

ECOSYSTEMS

* INTRODUCTION – SCOPE, IMPACTS, MANAGEMENT CONTEXT/RESPONSIBLE PARTIES, OTHER? CURRENT STATE OF **AFFAIRS**

An ecosystem is defined as a system made up of a community of animals, plants, and bacteria interrelated together with its physical and chemical environment. Whatcom County is vast, encompassing roughly 2,107 square miles (1,378,446 acres) of land and 397 square miles of water and contains a variety of different ecosystem types. Within its boundaries exist a great variety of geographic features, ranging from the marine waters, islands, bays, and shorelines of the Salish Sea—including northern Puget Sound and Georgia Strait—to the rich estuarine interface with the lowlands of the Nooksack River basin, to the expansive greater Cascades ecosystem at higher elevations. Despite the alterations of the landscape and impacts on wildlife over time, Whatcom County remains an area of significant biodiversity. According to the 2017 Ecosystem Report, Whatcom County is characterized by 36 general habitat types and presently has 433 non-fish vertebrate species, including 15 amphibians, 8 reptiles, 320 birds, and 86 mammals. If fish species were added to this list, there would be well over 500 vertebrate species known to occur. Whatcom County is also home to over 1,100 species of plants as well as an unknown number of fungi, invertebrates, and other organisms on which the higher forms, including humans, depend. From the depths of Rosario Strait to the Cascade crest, the natural cycle of life is both dynamic and delicate, the future of which depends on the scale of the projected climate impacts and the actions and reactions taken by the human community. Our ecosystems are responsible for maintaining many environmental processes that benefit everyone, sustain life as we know it, and determine how resilient our community can be to projected climate impacts. There are countless ecosystem services that humans and animals alike depend on for our health and wellbeing. There are the provisional services that come to mind for so many of us right away. Provisional services would include anything product based such as food, water, timber and other products that can be extracted from nature. Other services help to regulate the environment and sustain life within the ecosystem. This would include things such as pollination, decomposition, water purification, erosion and flood control, and carbon storage freshwater supply, and biodiversity.

Unfortunately we are already seeing many impacts from climate change in our ecosystem throughout Whatcom County, including wildfires, droughts, increasing temperatures, and changes in precipitation patterns. On our coasts there is evidence of sea level rise and we've seen fishing stock and commercial and recreational fishing numbers plummeting for multiple years in a row. This chapter addresses impacts that climate change has had on ecosystems in Whatcom County, how those impacts are likely to worsen without intervention, and strategies and actions to take in relation to climate change adaptation and mitigation.

Ultimately we can look at this through the lens of risk management. By implementing the strategies and actions in this document we can better control things like disease outbreaks, save resources, amplify social resilience, support ecological restoration, and foster engagement and collaboration between multiple stakeholders. Due to the complexity of challenges and the diversity of actors involved in addressing land challenges, a mix of policies, rather than single policy approaches, can deliver improved results in addressing the complex challenges of sustainable ecosystem management and climate change. Policy mixes can strongly reduce the vulnerability and exposure of human and natural systems to climate change. Elements of such policy mixes may include social protections and adaptive safety nets, universal access to early warning systems combined with effective contingency plans.

Framing land management in terms of risk management, specific to land, can play an important role in adaptation through landscape approaches, biological control of outbreaks of pests and diseases, and improving risk sharing and transfer mechanisms (*high confidence*). Providing information on climate-related risk can improve the capacity of land managers and enable timely decision making

Comment [NS1]: This intro should state what this section will discuss and clearly state the problem (too scattered and general). Use local examples to illustrate concepts. At least some of the likely and predicted effects of climate change in Whatcom County should be discussed.

GOALS

Three ecosystem specific goals have been proposed that echo the overarching goals for the Natural Resources section.

Conserving existing carbon stores and enhancing carbon sequestration

Ecosystem services like carbon sequestration and storage should play a central role in our climate change response, both toward achieving net carbon neutral or net negative targets and as a by-product of the other goals described below. Wetland, estuary, and forest ecosystems are capable of storing much more carbon than they release, accumulated in soil and sediments, live plant and animal tissues, and wood, and in some instances (e.g., in peatlands and conifer forests of the Pacific Northwest) to hold this carbon for centuries. Even in ecosystems where vegetation and soil carbon reservoirs reach saturation and the annual net removal of CO₂ from the atmosphere declines towards zero, carbon stocks can be maintained. Retaining, restoring, and expanding these critical habitats will therefore have outsized positive benefits. County Executive Sidhu's initiative to plant one million trees is an example of reforestation to increase carbon sequestration and provide a host of ancillary ecological services. Other land-based options to increase carbon storage on working forests may focus on changes in timber harvest practices (e.g., longer rotations, retaining downwood, and increased buffers and set-asides to protect sensitive resources), while agriculture land practices provide options to build soils richer in carbon. An effective strategy for carbon storage also requires protecting accumulated carbon in vegetation and soils from future catastrophic loss (or sink reversal) triggered by disturbances such as flood, drought, fire, or pest outbreaks, or future poor management.

Developing ecosystem resiliency

Ecosystems and their component elements, including biodiversity, and associated processes are not equally vulnerable to ongoing, gradual changes in climate, and extreme perturbations from storms, floods, droughts, or wildfires. Ecosystem resiliency is defined as "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks." Ecosystems most at risk are those that are already degraded or near the limits of tolerance. Low resiliency may be exacerbated by loss of key species, introduction of invasive species, including diseases, and reduction and fragmentation of habitats, factors that may or may not be related to climate change. As such, reversing or mitigating these factors can increase resilience. For example, restoring American beavers may mitigate for lower snowpack and increasingly dry summers by holding more water on the landscape. Similarly, connecting natural areas may allow plant and animal communities to adapt as climate zones shift northward and to higher elevations. Sustainable ecosystem management can also contribute to resiliency in various ways, which may require reduced extraction of natural resources, expanding protected areas, combatting invasive species, and managing for species at risk. The ability for all of the components that make up the ecosystem to function effectively is essential for the overall health of our natural resources.

Protecting and restoring ecosystems

Climate change response should also include strategies to protect natural ecosystems and restore ecosystems that are in degraded condition. Shorelines and stream banks degraded by erosion, forests with trees in poor health, and wetlands dominated by invasive species provide lower levels of ecological services and are at risk of loss of functions. Restoring degraded ecosystems is also a response to climate change because stressors are predicted to increase, including more intense rain and wind storms, floods, periods of extreme heat, drought, and wildfire, higher sea levels and damaging waves. For example, in Whatcom County, ongoing coastal erosion will only intensify as sea levels rise, adding to land use pressure. A proactive strategy is to restore, revegetate, and strengthen coastlines to withstand changing conditions before they occur. More generally, this strategy focuses on the resiliency aspects that will be affected by the changing climate, especially the changes that are inevitable as well as compensating for more extreme impacts if climate policy falls short.

STRATEGIES, ACTIONS AND BENEFITS

In this section we will break down the strategies and actions necessary to reach the goals we have set. These recommendations tie in with strategies listed in several plans previously approved by the County. We have also identified the relevant departments that individual actions can be delegated to, to assist in the implementation of this Climate Action Plan.

Many land-related responses that contribute to climate change adaptation and mitigation can also minimize land degradation. This can include things like soil organic carbon management, ecosystem conservation and land restoration. While

some response options have immediate impacts, others take decades to deliver measurable results. Examples of response options with immediate impacts include the conservation of high-carbon at risk ecosystems such as peatlands, wetlands, and forests. Examples that provide multiple ecosystem services and functions, but take more time to deliver, include afforestation and reforestation as well as the restoration of high-carbon ecosystems, agroforestry, and the reclamation re-carbonization of degraded soils.

A wide range of adaptation and mitigation strategies have the potential to contribute to sustainable development and enhancement of ecosystem functions and services. These include preserving and restoring critical natural ecosystems such as peatlands, coastal lands, and forests; biodiversity conservation, reducing conversion of land, fire management, soil management, as well as most risk management options (e.g., use of local seeds, disaster risk management planning, etc.).

STRATEGIES

Education, Outreach & Monitoring

1. Provide education on the importance of ecosystem resilience and the projected climate impacts on ecosystems
2. Provide technical, logistical, and financial support for citizen and community efforts to address climate impacts and build climate resilience

Planning & Development

1. Update land use and development code to incorporate projected climate change impacts to reduce development impacts in climate impact zones and improve protections for climate resilience areas and other areas vulnerable to climate change
2. Preserve and enhance ecosystems to restore hydrologic processes, improve air and water quality, store carbon, maintain ecological connectivity and build climate resilience
3. Implement long-term monitoring to assess climate trends, ecosystem impacts, including assessment of ecosystem resilience,

Strategy and Action Table

Education & Outreach	
<p>Strategy: Provide education on the importance of ecosystem resilience and the projected climate impacts on ecosystems</p>	<ol style="list-style-type: none"> 1. Partner with the City of Bellingham, Western Washington University, and other agencies to promote climate change education in school systems, work places, and other community venues 2. Utilize the Whatcom County Climate Science Summary to educate County staff and advisory committees of observed trends and projected climate change impacts 3. Develop educational tools and related outreach on importance of ecosystem services to build resilience to climate change, i.e. importance of trees/forest cover, wetlands, floodplains to flood attenuation, clean air and improved water holding capacity, moderating high temperatures, etc.
<p>Strategy: Provide technical, logistical, and financial support for citizen and community efforts to</p>	<ol style="list-style-type: none"> 1. Facilitate a community tree-planting program to plant 1,000,000 native trees in the next 5 years on previously non-forested land, including County owned lands and by partnering with other organizations and private landowners 2. Support organizations like Whatcom Land Trust, Whatcom Conservation District,

address climate impacts and build climate resilience	and Nooksack Salmon Enhancement Association that build ecosystem resilience to climate change through land protection, restoration, and community engagement
Planning & Development	
Strategy: Update land use and development code to incorporate projected climate change impacts to reduce development impacts in climate impact zones and improve protections for climate resilience areas and other areas vulnerable to climate change	<ol style="list-style-type: none"> 1. Conduct vulnerability assessments relative to projected climate changes when planning and developing public works and other County projects and performing ongoing maintenance for County infrastructure (roads, bridges, stream crossings, buildings) 2. Require vulnerability assessments relative to projected climate changes when permitting private development or land use projects in or adjacent to climate impact zones (100+ yr. floodplains, coastal shorelines, geohazard areas, etc.) 3. Designate climate impact zones within the Critical Areas Ordinance and regulate according to projected climate impacts and climate resilience needs Geohazard Zones and design climate migration corridors and refugia 4. Consider future climate conditions into the identification of fish and wildlife habitat conservation areas and wetlands. 5. Increase areas protected from development to incorporate greater diversity of topographic and climatic conditions to allow for shifts in species distribution and ensure ecosystem resilience through development of green infrastructure network that conserves migration routes, riparian and wetland habitats, other critical habitat that ensure climate 6. Maintain low-density zoning and rezone areas immediately adjacent to high-value habitat areas and climate movement corridors to maintain larger, undisturbed tracts of intact ecosystems. 7. Protect wetlands, riparian areas, and associated buffers from logging and other exempt stressors. 8. Incorporate climate change projections into the Ecosystem Plan and develop an adaptation plan.
Preserve and enhance ecosystems to restore hydrologic processes, improve air and water quality, store carbon, maintain ecological connectivity and build climate resilience	<ol style="list-style-type: none"> 9. Significantly increase the rate and scale of conservation easement acquisition through the Purchase of Development Rights Program on important ecosystems 10. As part of the County's Natural Resource Marketplace, develop a carbon valuation program to compensate property owners who voluntary protect and increase carbon stores (forests, wetlands, soils) to mitigate climate impacts 11. Restoring the structure, function, and spatial extent of floodplains 12. Enhance the River and Flood Program to further restore floodplain connectivity and restore native vegetation and forest ecosystems within floodplains to enhance natural flood storage and mitigate flood impacts to ecosystems. 13. Protect and restore mature forest stands that form connected habitat blocks from the Puget Sound to the Cascade Mountains (e.g., Chuckanut Wildlife Corridor, Nooksack River and associated tributaries) through development and adoption of development regulations and management guidelines
Implement long-term monitoring to assess climate trends,	<ol style="list-style-type: none"> 14. Monitor the status of critical areas and priority habitats (including ecological processes sustaining them and factors limiting them) and incorporate findings into planning and regulatory updates.

ecosystem impacts, including assessment of ecosystem resilience,	<ol style="list-style-type: none"> 15. Assess and monitor ecosystem condition and health on County owned properties, including parks, right of ways, floodplain properties, etc. 16. Develop goals, risk tolerances, and restoration strategies on County owned properties to address climate impacts and climate resilience. 17. Expand County-sponsored citizen science programs, Programs such as the Marine Resource Committee's programs could be expanded upon and projects targeting terrestrial ecosystems could be implemented. Developing a working relationship with Western Washington University could help to support these efforts.
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Open Space Parks Plan

Comprehensive Flood Hazard Management Plan