cohesion (A measure of mutual trust among neighbors, and informal social control- for example, the likelihood that a neighbor would intervene if children were noticed skipping school), and
- b) Residential Mobility (Percent of households that have moved residence within the last year).

### **MEA Cultural Services Measures**

Additional ideas for metrics relevant to open space and social equity can be gleaned from the Millennium Ecosystem Assessment (MEA). Open spaces improve the ability of ecosystems to function, and provide many of the goods and services upon which all species, including humans, depend. Improving social equity through open space relies on the cultural services category of ecosystem services as conceived by the MEA. Cultural services are the non-material benefits people obtain from ecosystems, such as aesthetic, heritage and spiritual values, recreation/ecotourism experiences, and science/education.

Addressing social equity through provision of open space services may help satisfy various competing interests and offer synergistic advantages when deciding how to manage efforts to achieve sustainable communities. From the MEA, the following metrics could be helpful for measuring gains and losses that occur as consequences of providing open space to improve social equity:

- a) Land use and cover characteristics and change (e.g., vegetative cover; habitat fragmentation from development, preservation of historic sites)
- b) Pollution (e.g., pollutant concentration that affect visibility – air, water)
- c) Species introduction or removal (e.g., presence/absence of species for)
- d) Storage capacity (e.g., nutrients, energy, water, carbon)

A clear limitation of these metrics is that they focus heavily on environmental factors, and less so on human interaction with open space.

## 5.0 CO-BENEFITS AND TRADEOFFS OF INTEGRATION

This section will explore the complex relationships between the five regional challenges through a discussion of the co-benefits and tradeoffs created by implementing recommendations for one challenge. Co-benefits include, for example, the secondary benefits created when climate change recommendations to reduce urban heat islands are implemented. These secondary benefits include positive externalities for human health, as heat stress and the likelihood of heat related deaths decreases, and many of the other challenges. Tradeoffs can occur when, for instance, efforts to improve economic development opportunities by increasing impervious surfaces, negatively impact biodiversity and climate change efforts. For the most part, the recommendations above will create stacked benefits for the environment, economy, and society of the Central Puget Sound Region, although there are some very real tradeoffs that must be weighed as well.

**Table 1.** Relationships between the Benefits of Open Space Preservation for the Five Regional Challenges.  
*(Note: + indicates a positive relationship (potential co-benefit), - indicates a negative relationship (potential tradeoff)*  
**Bold text indicates the recommendation that may cause the + or – effect).**

Climate Change	Biodiversity	Economic Development	Human Health	Social Equity
<b>Enhanced investment in urban green infrastructure to reduce urban heat island effect (shading and cooling).</b>	+ Reduced thermal stress. + Generally supports increased habitat.	- Increased urbanization and development in city centers may counteract ability to mitigate urban heat island effect if done without green infrastructure.	+ Alleviate heat-related impacts on vulnerable populations (e.g., elderly, sick). +/- Potential improvements to urban environment, but displacement and affordability challenge.	+ Alleviate heat-related impacts on vulnerable populations (e.g., elderly, sick). +/- Potential improvements to urban environment, but displacement and affordability challenge.
<b>Reduce flood risk vulnerability and severity.</b>	+ If flood risk reduced with increased riparian buffers and other green infrastructure, creates more habitat and areas for aquifer recharge. - If flood risk is reduced with gray infrastructure could negatively impact aquatic systems.	+ Reduced frequency and severity of floods will reduce the amount of damage to business and infrastructure. + Reduced public costs to manage and treat stormwater.	+ Reduced frequency and severity of floods will reduce the risk to human life. + Filtration and removal of water-borne pollutants.	+ Reduced risk to vulnerable infrastructure and neighborhoods.
<b>Provide space for regionally-sourced food and fiber.</b>	+ If managed properly, agricultural lands and working forests can provide habitat to wildlife, and corridors between wilderness areas.	+ Sustainable production of natural materials that provides jobs.	+ Space for recreation. + Sustainable food production/food security.	+ Sustainable food production/food security. + Protection of a way of life.
<b>Provide space for siting of alternative, low-carbon energy options.</b>	- Risk of prioritizing open space at expense of spatial needs of vulnerable species and/or habitats.	+ Possible job creation, enhanced energy industry. + Economic benefit through improved energy efficiency.	+ Less pollutants emitted into the atmosphere.	+ Reduced energy demand and costs. - Risk of prioritizing open space at expense of spatial needs of vulnerable populations.

Climate Change	Biodiversity	Economic Development	Human Health	Social Equity
+ Systems will become more robust and resilient to climate change.	<b>Striving for more intact native flora and fauna in terrestrial and aquatic systems.</b>	+ Food, building materials, fuel, and medical services provided.  + Substitutes for expensive and highly engineered solutions.  + Draw for business, the "Rainer effect."	+ Psychological health and well-being.  + Disease regulation.  - Some protected species may cause disease and create human-wildlife conflict.	+ Cultural and economic assets protected (such as salmon).  +/- Environmental justice, depending on where these areas are protected.
+ Permeable landscapes to facilitate water storage.  + More forest and vegetative cover to sequester GHGs.	<b>Create/maintain habitat.</b>	+ Possible economic benefit for restoration and maintenance through diversified job force.  + May improve on-site and adjoining land and property values.  - Preserved open space means less land is available for residential, commercial, and industrial development.	+ Improved air, water, and soil quality.	+ Enhanced access to open space.  - Risk of prioritizing open space at expense of spatial needs of vulnerable populations.
+ Improved land management can support climate mitigation.	+ Improved land management can support biodiversity.	<b>More sustainable approach to natural resource jobs (agriculture, forestry, fisheries).</b>	+ Potential air/water quality improvements.	+/- Resource-based job loss impacts rural community, but new practices may bring greater local benefit.
+/- Transition of resource based employment supports biodiversity, but enhanced recreational access can have negative impacts.	+/- Transition of resource based employment supports biodiversity, but enhanced recreational access can have negative impacts.	<b>Employment in the parks, outdoor recreation, tourism and ecological restoration.</b>	+ Potential air/water quality improvements.	+ Potential to address job needs in disadvantaged communities.
+ Increased visibility of climate issues.	+/- Increased visibility of issues, but potential human-wildlife conflicts.	<b>Increasing access/visibility of open space to support workforce productivity.</b>	+ Similar approach is recommended to improve health outcomes.	+ Potential improvements to worker conditions if strategically distributed.
+/- Potential improvements to urban environment, but increased development pressures.	+/- Potential improvements to urban environment, but increased development pressures.	<b>Retain + recruit new talent + businesses through investments in accessible open space.</b>	+/- Potential improvements to urban environment, but displacement and affordability challenge.	+/- Potential improvements to urban environment, but displacement and affordability challenge.

Climate Change	Biodiversity	Economic Development	Human Health	Social Equity
+ Generally supports climate adaptation with reduced hardscape footprint.	+ Generally supports habitat for biodiversity with reduced hardscape footprint.	<b>Orient open space investments to support real estate value capture + smart growth.</b>	+ Potential improvements to health outcomes with open space in urban environment.	- High potential for displacement and affordability challenge.
+/- Potential for increased rural footprint, but improved habitat conditions.	+/- Potential for increased rural footprint, but improved habitat conditions.	<b>Advance programs to use open space as to tool for more prosperous rural communities.</b>	+ Generally supports rural resident health with added prosperity.	+ Confronts job inequities between urban and rural community.
- Impacts ability to mitigate with conversion of vegetated land covers to more developed uses and/or increased GHG emissions. + Expansion of clean technology solutions generally supports climate resilience. + Potential increased giving to climate issues. +/- Varies with type.	-/+ Impacts habitat for biodiversity, varies by type. +/- New methods may support quality habitat, but reduce habitat with wind/solar investments (clean technology cluster). + Potential increased giving to biodiversity issues.	<b>A focus on economic development.</b>	- Can negatively impact air and water quality depending on type. + Economic prosperity is generally an indicator of human health. + Potential increased giving to health issues.	+/- Expansion of clean technology solutions generally supports climate resilience of cities, although not uniformly. + Potential increased giving to social justice issues.
+/- Generally supports increased areas for climate adaptation, but potential for green washing. + Increased regional resilience to natural disasters and climate change impacts such as flooding and urban heat islands.	+/- Generally supports increased habitat and health of species, but potential for green washing. - Recreational open spaces may compete with wilderness areas + Attentiveness and stress reduction is promoted when there are a diversity of species in open spaces	+ Increased open spaces could bring agricultural and recreational opportunities that would help the economy. + New business could be pulled to the area, the "Rainer effect."	<b>Orient open space investments to support healthy natural environment for humans.</b>	+/- Depending on the location of investments. As access to open spaces and their health benefits is often not uniform across certain communities, demographics and subpopulations. + increased focus on health could bring an increased focus on social equity
- Risk of prioritizing actions that may not address.	- Risk of prioritizing non-green open space.	+ Focus on marginalized communities to improve civic engagement will stimulate involvement by all.	+ Potential to increase sense of empowerment.	<b>Improved engagement by diverse populations in open space planning and decision making.</b>
+ Potential to maximize conservation efforts.	+ Potential to maximize conservation efforts.			<b>Improved coordination at all levels of government.</b>

Climate Change	Biodiversity	Economic Development	Human Health	Social Equity
<ul style="list-style-type: none"> <li>+ Improved air quality.</li> <li>+ Potential to reduce flood risk and damage.</li> <li>+ Potential to sequester and store carbon.</li> </ul>	<ul style="list-style-type: none"> <li>- Risk of creating non-permeable open space.</li> <li>+ Potential to connect fragmented habitat.</li> <li>+ Potential to reduce flood risk to habitats.</li> <li>+ Potential to increase forest and vegetation cover.</li> </ul>	<ul style="list-style-type: none"> <li>- Less land is available for development.</li> <li>+ More open space provides more opportunity for support industries and businesses.</li> <li>+ May improve on-site and adjoining land and property values.</li> <li>+ Potential for food production.</li> <li>+ Potential for production of natural materials.</li> <li>+ Potential to reduce public costs to manage and treat stormwater.</li> <li>+ Potential to reduce costs associated with flood events.</li> </ul>	<ul style="list-style-type: none"> <li>+ More open space will improve opportunities for all, resulting in improved public health.</li> <li>+ Filtration and removal of water-borne pollutants.</li> <li>+ Potential for food production/food security.</li> <li>+ Improved opportunity for physical exercise.</li> </ul>	<p><b>Expanded variety of open space resources in the urban area.</b></p>
<ul style="list-style-type: none"> <li>+ Potential to improve air quality.</li> </ul>	<ul style="list-style-type: none"> <li>- Could be intrusive to animal species.</li> </ul>	<ul style="list-style-type: none"> <li>+ Improved public transit for employees.</li> <li>+ Potential to reduce need for employer parking.</li> <li>- Potential to create conflicts w/vehicular access.</li> </ul>	<ul style="list-style-type: none"> <li>+ Enhanced access to open space.</li> <li>+ Improved opportunity for physical exercise.</li> </ul>	<p><b>Improved public transportation and non-motorized access to open space resources.</b></p>
<ul style="list-style-type: none"> <li>+ Potential to increase.</li> </ul>	<ul style="list-style-type: none"> <li>+ Potential to enhance biodiversity.</li> </ul>		<ul style="list-style-type: none"> <li>+ Potential to improve mental/emotional health.</li> </ul>	<p><b>Improved cross-generational access to nature.</b></p>

## 6.0 CONCLUSIONS

The ROSS team has coalesced around five regional challenges that capture both human and environmental areas of concern for the entirety of the Central Puget Sound Region. Each of these regional challenges represent both threats and opportunities, and can be addressed in part through conservation and enhancement of open spaces. The five regional challenges discussed within this paper include:

- Adapting to and mitigating against climate change;
- Maintaining biodiversity;
- Creating economic development opportunities;
- Improving human health; and
- Enhancing social equity.

This report is based on the work of five Task Forces that focused on creating:

- Recommendations to address these challenges;
- Metrics to measure the region's progress towards achieving the opportunities, and combating the threats associated with each challenge; and
- Revealing the co-benefits that could be realized from addressing one or all of the regional challenges.

This report has revealed that while each of the five regional challenges center on different opportunities and gaps within the region, there are clear connections. Many recommendations derived from different experts for different challenges, are strikingly similar. For instance, nearly every challenge has a recommended action surrounding the need for increased public outreach and education. The recommendations that generally apply to each of the regional challenges include:

- The need to map priority areas / spatialize the inventory of open spaces,
- The creation of regulatory / policy adjustments that prioritize open spaces,
- The need to find additional funding sources, and
- The need to increase public outreach and better engage the public about the importance of open spaces.

By translating these recommendations and strategies into actions, the region can begin to take steps towards addressing the regional challenges, and taking advantage of the opportunities that open spaces provide. Implementing the recommendations for each of the challenges, whether they are similar or not, is also expected to create positive outcomes that will benefit most if not all of the other challenges the region faces. The use of metrics, as discussed in this report, will be crucial in determining the progress the region makes toward creating a robust open space system able to meet the challenges of today and tomorrow.

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<sup>i</sup> Kirwan Institute and Puget Sound Regional Council (PSRC), "Equity, Opportunity, and Sustainability In The Central Puget Sound Region: Geography Of Opportunity In The Central Puget Sound Region," May 2012, 3. <http://www.psrc.org/assets/7831/EquOppSusReport2.pdf?processed=true>.

<sup>ii</sup> American Physical Society (APS). "Direct Air Capture of CO<sub>2</sub> with Chemicals: A Technology Assessment for the APS Panel on Public Affairs." Last updated June 1, 2011. <http://www.aps.org/policy/reports/assessments/upload/dac2011.pdf>.

<sup>iii</sup> Evans, Erv. "Tree Facts." *North Carolina State University*. Accessed April 12, 2015. <http://www.ncsu.edu/project/treesofstrength/treefact.htm>.

<sup>iv</sup> Frey, Sarah J. K., Adam S. Hadley, Sherri L. Johnson, Mark Schulze, Julia a. Jones, and Matthew G. Betts. "Spatial models reveal the microclimatic buffering capacity of old-growth forests." *Scientific Advances* 2 (April 2016). Accessible from: <http://advances.sciencemag.org/content/advances/2/4/e1501392.full.pdf>.

<sup>v</sup> Phillips, Don. "Assessment of Ecosystem Services Provided by Urban Trees: Public Lands Within the Urban Growth Boundary of Corvallis, Oregon: Technical Report." Accessed October 1, 2014. [http://www.itreetools.org/resources/reports/Corvallis\\_Urban\\_Tree\\_Assessment\\_Tech\\_Report.pdf](http://www.itreetools.org/resources/reports/Corvallis_Urban_Tree_Assessment_Tech_Report.pdf).

<sup>vi</sup> To the maximum extent possible, all of these initiatives should build on and complement existing efforts. The Task Force attempted to identify existing and/or complementary efforts wherever possible.

<sup>vii</sup> Kershner, J. M. "Helping Michigan's Farmers Understand and Adapt to the Impacts of Climate Change." [Case study on a project of Michigan State University Extension and Kellogg Biological Station – Michigan]. *Product of EcoAdapt's State of Adaptation Program*. Last updated October 2012. Retrieved from CAKE: [www.cakex.org/case-studies/helping-michigans-farmers-understand-and-adap...](http://www.cakex.org/case-studies/helping-michigans-farmers-understand-and-adap...);

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<sup>viii</sup> Washington's Growth Management Act coordinates state and local government decision making in order to achieve environmental and socioeconomic sustainability by identifying and protecting natural resource lands and critical areas, designating urban growth areas, and providing guidance on the preparation and implementation of comprehensive plans.

<http://apps.leg.wa.gov/rcw/default.aspx?cite=36.70A>

<sup>ix</sup> Shoreline Master Programs are shoreline-specific comprehensive plans aimed at managing activities, use, and modifications of local shoreline districts. These plans help manage competing uses of local shorelines while aiming to promote public access and use of water-oriented and water-dependent activities. <http://www.ecy.wa.gov/programs/sea/shorelines/smp/>

<sup>x</sup> Hazard mitigation plans currently exist for all four counties in the Central Puget Sound region.

<sup>xi</sup> Puget Sound Clean Air Agency, Air Quality Index: <http://www.pscleanair.org/airq/basics/aqi.aspx>

<sup>xii</sup> A *renewable portfolio standard* is "a regulatory mandate to increase production of energy from renewable sources such as wind, solar, biomass and other alternatives to fossil and nuclear electric generation."

[http://www.nrel.gov/tech\\_deployment/state\\_local\\_activities/basics\\_portfolio\\_standards.html](http://www.nrel.gov/tech_deployment/state_local_activities/basics_portfolio_standards.html)

<sup>xiii</sup> Prosperity Partnership. "Regional Economic Strategy for the Central Puget sound Region: Strategy." Last updated July 2012.

<http://www.psrc.org/assets/8558/RegionalEconomicStrategy.pdf>.

<sup>xiv</sup> Ibid.

<sup>xv</sup> Wolf, Kathleen L., PhD, "Trees mean business," invest from the ground up, Last updated May 29, 2013.

<http://investfromthegroundup.org/trees-mean-business/>.

<sup>xvi</sup> Washington State Office of Financial Management (OFM), "Final 2007 GMA Population Projections (RCW 43.62.035): Section 5. Additional Information for Puget Sound Counties," Last updated November 2007,

<http://www.ofm.wa.gov/pop/gma/pugetsound.pdf>.

<sup>xvii</sup> A full list of these measures is on the PSRC's Economic Development District (EDD) website: <http://www.psrc.org/econdev/res/res-performance-measures/>. An extension of this work is underway as the EDD participates in an International Regions Benchmarking Consortium in which a set of nine member regions have agreed to "allow self-evaluation of economy, society, environment, infrastructure, and other urban issues using peer regions as a benchmark." A beta proof of concept online and interactive city benchmarking tool was developed by Community Attributes to support this effort. (International Regions Benchmarking Consortium. "Home." Accessed May 2016. <http://www.internationalregions.org/>. And International Regions Benchmarking Consortium. "BETA." *Community Attributes Inc.* Accessed May 2016. <http://www.caimaps.info/irbc/Account/Login?ReturnUrl=%2Firbc>.)