

## **PRIORITY 3:**

### **How is urbanization and development impacting the Salish Sea social-ecological system and how can impacts be mitigated and minimized through planning?**

\* = not local

- (1) \*Boag, A. E., Hamilton, L. C., Hartter, J., Stevens, F. R., Palace, M. W. and Ducey, M. J. (2016). Shifting environmental concern in rural eastern Oregon: the role of demographic and place-based factors. *Population and Environment*. 38(2), 207-216. DOI: 10.1007/s11111-016-0261-z

This article examines how place-based and demographic variables influence public opinion on climate change and land development regulations, in addition to other environmental factors, in rural Oregon. Boag et al. suggested that notable shifts in opinions occurred during the three-year break between interviews (2011 to 2014), with an increase in support of increased development regulations in rural landscapes as well as increased concern for climate change impacts. The authors credit primarily external factors (shifting political narratives, media coverage, economic conditions) for these changes, but also recognized that demographics such as length of residency and education levels hold great influence. Those newer to the area appeared to primarily have re-located from urban regions where they were not dependent on natural resources for income and were drawn to the area for lack of development, while seasonal residents were much less likely to be supportive of developmental restrictions. Similarly, those with college or post-graduate degrees were more supportive of environmental regulations and gave more credence to climate change. Both surveys were conducted via telephone as part of the Communities and Forests in Oregon (CAFOR) research project in 2011 and 2014. Comparisons were analyzed via a design-based F test as well as weighted logit regressions. The authors communicate that more research is needed to provide insight into how cultural identity and individual psychology affect these beliefs. In particular, this article details the social characteristics and demographics associated with support of or against development in rural areas in the Pacific Northwest.

- (2) Jayakaran, A. D., Moffett, K. B., Padowski, J. C., Townsend, P. A. and Gaolach, B. (2020). Green infrastructure in western Washington and Oregon: Perspectives from a regional summit. *Urban Forestry & Urban Greening*. 50, 1-7.  
<https://doi.org/10.1016/j.ufug.2020.126654>

In this article, Jayakaran et al. detail the range of successes and challenges of implementing green infrastructure in Western Washington and Oregon, as well as possible solutions to these challenges. The authors state that while green infrastructure utilizes the power of natural ecosystem services to supply ecological services and safeguard resources for local communities, it also has inadvertent social consequences including green gentrification and environmental injustice. Challenges of implementing green infrastructure in the Pacific Northwest include lack of expertise and coordination, traditionalism, environmental costs, lack of consideration for maintenance, and the challenges of site-specific implementation. In order to combat these challenges, Jayakaran et al. suggest more widespread publication of studies, literature and grant opportunities for green infrastructure; potentially another green infrastructure summit; and increased research the intersection of green infrastructure and community health, ecosystem services, and economies. The ideas represented in this paper were the result of a green infrastructure regional summit in Oregon, hosting representatives from Washington and Oregon belong to local governments, non-profit organizations and other relevant fields. This article is particularly relevant to the priority three as it discusses how green infrastructure affects human and ecological health, as well as the costs and benefits of implementation.

- (3) Lipsky, R. S. and Ryan, C. M. (2011). Nearshore restoration in Puget Sound: understanding stakeholder values and potential coalitions. *Coastal Management*. 39(6), 577-597. DOI: 10.1080/08920753.2011.600241

In this article, Lipsky and Ryan analyze stakeholder preferences and values in the restoration of Whidbey Island to investigate how to effectively integrate these values in mid-progress large-scale coastal restoration projects. The authors stress the importance of collaborating at a high level and implementing public outreach efforts, as well as understanding potential coalitions to launch targeted outreach programs. Their research reveals that although majority of local

stakeholders and tribes disagree with the root causes of nearshore degradation, they believe it is urgent and requires restoration, generally supporting stronger enforcement of regulations as well as increased public ownership. Stakeholders and tribes ranged in support from opposition of government intervention to support of large-scale restoration, with a diverse range of demographics in each, suggesting that individual preferences may be a large driver versus organizing values. Data was collected via a non-random sampling survey and set of interviews including respondents from 12 different categories (agriculture; aquaculture; development and home-building; environmental; fishing; governments; historical societies; nearshore homeowners; ports and marinas; recreation; tourism; and tribes). The data was then analyzed quantitatively through cluster analysis. This article is useful for priority three as it suggests planning practices for better human and ecological health through the involvement of stakeholders and Indigenous communities throughout the decision-making process.

- (4) Norman, K. C., Safford, T. G., Feist, B. E. and Henly, M. (2016). At the confluence of data streams: mapping paired social and biophysical landscapes on the Puget Sound's edge. *Coastal Management*. 44(5), 427-440.

<https://doi.org/10.1080/08920753.2016.1208038>

This article examines the attitudes and perceptions of environmental and social conditions by sector within the Puget Sound to determine if there is a relationship between the physical environmental conditions within individual's zip codes and their perceptions of environmental conditions within the basin as a whole. The authors' purpose is to integrate social and natural sciences to demonstrate the connection between socially-derived perceptions of environment and physical environmental conditions. Norman et al. conclude that individuals living in regions with higher levels of development are more likely to view urban sprawl as a problem and thus support environmental regulations, while individuals in regions experiencing newly rapid growth are less likely to support these regulations. Additionally, demographic variables such as gender (women are more likely to consider urban sprawl problematic), length of residency (longer residency is correlated with larger concern for rapid growth), and political party affiliation (self-identified republicans are less likely to view rapid growth as a concern) influence views about

development. In order to come to this conclusion, the authors utilized data from a 2012 NOAA random telephone survey, weighted to correspond with the respondent pool's demographic characteristics in relation to the 2010 U.S. Census, via a mixed-effects logistic regression model. This article is relevant to priority one as it establishes variations of social responses to climate change and urbanization among different sectors and demographics within the Salish Sea. Additionally, the authors suggest that this form of social-ecological data should be used in the development of future social and institutional responses to climate change to ensure effective and realistic management goals in different regions of Puget Sound.

- (5) \*Powell, E. J., Tyrell, M. C., Milliken, A., Tirpak, J. M. and Staudinger, M. D. (2018). A review of coastal management approaches to support the integration of ecological and human community planning for climate change. *Journal of Coastal Conservation*. 23(1), 1-18. <https://doi.org/10.1007/s11852-018-0632-y>

In this article, Powell et al. discuss the distinction between green and grey methods of infrastructure, including their benefits, challenges, and negative impacts. While grey infrastructure is widely used around the world for its convenience and affordability, it can lead to unintended social, economic and ecological consequences in the long-term. Green infrastructure provides an opportunity for more individualized implementation with less adverse effects. Traditional grey infrastructure methods, while effective for erosion, can result in loss of beach and habitat, habitat fragmentation, reduction of marshes and wetlands, increased number of invasive species, and loss of biodiversity. In addition to enhancing shore stabilization and storm protection, green infrastructure can increase habitat connectivity and protection, support ecosystem services (such as carbon sequestration), improve water quality, and allow for natural marsh and beach migration. Human benefits include economic advantages (e.g., supports local economies through resilience fish and shellfish industries, lowered flood insurance rates, increased real estate value, etc.). Additionally, it creates increased access to beaches and recreational opportunities (including eco-tourism activities), greater climate change mitigation, improved water quality, and lower maintenance requirements. The authors suggest three methods to decrease uncertainty around the implementation of green or hybrid infrastructure:

emphasize information on benefits and costs of each method to improve decision-making, enhance evaluation and monitoring of natural infrastructure efforts, and make planning more centralized around socioecological resilience goals. The majority of the data from this article was compiled from literature reviews, meaning the main limitation of this article is that no new first-hand research was conducted. Additionally, this article is not local to Washington State, although one Puget Sound article is cited, it is a general evaluation of infrastructure along coastal communities. This article proves relevant to priority three as it details the benefits and costs of green, grey, and hybrid infrastructure methods, and how each affects resource access, human and ecological health.

(6) Von Reis Crooks, S. (2015). *Landowner experience with soft shore projects in Puget Sound* (Masters Dissertation). University of Washington, Seattle.

In this dissertation, Von Reis Crooks explores private landowner perspectives and decision-making when implementing soft shore projects in the Puget Sound. Decision-making factors varied greatly across the 15 participants, with concerns for both physical/environmental effects as well as social constraints and access to resources, indicating that social context and life experience plays a major role in shoreline management. Motivations for implementing projects ranged from providing/maintaining access and erosion control to improving ecological functioning or aesthetic value. Decision-making factors included direct or indirect interaction with relevant agencies, bulkhead function, cost comparison, aesthetic value, ecological functioning, knowledge of similar projects, site assessment, and influence of community. The author stresses the importance of incorporating local stakeholder and Indigenous knowledge and experiences into adaptive governance for inclusion of diverse perspectives and contexts, as well as the ability to adapt shoreline management methods to the specific needs of each site and stakeholder and Nation/tribe, rather than a one-size-fits-all method, to ensure the most ecologically sustainable and socially desirable outcomes. Data was gathered through semi-structured interviews and qualitatively analyzed. Limitations of the study include its small scale, thus it does not represent the experiences of all landowners in Puget Sound, and potential bias to newer projects due to lack of access to older sites, as well as potential interviewer/interviewee

bias due to rapport. This article is relevant to priority three as it elaborates on planning and development processes that could promote better ecological and human health, as well as landowner behaviors towards different shoreline management methods.

- (7) \*Yee, S. H., Paulukonis, E., Simmons, C., Russell, M., Fulford, R., Harwell, L. and Smith, L. M. (2021). Projecting effects of land use change on human well-being through changes in ecosystem services. *Ecological Modelling*. 440, 1-20, <https://doi.org/10.1016/j.ecolmodel.2020.109358>

This article examines how land use changes (in addition to temperature and precipitation changes) are predicted to affect ecosystem services and human wellbeing. The authors assert that ecosystem services play a crucial role in human wellbeing through culture, health, education, standards of living and connection to nature. The authors found that increases in development and urbanization were negatively correlated with ecosystem functioning (e.g., increased pollution, decreased habitat, decline in rainwater retention) and human wellbeing. Major projected impacts include an increase of urban heat islands and weather-related illnesses, and changes to pollen seasons. Projected changes also include declines in crop and livestock production requiring enhanced efforts required to sustain food security and production, thus a decline in leisure time. Loss of natural resources, increased weather hazards, declines in cultural opportunities, job security, community cohesion and sense of identity, and challenges in obtaining basic necessities were also listed. Data was collected through quantitative models of human well-being index and projected ecosystem service indicators on the Envision spatially explicit modeling platform. Unfortunately, this literature is not local to Puget Sound, as models are based off the Pensacola Bay watershed in Florida. Despite these limitations, this article proves important to priority three as it suggests how development and planning affect human health and security, in addition to detailing some of the socioecological consequences of urbanization.