Open Space and *Human Health* in the Central Puget Sound Region

PROBLEM STATEMENT + CONNECTION TO OPEN SPACE

The conditions in which people are born, grow, live, work and age are recognized determinants of health.[1] In addition to the social environment the physical environment is equally important, and interaction with open space and nature is a likely influence on personal and community level health and well-being.[2] This white paper considers how strategic open space planning may provide opportunities and affordances for increased human health and well-being in the Central Puget Sound Region. It is intended to be a succinct reference for planners, public health officials, and open space decision-makers to understand the relationship between health and open spaces, and assist in open space preservation and strategic planning decisions. The contents are based on the extensive research evidence about the positive relationships of nature and open space experiences for human health *(See Appendix A for more information).*

Defining Open Space

As used in the ROSS process, the term *open space* is broadly inclusive, referring to the diverse landscape elements within the landscape gradient – from wilderness to urban centers – that is the Central Puget Sound region:

- Patches or relic expressions of native ecosystems (e.g. urban forests, greenbelts, conservation lands, riparian corridors etc.),
- Constructed nature for cultural activities and recreation (e.g. parks, community gardens, pocket parks, botanical gardens)
- Active transportation corridors (e.g. streetscapes, bike paths and lanes etc.),
- Engineered technologies that are integrated within built form to serve ecological functions (e.g. green roofs, living walls, green stormwater infrastructure such as bioswales etc.),
- Located within public, private and working lands (e.g. farm and forest lands, backyards, golf courses etc.), and
- 'Blue infrastructure' (e.g. the waterways and shorelines available for fishing, boating, swimming, kayaking etc.)

Human Health Definition

Many people regard health as the domain of doctors, treatments and hospitals. Yet *health* is defined by a complex web of lifestyles and conditions, professional diagnoses, cultural values, and community circumstances that are interwoven with and influenced by broader economic, social, environmental and political systems. The World Health Organization (WHO) defines health as "a state of complete physical, mental and social well-being, and not merely the absence of disease[3]." Socio-economic conditions, including the physical environment, are referred to as social determinants by public health professionals. Conditions of one's community and the broader landscape can determine health status and the distribution of opportunities for healthful living.

Contemporary Health Concerns

A combination of physical, mental and social issues has created complex public health challenges in the region and nation. Noncommunicable 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[4].

Public health officials widely acknowledge the importance of both disease prevention and health promotion to address contemporary health concerns. 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.

What is the Role of Open Space in Health Promotion and Well-Being?
While the evidence linking open space with positive and specific health outcomes is still growing, key agencies such as the Centers for Disease Control and Prevention (CDC) and the National Parks Service (NPS) have recognized that parks and other open spaces are important resources for public health and are implementing programs and actions that address the growing challenges in public health. One of these is the Healthy Parks, Healthy People program, a movement to reframe the role of public open spaces as powerful health prevention strategies to inspire healthy lifestyle choices and opportunities through a relationship with nature and the outdoors. Discussions at a 2010 global summit converged on four major themes around health and open space, all relevant to the Central Puget Sound Region:

1. **Healthy Communities:** social and cultural connections, partnerships, economic development and tourism,
2. **Healthy Parks:** managing the environment, sustainability, effective park management, and designing healthy parks for people,
3. **Healthy Participation:** participation that includes people of diverse backgrounds and demographics, integrating facilities and programs, recreation and tourism experiences, and education
4. **Healthy People:** mental and physical health, quality of life, and holistic well-being[3]

Open spaces provide unique resources for promoting healthy behaviors, lifestyles and opportunities, and can offer demonstrable and often distinct physical, mental and social health benefits through their **environments** (e.g. green and blue spaces), **facilities** (e.g. multi-modal transportation infrastructure) and **programs** (e.g. educational and cultural programs).

Health Outcomes and Pathways
Current evidence suggests that open space planning and management can contribute to health promotion and disease prevention through specific pathways *(see articles in Appendix A for greater detail)*. Open space environments and associated facilities and programs can promote behaviors leading to specific health improvements:

1. **Promoting physical activity** (e.g. to increase walking, cycling), reducing the risk of cardiovascular disease, cancer, depression and many other noncommunicable, chronic conditions.
2. **Promoting mental health** (e.g. to provide mental restoration, stress recovery, therapy), reducing impacts on conditions ranging from ADHD to depression, and dementia in older adults.
3. **Building social capital** (e.g. promote social interactions, social capital), maintaining supportive social connections that contribute to health and improving community cohesion (associated with crime reduction).
4. **Improving air quality** (e.g. increase oxygen, reduce ozone and air particulates), improving cardiovascular and respiratory health.
5. **Improving water supply and quality** (e.g. restore predevelopment hydrologic cycles, reduce flooding, provide clean water), reducing digestive diseases, neurotoxicity, cancer risks, mold exposure etc.
6. **Reducing toxic chemical exposures** (e.g. clean soil through phytoremediation of plants, provide pesticide-free foods) reducing cancer risks, neurotoxicity, human development toxicity risks etc.
7. **Improving access to healthy food** (e.g. P-patches, backyard gardens, farms), improving local food supply and household nutrition.

8. **Improving resilience to environmental disasters** (e.g. flooding, sea level rise, high heat episodes etc.), enabling citizen-based first response and adaptive response based on prior community level open space engagement and stewardship.

Why Is a Regional Approach to Open Space Necessary in Advancing Objectives for Human Health?

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 space 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:

1. Recognizing and Connecting Varying Spatial Scales

Open spaces and their health benefits occur at different scales, from backyard gardens to the national parks. A regional approach recognizes the value of formulating interventions across multiple spatial scales. Tim Beatley, an urban planner, proposes the 'nature pyramid' (similar to a food pyramid) as a guideline for how much nature exposure humans require in their lives in order to maximize health benefits. The nature pyramid concept speaks to the need for access to small-scale everyday nature such as street trees, as well as access to larger regional parks to maximize health and well-being benefits.[5] Creative approaches are needed; for instance well-designed engineered technologies (i.e. green walls and roofs) can provide access to small-scale, nearby nature within dense urban areas. The ability of any single jurisdiction to address access and connectivity needs varies; only the largest jurisdictions in the Central Puget Sound Region may now have the necessary capacity. Achieving better access across this nature pyramid requires a regional approach to open space planning and policy.

2. Connecting Ecological and Infrastructure Systems

Ecological and cultural functions, and the situations that support causal pathways for health outcomes, are optimized by open space connectivity. Comprehensive open space planning should interface projects having ecological goals and objectives (such as riparian habitat restoration) with human health potential (including trails and water access). Other examples include: linked wetlands to maximize stormwater cleansing thus reducing toxic chemical exposures and cancer and neurotoxicity risks; extended trail systems having clear social or nature destinations provided across conservation lands thus providing higher quality long distance recreation, and contributing to reduced risk of cardiovascular disease, diabetes or depression. Open space systems could also align with and connect to other multi-jurisdictional infrastructures such as transportation, watershed, and stormwater systems. For example, bicycle lanes and paths that connect parks provide both recreation and active transit opportunities. An integrated systems outlook is necessary to optimize health benefits.

3. Uniting Communities and Resources

Many local governments are working to improve community conditions yet their programs and actions are focused within their jurisdictional boundaries. Local jurisdictions will often collaborate on broader policy or regulations in order to address needs or initiate improvements with neighboring communities. A regional approach to open space systems planning could provide shared policies and goals needed to stimulate dialogue and action across communities. Coordinated, strategic investment in open spaces by multiple communities may be especially critical to help less wealthy communities address health issues.

Models and Precedents

National, regional and local efforts related to health and open space systems are emerging, as interest in this integration of policy and programs is growing rapidly across the United States. Here is a sample of programs and precedents for region-wide approaches to open space uses that incorporate improved population health.

1. **National Efforts**

- **Parks Prescription** programs are supported by medical professionals in some communities in the U.S. Patients are prescribed frequency, duration, and extent of routine physical activity within local parks.[6]
- A **Complete Streets** policy promotes active transportation systems of all modes of transport (including pedestrian mobility, bicycle usage, and connectivity to mass transit) and utilizes open space connections.[7]
- **Safe Routes to School** programs encourage active transit for children from their homes to school and can utilize open space connections.[8]
- The Health Impact Assessment (HIA)[9] approach introduces health considerations into community planning and new development or policies.
- The Centers for Disease Control and Prevention (CDC) support a **Healthy Communities Program**[10] that offers guidance, best practices, and technical meetings for better health at the community level, including the physical environment. Local entities, including Public Health – Seattle and King County, Seattle Children's Hospital, and the Healthy King County Coalition, have received healthy communities funding to work on regional population health policies and environment change
- As part of its Healthy Places program the CDC provides resources and tools for **Parks, Trails, and Health**[11].
- The **Trust for Public Lands** has published a series of case studies and policy documents concerning parks and health, including Fitness Zones to the Medical Mile: How Urban Park Systems Can Best Promote Health and Wellness[12] and ParkScore.[13]
- **America's Great Outdoors** is a national initiative to promote conservation and recreation, and calls out public health as an important concern[14].
- The **City Parks Alliance** has issued a policy statement about why parks matter for public health[15].
- **Active Living Research**, funded by the Robert Wood Johnson Foundation, provides research, policy and program support for community programs.[16]

2. **Pacific Northwest and Regional**

- The Washington Growth Management Act directs communities to identify lands and corridors within the urban growth area that could be useful as open spaces and provide health and recreational opportunities[17]
- The Puget Sound Regional Council is doing work around health equity and transportation[18]
- The Portland metro area Intertwine Alliance engages residents with nature and the outdoors and has launched a health program[19]

3. **Local**

- The Seattle Shoreline Street Ends program converts unused pocket parcels of public land to become parks and water access points across communities[20]
- Precedents of Shared Use Agreements have allowed communities to use open space resources otherwise reserved to a single district or jurisdiction[21].

What Are the Challenges to Health and Open Space Initiatives in Central Puget Sound

There are several key challenges to understanding and addressing health and well-being as it relates to open spaces:

1. Open Space Equity

The Central Puget Sound region is uniquely abundant in forests, freshwater and marine systems, and mountain landscapes. However, access to open spaces is not uniform across all communities and demographic groups. Additionally, open space programming, training, social support, maintenance and resources are also not equitably distributed. And 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 now having fewer nature amenities. Open space quantity, access, quality, and cultural applicability are recognized environmental justice concerns, including access by vulnerable and less mobile populations *(see Section 3, cross pollination with Social Equity Task Force)*.

2. Open Space and Health Economics
Justifying the costs of open spaces by examining the human health benefits and their associated cost savings is a difficult task and not often examined. A benefits analysis entails specifying health outcomes, predicting outcomes at a population or geographic scale, and assigning a monetary value to these health benefits.[22] A cost analysis, or the determination of what organizations, agencies, or individuals should pay for to create, sustain, and maintain open space, is another challenge. Costs include land base, programs, facilities and maintenance. Such in depth analysis to determine full cost accounting of open spaces, and especially in terms of net health benefits and cost savings is difficult, and requires collaboration of both health and natural resource economists.

Traditional health service providers and insurers have not yet included open spaces in their financial models. Entities that provide support for health prevention programs and cost reductions may not be the same that pay for related medical treatments and therapies. For example, insurance companies may benefit from preventive measures paid for by local government jurisdictions. Additionally, jurisdictions might provide programs or actions that are indirectly paid for by the public and provide societal benefits that are not easy to measure and communicate back to the public. Because of the complex and diverse institutions associated with health and open spaces, full cost/benefit accounting, and applying new financing models is a challenge for health and open space planning.

3. Cross-Departmental and Multi-Jurisdictional Collaboration
Effective incorporation of open space environments, facilities and programs for health and well-being in any single local government jurisdiction requires collaboration between governmental departments, including public health and safety, public utilities, parks and recreation, transportation and planning. While research shows that experiences with nearby open spaces are highly effective in addressing health, communities are learning that open space connectivity across scales is also important (e.g. bicycle transit or recreational trails supporting active living). Such large scale systems often span political boundaries so collaboration must also be multi-jurisdictional. Obstacles can include funding, regulatory, and communication barriers between departments, disciplines, agencies and jurisdictions.

4. Accessing and Understanding the Evidence-Based Literature
Literally thousands of studies have been done in recent decades on the role of open space and nature experience in human health and well-being promotion and disease prevention. The evidence about the relationship between open space and health spans many topics including the extent of nature (such as presence of parks or trees), access disparities for specific populations (e.g. children, elderly), economic benefits (e.g. reduced health care costs), and comprehensive or community planning *(see Appendix A: Supportive Research and Publications).* While much of the research can be found using health search engines such as PubMed, local decision-makers and practitioners may not be able to purchase articles, or know search keywords. Additionally, most research on health and open space experiences has limitations: limited sampling, nature settings that are not landscape scale (e.g. healing gardens for hospital patients), and small outcome effects. Few studies have examined health outcomes based on large-scale open space conditions that can be translated to regional public health or planning programs

Summary
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. Regional multi-scale (from neighborhood to region) open space systems planning is needed to create opportunities for activities and programs that promote better health and wellness for individuals and communities, and address health disparities in the region. However, more analysis may be needed to better understand the current inventory of open space, the range and type of health benefits that such spaces can provide, and the open space conditions that are most supportive at the regional level. Innovative programs are emerging locally and nationally, and a review of examples can help jump start ideas about open space potential and health oriented activities.

SECTION 2: RECOMMENDED ACTIONS AND POTENTIAL METRICS

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 to public health and bring unique resources and knowledge to the effort. Finally, 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.

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.

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 Regional Open Space Strategy, and contribute to coalition building. Five action themes are each followed by specific action recommendations, then related potential metrics. The combined Actions and Metrics are an ambitious agenda; prioritization of activity will be necessary.

Engagement
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.

1. Engagement Actions

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 languages.

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 efforts.

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. 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.

Original Research
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.

1. Research Actions

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
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.

c. 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.

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.

Assessment and Inventory
Original research addresses research questions and hypotheses that explore unknowns and generate new knowledge. Research often launches new techniques and methods that can be broadly applied to practical needs. 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.

1. Assessment Actions

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 of Section 1.

b. Open Space Lands and Health Geospatial Synthesis
Conduct secondary analyses using the products(s) of 1.a. 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.

2. 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.

Planning and Policy
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.

1. Planning Actions

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.

2. 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).

Demonstrate
Innovations and programs are underway. Additional research, assessments, and planning will initiate new efforts. 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.

1. Demonstrate Actions

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).

2. 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.

Summary

A variety of actions, assessments, and metrics are identified in this section. The first, high level action would be to draft a more detailed strategy that, considering available resources and capacity, would prioritize across possible programs, policy, and research. Once priorities are agreed upon, perhaps by representatives of a mixed interest coalition described above, a list of relevant data sources should be cataloged and, when data are not available, suggest a reasonable and efficient process to collect information or data. A key need in this discussion would to identify an organization that would be responsible for collecting, aggregating, analyzing, then archiving and presenting data and results.

SECTION 3: SUMMARY OF ECOSYSTEM/CULTURAL SERVICES, CO-BENEFITS + TRADEOFFS

In this final section the definitions, frameworks, and actions of Sections 1 and 2 are considered in light of the other elements of the Regional Open Space Plan.

Understanding Human Health as an Ecosystem/Cultural Service
The Millenium Ecosystem Assessment proposed a classification of ecosystem services that included provisioning, regulating, supporting and cultural services. The provisioning and regulating services directly contribute to the fundamentals of human health as they address air, food, and water supply and quality. Supporting services are also important to human health as they initiate the conditions from which materials are derived and produced (such as the decomposition and soil formation that supports food production).

As described in this white paper open space contributions to health align with cultural ecosystem services. Similar to spiritual experiences, aesthetics, education, the salutary benefits of being outdoors enrich quality of life and improve social capital. Outdoor recreation is popular in the region, providing benefits based on physical activity. Psychosocial services are of increasing interest, including the cognitive, emotional, and psychological benefits derived from interactions with nature.

Based on early science and policy, there are lingering perceptions that ecosystem services are generated in, or are provided by, more rural or pristine landscapes. Yet urban sustainability and resilience initiatives are accompanied by expanded recognition of the ecosystem services provided by engineered and designed nearby nature in cities, as well as endemic ecosystem patches. Within-city outcomes such as air and water purification, stormwater management, carbon sequestration, and reduction of heat island effects are now fairly well-defined, and have been assessed for their potential economic values (for example, i-Tree assessments by the USDA Forest Service).

The central Puget Sound region is highly urbanized, and population projections indicate that future landscape change and land use densification will be significant. Open space that includes well designed and managed opportunities for health-oriented experiences is needed across the entire landscape gradient – from downtown areas extending in suburbs, working landscapes and into wildlands. A snow cap to white cap perspective will assure diverse, high quality access to nature in all communities, and optimize the provision of ecosystem services.

Understanding Services, Co-Benefits and Tradeoffs
Any single open space has the potential to be hyperfunctional, providing multiple influences on health, that combine with additional economic, ecological or social systems co-benefits. All open spaces may perform ecological functions (*environmental services)* including stormwater cleansing, fossil fuel reduction, carbon sequestration, and temperature and noise regulation, as well as cultural functions (*cultural services)* such as opportunities for play and recreation, education, social gathering, and access to nature and beauty.

However, it is important to understand that open spaces are not a panacea for positive human health; many other factors such as diet, social connections, and access to primary care are primary determinants of individual health. Recognizing both the benefits of open space as well as potential cultural and ecosystem *disservices* (e.g. where a positive impact on one aspect of health results in a negative impact on another aspect of health) is important. Potential disservices include, for example, presence of pollen and other allergens, and loss of pets to predators.

Cross-Pollination, Co-Benefits and Trade-Offs Related to Other ROSS Task Force Topics
Health is a topic that spans all of the other ROSS Task Force topic areas, many of which can be regarded as determinants or indicators of health.

Task Force 1: Social Equity
Access to open spaces and their health benefits is not uniform across certain communities, demographics and subpopulations. The Central Puget Sound region contains the most ethnically/culturally diverse zip code in the United States. There are many other communities of diverse socio-economic and ethnic backgrounds, including the federally recognized and unrecognized Native American tribes in the region. A commitment to social equity includes attention to all the elements that contribute to individual and community health, such as socio-economic status, race, ethnicity and educational status.

Careful consideration should be made to understand the distribution of open space amenities, collaborate with specific populations to understand their needs and health views, and address environmental justice in the region. Open spaces are not only conserved natural lands, but are also interlaced, even engineered, open spaces within the urbanized built environment. A diversity of open space type and function integrates nature where people live, especially for vulnerable populations that deserve more equitable health service.

Task Force 2: Economic Development
Economic development influences access to fresh food, nature and recreation opportunities and influences socio-economic status in a community, an indicator of health. Open spaces can create economic opportunities, such as increased property values and revenues from nature-based industries, such as tourism. Yet there is concern that open space and nature enhancements can contribute to gentrification and displacement of vulnerable populations, resulting in continued health inequity.

Task Force 3: Biodiversity
Biodiversity is an indicator of an ecologically healthy landscape for humans and other species that share in receiving resulting ecosystem and cultural services. Experience of a diversity of species in open spaces can promote attentiveness and stress reduction, supporting a wide range of mental health and wellbeing outcomes. The ecosystem services of a biodiverse landscape may however compete with the desire for cultural and societal services derived from open space (e.g. a ball field is not biodiverse, however offers cultural and social opportunities).

Task Force 4: Climate Adaptation and Mitigation
Climate change is anticipated to have a wide spectrum of health impacts in the Central Puget Sound region such as increased presence of diseases and pests; increased incidence and severity of disease and illness due to changing temperatures; strained agricultural and fishing production; and injury, trauma and relocation from increased and intensified extreme weather events. Additionally, the Central Puget Sound region may see an influx of climate refugees from other regions, a regional public health concern. A regional approach to open space systems planning may be helpful in managing regional resilience, particularly in the face of natural disasters and climate change health impacts.

APPENDIX A: SUPPORTIVE RESOURCES and PUBLICATIONS (3-5 pages)

Academic Literature on Open Spaces and Health Topics

These peer-reviewed research articles highlight the state of the science concerning nearby nature experiences and outdoor activity. Abstracts, and some entire articles, can be accessed using scholarly search services such as PubMed or Google Scholar. A more complete presentation of nearly 40 years of research on these topics can be found at the Green Cities: Good Health web site, hosted by the University of Washington.

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Wolf, K.L., and A.S.T. Robbins. 2015. Metro Nature, Environmental Health, and Economic Value. Environmental Health Perspectives 123, 5: 390-98.

Technical Literature on Open Spaces and Health Topics

These publications have been published by regional and local organizations to highlight key research about the connection between open space and human health and wellbeing topics, and to support regional planning. They provide information and guidance to planners, public health officials, grant writers and open space decision makers that may not have easy access or training to use academic literature such as articles found through PubMed. Most of these can be easily accessed online using Google search.

#	Title	Sponsor/Publisher	Year	environmental risks (e.g. air, water, climate)	physical activity + obesity	stress + physiological conditions	mental health + function	focus on children	social + community cohesion/benefits	economic benefits and/or costs	environmental justice or inequalities	planning, mgmt + stewardship
1	Designing for Active Living Among Adults	Robert Wood Johnson Foundation	2008		x							
2	Do All Children Have Places to Be Active?	Active Living Research	2011		x			x				
3	Improving Health and Wellness Through Access to Nature	American Public Health Association	2014	x	x	x			x			x
4	Health Benefits to Children from Contact with the Outdoors and Nature	Children & Nature Network	2010		x	x	x	x				
5	An Unhealthy America: The Economic Burden of Chronic Disease	Milken Institute	2007			x				x		
6	The Economic Benefits of Open Space, Recreation Facilities and Walkable Community Design	Robert Wood Johnson Foundation	2010		x					x		
7	Benefits of Urban Parks: A Systematic Review	The International Federation of Parks and Recreation Administration	2013	x	x	x			x		x	
8	Mindfulness Practice in Woods and Forests: An Evidence Review	The Mersey Forest Forest Research	2013			x	x					
9	Natural Thinking	The Royal Society for the Protection of Birds	2007			x	x	x	x			
10	Parks and Other Green Environments: Essential Components of a Healthy Human Habitat	National Recreation and Park Association	2010		x	x	x		x			
11	Healthy Planning: An Evaluation of Comprehensive and Sustainability Plans Addressing Public Health	American Planning Association	2012									x
12	Research on the Beneficial Aspects of	TKF Foundation	2012		x	x	x		x			

#	Title	Sponsor/Publisher	Year	environmental risks (e.g. air, water, climate)	physical activity + obesity	stress + physiological conditions	mental health + function	focus on children	social + community cohesion/benefits	economic benefits and/or costs	environmental justice or inequalities	planning, mgmt + stewardship
	the Experience of Nature in Cities: A Literature Review											
13	Reflect and Restore: Urban Green Space for Mental Wellness	Nature Sacred (TKF Foundation)	2014			x	x					
14	Feeling Stressed? Take a Time Out in Nature	Nature Sacred (TKF Foundation)	2013			x	x		x			
15	From Fitness Zones to the Medical Mile: How Urban Park Systems Can Best Promote Health and Wellness	Trust for Public Land	2011		x					x		x
16	Intersections: Health and the Built Environment	Urban Land Institute	2013		x					x		x
17	Urban River Parkways: An Essential Tool for Public Health	Center for Occupational and Environmental Health	2014	x	x							
16	Outside our Doors: The Benefits of Cities Where People And Nature Thrive	The Nature Conservancy	2016	x	x	x	x		x			

APPENDIX B: AUTHORSHIP + CITATIONS

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