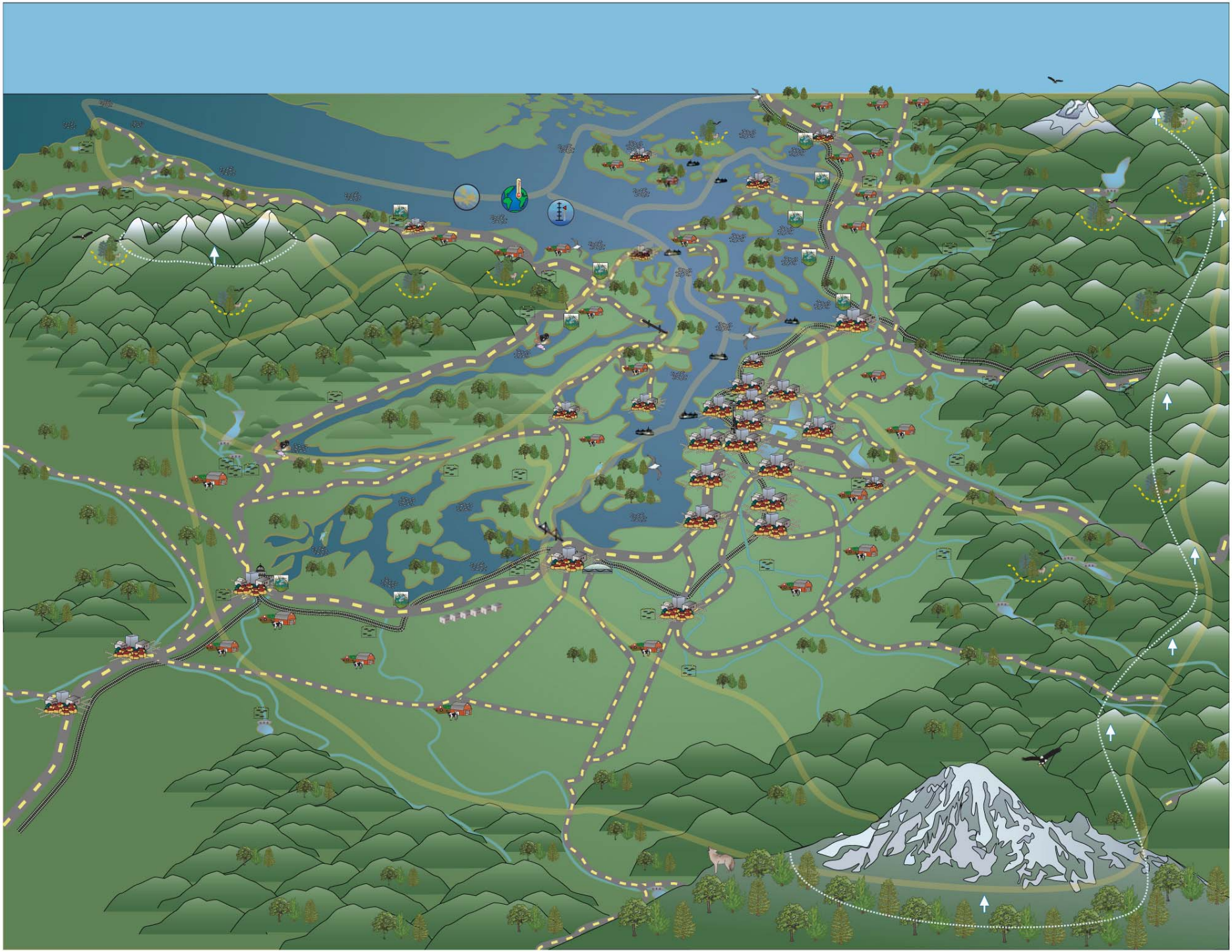

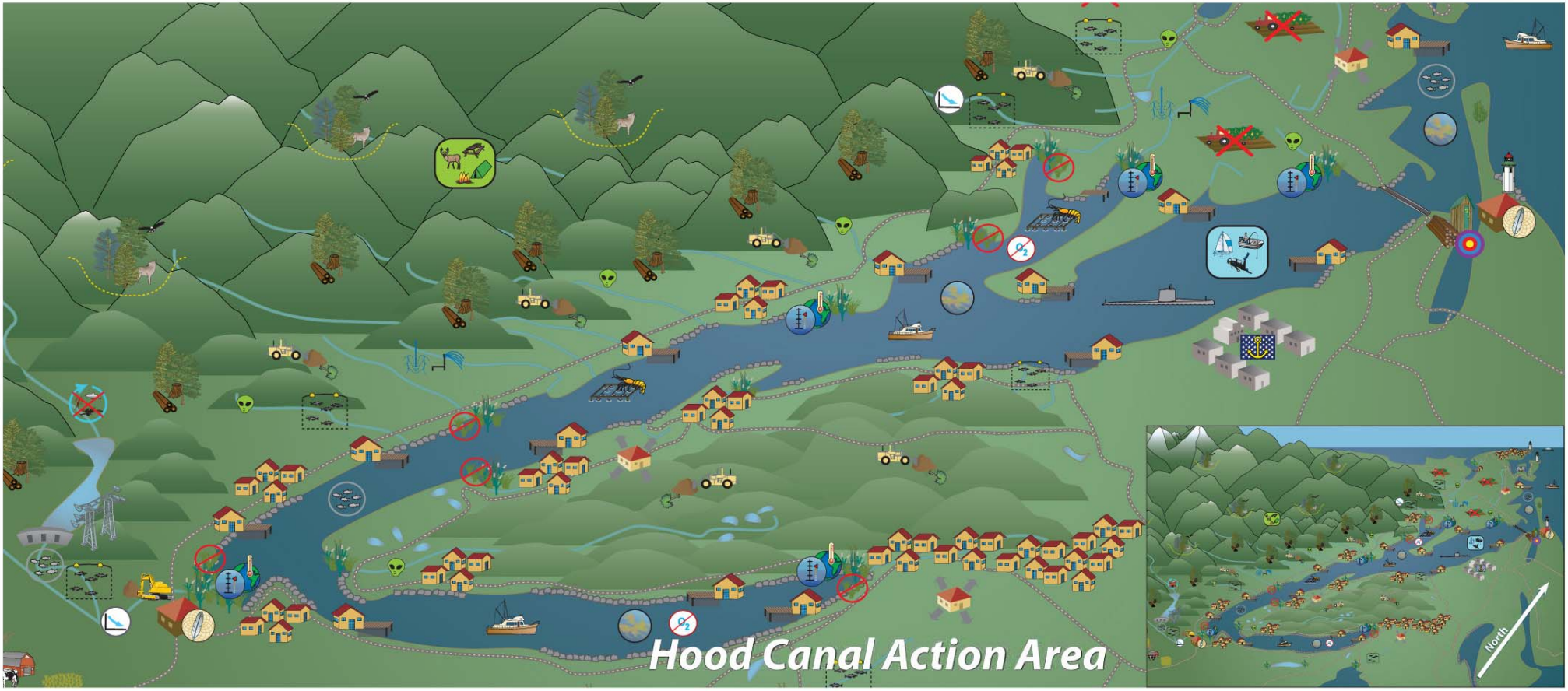

2008

KEY ECOSYSTEM BENEFITS

- Skokomish River is largest salmon producing river in West Sound
- Unique summer chum salmon species spawns only in Hood Canal and Eastern Strait of Juan de Fuca
- Forest lands: Timber production, soil & water retention in uplands, wildlife habitat
- Internationally renowned shellfish from Quilcene, Dabob, Hamma Hamma; also prawn and Dungeness crab harvest
- Recreation: boating, sailing, water skiing, diving, camping, hunting, Olympic National Park
- Fishing: sport fishing, commercial fishing, tribal fishing and shellfishing, including salmon, geoduck, crab, oysters, clams, and shrimp
- Vacation residences
- Hood Canal Bridge provides transportation linkage between Kitsap and Olympic Peninsulas
- Water and/or power supply for City of Bremerton, Lilliwaup, Port Townsend, City of Tacoma
- US Navy Submarine Base at Bangor
- Skokomish Tribal Reservation
- Port Gamble S'Klallam Tribal Reservation

LOCAL PRESSURES (KEY THREATS IN BOLD)

Habitat Alteration:

Blocked habitat: particularly habitat in North Fork of Skokomish blocked by Cushman dam

Alteration of Skokomish River form and function from structures such as Hwy 106, Hwy 101, and the diking network throughout the valley

Loss of estuary habitat and pocket estuaries

Loss of flood storage capacity: altered flow regimes in Skokomish River; flood plain disconnection and alteration of tributaries and flood channel network within the Skokomish Valley

Loss of working farms and forests through conversion and habitat modifications

Disruption of marine shoreline processes: 59 miles of roads and extensive homes, bulkheads, and shoreline armoring including altered sediment supply and freshwater inputs

Pollution

Pollutant loading leads to low dissolved oxygen (dead zones) and shellfish closures—Sources: inadequate/failing septic systems, nutirent loading from land use and development, logging practices, salmon carcasses

Mill site in Port Gamble Bay

Surface/Groundwater Impacts

Limited water availability for people and instream uses

WRIA 16 and 17: low summer flows, extreme high flows

Invasive Species

Tunicates, Japanese knotweed, reed canary grass, Hosweed, yellow flag iris, purple loosestrife

Artificial Propagation

High salmon hatchery production has potentially negative impacts on wild salmon; legacy broodstock management issues resulting from out-of-basin fish

Harvest

Fishing and bycatch, logging and hunting practices: Local pressures need to be identified

Localized climate change impacts

Sea level rise: loss of estuarine beaches

Population/Other

Harmful algal blooms and biotoxins: seasonal or occasional shellfish bed closures

Conflicting use values of marine shorelines

Increase in population by 2030: 12% in Kitsap, Mason, and Jefferson counties (more than 36,000 people)

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science

Sources: 1. Initial Discussion Draft Paper. Land Use/Habitat Protection and Restoration in Puget Sound 4/14/2008 2.Hood Canal Action Area Profile (DRAFT), Ann Seiter, 5/19/2008 3. Hood Canal Action Area Action Agenda Basis, 5/2008
4. The Nature Conservancy Ecoregional Assessments. Willamette Valley-Puget Trough-Georgia Basin (3/2004), East and West Cascades (6/2007)

JONES JONES

Strait of Juan de Fuca Action Area

2008

KEY ECOSYSTEM BENEFITS

- Exchange of fresh and marine waters helps keep Puget Sound from becoming stagnant
- Migration corridor for fish, bird, and marine mammal species along nearshore.
- Rare and unique upland species of birds, plants, and animals in functioning pristine high elevation habitat (Olympic National Park)
- Forest lands: Timber and pulp production, soil and water retention in uplands, cultural resource for basketry, carving
- Agricultural production with an extended growing season
- Shellfish production
- Recreation and tourism, especially Olympic National Park, Dungeness National Wildlife Refuge, Olympic Discovery Trail, numerous local parks and beaches, and community events throughout the Strait from Neah Bay to Fort Worden
- Rainshadow effect draws retirement communities
- Marine vessel passage, shipping and marine trades

LOCAL PRESSURES (KEY THREATS IN BOLD)

Habitat Alteration:

Blocked habitat: Over 70 miles of mainstem and tributaries are blocked; 95% of historic Chinook habitat blocked by Elwha dam system

Nearshore alterations: 14% shoreline armored, stretching from Point Wilson to Elwha; 1439 overwater structures; 1.8 miles of railroad along marine shoreline

Loss of working farms and forests through conversion

Loss of estuary habitat and pocket estuaries

Disruption of river processes through dikes, riparian development, and vegetation removal; historic land divisions enables development in sensitive habitat areas.

Pollution

Toxics and nutrients: Port Angeles Harbor contamination, including Rayonier Mill site contamination; CSO events (69 in 2007)

Contamination at Warmhouse Beach Open Dump site threatens water, health

High fecal coliform levels in lower Dungeness River and Dungeness and Discovery Bays have resulted in shellfish closures

Surface/Groundwater Impacts

Water shortages for people and instream uses
WRIA 17: low summer flows; WRIA 18 & 19: low summer flows, extreme high flows; Neah Bay has critical shortages
Instream flows not yet established

Major alteration of flows in Elwha and Dungeness Rivers

Invasive Species

Japanese knotweed, reed canary grass, and butterfly bush infestations along riparian corridors

Artificial Propagation

Not identified

Harvest

Strait salmon runs are heavily impacted by Canadian harvest

Localized climate change impacts

Sea level rise: loss of tidal flats, complete loss of Dungeness Spit, loss of 58% of estuarine and ocean beaches

Population/Other

Increase in population by 2030: 8% in Clallam County (more than 5,000 people) and 33% in Jefferson County (more than 8,500 people)

Harmful algae blooms: seasonal or occasional shellfish bed closures from paralytic shellfish poisoning and amnesic shellfish poisoning

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science

Sources: 1. Initial Discussion Draft Paper. Land Use/Habitat Protection and Restoration in Puget Sound 4/14/2008 2. Strait of Juan de Fuca Action Area Profile (DRAFT), Ann Seiter, 5/19/2008 3. Strait of Juan de Fuca Action Area Action Agenda Basis, 5/2008
4. The Nature Conservancy Ecoregional Assessments. Willamette Valley-Puget Trough-Georgia Basin (3/2004), East and West Cascades (6/2007)

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2008

KEY ECOSYSTEM BENEFITS

- Nearshore habitat for 22 populations of migrating Chinook salmon, supporting Orca populations and marine birds
- Extensive forage fish spawning habitat
- Rich diversity of marine life and marine habitats
- Boutique agriculture industry
- Shellfish industry and crab fishery
- Recreational fishing and crabbing
- Recreation: Moran State Park, American & English Camp, Lime Kiln Park, Turtleback Mountain, Lopez Hill
- Vacation residences
- Local & international tourist destination (whale watching, kayaking, biking, boating)
- Pinto abalone at risk of extinction

LOCAL PRESSURES (KEY THREATS IN BOLD)

Habitat Alteration:

Nearshore alterations: limited soft shoreline sensitive to modification; 11 of 27 historical pocket estuaries at risk of degradation

Loss of eelgrass habitat

Potential threat from derelict fishing gear

Pollution

Inadequate waste management to handle summer influx of visitors

Localized pollutant loading from stormwater runoff (e.g., Friday Harbor, ferry landings)

Boater pollution in bays and marinas

Poorly treated wastewater from Victoria B.C. outfall

Potential for localized oil spills

Surface/Groundwater Impacts

Saltwater intrusion into drinking water supply (San Juan Island, Lopez)

Limited water availability for people and instream uses: groundwater dependent system is vulnerable to groundwater pollution from septic systems and alterations to surface flow

High future water demand

Invasive Species

Tunicates, Japanese seaweed, purple varnish clams

Artificial Propagation

Unknown impact on wild salmon from hatchery salmon in marine waters surrounding San Juan Islands

Harvest

Commercial and recreational harvest rates of salmon and groundfish in the San Juan Islands may reduce recovery potential

Localized climate change impacts

Sea level rise and ocean acidification due to climate change are occurring—their immediate and longer-term impacts are not well understood

Population/Other

Population doubles in summer months

Increase in year-round population by 2030: 38%, more than 5,000 people

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science

Sources: 1. Initial Discussion Draft Paper. Land Use/Habitat Protection and Restoration in Puget Sound 4/14/2008 2. San Juan Island Action Area Profile (DRAFT), Ann Seiter (2008) 3. San Juan Island Action Area Action Agenda Basis, 5/2008
4. The Nature Conservancy Ecoregional Assessments. Willamette Valley-Puget Trough-Georgia Basin (3/2004), East and West Cascades (6/2007)

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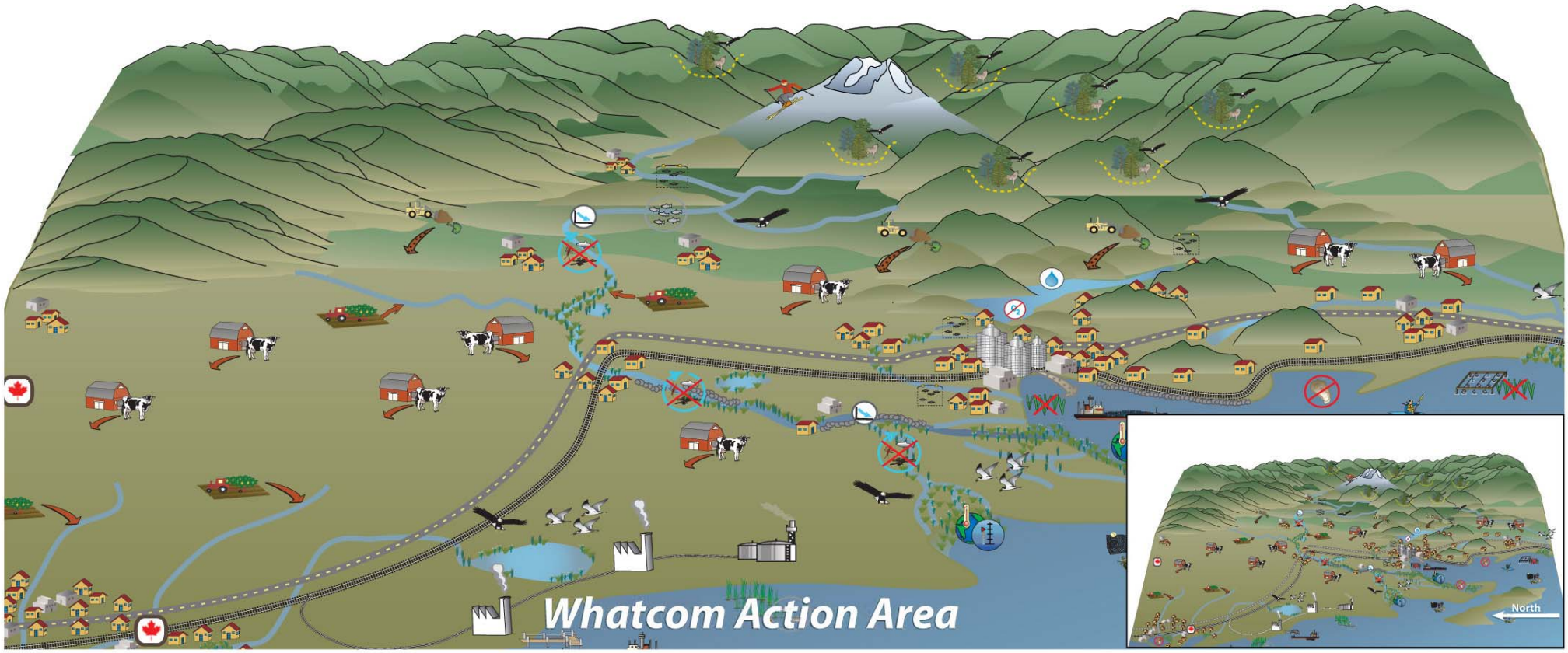

2008

KEY ECOSYSTEM BENEFITS

- Two unique spring run Chinook populations in Nooksack River
- Cherry Point: historically significant herring spawning area
- Forage fish habitat
- Migratory bird habitat
- Agriculture: significant dairy industry (ranks in top 5 dairy regions nationally), berries
- Shellfish aquaculture and Dungeness crab fishery
- Pristine high-alpine habitat at Mt. Baker National Park
- Recreation: Mount Baker, North Cascades, rafting, hiking, kayaking, Birch Bay, Lake Whatcom; proximity to recreation draws outdoor enthusiasts to reside in area
- Rural communities
- Lake Whatcom watershed provides water for half of Whatcom County
- Port of Bellingham
- Gateway to Canada

LOCAL PRESSURES (KEY THREATS IN BOLD)

Habitat Alteration

Loss of mainstem and floodplain river habitat

Loss of forest cover resulting in landslides

Nearshore alterations: 36% shoreline armored

Blocked habitat: culverts and dams disrupt hydrology and/or block habitat

Loss of native eelgrass meadows due to shoreline modification and dredging in inner Bellingham Bay

Some loss of Samish Bay eelgrass to provide for shellfish aquaculture

Pollution

Nutrients and pathogens from livestock waste lead to shellfish closures: Drayton Harbor, Portage Bay, Chuckanut Bay

Industrial pollution in bays: Bellingham Bay includes toxics, metals, PAHs, nutrients

Low dissolved oxygen, mercury, and phosphorous in Lake Whatcom

Surface/Groundwater Impacts

Low instream flows and many established instream flows not being met

Invasive Species

Need to identify

Artificial Propagation

Fall Chinook hatchery production has potential negative impacts on native spring-run Chinook

Harvest

Nooksack Chinook salmon runs are heavily impacted by Canadian harvest

Localized climate change impacts

Sea level rise: loss of swamp, marsh, and estuarine beach in Nooksack Delta

Population/Other

Increase in population by 2030: 30%, more than 50,000 people

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science

Sources: 1. Initial Discussion Draft Paper. Land Use/Habitat Protection and Restoration In Puget Sound 4/14/2008 2. Whatcom Action Area Profile (DRAFT), Ann Seiter, 5/19/2008 3. Whatcom Action Area Action Agenda Basis, 5/2008 4. The Nature Conservancy Ecoregional Assessments. Willamette Valley-Puget Trough-Georgia Basin (3/2004), East and West Cascades (6/2007)

JONES JONES

2008

KEY ECOSYSTEM BENEFITS

- Major Chinook-producing rivers in Puget Sound: Skagit, Stillaguamish, Snohomish systems; major producer of Coho in Puget Sound and west coast; core bull trout populations
- Important hake spawning area (Port Susan)
- Three large estuaries; migratory crossroads for many salmon populations; significant bird habitat; some of the largest eelgrass beds in Puget Sound; significant freshwater input from large rivers
- Functioning pristine high-elevation habitat, including North Cascades National Park, Alpine Lakes, Wild Sky, Glacier Peak Wilderness
- Strong agriculture base: dairy, flowers, vegetables, berries, nursery
- Shellfish and crabbing industries
- Recreation: sport fishing, boating, whale watching, camping, skiing North Cascades National Park and Wilderness areas
- Tourist attractions at small waterfront communities; significant employment and population centers, including rural water-connected communities (Camano, Whidbey Islands)
- Timber industry including pulp
- Regional power generator: hydropower for western Washington power grid; Sultan River provides water supply for Everett; potential tidal power
- Port of Everett
- Homeland security; Whidbey Island Naval Air Station; Naval Station Everett—home of the USS Abraham Lincoln

LOCAL PRESSURES (KEY THREATS IN BOLD)

Habitat Alteration:

Loss of estuary tidal marsh and habitat connectivity: More than 80% of the Snohomish and approximately 75% of the Skagit and 85% of the Stillaguamish estuaries have been diked, cutting off tidal marshes and blind tidal channels

Loss of nearshore habitat quality and complexity: 38% of marine shoreline armored; over 5,000 overwater structures; 5.6 miles of railroad grade; disconnected feeder bluffs and pocket estuaries, development in sensitive areas, loss of riparian forests

Loss of large river habitat complexity and floodplain connectivity: diking, riparian clearing, and floodplain development have reduced wood debris jams, side-channels, forested islands and pools

Decreasing forest cover and increasing impervious surface: 16% increase in impervious surface in Snohomish watershed from 1991–2001, loss of over 39,000 acres of wetlands (only 18% of historic remain), clearing and conversion of working forestland in foothills and Puget lowlands resulting in altered basin hydrology and degraded habitat

Pollution

Nutrient loading: high concern for eutrophication and presence of "dead zone" in Penn Cove, Saratoga Passage, Possession Sound

Dissolved oxygen, bacteria, and temperature concerns found in streams throughout action areas: 48% of impaired waters listed due to bacterial pollution

Pollutants from urban stormwater and agricultural runoff

Surface/Groundwater Impacts

Low summer flows in WRIAs 5 &7 for fish and human uses resulting from loss of forest cover, increased impervious surface, over-allocation of groundwater resources, and climate change

Altered magnitude, frequency, and duration of peak flow events in WRIAs 3, 4, 5 &7 from decreased forest cover, decreased wetland storage, and increased impervious surface

Altered flows in Skagit and Sultan Rivers below dams

Increased freshwater demand with more people, resulting in decreased aquifer levels and decreased groundwater discharge

Invasive Species

Pocket hotspots of invasive species (Japanese knotweed, Spartina)

Artificial Propagation

Multiple hatcheries reduce genetic fitness of wild populations; increase competition and predation

Harvest

Need to identify

Localized climate change impacts

Sea level rise: significant change and loss of estuarine habitat in Snohomish, Stillaguamish, and Skagit estuaries; significant loss of Whidbey Island beaches; risk of salt water intrusion

Other

Increase in population by 2030: 31% in Skagit, Island, Snohomish counties (over 240,000 people)

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science
Sources: 1. Initial Discussion Draft Paper. Land Use/Habitat Protection and Restoration in Puget Sound 4/14/2008 2. Whidbey Basin Action Area Profile (DRAFT), Ann Selter, 5/19/2008 3. Whidbey Basin Action Area Action Agenda Basis, 5/2008
4. The Nature Conservancy Ecoregional Assessments. Willamette Valley-Puget Trough-Georgia Basin (3/2004), East and West Cascades (6/2007)

JONES JONES

South Central Action Area

2008

KEY ECOSYSTEM BENEFITS

- Unique salmon populations: Lake Sammamish Kokanee; spring White River Chinook; summer and fall North Lake Washington and Cedar River Chinook, steelhead
- Lake Washington sockeye and Issaquah Creek Chinook provide recreational harvest opportunities
- Core area for bull trout recovery (Puyallup/White)
- Functioning pristine high-elevation habitat in Mt. Rainer National Park
- Significant agriculture and rural areas
- Modest timber production
- Recreation: Mount Rainer National Park; Mount Baker-Snoqualmie National Forest; Lake Washington, Lake Tapps, Lake Sammamish, Mountains to Sound Greenway
- Population center for Puget Sound (more than three million residents); significant growth will occur in this area
- Water supply for City of Seattle and City of Tacoma and much of the surrounding metropolitan areas; many water supply watersheds are protected
- Commercial and industrial hub, generating 63% of the gross state product
- Home of the North Pacific fishing fleet
- International port facilities (Tacoma and Seattle) and cruise ship terminal

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science

LOCAL PRESSURES (KEY THREATS IN BOLD)

Habitat Alteration:

- Nearshore alterations: 75% shoreline armored
- Major loss of estuary habitat in Duwamish and Puyallup River estuaries
- Significant alteration of rivers, floodplains and shorelines; river straightening and channelization (Duwamish, Puyallap, Cedar); floodplain development; loss of floodplain storage
- Extensive alteration of surface hydrology: Lake Washington, Ballard Locks, White, Cedar, Puyallup and Black Rivers
- Blocked habitat: dams and diversions (Green, White, Puyallup)
- Significant diversion of water through wastewater system to Puget Sound
- Loss of working farms and forests through conversion
- 12% impervious surface; significantly higher in urbanized areas

Pollution

- Legacy toxics: Duwamish and Commencement Bay Superfund sites; recontamination of previously cleaned-up sites
- Major source of urban stormwater runoff and pollutants in Puget Sound
- Contribution of bacterial pollution from agricultural runoff
- Significant source of air pollution
- Failing septic systems in nearshore areas and throughout watersheds

Surface/Groundwater Impacts

- WRIAs 8,9,10/12: low summer flow; high peak stream flows; low mainstem winter flows
- Increased future water needs for higher population
- Localized areas of saltwater intrusion into groundwater

Invasive Species

- Japanese knotweed, reed canary grass, and butterfly bush infestations along riparian corridors; non-native fish species in Lake Washington for recreational harvest

Artificial Propagation

- Hatchery salmon production in Lake Washington/Sammamish and White rivers have potentially negative effects on wild salmon; legacy broodstock management issues resulting from out-of-basin fish

Harvest

- Need to identify

Localized climate change impacts

- Significant source of Puget Sound carbon emissions
- Sea level rise: risk of conversion of upland to shoreline; loss of estuarine beaches; limited impacts in Tacoma

Population/Other

- Increase in population by 2030: 22% in King, Pierce, Snohomish counties (more than 660,000 people)

Sources: 1. Initial Discussion Draft Paper. Land Use/Habitat Protection and Restoration in Puget Sound 4/14/2008 2. South Central Puget Sound Action Area Profile (DRAFT), Ann Seiter, 5/19/2008 3. South Central Puget Sound Action Area Action Agenda Basis, 5/2008 4.The Nature Conservancy Ecoregional Assessments. Willamette Valley-Puget Trough-Georgia Basin (3/2004), East and West Cascades (6/2007)

JONES JONES

2008

KEY ECOSYSTEM BENEFITS

- Nisqually River is largest undeveloped delta in Puget Sound, important for salmon and wildlife; largest National Wildlife Refuge in Puget Sound
- Nursery area for multiple Chinook populations
- Areas of intact shoreline
- Unique prairie habitat with endemic species
- Some forest lands
- Nationally renowned shellfish; one of the largest shellfish producing areas in state
- Recreation: clamming, crabbing, Mt. Rainier National Park, kayaking, boating
- Numerous commercial and residential centers
- Center of government
- Hydropower for City of Centralia and City of Tacoma
- Regional leadership in reclaiming municipal wastewater
- Ports of Olympia and Shelton
- Homeland security: Fort Lewis & McCord Air Force Base

LOCAL PRESSURES (KEY THREATS IN BOLD)

Habitat Alteration

Nearshore alterations: 40% shoreline armored; __ miles of BNSF rail along eastern shoreline, loss of riparian and estuary habitat, some intertidal alterations

Blocked habitat: dams on Deschutes and Nisqually Rivers; fill for I-5 on Nisqually

Loss of prairie habitat through land conversion

Loss of hydrologic function from existing and expanding impervious surface

Pollution

Industrial pollution in bays and contaminated sediments: Oakland Bay, Chambers Bay, Budd Inlet

Pollutant loading leads to low dissolved oxygen: Budd Inlet, Case Inlet, Carr Inlet

Bacteria and pathogens from human and animal waste

Poor air quality due to particulate pollution (wood smoke, diesel emissions, etc.)

Surface/Groundwater Impacts

Low flows in WRIA 12; flow issues in WRIA 13

Invasive Species

Need to identify

Artificial Propagation

Potential ecosystem impacts related to some aquaculture practices

High proportion of hatchery salmon in South Sound nearshore and marine waters have unknown impacts on wild salmon

Harvest

Need to identify

Localized climate change impacts

Sea level rise: Significant loss of estuarine beaches potentially sooner than other areas of Puget Sound; inundation of tidal flats; flooding at downtown Olympia

Population/Other

Conflicting use values of marine shorelines

Increase in population by 2030: 33%; more than 310,000 people, in Thurston, Pierce, Mason counties

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science

sources: 1. Initial Discussion Draft Paper. Land Use/Habitat Protection and Restoration in Puget Sound 4/14/2008 2. South Puget Sound Action Area Profile (DRAFT), Ann Seiter, 5/19/2008 3. South Puget Sound Action Area Action Agenda Basis, 5/2008
4. The Nature Conservancy Ecoregional Assessments. Willamette Valley-Puget Trough-Georgia Basin (3/2004), East and West Cascades (6/2007) 5. NOAA Status Assessments (DRAFT) 5/2008

JONES JONES

2008

KEY ECOSYSTEM BENEFITS

- Nearshore habitat serves as salmon refugia for several salmon populations
- Shellfish production
- Recreation: Boating, state parks, shoreline access
- Water-oriented communities
- Accommodate significant amount of future population growth
- WSF maintenance facility at Eagle Harbor (Bainbridge)
- Commerce, military, and marine transportation hub
- Homeland security—Key port Naval Undersea Warfare Center, Puget Sound Naval Shipyard
- Regional leadership in water quality improvements via "pollution identification and control"

LOCAL PRESSURES (KEY THREATS IN BOLD)

Habitat Alteration:

Conversion of working farms and forest for urban and suburban uses

12% impervious surface

Nearshore alterations: 49% shoreline armored, especially in south part of action area and Bainbridge Island; 291 piers and docks, 108 boat ramps on Bainbridge Island

Pollution

Bacteria contamination from human and animal waste, CSO events and urban stormwater; threatened and closed shellfish growing areas; 7 local streams closed for human contact

Poor flushing leads to low dissolved oxygen in bays

Groundwater contamination resulting from Eagle Harbor superfund site

Hundreds of acres of contaminated sediments, especially at Sinclair and Dyes inlets, Liberty Bay, and Eagle Harbor attributed to naval and industrial activities

Surface/Groundwater Impacts

Limited water availability for people and instream uses: streamflows dependent on precipitation and groundwater; 80% of drinking water comes from groundwater WRIA 15: Low summer flows, winter flash flows

Invasive Species

Spartina, non-native tunicates (?)

Artificial Propagation

High proportion of hatchery salmon in marine and fresh waters have unknown impacts on wild salmon

Harvest

Not specifically identified

Localized climate change impacts

Sea level rise: Loss of beach land by 2050, converted to tidal flats

Population/Other

Population growth 43% in 20 years (+100,000 people) need to verify

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science

Sources: 1. Initial Discussion Draft Paper. Land Use/Habitat Protection and Restoration in Puget Sound 4/14/2008 2. North Central Puget Sound Action Area Profile, Ann Seiter (2008) 3. North Central Puget Sound Action Area Action Agenda Basis, 5/2008
4. The Nature Conservancy Ecoregional Assessments. Willamette Valley-Puget Trough-Georgia Basin (3/2004), East and West Cascades (6/2007)

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