Science, Service, Stewardship

Puget Sound Sustainability

Michael Grady

NOAA Fisheries
Transportation Branch Chief

7 February 2012

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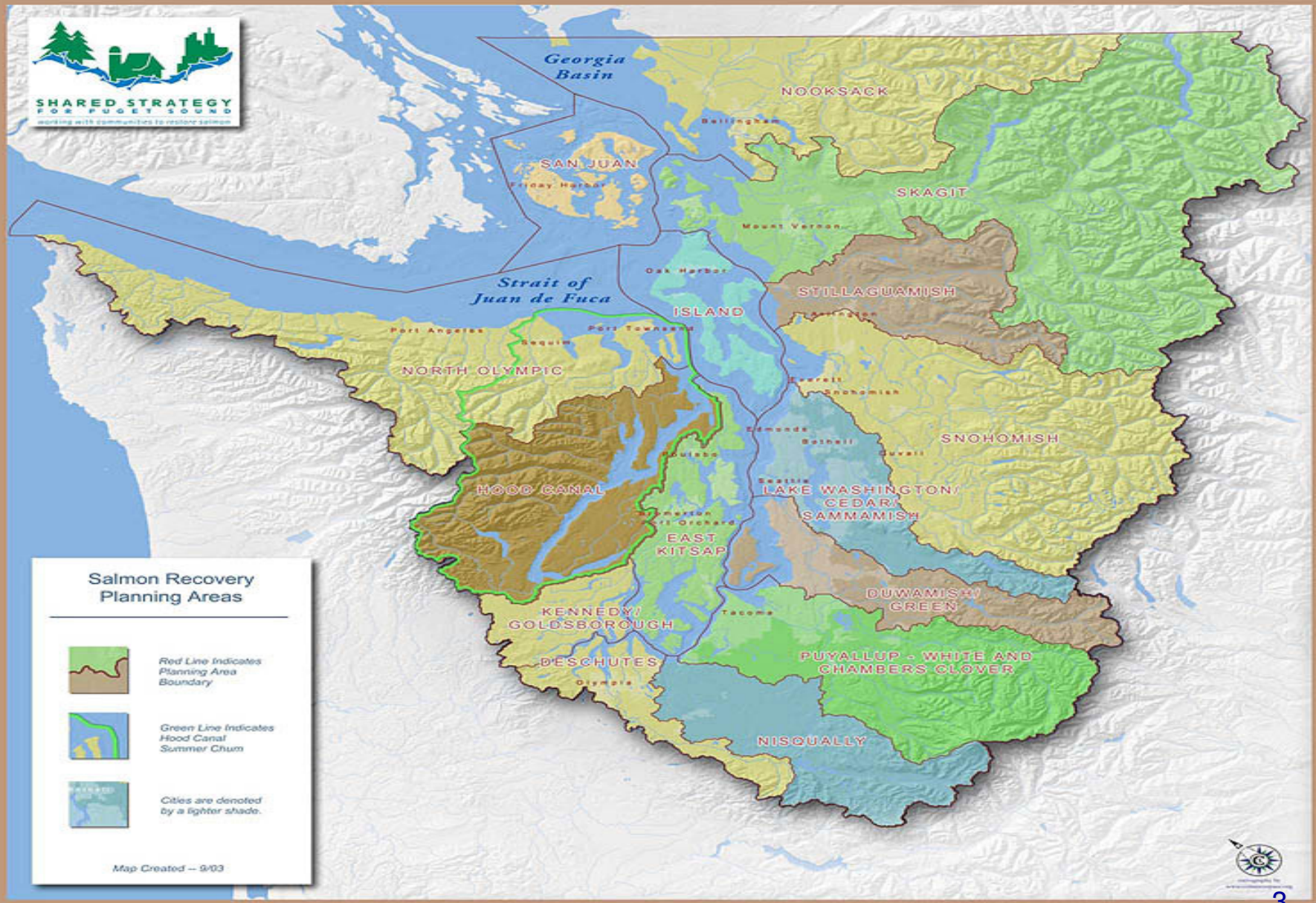
Essential Elements for a Sustainable Puget Sound

- Clean, cool water
- Protected marine, nearshore and freshwater habitats
- Smart growth that uses Low Impact Development
- Stormwater treated to eliminate toxins
- Clean mobility for goods and people
- Science-based planning and decision-making
- Champions

Salmon Recovery Planning Areas

Shared Strategy for Puget Sound



The Painful Cost of Booming Growth

(Seattle Times May 11, 2008)

Photo courtesy of Steve Ringman-Seattle Times May 11, 2008

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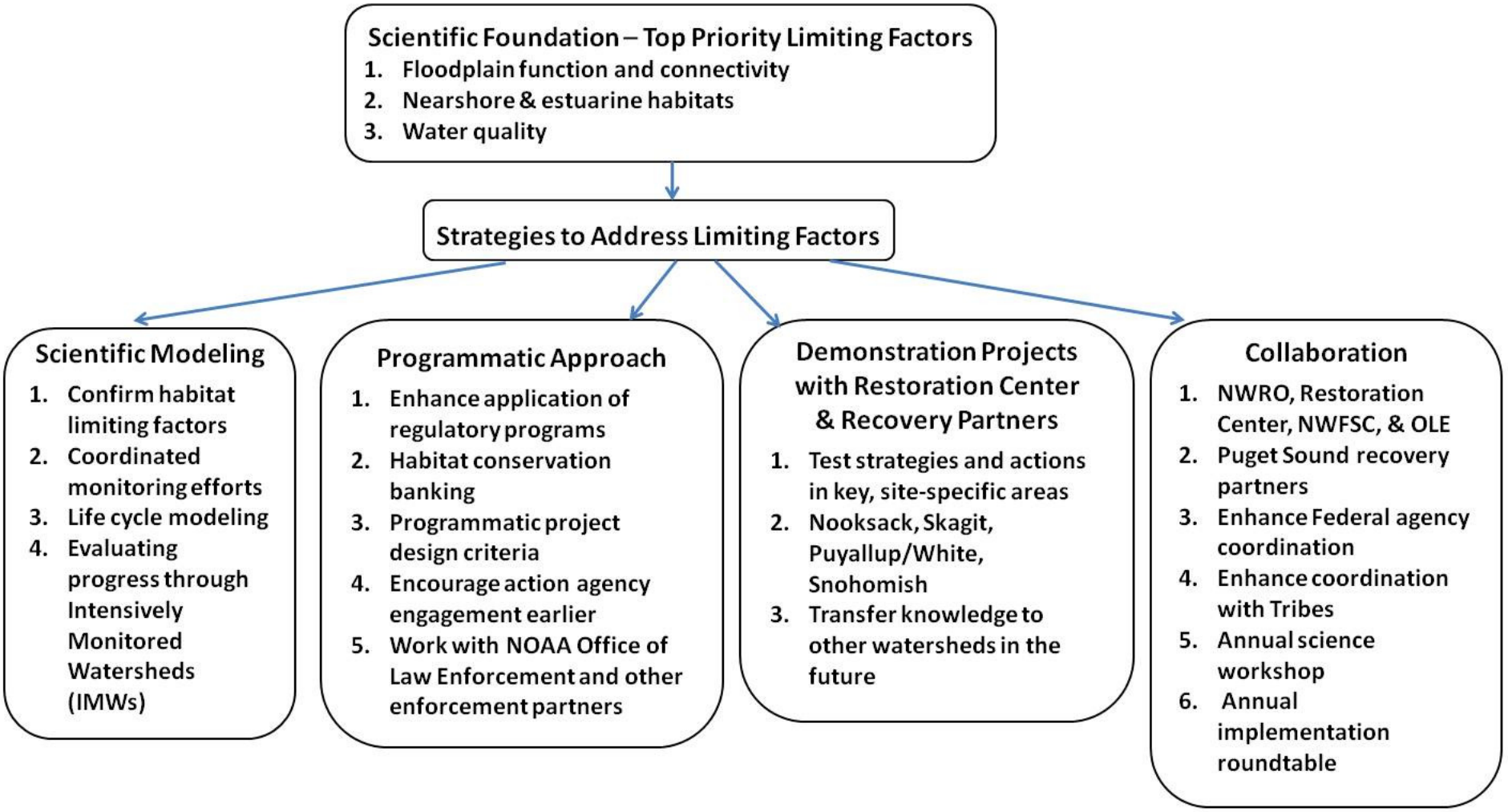
Challenges

- Nine Species listed in Puget Sound under ESA since 1990
- 2007 Puget Sound Chinook Salmon Recovery Plan documented habitat loss and degradation as limiting factors for the species
- Recent study commissioned by NOAA Fisheries indicates habitat is declining despite Recovery Plan implementation
- Puget Sound Tribes voicing concerns about diminishing Tribal treaty rights due to habitat loss, while NOAA Fisheries directly regulates harvest levels
- Limited NOAA Fisheries authority over local land use
- Local, state and federal permits lack rigor and ecosystem approach
- Game Changer: Global Warming

Framework for Action Puget Sound Initiative



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Opportunities

- Puget Sound Partnership
- Federal Green Challenge
- D.O.D. goals and initiatives
- Nisqually River delta restoration
- H.U.D. Sustainability Projects with Regional Councils
- PS New Energy Solutions, Clean Cities and local efforts to electrify the transportation sector and create Transit -Oriented Developments
- NWFSC, FHWA/WSDOT and WSU stormwater research

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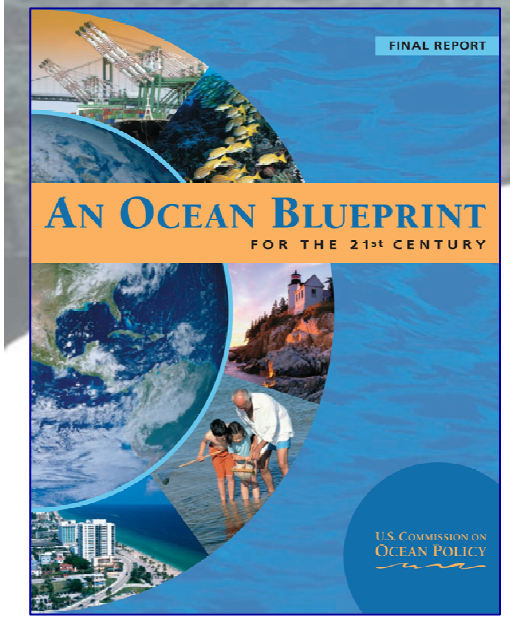
Stormwater

- Puget Sound Partnership focus on state and local government plans
- EPA and Ecology permits to require Low Impact Development
- NWFSC, FHWA/WSDOT and WSU stormwater research
- ESA consultations with FHWA-WSDOT using biological thresholds

Non-point source pollution

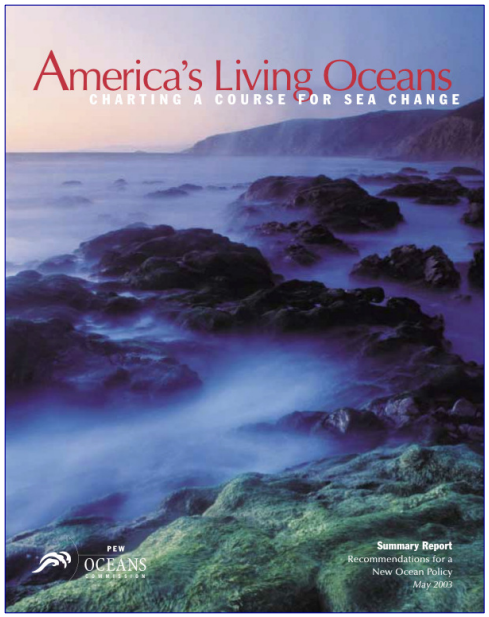


"Non-point source pollution occurs when rainfall and snowmelt wash pollutants… into our rivers and coastal waters… Our failure to manage the human activities that affect the nation's oceans is compromising their ecological integrity, diminishing our ability to fully realize their potential, costing us jobs and revenue, threatening human health, and putting our future at risk"

- An Ocean Blueprint

"Today, non-point sources represent the greatest pollution threat to our oceans and coasts… the situation requires that we apply new thinking about the connection between the land and the sea, and the role watersheds play in providing habitat and reducing pollution"

- America's Living Oceans



Coho pre-spawn mortality (PSM)

Coho PSM is widespread and recurrent in urban streams

Longfellow Creek 2003

Des Moines Creek 2004

Longfellow Creek 2005

Coho PSM rates measured to date in Seattle-area urban streams have ranged from ~ 40 – 90% of the total run (2002-2009)

SCIENCE NEWS
THE WEEKLY NEWSMAGAZINE OF SCIENCE

JANUARY 27, 2007 PAGES 49-64 VOL. 171, NO. 4

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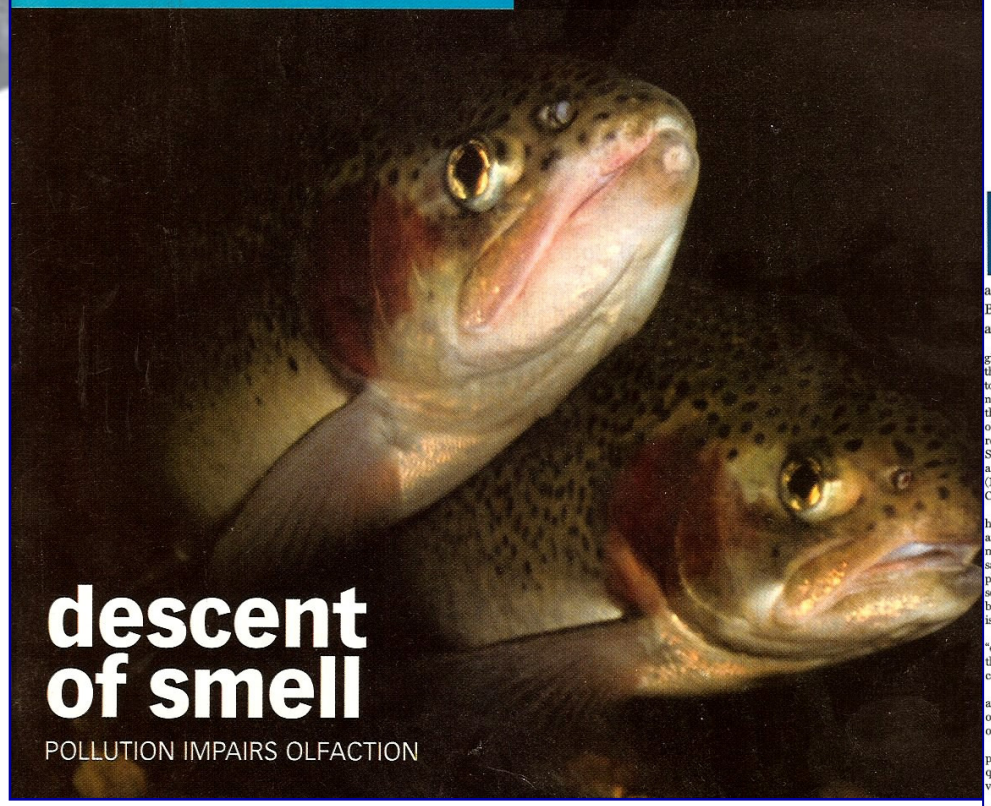


descent of smell

POLLUTION IMPAIRS OLFACTION

AQUATIC NON-SCENTS

Repercussions of water pollutants that mute smell

BY JANET RALOFF

People complain about the way that fish smell. But it's the fish that should be doing the grumbling. In pristine waters, the animals smell quite well, thank you. Those tiny holes near fishes' mouths are, in fact, nostrils through which the animals draw in water to pump over olfactory nerves. By distinguishing scents, fish find food and mates and avoid predators.

Studies decades ago, for instance, showed that mechanically plugging the nostrils of adult salmon prevented them from locating their natal streams when they attempted to return home to spawn. The fish as juveniles had recorded memories of smells as they went to sea. Without detecting the olfactory signposts, the fish couldn't retrace their routes, says Nathaniel L. Scholz, a zoologist at the National Oceanic and Atmospheric Administration's (NOAA's) Northwest Fisheries Science Center in Seattle.

In a series of studies over the past 6 years, his group has demonstrated that metals and pesticides—at concentrations commonly found in streams—can impair a salmon's sense of smell just as effectively as plugging the nostrils did. Meanwhile, other scientists have shown that such pollutants block the sense of smell in other organisms.

"What we're finding," says Scholz, is that "even short-term exposure to many of these pollutants—on the order of hours—can interfere with olfaction."

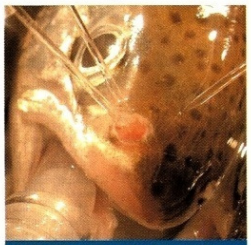
Researchers have reported that the impairment can disrupt the animals' normal behaviors in several ways. Fish use their keen sense of smell not only to navigate dark and cloudy waters but also to nose out scents indicating danger, such as chemicals from a predators' skin.

The studies are establishing that aquatic animals exposed to pollutants miss chemical cues that have life-and-death consequences, says ecotoxicologist Gregory C. Pyle of Nipissing University in North Bay, Ontario.

PESTICIDAL NOSE PLUGS North America's most widely used herbicide blunts a fish's sense of smell, according to work by Keith Tierney and his colleagues at Simon Frasier University in Burnaby, British Columbia. The herbicide is sold under a number of trade names, including Roundup.

A 30-minute exposure to a 1 parts per billion (ppb) concentration of atrazine reduced the activity of olfactory neurons in coho salmon (*Oncorhynchus kisutch*) by 11 percent, the researchers reported last November at the annual meeting of the Society of Environmental Toxicology and Chemistry (SETAC) in Montreal. The animals' neural responses to alarm odors dropped by 45 percent. Higher doses of the herbicide triggered greater losses in smell; 100 parts per million atrazine eliminated any response to a predator's scent. River concentrations up to 20 ppb can occur briefly near farms that apply it, says Tierney.

Pure glyphosate, the active ingredient in atrazine, caused similar changes in salmon olfaction, although only at far higher doses than were required of the commercial herbicide formulation. At the November SETAC meeting, these researchers presented data showing that atrazine was 100 times as powerful at blocking fishes' sense of smell as was an equal quantity of pure glyphosate.



NOSE JOB — Probes in this fish's nostrils measure neurons' ability to pass a scent signal to the brain. Pollutants such as copper and several pesticides shut down that signaling.

Atrazine contains a variety of ingredients added to glyphosate to increase the herbicide's adhesion to leaves and to retard its breakdown. Although these ingredients are listed as inert components on herbicide labels, Tierney's team concludes that they aren't inert as far as fish olfaction is concerned.

"I'd like to find out what those inerts are," Tierney says, but he notes that pesticide manufacturers regard them as part of their proprietary recipes.

Tierney isn't alone in his concern over supposedly inert ingredients. Some "4.1 billion pounds of inert [pesticide] ingredients are applied annually" to the U.S. environment, Christian E. Grue of the University of Washington in Seattle and his colleagues reported at the SETAC meeting.

Because these compounds aren't lethal to untargeted organisms, they don't require identification on labels, the Seattle researchers note—even though the inerts may exert a subtle but substantial toxic effect on aquatic life. Grue argues that "a new regulatory strategy is needed," which would require toxicity analyses of any supposedly inert ingredients.

Atrazine isn't the only chemical pesticide that can suppress a fish's ability to smell. Tierney's group showed that at exposures of about 10 ppb, the fungicidal wood-preservative known as IPB turned off olfaction in coho salmon. The researchers described that finding in the August 2006 *Aquatic Toxicology*.

They also reported in the October 2006 *Environmental Toxicology and Chemistry* that the insecticide endosulfan and the herbicides trifluralin and 2,4-D can impair a fish's sense of smell.

Scholz' group, too, has made contributions to the list of pesticides that affect fish olfaction. Six years ago, that team showed that diazinon significantly impaired responses by Chinook salmon (*Oncorhynchus tshawytscha*) to alarm scents and reduced their success in finding their natal pools.

Sublethal exposure to crude oil during embryonic development alters cardiac morphology and reduces aerobic capacity in adult fish

Corinne E. Hicken[a], Tiffany L. Linbo[b], David H. Baldwin[b], Maryjean L. Willis[b], Mark S. Myers[b], Larry Holland[c], Marie Larsen[c], Michael S. Stekoll[a], Stanley D. Rice[c], Tracy K. Collier[b,1], Nathaniel L. Scholz[b], and John P. Incardona[b,2]

[a]University of Alaska-Fairbanks Fisheries Division, University of Alaska-Fairbanks Juneau Center, Juneau, AK 99801; [b]Environmental Conservation Division, Northwest Fisheries Science Center, National Oceanic and Atmospheric Administration, Seattle, WA 98112; and [c]Auke Bay Laboratory, Alaska Fisheries Science Center, National Oceanic and Atmospheric Administration, Juneau, AK 99801

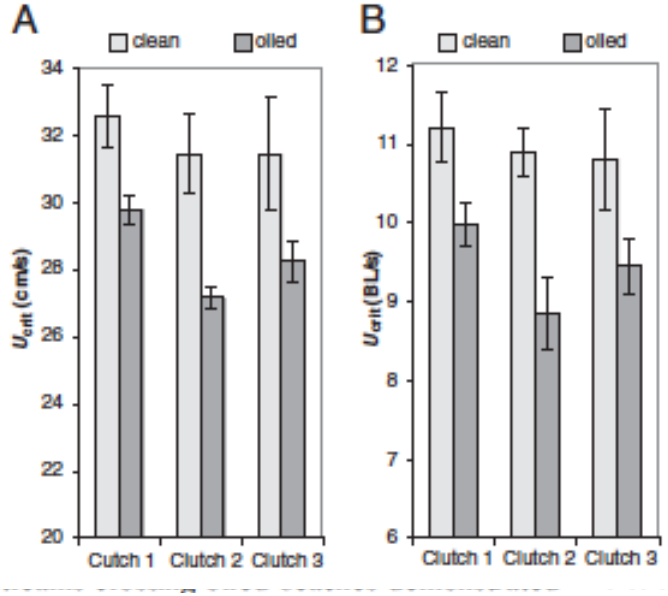
Edited by Greg Goss, University of Alberta, Edmonton, AB, Canada, and accepted by the Editorial Board March 21, 2011 (received for review December 17, 2010)

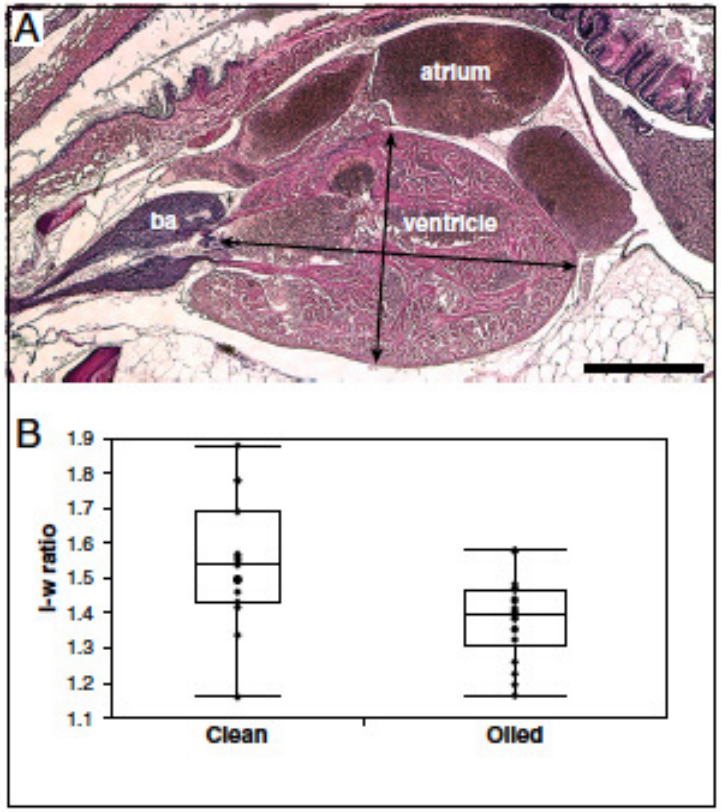
Exposure to high concentrations of crude oil produces a lethal syndrome of heart failure in fish embryos. Mortality is caused by cardiotoxic polycyclic aromatic hydrocarbons (PAHs), ubiquitous components of petroleum. Here, we show that transient embryonic exposure to very low concentrations of oil causes toxicity that is sublethal, delayed, and not counteracted by the protective effects of cytochrome P450 induction. Nearly a year after embryonic oil exposure, adult zebrafish showed subtle changes in heart shape and a significant reduction in swimming performance, indicative of reduc impacts on cardi vide a potential r population-level low-level oil poll

cardiac toxicity | fis

Oil spills such Deepwater H and population v to discern how t on pink salmon (*Clupea pallasi*) garding the effec Horizon. Eviden salmon, for whic intertidal zone o

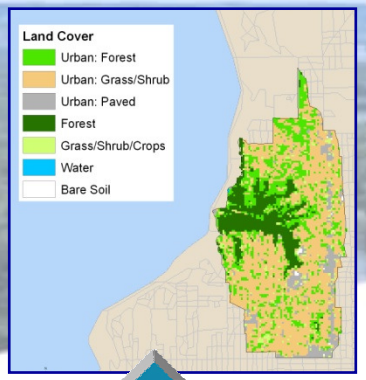
tricyclic PAH concentrations in the tissue as low as 0.8 μmol/kg (150 ppb) wet weight, indicating a specific, high-affinity cellular target (1 ventricu caused b the repo PAH m cardiac pacemal





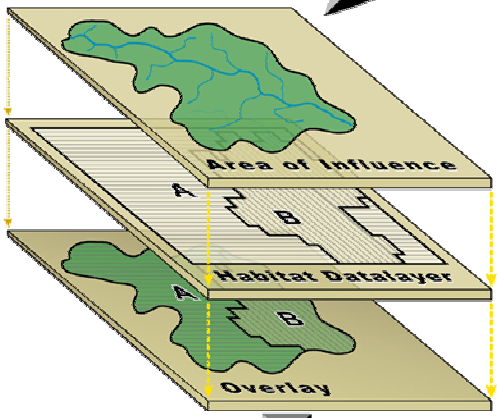
Model Overview

Pre-spawn Mortality Data

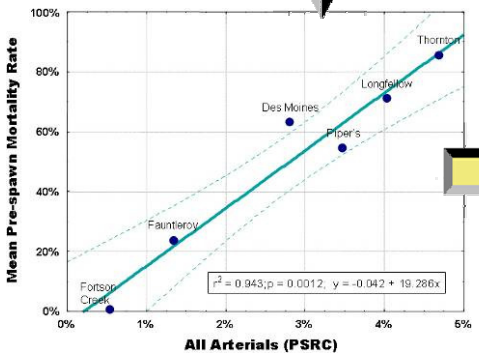


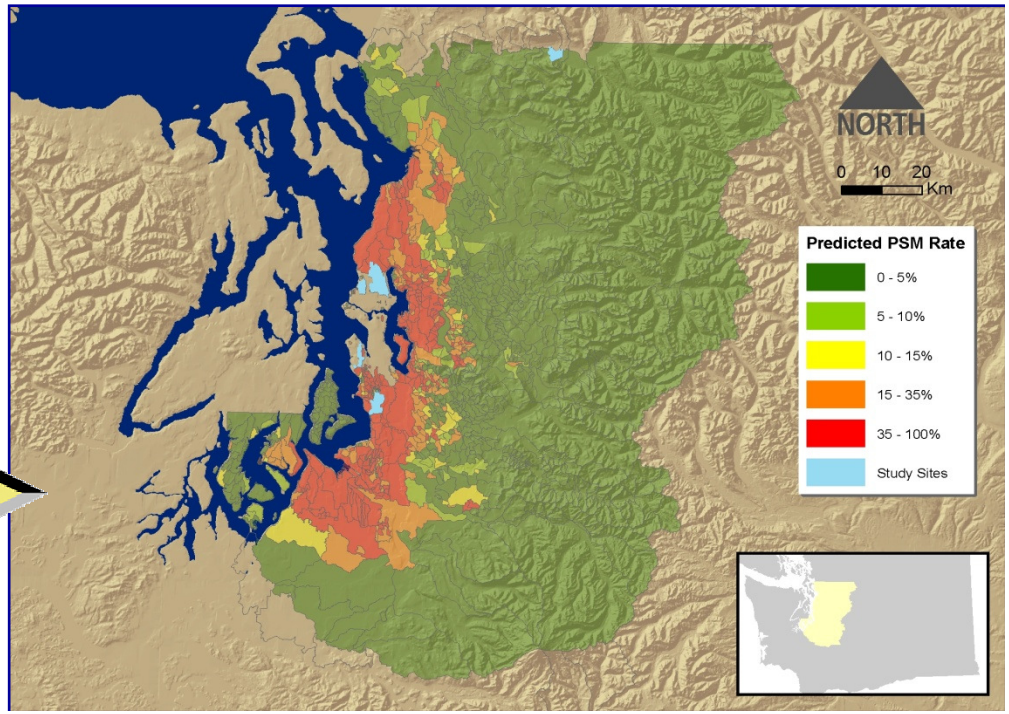
GIS (Habitat) Datalayers

Overlay GIS Datalayers with Drainage Basins



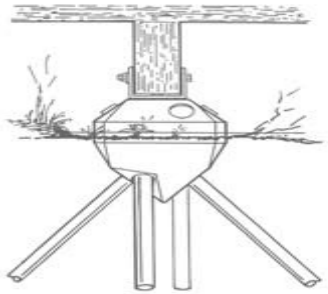
Statistical Analysis





LOW IMPACT DEVELOPMENT

TECHNICAL GUIDANCE MANUAL FOR PUGET SOUND



Biological Effectiveness of LID

Current Partners:

- WA Stormwater Program
- WSU-Puyallup
- US Fish &Wildlife
- UW-Tacoma
- City of Tacoma

Limiting the use of copper and other substances in vehicle brake pads

Washington State
House of Representatives
Office of Program Research

BILL ANALYSIS

Environmental Health Committee

HB 3018

Brief Description: Limiting the use of copper and other substances in vehicle brake pads.

Sponsors: Representatives Chase, Upthegrove, Dunshee, Campbell, Ormsby, Appleton, Kagi, Wallace, Kenney and Simpson; by request of Department of Ecology and Puget Sound Partnership.

Brief Summary of Bill

- Restricts the use of brake friction material that exceeds certain specified quantities of designated metals beginning January 1, 2014.
- Prohibits the use of after-market brake friction material that exceeds 5 percent copper by weight beginning January 1, 2015.
- Requires the use of brake friction material of 5 percent copper or less in new motor vehicles beginning January 1, 2020.

Hearing Date: 2/2/10

Staff: Pam Madson (786-7111).

Background:

Motor vehicle brakes contain friction material (brake pads) designed to retard or stop movement of a motor vehicle through friction against a rotor. Brake pads may include several substances, including copper and other metals. Operation of brake systems can generate debris containing these substances.

Copper is a highly toxic substance in the aquatic environment and is of particular concern in Washington to the health of salmon. Research suggests that vehicle brake pads containing copper are a significant source of copper from surface water runoff that reaches rivers and marine environments.

SENATE BILL REPORT
SB 6557

As of January 21, 2010

Title: An act relating to limiting the use of certain substances in brake friction material.

Brief Description: Limiting the use of copper and other substances in vehicle brake pads.

Sponsors: Senators Ranker, Swecker, Rockefeller, Brandland, Brown, Kohl-Welles, Shin, Fraser and Kline; by request of Department of Ecology and Puget Sound Partnership.

Brief History:
Committee Activity: Environment, Water & Energy: 1/22/10.

SENATE COMMITTEE ON ENVIRONMENT, WATER & ENERGY

Staff: Sam Thompson (786-7413)

Background: Motor vehicle brakes contain friction material (brake pads) designed to retard or stop movement of a motor vehicle through friction against a rotor. Brake pads may include several substances, including copper and other metals. Operation of brake pads generates dust containing these substances. Brake pad dust has been identified as a significant source of copper in the environment. High copper levels are toxic to aquatic life, including salmon.

Summary of Bill: Sale of brake pads containing several substances is prohibited in Washington. Beginning in:

- 2014, sale of brake pads containing more than trace amounts of asbestos, cadmium, chromium, lead, and mercury is prohibited;
- 2015, sale of after-market (replacement) brake pads exceeding 5 percent copper by weight is prohibited; and
- 2020, sale of new vehicles with brake pads exceeding 5 percent copper by weight is prohibited.

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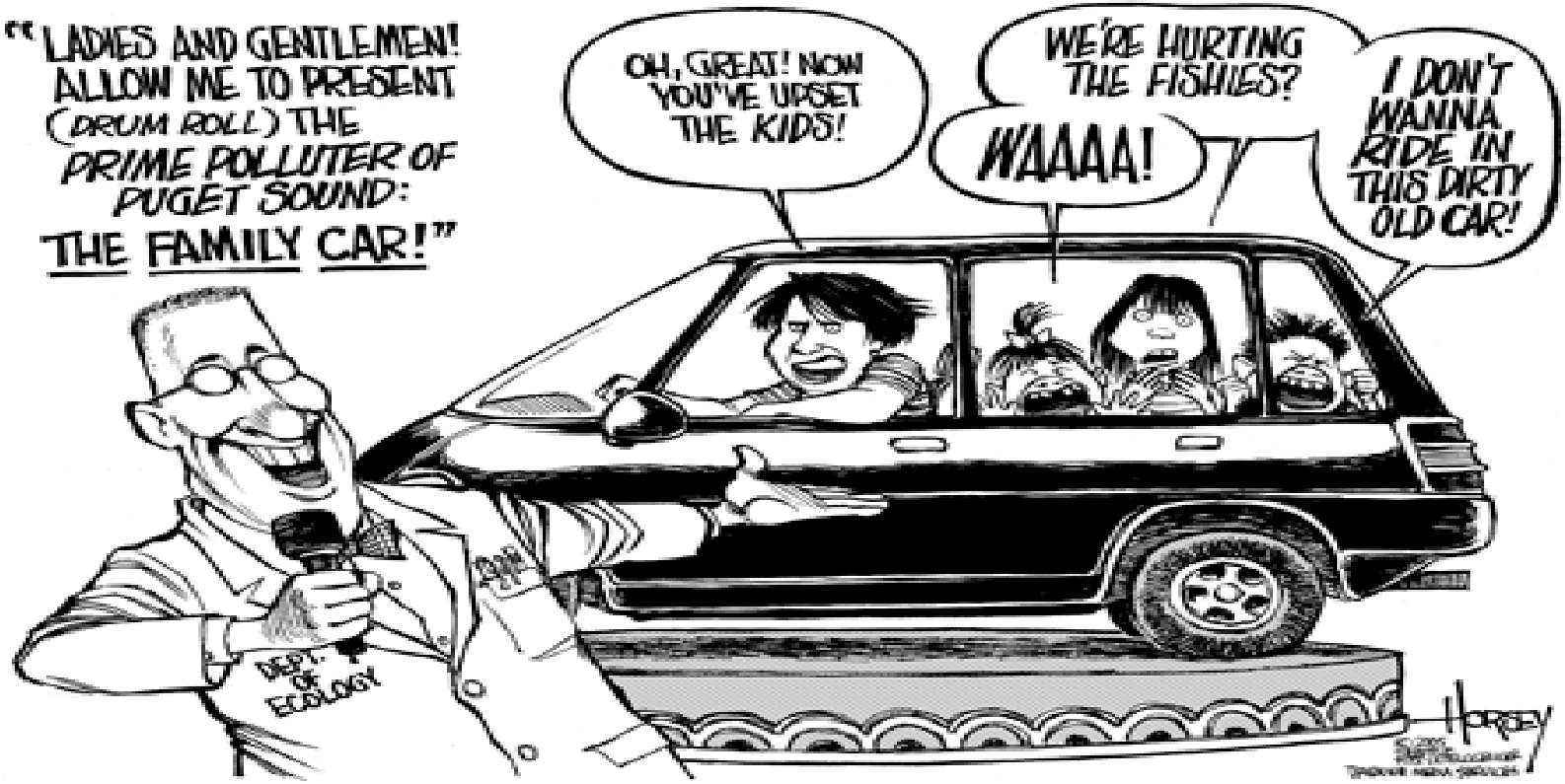
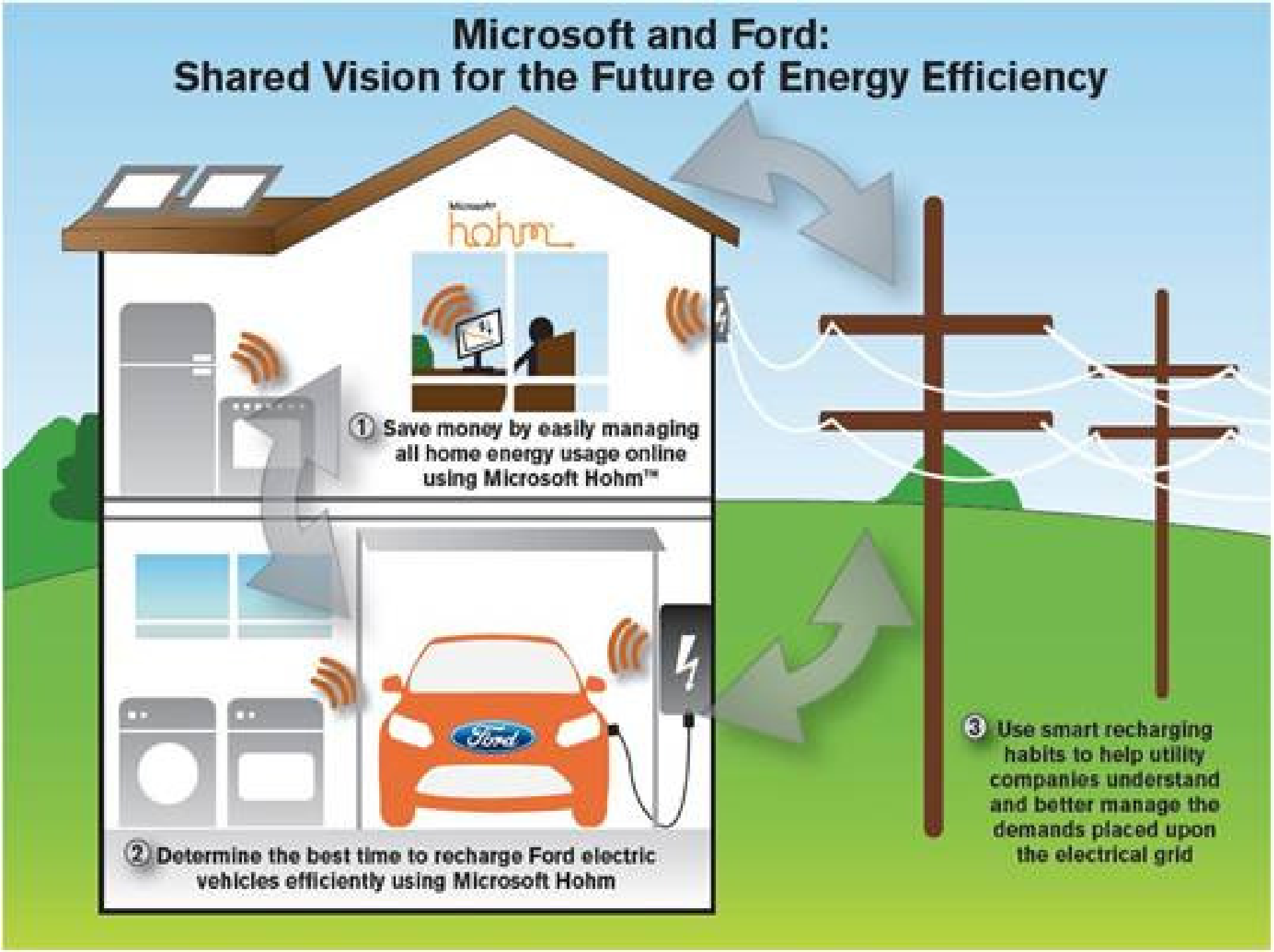


COURTESY: FORD MOTOR CO.


Microsoft and Ford:
Shared Vision for the Future of Energy Efficiency
hohm
1 Save money by easily managing all home energy usage online using Microsoft Hohm™
2 Determine the best time to recharge Ford electric vehicles efficiently using Microsoft Hohm
3 Use smart recharging habits to help utility companies understand and better manage the demands placed upon the electrical grid

CONCEPTUAL VIEW

SOUTH KIRKLAND TRANSPORTATION HUB

CASCADIA

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SHOWING:
- Swiss 2-car Diesel Multiple Unit (DMU) Train
- Microsoft "Connector" Service
- Sea-Tac Express Motor Coach
- Advance Airport Check-In Service
- Plug-In Hybrid Electric Vehicle Stalls
- Zipcar Parking
- Adjustable solar panels (on south side of canopy)
- Video Conferencing and Telework Center
- Typical Retail Vendors

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What's Needed

- Expand Federal Green Challenge to help meet Executive Order goals
- Protect habitat with proactive efforts (acquisition, restoration, sanctuaries)
- Implement sustainability projects with tribes, Restoration Center, NWFSC, Puget Sound Partnership, NGOs, local governments, and utilities
- Enhance coordination and alignment of Federal actions through Puget Sound Federal Caucus and Puget Sound Habitat Initiative
- Deploy EV fleets and infrastructure
- Continued research on stormwater solutions for local plans and permits