# CHANGING COURSE: Why protecting floodplains is good for people and wildlife

NATIONAL WILDLIFE FEDERATION | 2013

Protecting and restoring floodplains is **one of the most important things we can do** to recover imperiled salmon and reduce flood risk.

Monika Wieland

# Welcome to Puget Sound's floodplains


USFWS

Home to over four million people and a rich diversity of fish and wildlife, Puget Sound is the economic and ecological hub of Washington State. Although quality of life continues to attract people to the region, important indicators suggest our current development path may not be sustainable. The health of Puget Sound's ecosystem is under threat, iconic salmon and orca populations are a fraction of their previous levels, and the region is increasingly devastated by costly floods. Loss of floodplains plays a key role in all of this.

The importance of floodplains is rising in prominence. Many scientific assessments suggest that protecting and restoring floodplains is one of the most important things we can do to recover imperiled salmon[1] and reduce our risk of devastating floods. In 2008 the National Marine Fisheries Service came to a similar conclusion when it issued a Biological Opinion assessing the impacts of FEMA's National Flood Insurance Program (NFIP) on declining salmon populations. The results confirmed that floodplain development supported by the NFIP was contributing to the demise of salmon and orca, and if left unchanged, those iconic species would decline to extinction. Protecting floodplains from further harm was their primary remedy.

As this report demonstrates, salmon and orca are not the only ones who suffer the costs of unwise floodplain development. Thousands of Puget Sound residents have been flooded from their homes, scores of communities have been ravaged by floods, and taxpayers end up paying the costs to rebuild, in some cases multiple times in the same unwise location. Protecting and restoring floodplains is essential if we hope to restore salmon and orca, recover Puget Sound, and protect public safety. The NFIP Biological Opinion establishes the minimum requirements necessary toward achieving those outcomes.

Unfortunately, most of the changes required of FEMA's flood insurance program remain unfulfilled. A key recommendation of this report is that FEMA must revise the NFIP to fully implement the requirements of the NFIP Biological Opinion. Yet it is not just FEMA that must change its approach to floodplain management. To protect public safety, local jurisdictions and the state must also act to protect and restore floodplains.


Bob Chalfrey

Until now, Puget Sound has not had a meaningful tally of floodplain development and its costs. This report is intended to address that gap and to shed light on how much of our floodplains have been lost to development, how much that has cost us in human, financial, and ecological terms, and what can be done about it. We hope this report generates greater consideration of how to live with our rivers and how to understand the value that our floodplains provide.


KJF Martin

# Floodplains are among the most valuable ecosystems on earth

Puget Sound's floodplains are an unrecognized treasure. They absorb floodwaters and prevent the most destructive effects of flooding. They improve water quality by cleansing polluted stormwater. They create lush river valleys that provide aesthetic and recreational opportunities. And they are vital habitats for fish, birds, and a rich diversity of plants and wildlife. Indeed, natural floodplains are one of the most biologically productive and important ecosystems on the planet.[2] In Puget Sound, they are essential for the recovery of imperiled salmon and orca.

The value of floodplains is well documented:

- **Floodplains reduce flood damage:** Well functioning floodplains can absorb stormwater and reduce flood damage to nearby areas. An acre of floodplain saturated with a foot of water can hold 330,000 gallons of water[3]—water that is not flowing into nearby homes or businesses. By retaining and gradually releasing stormwater, floodplains can slow the velocity of stormwater and reduce damaging peak flows.
- **Floodplains improve water quality:** Stormwater tends to flush toxic oils, pesticides, and other pollutants into rivers from our roads, lawns and agricultural fields. These pollutants concentrate and flow into Puget Sound unless they are captured by floodplains along the way. Many studies have highlighted the value of floodplains on water quality. In one, floodplains improved water quality 1.4- to seven-fold across parameters such as dissolved oxygen, pH, temperature, phosphorus, nitrogen, and total dissolved and suspended solids.[4]
- **Floodplains provide essential habitat:** More than 86% of wildlife species in western Washington and Oregon depend on floodplains, wetlands, and riparian zones during part of their lifecycle. These include shorebirds, gulls, beaver, muskrat, Pacific tree frog, Cooper's hawk, and yellow warbler.[5] Salmon are especially dependent on floodplain systems. Chinook and coho rely on side channels, pools and vegetative cover for rearing during their juvenile stages, while chum salmon primarily seek floodplain habitat for spawning. Marbled murrelet, gray wolf, fisher and wolverine are among many at-risk species found in floodplains.

The value of floodplain services adds up—and these services can be extremely expensive or impossible to replace. A seminal study on valuing ecosystem services ranked floodplains second only to estuaries in terms of the value of services they provide.[6] In Puget Sound, a recent study estimated that the annual value of Puget Sound's floodplains is $96,000 per acre for the flood control and storm buffering value of salt marshes, $31,400 per acre for the water supply services provided by freshwater wetlands, and $19,700 per acre for aesthetic and recreational uses of rivers and lakes.[7] Another study calculated that the ecosystems of the Puyallup River Watershed provide $526 million to $5 billion in annual benefits to the regional economy. These benefits include floodwater attenuation, water quality, salmon habitat, aesthetic value, and nutrient cycling. The study found that the Puyallup Watershed is an asset worth between $13 billion and $120 billion.[8]

Because of the natural services they provide, floodplains are one of the most valuable ecosystems on earth. They are crucial for public safety, the health of Puget Sound and the recovery of declining salmon and orca. Protecting floodplains is essential if we hope to recover Puget Sound, restore salmon and orca populations, and protect communities from destructive flooding.

### WHAT IS A FLOODPLAIN?

A floodplain is a flat or nearly flat area near a river or shoreline that is susceptible to inundation. Floodplains are typically formed over thousands of years through periodic floods and sediment deposition. Floodplains develop specific ecological features that influence wildlife and plant communities as well as river dynamics and ecosystem processes. Features associated with floodplains include oxbows, side channels, logjams, meander bends, and wetlands. Floodplains provide a disproportionate share of biodiversity and ecological services to society, making them one of the most valuable ecosystems on the planet.

## Floodplains are Essential Salmon Habitat


*Salmon rely on floodplains throughout Puget Sound. FEMA's regulatory floodplain is shown in yellow and regulated salmon streams are shown in purple. Much of the floodplain adjacent to salmon streams is critical habitat. Sources: FEMA, USGS, WSDOT, NOAA; see also Map Data Sources, pg. 31.*

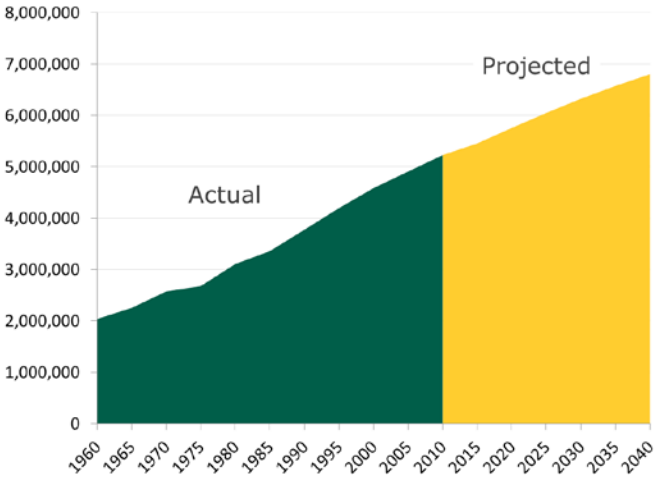
# Floodplains transformed by human actions

Although floodplains are among the most valuable ecosystems on earth, they are also one of the most threatened. The Puget Sound lowlands were once largely floodplains and wetlands. They accommodated flows running off the Olympic and Cascade Mountains to create a verdant and biologically rich landscape.

Today, much of the region's floodplains have been lost—damaged or destroyed by human activity. They are leveed, diked, and filled with roads, homes and buildings, cutting off key floodplain areas that formerly accommodated floodwaters and provided habitat to fish, mammals, birds and more. More than 90% of Puget Sound's floodplains and wetlands have been lost due to development, agriculture, and other human activities.[9] Most of the remaining floodplains are in poor condition, especially in urban and agriculturally dominated areas.[10]

As our regional population continues to grow, pressure to build in flood-prone areas will also continue, placing even more people, homes, and businesses in harm's way.

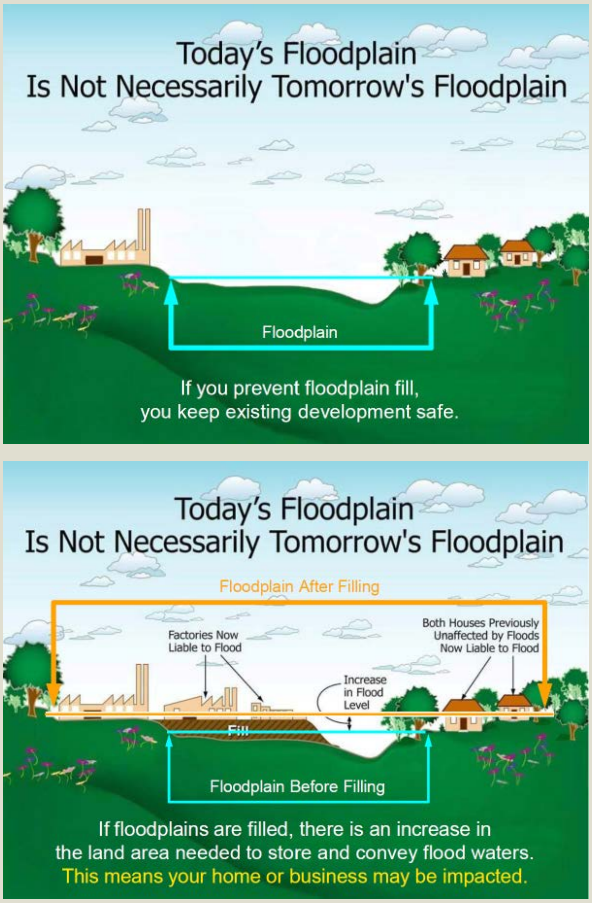
**Where will we put the next million people, safely?**




*Western Washington is home to approximately 5.2 million people and is projected to add another 1.6 million people in the next 30 years (6.8 million by 2040).[11] The question is not, Where will we put them? Rather, the question should be, Where will we put them safely? Source: WA OFM.*

**71% of the State's floodplains are in poor condition[12]**

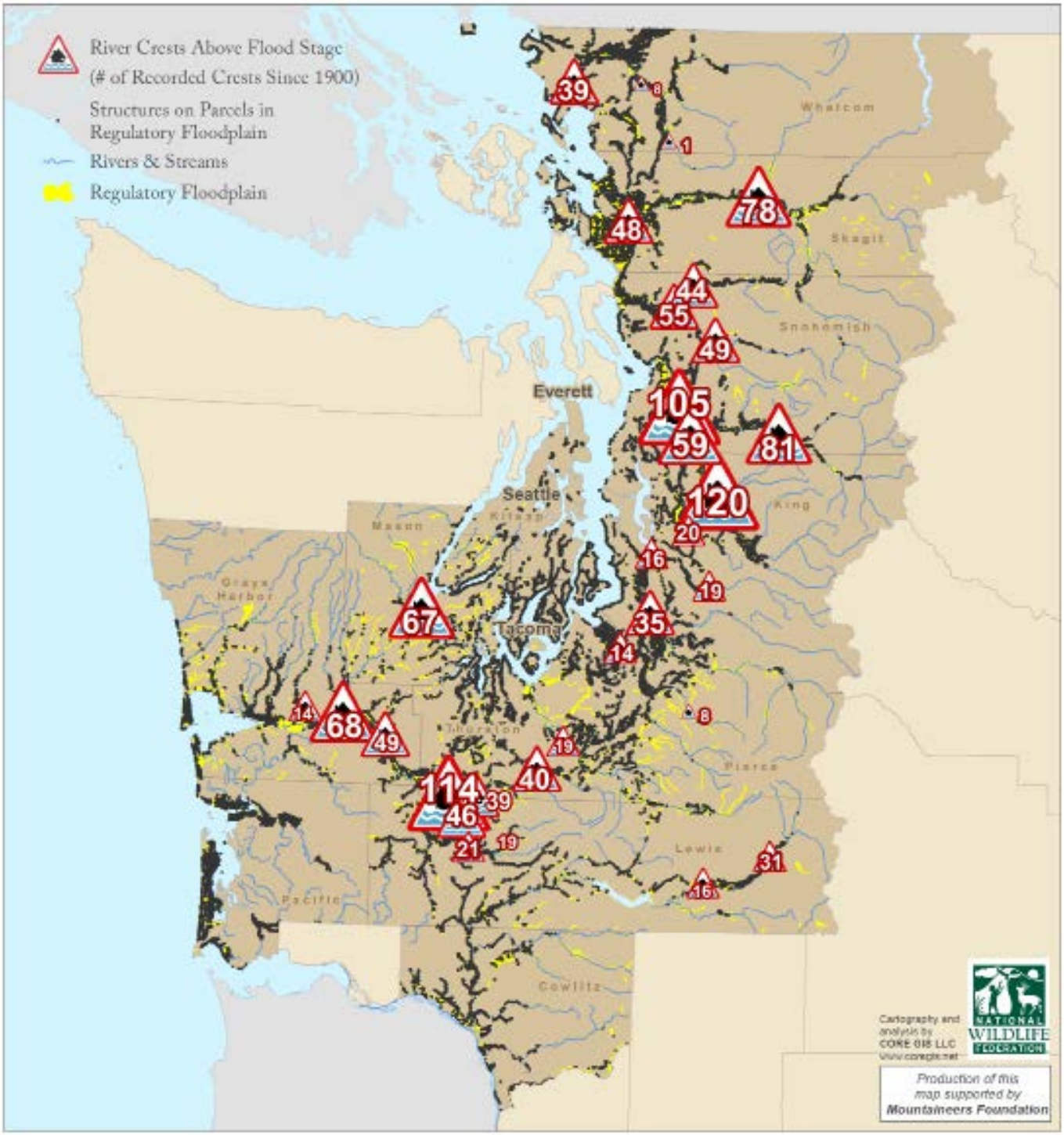
**Where will the water go?**




Association of State Floodplain Managers

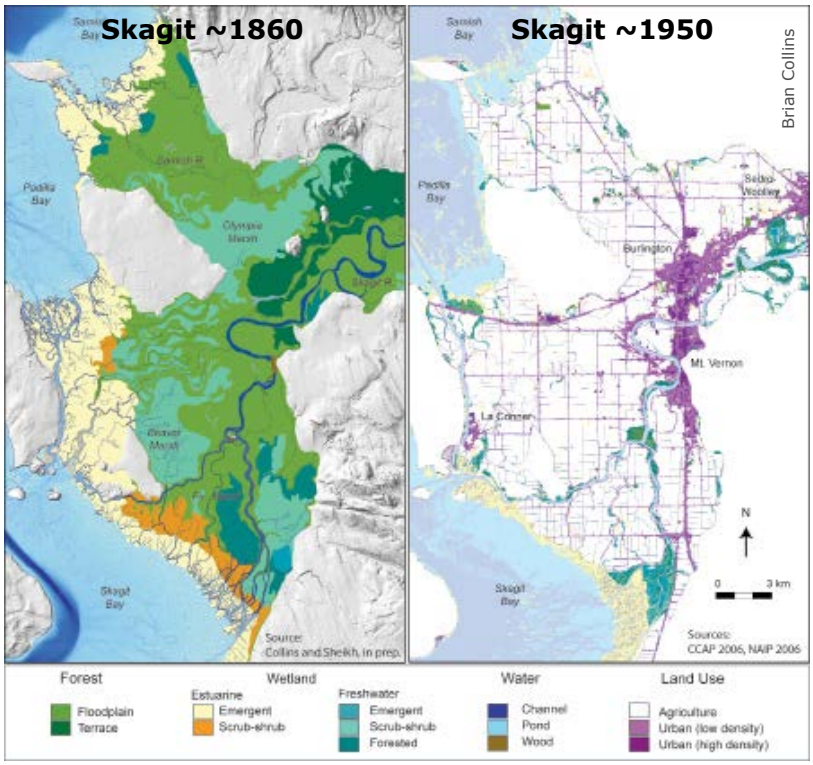
*The cumulative effects of filling in floodplains can be surprising. Losing just one percent of a basin's floodplains and wetlands can increase peak flows by almost eight percent.[13] Filling in floodplains displaces water storage capacity, compounding flood risk and destroying habitat.*

## Floodplain Development and Floods



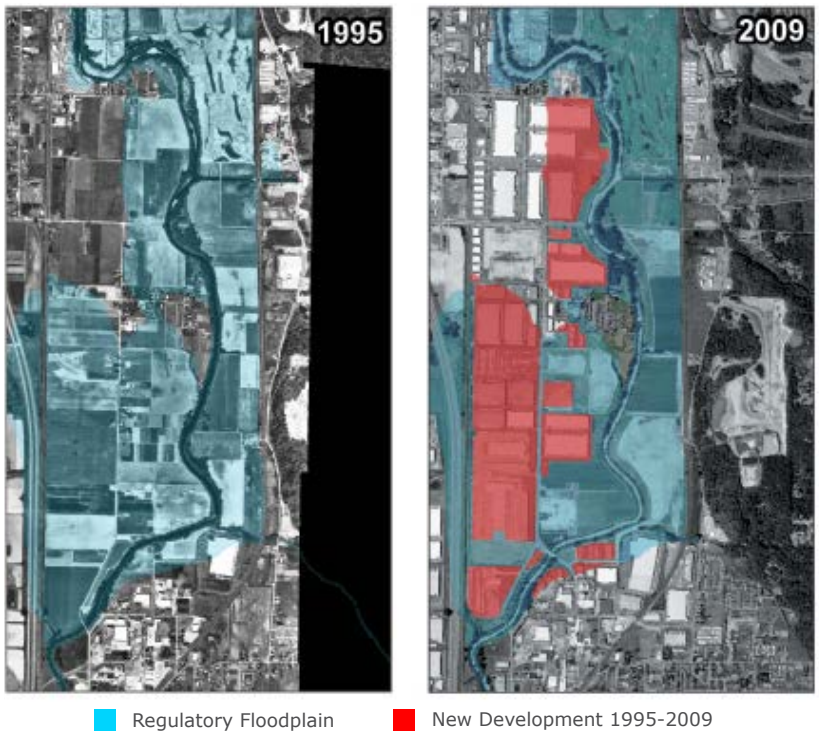

*Using county assessor data, we estimate 105,332 structures are located on parcels within FEMA's regulatory floodplain boundary. These structures at high risk of flood damage are valued at more than $28.7 billion. USGS river gauges show the number of times that a gauge recorded a crest above flood stage since 1900. During this period, river gauges have recorded crests above flood stage at least 1,497 times across western Washington. Sources: FEMA, USGS, WSDOT, County Assessor Offices; see also Map Data Sources, pg. 31.*

# A closer look at floodplain loss:




**Transformation of the Skagit: ~1860–~1950**

*The lower Skagit basin was once mostly floodplain and wetland, but by mid-1950, nearly all the freshwater wetlands that had once existed were diked, ditched, and drained and are no longer present.*[14]




**Floodplain Development along the White River**

*The conversion of floodplains from water-absorbing agriculture to impervious development is illustrated in these aerial photos comparing lands near the White River in 1995 and 2009. Areas shaded in blue are regulatory floodplain; areas shaded in red are impervious surfaces located in the regulatory floodplain. Sources: FEMA, UW RHP, WSDOT, USGS, NOAA.*

# Building in floodplains can be costly

**"Floods are 'acts of God,' but flood losses are largely acts of man."**

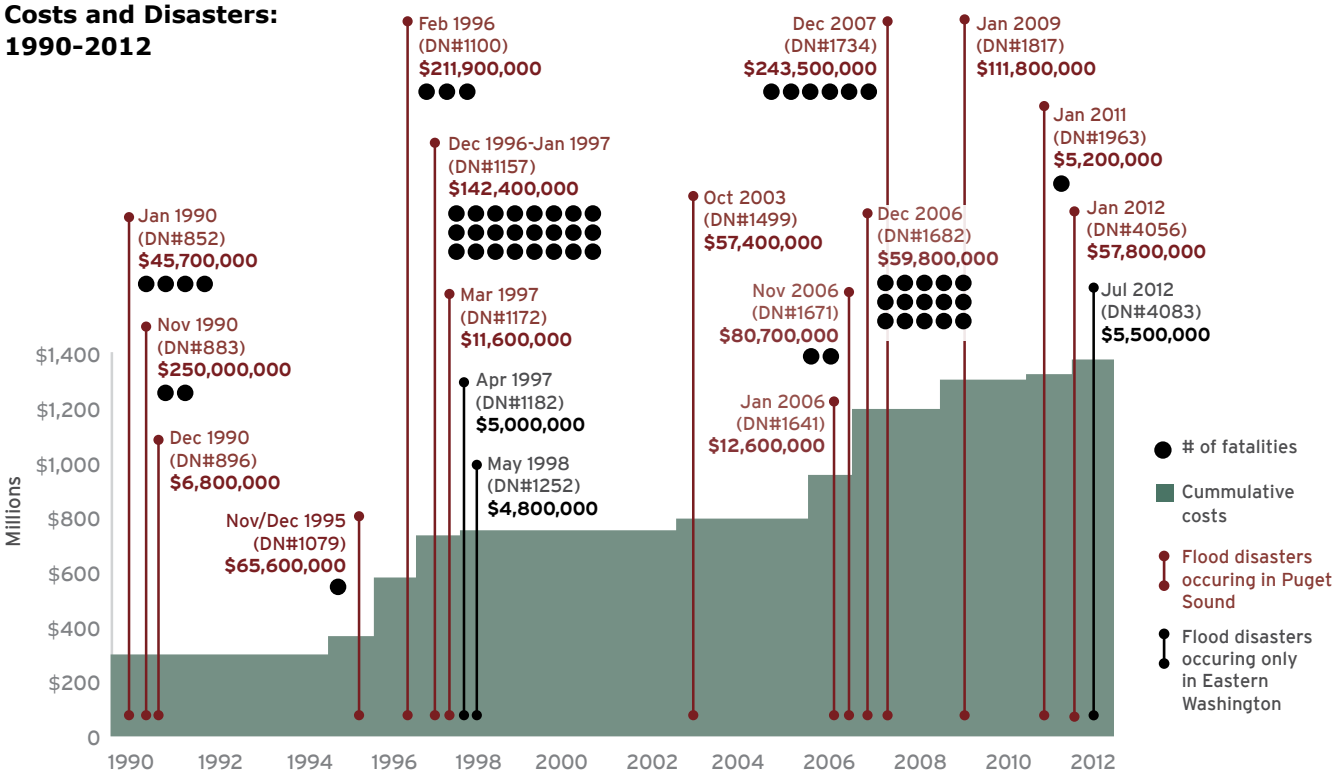
**– Gilbert F. White[15]**

The costs of development in floodplains are significant, and are borne by communities, businesses, individuals, farmers and our fish and wildlife. Insurance covers only a small part of the financial toll, and thus taxpayers, individuals, and businesses shoulder much of the financial burden of clean up and rebuilding after floods. Those who live far from flood prone areas also pay through taxes that support building and rebuilding in flood risk locations. Federal and state disaster funds often function as a subsidy that reduces financial risk, shielding people, communities and businesses from the true risks and costs of locating in flood-prone areas.

## Floods and Financial Costs

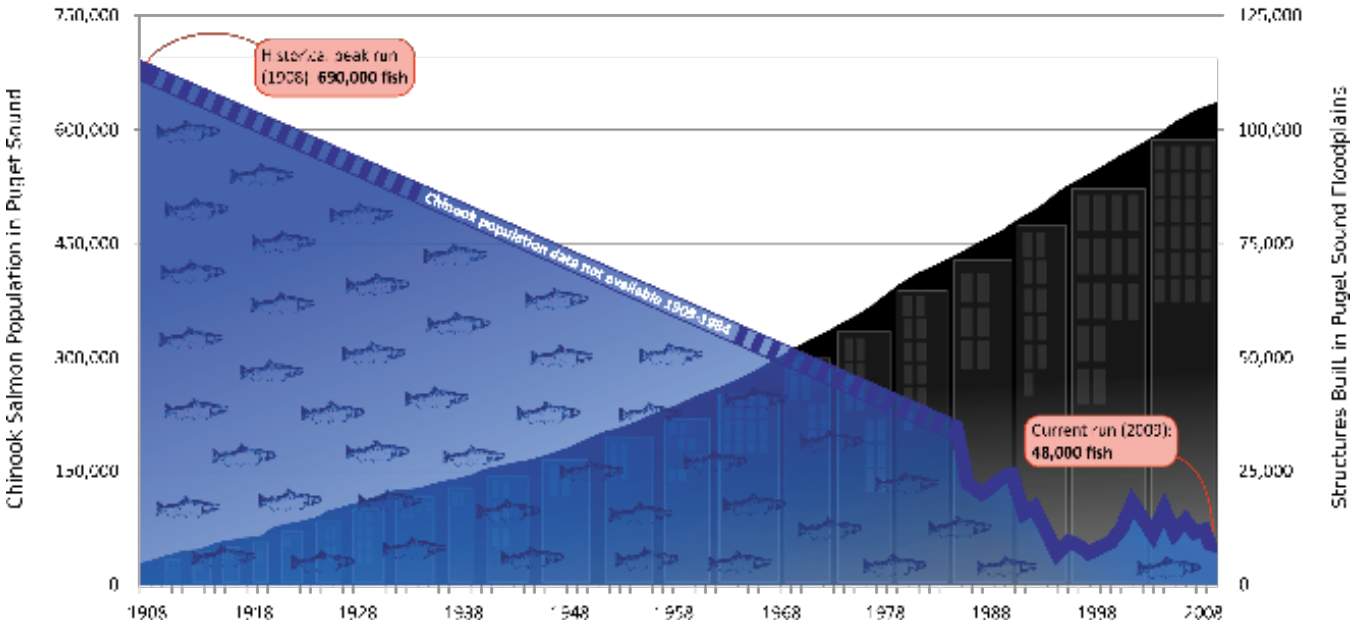
Puget Sound experiences a disproportionate share of flooding in the state. In the 22 years from 1990 to 2012, Puget Sound experienced 15 of the 18 presidentially declared flood disasters that struck Washington. On average, major floods ravaged Puget Sound counties every 1.5 years. During this

**Cumulative Flood Costs and Disasters: 1990-2012**




*Eighteen major flood disasters have cost the state more than $1.37 billion in damages during the 22 years between 1990 and 2012. Fifteen of these disasters have occurred in Puget Sound (shown in red). Data derives from state and federal disaster grant programs such as Public Assistance Grants, FEMA Individual and Households Program, and Small Business Administration loans. However, this is an underestimate of the true cost of flooding as it does not include flood insurance payments, unreported or unreimbursable costs of flood damage, and payments from most of the more than 40 disaster-related grant and loan programs provided by the federal government. Sources: FEMA; WA EMD; County reports.*

**Chinook Salmon Population & Floodplain Development in Puget Sound**




*Puget Sound Chinook salmon have declined 93% since 1908, while more than 105,000 structures were built in the regulatory floodplains of Western Washington.[16] Sources: NOAA; County assessors; FEMA.*

period, at least 58 people were killed due to floods and the state suffered more than $1.37 billion in flood damage. Yet this is a significant underestimate of the true costs of flooding. When the full range of impacts to the economic and transportation systems is tallied, the price goes even higher. The 2007 storm that closed Interstate 5 near Chehalis is estimated to cost $900 million for that single event.[17] And in 2009, another "Storm of the Century" closed I-5 for the second time in less than two years, leaving similarly costly destruction in its wake.

## Frequent Flooding

Flood events are more common than we might think. In Puget Sound, rivers have crested above flood stage more than 1,400 times since 1900. While most of these crests do not rise to the level of a presidentially declared disaster, they typically cause localized flood damage. Areas where floodplains have been lost or developed tend to be places where flooding is most costly.

## Ecological Costs

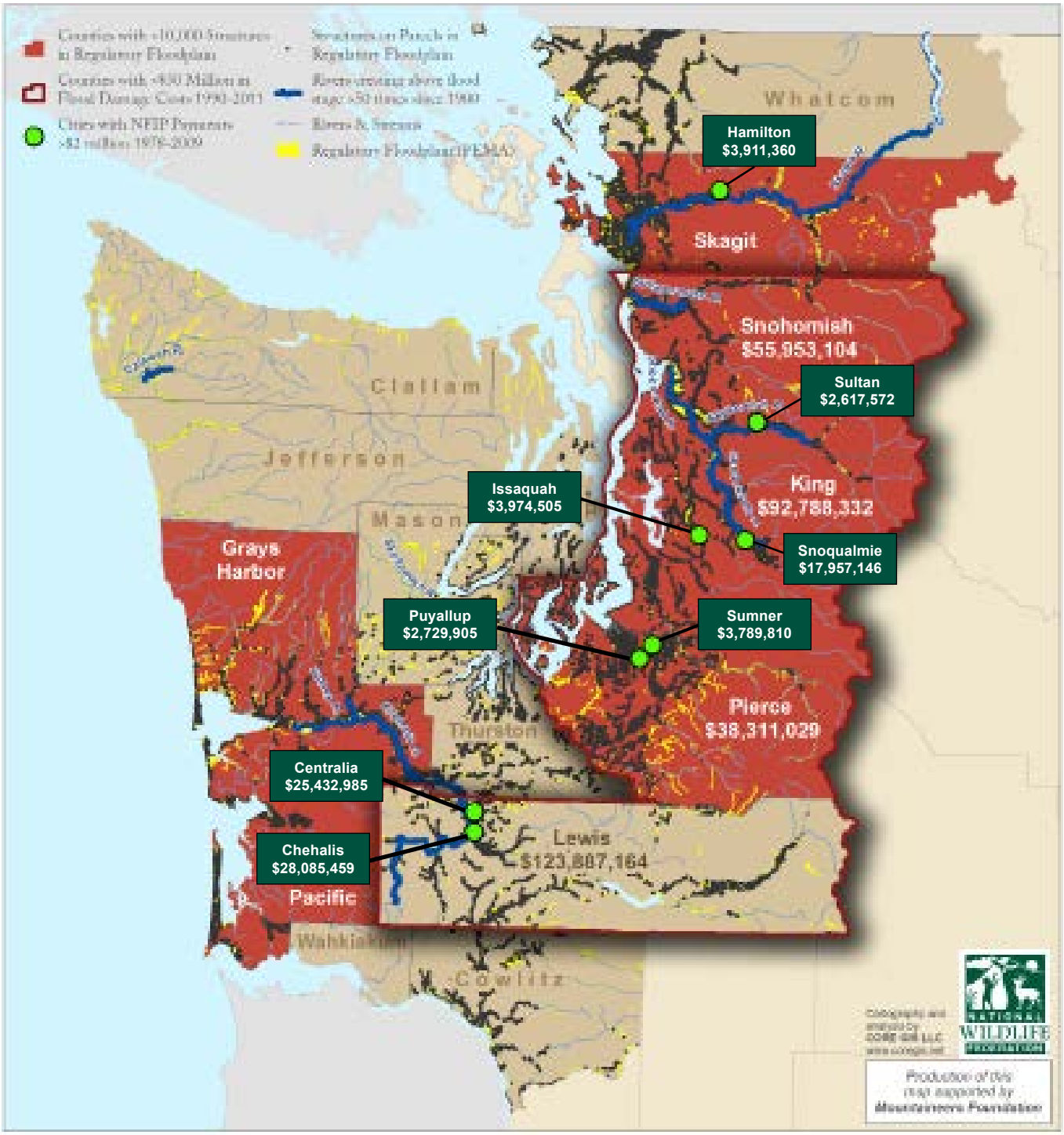
The costs for fish and wildlife are equally severe. Puget Sound once hosted 31 runs of Chinook salmon in its rivers. Over the past 100 years, 9 of those runs have gone extinct, leaving only 22 runs remaining.[18] Overall, wild Chinook salmon populations in Puget Sound have declined 93 percent[19] while development in floodplains has steadily grown. Similarly, the number of Puget Sound's orca whales have declined by more than half,[20] in part because they depend on declining Chinook salmon as their primary food source. These declines have led to federal protection for orca and many runs of salmon under the Endangered Species Act in an effort to improve their prospects for recovery. Loss of floodplain habitat is a key reason for these declines.

## The Price to Fix our Mistakes

The full cost of floodplain development is hidden in many places, including undoing the damage caused by past actions. From stormwater management and floodplain restoration to Puget Sound cleanup and salmon recovery, taxpayers are paying a hefty bill to fix our past mistakes:

- In Pierce County, the total bill for 20 years of work (1991-2011) to rebuild from floods and continually manage floodwaters in the county exceeds $155 million, including more than $27 million to buy out properties in floodplains that should never have been built.[21]
- In King County, more than $34 million was spent on projects to reduce flood risk between 1993 and 2006. The County estimates needing $335 million more for projects over the next 10 years to ensure public safety and to reduce flood risks.[22]
- And for Puget Sound protection and restoration, the public sector spends about $564 million per year. On top of this, taxpayers also pay an estimated $799 million for wastewater treatment and $646 million for mitigation in Puget Sound.[23]

# Floodplain Development and the Financial Cost of Flooding




*High flood damage costs and frequent river crests above flood stage largely overlap with high rates of development in floodplains. Snohomish, King and Pierce counties each have more than 10,000 structures built on properties located in the regulatory floodplain, and they each experienced more than $30 million in flood damage between 1990 and 2012. Lewis County experienced the highest flood damage costs at more than $123 million. Skagit, Pacific and Grays Harbor counties also have high rates of development in the regulatory floodplain. NFIP claim payments are shown in green boxes for cities whose residents received more than $2 million between 1978-2009. Sources: FEMA, USGS, WSDOT, County Assessor Offices, WA EMD, County reports; see also Map Data Sources, pg. 31.*

## Cost of a Major Flood in Pierce County: $725 Million

The cost of future floods is likely to grow due to increased infrastructure in flood prone areas and larger storms fueled by climate change. In Pierce County, a recent study estimates that the cost of a single major flood could top $725 million. The study estimated damage to 9,000 homes located in flood hazard areas, clean up and repair of three waste water treatment plants, transportation delays, recreation closures around Mt. Rainier, and loss of business and agricultural output. Thirty four percent of the county's regulatory floodplains are now developed by residential and commercial areas. Nearly $3 billion worth of homes and businesses are located in the regulatory floodplain.[24]

**Floods have cost our region more than $1.37 billion in damages**

To our knowledge, a similar calculation for all of Puget Sound's flood-prone assets does not exist. However, based on an assessment of county assessor records for a subset of counties in which data was accessible, more than 105,000 homes and buildings in Puget Sound are built on properties located in the regulatory floodplain. These structures, valued at more than $28.7 billion, are all at risk of damage in the event of a major flood event.[25]

## FLOOD COSTS BY THE NUMBERS

*Between 1990-2012:*

**15** flood disaster declarations in Puget Sound

**58** deaths during flood disasters

**$71 million** in repeat insurance claims

**900** cattle and farm animals drowned

**10** of the **15** flood disasters caused **levee damage, overtopping or failure**

**$125 million** in levee repairs

**4** times that Interstate 5 closed due to flooding

**$1.37 billion** in flood damage statewide

**833:** Homes damaged multiple times by floods since 1978

**105,332:** Total structures in Puget Sound regulatory floodplains

**$28.7 billion:** Value of structures at high risk of flood damage in Puget Sound

**36:** Total federally declared flood disasters in Washington State (through Dec 2012)

## A RUDE AWAKENING


It was 4 am on January 10, 2009 when Dave Berry and his family were woken by a knock. It was a neighbor telling them the levee protecting them from the Tolt River had failed and their home was now in jeopardy. Sure enough, within a few hours floodwater began to swirl onto their property, growing deeper by the moment. "If we'd stayed much longer, we wouldn't have gotten out," said Mr. Berry. The water became too deep for their car and they had to make a narrow escape in the truck of a neighbor's friend. "We handed him our daughter, who was still in her nightclothes, then we waded across waist-deep water to get in." The floodwaters were so strong that Berry's home was knocked off its foundation. Others suffered similar fates, and spent weeks afterwards cleaning the muck from their homes, searching for precious photos, toys, and keepsakes, and tossing destroyed belongings. While the Berry's had renters insurance, flood damage was probably not covered. Said Mr. Berry, "We got out safely. That's what matters most. But we'll never live by water again."[26]

# The NFIP has failed to protect floodplains...and us

Floodplains are largely managed through the National Flood Insurance Program (NFIP), which is run by FEMA. This little-known program has a big influence on development in riparian and flood-prone areas and along the shorelines of rivers, lakes and the coast. Fixing this program would go a long way toward protecting critical habitat for imperiled species and slowing the increasing risk from floods—not just in Puget Sound but throughout the nation.

**"Governments should stop subsidizing insurance in vulnerable areas...and thus stimulating development there. People need to be encouraged to migrate away from vulnerable areas, not into them."**

**– Economist Magazine, Nov 25th 2010**

The NFIP was created by Congress in 1968 with the express purpose of reducing flood risk and directing development away from flood-prone areas.[27] If the program lived up to those goals, people, communities and fish would all be better off. Unfortunately, the NFIP has failed to make us safer. Instead, the NFIP has fueled floodplain destruction by providing below-cost flood insurance and encouraging levee construction and the filling of floodplains to map areas out of the regulatory floodplain. It has actually subsidized new development that increases the risk of flooding and destroys fish and wildlife habitat. The result is more than 28,000 at risk homes built in Puget Sound's regulatory floodplains since 1970. Indeed, the NFIP has supported so much flood-prone development that in 2009 it was $19.3 billion in debt and incurring nearly $1 billion in interest payments annually.[28]

The NFIP is supposed to regulate development in the area subject to a one percent annual chance of flooding, often inaccurately called the "100 year flood."[29] While this may seem like a rare event, it actually has a one in four chance of occurring during the life of a 30-year mortgage. For comparison, the same structure has only a 1% probability of being damaged by fire in that same period of time. Many experts agree that limiting regulations to the "100 year flood" area is inadequate and that a higher level of protection is preferable, especially as climate change exacerbates flooding due to increasingly severe storms.[30] In urban areas, California now requires protection against the "200 year flood", or that with a 0.5% annual probability of occurrence.

### HOW THE NFIP WORKS

The NFIP is a voluntary program that provides federal flood insurance to property owners, residents and businesses in exchange for state and local government actions that reduce flood damage to new development. The program combines flood risk mapping, flood insurance and regulatory standards intended to reduce flood damage. In order for community members to buy federal flood insurance, their jurisdiction must qualify for the program by adopting floodplain management regulations that meet FEMA's minimum requirements. However, FEMA rarely penalizes communities that fail to enforce floodplain development restrictions. In fact, in Puget Sound no community has ever been suspended from the program.

**Probability of Flooding over Time**

| | Flood Size (Recurrence Interval) | | | |
|---|---|---|---|---|
| **Time Period** | **10-year** | **25-year** | **50-year** | **100-year** |
| **1 year** | 10% | 4% | 2% | 1% |
| **10 years** | 65% | 34% | 18% | 10% |
| **20 years** | 88% | 56% | 33% | 18% |
| **30 years** | 96% | 71% | 45% | 26% |
| **50 years** | 99% | 87% | 64% | 39% |

*The likelihood of being flooded grows over time. A "100-year flood" has a 1% chance of occurring each year, but has a 26% probability of occurring during the life of a 30 year mortgage. Smaller floods are even more likely to occur. A "25-year flood" has a 71% probability of occurring during that same 30 year period. These recurrence intervals do not factor in the effects of climate change, which will increase the size and frequency of floods in many areas of Puget Sound and make the risk even greater.*

## How has the NFIP failed us?

Here are a few of its many deficiencies:

- **FEMA's flood insurance maps are inaccurate:** Although FEMA is insuring against future floods, its floodplain delineations reflect an inaccurate and outdated past that does not incorporate future flood risk due to climate change. Many of FEMA's maps date from the 1970s, 1980s and 1990s and have not been updated to reflect current development or increased stormwater flows. For example, when Pierce County updated its maps in 2009, it found that the regulatory floodplain increased 54%.[31]
- **Subsidized insurance encourages floodplain development:** FEMA provides flood insurance below its actual cost, thereby masking the true price of living in a floodplain. For example, Skagit County property owners have received four times more in flood insurance claims than they have paid in NFIP premiums. Even more shocking, property owners in the town of Hamilton have received 60 times more in flood insurance claims than they have paid in premiums.[32]
- **FEMA fails to enforce its own requirements:** FEMA has allowed many communities to continue receiving NFIP insurance even though they should not qualify for it because of inadequate floodplain protections. In Puget Sound, a number of communities have received multiple warnings but have never been suspended from the program.
- **The NFIP supports rebuilding in flood-prone areas:** Many properties are flooded over and over again, and then rebuilt with NFIP funds. Repeatedly flooded properties represent a disproportionate share of NFIP claims—about 40% in one study.[33] In Puget Sound, more than 800 structures are on FEMA's repetitive loss list, meaning that they have been flooded at least twice in ten years. These properties should be candidates for buyouts and relocations, rather than rebuilding on the same flood prone parcel.

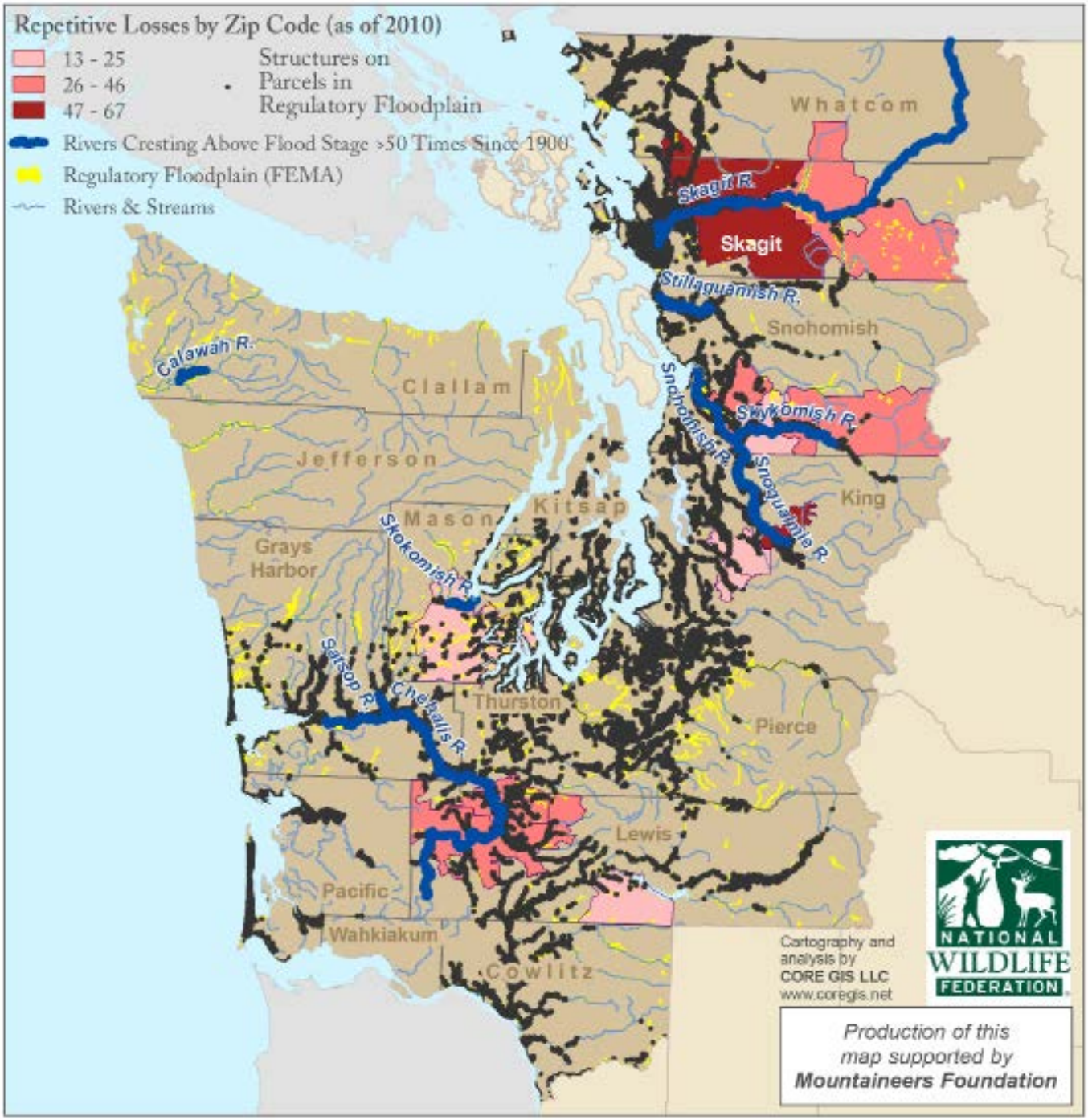
### Many of FEMA's Maps are Inaccurate

*This map shows a particularly egregious floodplain delineation, in which the river shown on this 2009 aerial photo flows outside the incorrectly mapped regulatory floodplain. This map depicts the Sauk River near Bryson Road.*



©PhotoDisc/Getty Images

## Repetitive Flood Damage Hot Spots




*Flood, rebuild, repeat. This map shows concentrations of repetitive loss properties along frequently flooding rivers, especially the Skagit, Snoqualmie, Skykomish, and Chehalis Rivers. FEMA identifies repetitive loss properties as those that have received two or more claim payments of more than $1,000 from the National Flood Insurance Program within any rolling 10-year period. Sources: FEMA, USGS, WSDOT, County Assessor Offices; see also Map Data Sources, pg. 31.*

# The NFIP is causing the extinction of Puget Sound salmon and orca

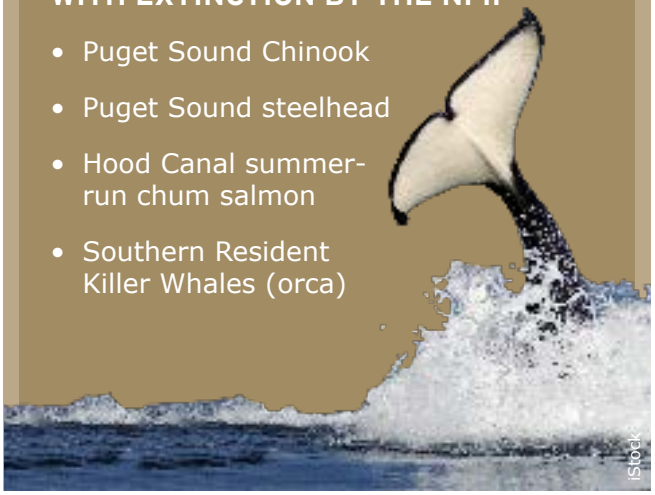
## The Biological Opinion

The NFIP is not only harming public safety, it is also causing the demise of iconic fish and wildlife in Puget Sound.[34]

In 2008, the National Marine Fisheries Service (NMFS) completed an exhaustive study of the NFIP's effects on federally protected salmon and orca.[35] As the federal agency responsible for protecting these species under the Endangered Species Act, NMFS determined that the NFIP is "likely to jeopardize the continued existence" of these species[36] (see box). In other words, if left unchanged, the NFIP allows land use actions that would eventually drive these species to extinction. NMFS's study, known as a Biological Opinion, emphasizes the importance of floodplain habitat for salmon rearing, foraging, refuge, migration, and spawning.

**PUGET SOUND SPECIES THREATENED WITH EXTINCTION BY THE NFIP[40]**

- Puget Sound Chinook
- Puget Sound steelhead
- Hood Canal summer-run chum salmon
- Southern Resident Killer Whales (orca)




**9 runs of Puget Sound Chinook have gone extinct[37]**

NMFS's study found that the flood insurance program actually promotes the destruction of floodplains, primarily by encouraging developers to map parcels out of the regulatory floodplain through the use of levees and fill that raises the land above the base flood elevation.[38] Once outside the regulatory floodplain, properties avoid floodplain regulations and the flood insurance purchase requirement. However, NMFS also found that this practice is extremely harmful and leads to constricted river channels, concentrated runoff, increased bank erosion, decreased water quality, disruption of essential ecological processes, loss or inaccessibility of habitat and more intense flooding.[39]

NMFS also found that FEMA does not prevent harm to federally protected critical habitat elements such as floodplains, the channel migration zone, riparian vegetation, river banks, or off-channel and in-stream habitat. The result is habitat destruction or degradation and reduced productivity and survival for salmon and steelhead.[41] Because Puget Sound orca rely on Chinook salmon as their primary prey species, they too face extinction from the NFIP. In short, the NFIP violates the Endangered Species Act and must be changed.

## Fixing the NFIP: What the Biological Opinion Requires

NMFS specified changes to the NFIP that would allow the program to continue operating without harming salmon or violating federal law. These common-sense changes not only


### CONFIRMED: SALMON AND HABITAT CONTINUE TO DECLINE

A federal 2010 status review confirms that for Puget Sound Chinook, "most populations have declined in abundance somewhat since the last status review in 2005, and trends since 1995 are mostly flat. Several of the risk factors identified [in 2005] are also still present, including…widespread loss and degradation of habitat".[42]


benefit salmon, they also reduce flood risk and enhance public safety. Required changes include:

- **Increase the accuracy of floodplain maps** and include future conditions such as anticipated development and changes in flood risk due to climate change.
- **Incorporate habitat protections into minimum floodplain regulations** that prevent further harm to imperiled species.
- **Alter the Community Rating System** to increase points for habitat protection and remove incentives for habitat destruction.[43]
- **Maintain vegetation on levees** to provide shade, reduce water velocities, and improve habitat quality.[44]

Thus far, FEMA has failed to satisfactorily change any of these components, and recent studies show that salmon habitat and salmon populations continue to decline.[45]

### Salmon Survival Improves in Floodplains


*This photo compares same-age salmon reared in river habitat (left) with salmon reared in floodplain habitat (right). The study found that salmon using floodplains have higher growth and survival rates, while salmon confined to the river channel must expend more energy, are subject to increased threats and have lower survival rates.*[46]

## STATE HABITAT PROTECTION PROGRAMS ARE INADEQUATE

The Biological Opinion highlights the inadequacy of current state and local policies designed to conserve habitat. The Shoreline Master Program, Critical Areas Ordinance (part of the Growth Management Act), and the Hydraulic Project Approval program are all supposed to prevent harm to critical salmon habitat. None of these are adequately protecting shorelines and habitat, as evidenced by continued development and armoring of shorelines, and continued decline of salmon habitat.


A primary problem is that state programs rely on a "no net loss" standard that allows harm to habitat as long as it is mitigated through restoration or other means. However, according to a Washington State Department of Ecology report, more than 50% of mitigation projects "fail to fully achieve their intended goals," and 20% of projects fail after only two years. Thus, a "no net loss" standard inevitably leads to a net loss, sometimes significantly so. As the report bluntly states, "We are not even close to achieving the goal of no net loss for wetlands and other aquatic habitats."[47]

# Climate change will make flooding worse

Flood disasters in Puget Sound are already a common occurrence. Climate change is making them worse.

Storms are becoming more intense primarily because warmer air holds more moisture and leads to heavier downpours. In addition, higher temperatures mean more precipitation is falling as rain rather than snow, and rising snow lines increase the size of the drainage basin, all of which leads to larger volumes of storm runoff and higher risk of floods.

**We can no longer afford to pretend that flooding is an uncommon occurrence**

Recent studies suggest that a temperature increase of less than 2° F causes a 100% increase in the annual top 10% of heavy precipitation events,[48] which are the storms that are most likely to cause damaging floods. In Puget Sound, average winter temperature has increased 2.7°F,[49] and the results are predictable.

A "50-year storm" in the 1960s and 70s now occurs every 8.4 years on average in Puget Sound.[50] Extreme precipitation events in Seattle increased 39% from 1949 to 2007, and three of Seattle's four highest one-day precipitation totals during this period occurred in the most recent five years.[51] Lewis County experienced "storms of the century" just 13 months apart in 2007 and 2009. Each storm shut down Interstate 5, inundated homes, businesses and farms and caused massive flood damage.

The New York Times

July 22, 2011

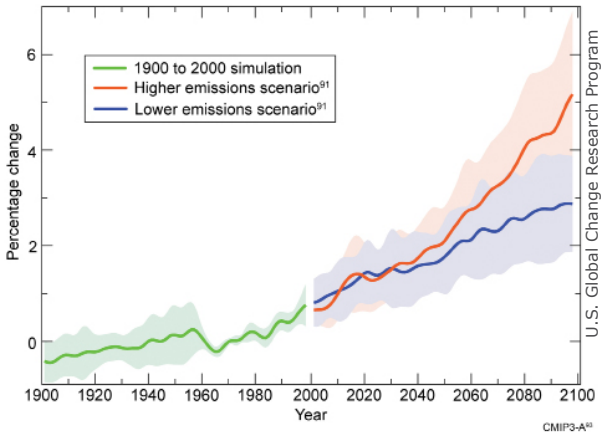
**Flood-Prone Land Likely to Increase by 45% -- a Major Challenge to Federal Insurance Program**

By EVAN LEHMANN of

CHICAGO -- A three-year study to determine the possible impacts of climate change on federal flood insurance will warn of huge increases to the amount of land that could be inundated by rising sea levels, heavier downpours and stormier coastlines.

The size of the nation's flood plains is expected to grow by 40 or 45 percent over the next 90 years, says the study, which is scheduled to be released later this summer.

**Extreme Storms are Becoming More Severe**




*This graph shows the observed and projected increase in the amount of precipitation falling in the largest 5% of daily storm events, which are the storms most likely to cause flooding. The shaded area shows the likely ranges while the lines show the central projections from a set of climate models. Changes are relative to the 1960-1979 average.*[52]

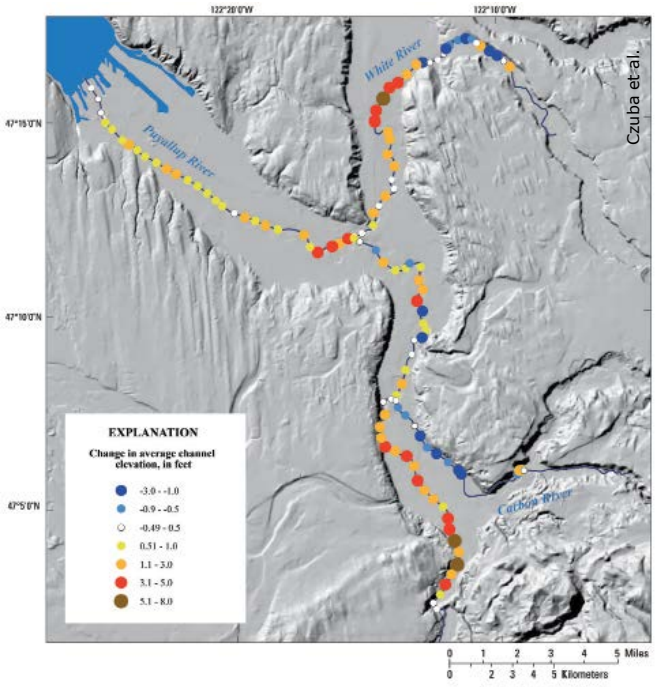
Most climate models project increasingly extreme storm events over the next century, causing a re-evaluation of flood risk. In the Skagit River, for example, flows are projected to grow 23% by the 2040s and 49% by the 2080s. As a result, scientists project that by the 2040s the historical 100-year event will occur every 22 years, and the historical 30-year event will occur every 7 years, on average.[53] UW's Climate Impacts Group projects that flood frequencies will increase in much of Puget Sound, southwest Washington, and low elevations east of the Cascades where basins are currently rain-dominated or transitioning from snow to rain dominated.[54]

In addition, melting glaciers are exposing unvegetated slopes, leading to increased rocks and sediment in rivers that actually raises the height of river beds and increases flooding.[55] Around Mount Rainier, the beds of the Puyallup and White Rivers have risen as much as 7.5 feet in some places, causing major flood problems, erosion, and channel migration risks.[56] These changes are at least partly attributed to the effects of climate change.[57]

## What was a "50-year storm" now occurs every 8.4 years

As flood frequencies increase along heavily populated river basins, our policies and settlement patterns must adapt. We can no longer afford to pretend that flooding is an uncommon occurrence. It is all too common in Puget Sound now, and climate change will make flooding even more common, more destructive, and more costly.

**River Beds are Rising**




*In Pierce County, river beds have risen as much as 7.5 feet in some places between 1984 and 2009.[58] Climate change is causing glaciers to retreat, releasing more sediment and leading to increased flooding.[59]*

### THE NEW NORMAL?

The January 2009 storm in Puget Sound is a prime example of how warming temperatures and extreme downpours in midwinter can cause heavy flooding. The region experienced record snowstorms the previous month followed by a strong, warm and wet atmospheric river (often dubbed "Pineapple Express") that set daily rainfall records. The combination of melting snowpack and heavy rain exacerbated flood damage, and the impacts were widespread: Twenty two western Washington rivers went above major flood stage and six hit near-record crests; the Snoqualmie River at Carnation hit a height of 61.5 feet—7.5 feet above flood stage and the highest level since records began in 1932; more than 30,000 people were asked to evacuate; Howard Hanson Dam on the Green River was damaged, requiring at least $40 million in repair costs; roads and rail service were closed and Interstate 5 was underwater and closed for the second time in two years. Total storm damages were estimated at $125 million.[60]

# Coastal flood risks are increasing

In October 2012, Superstorm Sandy flooded the east coast of the United States and underscored the destructive flood potential of extreme rain events and storm surge stacked on top of rising sea levels. Washington's coastal communities face similar risks.

Global sea levels have already risen about seven inches over the past 100 years[61] and recently the rate of sea level rise has begun to accelerate. Along the Washington and Oregon coasts, sea level is projected to rise as much as 9 inches more by 2030, and by 2100 sea levels could rise as much as 4.6 feet higher.[62]

The combined impacts of sea level rise and larger storms is causing increased risk of coastal flooding. For example, recent studies in the Skagit watershed highlight the projected change in flood dynamics caused by rising seas:

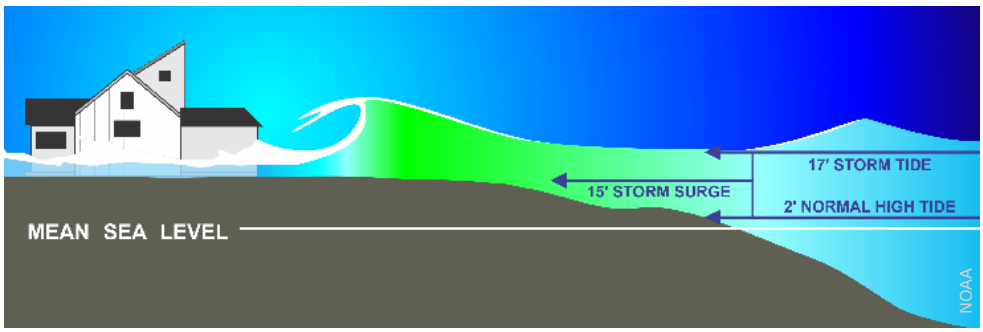
- By 2050, 12" of sea level rise is projected to turn today's 100-year storm surge into a 10-year event.
- By 2100, 24" sea level rise is projected to turn today's 100-yr storm surge into an annual event.[63]

When projected increases in flood magnitudes are combined with projected increases in sea level the area projected to be inundated by major flood events increased by 74%.[64]


*Erosion of beaches and bluffs is projected to accelerate due to sea level rise and increasingly powerful storms fueled by climate change. Many coastal structures will be no match for the power of the seas.*

Most coastal damage is caused by the convergence of large waves, storm surge, and high tides. Studies show an increase in the frequency and magnitude of extremely high coastal wave events and some climate models show the North Pacific storm track shifting northward and generating more damaging storms on Washington's outer coast. The projected net effect of these changes is coastline retreat of five, ten or more feet per year for beaches and dunes. Erosive coastal cliffs could retreat more than 100 feet by 2100.[65] The combined result of these impacts will be increased frequency and severity of coastal flooding, damage to communities and infrastructure, and loss of valuable fish, bird, and wildlife habitat.

### Higher Seas and Stronger Storms




*When storm surge and high tides are stacked on top of rising sea levels, coastal structures and inland areas are at higher risk of inundation.*

Coastal areas are considered floodplains, designated as "velocity zones" by FEMA because they are subject to powerful waves, storm surge, high wind and erosion. Because of the force of waves striking them, buildings in these areas are subject to greater hazards than buildings in other types of floodplains.

Along Puget Sound's coasts, approximately one-third of the shoreline is armored with seawalls, bulkheads and rip rap,[66] and as much as four miles of new armoring is added each year.[67] Much of this armoring protects thousands of single family homes along the coast, but it also severs the connection between nearshore

## WHAT WILL PEOPLE DO WHEN THE SEAS RISE?

A recent study combined physical models of coastal risk from climate change with behavioral studies from real estate markets and found that property owners will tend to invest heavily in defense mechanisms in the near term to protect their coastal homes as sea levels rise. But as flood risk increases, property values decline. Declines are especially abrupt after major storm events. Once property owners no longer believe that defensive expenditures are worthwhile, they abandon the property.[68]


ecosystems and former coastal floodplains that are so important for salmon, forage fish, shorebirds, and other wildlife. Although seawalls and other shore armoring can temporarily limit impacts from wave attack, they also prevent beaches and coastal habitats from migrating inland and will eventually be overtaken by rising sea levels. In many cases, natural ecosystems such as mudflats and marshes can decrease coastal flood risk by absorbing wave energy and floodwaters.


*Higher tides are inundating coastal communities and damaging infrastructure with increasing frequency.*

## COASTAL FLOODING IS BECOMING MORE COMMON

The effects of sea level rise are already being felt. For example, the City of Olympia is experiencing frequent coastal flooding because the land around southern Puget Sound is sinking, compounding the effects of rising sea levels. During extreme high tides, storm drains back up and send saltwater onto streets and inundate large areas of downtown. The city is now planning to defend itself from flooding under a 50 inch sea level rise scenario.[69]


*Historic district structures at 50″ sea-level rise*

# Levees provide a false sense of security

Flood protection provided by levees is not as dependable as most believe. Although levees typically reduce the frequency of flood events, they do not eliminate flood risk. When levees fail, as they sometimes do, high velocity floodwaters typically inundate large and unprepared areas, often causing catastrophic damage. Levees also encourage development behind the barrier, bringing more people into harm's way and causing greater damage when the levee fails.

Puget Sound has many aging levee systems that do not provide protection from the "100 year storm." Many were originally built to protect agricultural land, but now have homes and business located behind them. A recent state levee inventory found that 91% of levee miles in the state (627 miles) did not meet the federal requirements for FEMA accreditation, meaning they do not protect against the one percent chance flood.[70]

The cost of levees can be measured in numerous ways. Levees have failed or overtopped in 10 of the 15 major Puget Sound floods since 1990. More than 200 levee repair projects have been required during that period at a cost to taxpayers of more than $128 million.[71] In 2007, King County reported a backlog of $335 million worth of levee repairs and other flood control measures.[72] Some levees along the Puyallup River require expensive repairs on a nearly annual basis. In the city of Kent, proposed improvements to a 3-mile section of levee at Horseshoe Bend could cost as much as $40 million. When levees fail, the costs to unsuspecting homeowners is huge. They rarely have flood insurance and falsely believe they are protected.

The cost of levees is also reflected in the destruction of habitat and increased risk of flooding downstream. Levees typically pinch the river, sever connections to the floodplain and funnel the water faster downstream. As a result, the river and floodplain can no longer create side channels and off channel areas that are essential shelter and forage areas for juvenile salmon.[73] Levees are often lined with rocks (rip rap) that are inhospitable for salmon and are often devoid of trees and vegetation that cool the water through shade and provide key habitat.

The problem with levees is well described by NMFS in the NFIP Biological Opinion:

"If a levee is constructed to withstand a base flood and meets FEMA operation and maintenance standards, FEMA

**Levees and Salmon Habitat in Puget Sound**


*Levees line significant stretches of many salmon bearing rivers and streams in the Puget Sound region. Levees are shown in black. Levee data derives from Army Corps of Engineers.*[74]


*When levees fail, the results can be devastating. This photo shows a large section of levee washed out along the Cedar River during a 1990 flood.*

will 'map out' of the floodplain the areas protected by the levee. Therefore, the protected areas are not subject to the flood insurance purchase requirement or other NFIP criteria. Levees diminish floodplain storage of water during floods, and confine the river within a walled in channel, pushing the flooding farther downstream, and adding pressure to extend the levee. As a result, the river can no longer move across the floodplain and no longer support the natural processes of channel migration that create the side channels and off-channel areas that shelter juvenile salmon. Flood control efforts also often exacerbate flood hazards by encouraging human occupation of flood-prone areas. Once levees stop the annual high flows from reaching the floodplain, development typically spreads across the floodplain right up to the levee. Heavier flooding puts development at risk when the levees are overtopped or they fail."[75]


*Levees encourage construction in places that shouldn't be developed, in this case the Signature Point Apartments in the middle of an oxbow along the Green River in Kent. Photo taken November 9, 2006.*

**Levee Failures in Puget Sound 1990-2010**

*Levees have failed in 10 of the 15 federally declared disasters in Puget Sound between 1990 and 2012.*

| Date of Storm Event and FEMA Disaster Number (DN) | Location and Impact to Levees |
|---|---|
| **Jan 1990** DN 852 | Skookumchuck River: Dikes breached |
| **Nov. 1990** DN 883 | Snohomish County: Levee failure<br>Skagit County: Levees overtopped<br>Marshland: Major breaks in Dikes |
| **Dec 1995** DN 1079 | Snohomish River and French Slough: 1500 ft wide hole breached in levee |
| **Feb 1996** DN 1100 | Widespread levee damage throughout Puget Sound |
| **Mar 1997** DN 1172 | Snohomish County: Dikes Breached |
| **Oct 2003** DN 1499 | Clallam County: Dike failure |
| **Jan 2006** DN 1641 | Snohomish County: Levee Damage |
| **Nov 2006** DN 1671 | Snohomish River and French Slough: 30 ft wide hole breached in levee<br>Marshland: Levee Breached<br>Puyallup River: Dikes Broken<br>Green River: Levees Damaged |
| **Dec 2007** DN 1734 | Chehalis River: Levees breached and Dikes overtopped<br>Tahuya River, Mason County: Dike failure |
| **Jan 2009** DN 1817 | Tolt River: Levee Damaged and overtopped<br>Nooksack River: Multiple levees overtopped and damaged<br>Carbon River: Multiple levees damaged<br>Chehalis River: Extensive levee damage |

# Solutions to our floodplain problems

As we've seen, much of our region's floodplains and riparian habitat have been degraded or destroyed by development, roads, levees, and other human activities. The consequences of our current course are costly and include escalating flood damage, decreased water quality, and nearly extinct Puget Sound orca and salmon runs. Unless we change course, these consequences will only worsen as our population grows and climate change brings rising sea levels and increasingly severe storms.

Although floodplain destruction has been more than a hundred years in the making, we have the ability to reverse this trend. Fortunately, addressing these problems requires two basic steps:

## Step 1:

### Stop making the problems worse—stop harmful building in flood-prone areas

Preventing harmful and dangerous development in floodplains is the first step toward addressing our region's flooding and salmon habitat problems. This does not mean halting all development in floodplains, but it does require careful consideration of where development occurs, how it is designed, and what effects it has on flood risk and habitat.

### NEW STANDARDS FOR FLOODPLAIN PROTECTION

The NMFS Biological Opinion limits the effects new development can have on critical salmon habitat. According to the Biological Opinion, new development may not cause adverse affects in the area encompassing the:

- Floodway
- Channel Migration Area plus 50 feet
- Riparian Habitat Zone, which extends 150-250 feet from Ordinary High Water, depending on the stream or shore type.

The Biological Opinion limits adverse affects to Water quality; Water quantity; Flood volumes; Flood velocities; Spawning substrate; and Floodplain refugia for listed salmonids. If implemented, these restrictions should protect habitat and also slow the number of homes and businesses built in harm's way.

## Puget Sound Partnership Commits to Protecting Floodplains

The Puget Sound Partnership's Action Agenda highlights the vital role floodplains play in maintaining the health of Puget Sound. The Partnership's Leadership Council set two recovery targets for floodplains that it aims to achieve by 2020:


**15 percent of degraded floodplain areas are restored** or floodplain projects to achieve that outcome are underway across Puget Sound

**No additional loss of floodplain function** in any Puget Sound watershed relative to a 2011 baseline.[76]


*Flooding without consequences. This park provides recreation and accommodates floodwaters without threat to life or property.*

Rivers need room to flow—and to expand when necessary. Continuing to allow harmful floodplain development only serves to put more people in harm's way and intensifies flood risk for others.

The NMFS Biological Opinion provides a clear pathway to taking this step. It establishes parameters for preventing further harm to floodplains and critical salmon habitat. Adhering to the requirements in this document are a minimum step towards ensuring the viability of our threatened and endangered species and also making our communities safer from floods. Unfortunately, most communities in Puget Sound have not fully incorporated these new standards into their local codes. Many are still permitting harmful construction in floodplains that degrades habitat.[77]

## Step 2:

### Fix past mistakes by restoring damaged floodplains

Preventing additional harm to floodplains will not be enough to reduce catastrophic flood events and restore critical habitat. Our legacy of floodplain development has resulted in rising flood damage and the near demise of salmon and orca. More than 90% of our region's historical floodplains have been destroyed and most of the remaining floodplains are highly impaired. It is not surprising, then, that salmon and orca are near extinction and floods ravage our communities so frequently. As climate change causes storms to become increasingly severe, our landscape will need to enhance its capacity to absorb stormwater or risk even greater and more frequent flood damage.

#### FLOODPLAIN RESTORATION PAYS DIVIDENDS

$

Studies show that floodplain restoration is a fiscally wise investment. A major study on hazard mitigation found that flood mitigation efforts have a 4.8 to 1 benefit cost ratio, meaning every dollar spent on flood reduction efforts is estimated to save almost $5 in reduced disaster recovery spending and avoided damage.[78] This study included none of the ancillary ecosystem service benefits of floodplains, such as improved water quality, habitat for fish and wildlife.

Our previous attempts to "control" floodwaters are an outdated failure. We need a new approach if we hope to sustain our quality of life for the long term. We need an approach that accommodates floodwaters rather than attempting to control them. An approach that prefers natural systems and non-structural mechanisms over structural controls like levees and dikes. An approach that makes room for the river and works with it rather than against it. And an approach that integrates fish and wildlife habitat, ecosystem services, and natural processes along with floodwater management and public safety.

Not only must we stop harming floodplains, we must also start healing them.

There are many approaches to restoring floodplains. Key activities include:

## A. Buy out frequently flooded properties

Repetitive flood damage is an indication that structures are located in the wrong place, yet FEMA continues to support rebuilding homes and businesses flooded multiple times. Instead, funds should be used to buy out and remove structures from frequently flooded properties. These areas should then be restored to support natural floodplain functions such as storing floodwaters, filtering pollutants, and providing riparian habitat. This approach not only gets people out of harm's way, it also reduces flood risk for nearby properties by increasing floodwater storage and reducing flood flows. Rebuilding structures that have already been flooded multiple times is simply throwing money down the drain. Buying them out and restoring floodplains is an investment in reduced flood risk and increased public safety.

### Buyout of Cedar Grove Mobile Home Park

**Before:** Homes and Residents at Risk

**After:** Tenants Relocated and Structures Removed


Rainbow Bend, Cedar River

*Some municipalities are already buying out frequently flooded properties, but much more is needed. One example is the Cedar Grove Mobile Home Park in Maple Valley, which experienced significant damage in 1990 and again in 1995/96 when high riverflows overtopped a levee. The resulting floodwaters cut off access in and out of the park, caused septic system failure, contaminated the drinking water supply and damaged numerous homes. Rather than rebuilding and perpetuating the problem, King County acquired the 20.4-acre site from property owners at fair market value, assisted residents with relocation, and is restoring the natural floodplain functions.[79] The county is now preparing to remove the Rainbow Bend levee to reduce flood risks to SR-169 and the Cedar River Trail, restore natural floodplain functions, and improve habitat conditions.[80]*

## B. Move levees back or remove them

Levees can cause as much harm as they attempt to prevent. When levees are built close to the river, they constrict flows, eliminate floodplain storage, push flood risk downstream, and cut off access to side channels and off channel areas that provide valuable habitat for juvenile salmon. They also encourage development of flood prone areas behind the levee, exacerbating the risk from levee failure.

Levees that are adjacent to the river or that require repeated repair and maintenance are good candidates for setback or even removal. Removing levees in less urbanized areas reduces downstream flood risk while still allowing for flood-tolerant land uses such as agriculture, timber, recreation, and wildlife habitat. Moving levees away from the river is also a win-win strategy: it enhances public safety by increasing floodwater storage and it creates opportunities to re-establish floodplain functions that improve water quality and create fish and wildlife habitat, while still providing back up protection against floods. Setting levees back from the river banks provides room for the river to flow more naturally—and to flood as rivers will inevitably do—while still protecting structures against flood damage when necessary.

### Setting Back the Lower Tolt River Levee


*These photos illustrate the reclaimed floodplain area created by setting back a levee along the Lower Tolt River where it joins with the Snoqualmie River in Tolt-MacDonald Park. The $6.4 million project enhanced habitat for salmon and maintained flood protection for Carnation, while also improving recreational opportunities in the Park.*

## C. Restore damaged floodplains

In addition to the harm done by development and levees, many floodplain areas have been damaged by revetments, rip rap, agriculture, vegetation removal and other forms of human activity. Where these activities are abandoned or no longer needed, restoration could once again allow these areas to provide valuable flood reduction, water quality and habitat benefits.

Restoring floodplains is often as easy as removing barriers that prevent the river from accessing side channels and off channel areas. Over time, the natural ebb and flow of the river typically re-establishes floodplain functions. However, additional work can be done to hasten the re-emergence of valuable habitat features by creating side or off channel areas, planting native vegetation, removing invasive plants, installing large woody debris to slow water flow, and supporting the natural habitat-forming processes inherent in the system.[81]

**Restoring Puyallup River Floodplains**


*Pierce County is restoring 40 acres of floodplain by removing a rock wall revetment, creating side channels and meanders, removing invasive weeds, and planting native vegetation and trees to provide shade and stabilize the banks. They are also placing large root wads in the stream to create pools and riffles that shelter juvenile salmon. The project will reduce the risk of floods for neighboring properties and will provide habitat for salmon, deer, elk, beaver, amphibians and other wildlife.*[82]

## D. Prepare for relocation due to climate change

Many Puget Sound river basins are already experiencing increased flooding due to climate change. On the coasts, rising sea levels, higher waves, and stronger storms will also increase the frequency of inundation in many areas. However, few communities have planned and prepared to relocate structures once the location of current structures is no longer reasonably safe from floods. This is especially true for critical facilities such as hospitals, police and fire stations, schools, and nursing homes, but is also relevant for residences and businesses in any flood prone area. Once a devastating flood strikes, emergency funds pour in to rebuild. Without a relocation plan, communities tend to rebuild in the same unwise location, where the cycle is perpetuated. Instead, communities should plan for relocation so that when funding is made available, it can be wisely used to relocate structures out of harm's way.

**Prepare to Relocate Rather than Rebuild**


*Property owners and governments should identify safe relocation sites for structures in flood-prone areas so that disaster and flood mitigation funds can facilitate wise investments after flood disasters rather than rebuilding in places that are likely to be flooded again.*

# Implementing the Solutions

Identifying solutions to our region's flood problems is not difficult, but making the changes necessary to implement those solutions at the scale necessary to reverse our increasing flood trends has proved elusive. Indeed, the trend continues in the wrong direction: increasingly severe and costly floods, declining floodplain habitat, and more building in flood-prone areas.

Implementing floodplain solutions requires a long term vision that integrates flood safety, salmon recovery and economic vitality. It requires sufficient funding to design and implement projects. And it requires leadership among our elected officials. The unwise decisions of our predecessors have saddled us with huge and growing costs to recover from floods and maintain flood protection structures. We are already paying more than we realize to address past development in flood-prone lands. We must now invest in a new approach that acknowledges floods are natural and inevitable. We must learn to live with and accommodate increasingly larger floods. Rivers need room to flow, and we must re-create that room or the rivers will create it themselves, at increasing expense for flooded residents, communities and taxpayers.

The following recommendations are intended to create the conditions necessary to implement solutions to our region's flood problems.

## Recommendation: Fully implement the NFIP Biological Opinion.

The NFIP Biological Opinion defines the minimum requirements necessary to prevent further harm to floodplain habitat from new development. However, neither FEMA nor most Puget Sound communities have fully implemented it.

- FEMA must revise its implementation of the NFIP in Puget Sound to fully comply with the requirements of the Biological Opinion and the Endangered Species Act. This includes making flood insurance rate maps more accurate and incorporating future conditions such as climate change; Incorporating habitat protections into NFIP minimum criteria to prevent additional harm to salmon floodplain habitat; Altering the Community Rating System to increase points for habitat protection and remove incentives for habitat destruction; And addressing levee vegetation maintenance to encourage vegetation on levees that reduces water velocities and improves habitat quality.


WDFW


Brian Schultz

- Puget Sound jurisdictions should incorporate the requirements of the NFIP into their floodplain management and building codes. While most communities claim to be complying with the Biological Opinion, few have actually modified their codes and procedures to reflect the new requirements.

## Recommendation: Develop a regional plan that simultaneously addresses flooding and salmon recovery issues and also improves our economy.

Currently, restoration projects typically address either flood mitigation or salmon recovery, but they rarely integrate the two. However, in Puget Sound there are many opportunities to combine salmon recovery with flood hazard reduction through buyouts, levee removal or setbacks, and floodplain restoration. Unfortunately, most funding mechanisms are designed to support a single purpose, such as Stafford funding for hazard mitigation or grants disbursed through the Salmon Recovery Funding Board that focus on salmon restoration. To bridge this gap, the region should develop a plan that identifies high priority restoration sites for both flood risk reduction and salmon recovery and seek to combine funding sources to implement high value projects. Puget Sound Partnership, Ecology, Department of Fish & Wildlife, Emergency Management Division, tribes, and local governments should jointly lead this effort.

## Recommendation: The state should become more active in floodplain protection and restoration.

Currently, the state is largely absent, in part because the legislature has prevented Ecology from protecting floodplains beyond federal minimum standards. However, this forces local jurisdictions to shoulder the full responsibility for floodplain management, which often leads to inconsistent protections between jurisdictions, often pushing flood risk downstream that receiving communities are powerless to influence. The state should:

- Establish floodplain management standards beyond the NFIP minimums that protect salmon habitat and key ecological functions of floodplains. At a minimum, the state should protect floodplains to the level required by the NFIP Biological Opinion.
- Amend regulatory programs to make them consistent with the NFIP Biological Opinion, including the Shoreline Master Program, Growth Management Act, Critical Areas Ordinance, and the Hydraulic Project Approval (HPA) permit. Currently, state floodplain and shoreline protection programs apply a lesser standard than the Biological Opinion, which creates inconsistency and confusion for local jurisdictions and developers. Making these programs consistent with the Biological Opinion will create a single scientifically-based standard for floodplain and shoreline management and facilitate appropriate development at the local level.
- Stop funding inappropriate capital projects located in flood-prone areas. The legislature should require that state funded capital projects be located outside the regulatory floodplain except in limited circumstances. Projects located in flood prone areas have a high probability of being damaged by floods and thus requiring continued public expenditure.
- Comprehensively map the remaining natural floodplain, the channel migration zone and the full extent of floodplains identified for protection by the Biological Opinion. FEMA's Flood Insurance Rate Maps are for insurance purposes only. They do not reflect the functional or ecological floodplain and they do not map areas requiring protection by the NFIP Biological Opinion. The state should map floodplains separately from FEMA to identify and protect areas of importance to the state, including channel migration zones, riparian habitat areas, water filtration areas, groundwater recharge areas, and other valuable functions. When calculating floodplain extent, mapping should include climate considerations and the effects of future development.
- Compile and report annually on the extent and cost of flooding throughout the state. This information is essential if we are to understand the effects of flooding on communities, taxpayers and the economy and take appropriate corrective action.

iStock

## Recommendation: Increase funding for floodplain restoration

Limited funding is currently available to purchase frequently flooded properties, remove or set back levees, and restore floodplains. However, it is insufficient to address the backlog of projects already identified or to address the increasing flood risk due to climate change and floodplain development. Current funding sources for disaster response and flood mitigation often prioritize structural repair over natural approaches to reducing flood risk and do not take account of ecosystem service values when calculating the ratio of benefits to costs. To increase funding for floodplain restoration:

- Federal and state flood disaster and flood hazard mitigation funds should prioritize natural approaches to flood managements rather than prioritizing structural approaches such as levees and dams. Natural approaches include buyouts of frequently flooded properties, removing or setting back levees, relocating structures outside flood hazard areas, acquiring flood easements on agricultural or other safely flooded property, and restoring floodplains and wetlands to increase absorptive capacity.
- Benefit-cost assessments of flood mitigation projects should incorporate the full range of ecosystem service values that would be enhanced by the project. These often include improved water quality, groundwater recharge, stormwater management, and fish and wildlife habitat values.
- Single-purpose funding mechanisms for flood mitigation or salmon recovery should be made more flexible to allow some portion of these funds to support combined flood mitigation and salmon recovery projects. By doing so, worthy multi-benefit projects that do not score high enough on single purpose criteria could still be funded.

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## Map Data Sources

| County | Floodplain Data Type and Date | Development Data Source | Development Data Year |
|---|---|---|---|
| Whatcom | DFIRM, 2007 | Assessor | 2010 |
| Skagit | DFIRM, 2010 | Assessor | 2010 |
| Snohomish | DFIRM, 2006 | Assessor | 2010 |
| King | DFIRM, 2009 | Assessor | 2012 |
| Kitsap | DFIRM, 2009 | Assessor | 2012 |
| Pierce | DFIRM, 2007 | Assessor | 2010 |
| Mason | Q3, 2003 | Assessor | 2012 |
| Thurston | Q3, 2003 | Assessor | 2010 |
| Lewis | DFIRM, 2010 | Assessor | 2007 |
| Grays Harbor | Q3, 2003 | Assessor | 2010 |
| Pacific | Q3, 2003 | Assessor | 2010 |
| Cowlitz | Q3, 2003 | Assessor | 2010 |

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