# LIVING NEAR THE EDGE OF THE SALISH SEA

### NATIVE PLANTS, STORMWATER, EROSION, SLOPE STABILITY & YOU

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The following lecture is offered by Greenbelt Consulting to educate landowners & promote informed choices regarding rural site development, view clearing, stormwater management, landscaping practices, erosion control measures & slope stabilization efforts on marine shorelines & other erosion-prone areas of **Puget Sound & the Salish Sea** 



**ELLIOTT MENASHE** 

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1. Introduction • Nearshore Environments •	
Setting of Puget Sound & the Salish Sea •	
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3. Living on the Edge is Different.	
What is REALLY Important?(67-80	)
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Planting for Stormwater Management,	
Erosion Control & Slope Stability •	
Conclusion	<b>')</b>

(NOTE: live-links to sources of more detailed information about specific topics can be found throughout the lecture)

## **CHAPTER 1**

- INTRODUCTION

-SALISH SEA NEARSHORE ENVIRONMENTS

- PHYSICAL & CLIMATIC SETTING OF PUGET SOUND & THE SALISH SEA
- EROSION & LANDSLIDES
- LIVING ON THE EDGE IS RISKY

### **SLIDES 4-17**



**PUGET SOUND** is a complex bay & saltwater estuary fed by freshwater runoff from the Olympic Mountains & Cascade Range watersheds.

### Courtesy of DENISE DAHN Denise Dahn

**Puget Sound** is but a portion of a much larger system of intricate inland marine waterways known as **THE SALISH SEA** which is fed by numerous rivers and their surrounding watersheds in Washington and **British Columbia** 

Map courtesy of Stefan Freelan, 2009



http://maps.stefanfreelan.com/salishsea/

The place where land & water meet is known as

### **THE NEARSHORE**

SUBTIDAL

#### NEARSHORE

**RIPARIAN** 

Beach

INTERTIDAL

**GRAPHIC: MEGAN DETHIER, UW, FRIDAY HARBOR. LAB** 

## It is a place of constant change & transformation

### *THE NEARSHORE*

includes the estuarine delta & marine shoreline areas which extend from the top of coastal banks or bluffs to the marine waters at subtidal depths where sunlight can still penetrate (photic zone), allowing photosynthesis and plant growth (such as kelp & eelgrass) to occur.



http://www.coastalwiki.org/wiki/Coastal\_Hydrodynamics\_And\_Transport\_Processes

THE **NEARSHORE ENVIRONMENT** produces much of the food which fuels the rich & complex web of life in the Salish Sea

from coastal forests to kelp forests – it is all connected

GRAPHIC SOURCE: THE DAILY OLYMPIAN NEWSPAPER



### FORAGE FISH IN NEARSHORE KELP FORESTS

Adult surf smelt nearshore central Strait of Juan de Fuca 31 August 2019. Photo by Anne Shaffer and CWI. All rights reserved.

forage fish are a staple food for salmon, seabirds & marine mammals

PHOTO COURTESY OF ANNE SHAFFER, https://coastalwatershedinstitute.org

# PHYSICAL & CLIMATIC SETTING OF THE The landscape has been SALISH SEA REGION

(and continues to be) formed & influenced by: tectonic/volcanic activity mountain building •seismic events/tsunamis rapid climatic fluctuations •glacial advances & retreats crustal subsidence & post-glacial rebound sea-level variability post-glacial erosion



a young, wild, restless, and unruly landscape

## **EROSION & LANDSLIDES HAPPEN**

resulting from complex interdependent factors

**SUSCEPTIBILITY** (contributing factors) •geology/stratigraphy •topography/slope •soil type/depth slope hydrology •weather/climate landscape alteration slope modification •logging/roads •clearing/grading development

**TRIGGERS** (proximate causes) volcanic eruptions •earthquakes/blasting vibration •freeze/thaw altered hydrology •prolonged & intense rainfall increased soil moisture slope modifications

**CONTRIBUTING FACTORS ARE OFTEN CUMULATIVE** 

To learn about landslides contact:

The WA State Dept. of Natural Resources Landslide Hazard Program

# A Homeowner's Guide to Landslides

for Washington and Oregon



Washington Geological Survey

and

Oregon Department of Geology and Mineral Industries

https://file.dnr.wa.gov/publications/ger\_homeowners\_guide\_landslides.pdf

Request a copy of <u>A HOMEOWNER'S</u> <u>GUIDE TO</u> <u>LANDSLIDES</u> <u>FOR WA & OR</u>



LANDSLIDES ARE ONE OF THE MOST COMMON AND DEVASTATING NATURAL HAZARDS IN THE PACIFIC NORTHWEST. THE DAMAGE THEY CAUSE IS ALMOST NEVER COVERED BY INSURANCE.

# **EROSION & LANDSLIDES ARE A FACT OF LIFE Throughout The Puget Sound Region**

the landscape has been eroding since the last glacier receded



https://epod.usra.edu/blog/2020/12/puget-sound-feeder-bluff.html

# **Puget Sound shorelines, ravines & lakeshores can be risky places to live**



https://www.eopugetsound.org/magazine/armoring-bluffs

regardless of the risks, PEOPLE WANT TO LIVE ON THE EDGE

**MAGNOLIA DISTRICT, SEATTLE** 

so we build permanent structures in temporary locations

## poor development & management practices can make shorelines even MORE temporary

### **ADMIRALTY INLET**

### **CHAPTER 2**

- MAKING YOUR PROPERTY LESS TEMPORARY. IMPORTANCE OF VEGETATION MANAGEMENT
- HYDROLOGICAL, STRUCTURAL & ECOLOGICAL ROLE OF FORESTS, VEGETATION & OTHER ORGANIZMS
- BENEFITS OF VEGETATION IN REDUCING STORMWATER, EROSION & LANDSLIDES
- FROM OLD-GROWTH FORESTS TO TODAY'S SHORELINES
- ROLE & VALUE OF TREES ON SLOPES. ADAPTABILITY OF TREES. LIMITATIONS OF VEGETATION FOR SLOPE STABILIZATION

**SLIDES 18-66** 

# You can make your property <u>LESS TEMPORARY</u> by improving management

http://www.greenbeltconsulting.com/articles/preservingnative.html

LOPEZ IS., SAN JUAN CO.



<u>Vegetation Management</u> is a key aspect of good shoreline management

# WHY IS VEGETATION SO IMPORTANT?

Improving vegetation management can reduce the inherent risks & hazards of living on the edge



#### Vegetation Management: A Guide for Puget Sound Bluff Property Owners

https://www.shorelinewa.gov/home/showdocument?id=21782

This publication is available from the WA DEPT of ECOLOGY in both a print & on-line format



WRITTEN BY ELLIOTT MENASHE GREENBELT CONSULTING

## FORESTS PROTECT LAND & WATER IN THREE BASIC & CLOSELY INTERRELATED WAYS

Trees, shrubs, groundcovers & forest soils provide: **1. Hydrological Benefits** 2. Structural Soil Reinforcement **3. Ecological Benefits** 



http://www.greenbeltconsulting.com/articles/valuesbenefits.html

**1. Hydrological Benefits**  'METERS' THE RAINFALL **REDUCES SOIL** • SATURATION REDUCES **STORMWATER** REDUCES RUNOFF

MINIMIZES EROSION & LANDSLIDES PURIFIES GROUNDWATER



### THE MULTI-LAYER FOREST CANOPY IS VERY EFFECTIVE FOR INTERCEPTION & EVAPORATION OF RAINFALL



Organic forest soils hold water like a sponge. They also insulate top soils & protect underlying mineral soils from compaction & surface erosion



## FOREST SOIL IS MUCH MORE THAN JUST A SPONGE IT IS ALSO A COMPLEX BIOCHEMICAL SYSTEM WHICH MAINTAINS FOREST HEALTH & CLEAN WATER

### It's Alive!!

# mutualistic associations

Living organisms <5%

Stabilized organic matter (humus) 33% - 50% Decomposing organic matter (active fraction) 33% - 50%

FROM: Söderström B. & Read D.J. 1987

**ORGANIC SOIL COMPOSITION Elaine R. Ingham, OSU** 

Fresh

residue

<10%

## **MUTUALISTIC SOIL-PLANT ASSOCIATIONS**

a relationship where two or more organisms derive benefits from their association

SHORELINE FOREST, VANCOUVER ISLAND, BC

Mycorrhizae provide a beneficial mutualistic relationship between soil fungi & plant roots

fungal hyphae (tiny filaments) bring water & nutrients to roots

plants provide fungi with the products of photosynthesis (oxygen & sugar)



PLANT GROWTH

### **BENEFITS OF MUTUALISM BETWEEN PLANTS & SOIL**



http://pubs.cahnrs.wsu.edu/publications/wp-content/uploads/sites/2/publications/FS269E.pdf

### Native forest soil is a complex & fragile system which takes decades to develop



## MOSSES, LIVERWORTS & LICHENS



they form biological soil mantles which cement loose surface soil particles & resist surface erosion

https://pubs.usgs.gov/fs/2002/0154/fs15402.pdf

EPIPHYTES (mosses, lichens, ferns, etc. which grow on trees) THEY INTERCEPT AND HOLD RAIN WATER DURING HEAVY STORMS

*Epiphytes very seldom harm trees & often provide benefits* 

http://www.indefenseofplants.com/blog/2018/8/30/maples-epiphytes-and-canopy-roots

**BIGLEAF MAPLE** 

# 2. Structural Soil Reinforcement

- ORGANIC SOILS PREVENT EROSION OF MINERAL SOILS
- GROUNDCOVERS & SHRUB ROOTS HOLD SOIL PARTICLES
- SHRUB & TREE ROOTS
   ANCHOR SOIL BLOCKS
- ROOTS MAINTAIN SOIL
   STRUCTURE
- TREE ROOTS RESIST SHALLOW
   LANDSLIDES



**NATIVE GROUNDCOVERS & SHRUBS** protect soil surface. Fibrous roots hold erodible mineral soils & maintain porous soil structure.



### **PLANT ROOTS MAINTAIN SOIL STRUCTURE & POROSITY** (and porous soils hold more water than compacted soils)

Root

Picture: Pietola 2011 There is water between and within granules

Large, continuous pore



## A complex root network exposed by removal of forest trees, understory plants, organic and top soils in a University of Washington Forest Health Study

### Roots permeate and stabilize the soil

A 26 yr old Hemlock stand, Clallam Bay. photo courtesy of Dr. Bob Edmonds, UW, School of Forest Sciences
#### **COMPONENTS OF AN UPLAND TREE'S ROOT SYSTEM:** *Provides Effective Mechanical Reinforcement of Soils*



http://www.greenbeltconsulting.com/articles/treeandsoil.html

## THE ACTUAL DEPTH & EXTENT OF ROOTING DEPENDS UPON SOIL, GEOLOGY & HYDROLOGY





#### **PONDER THE WORLD BENEATH YOUR FEET**



**Giuseppe Licari "HUMUS" INSTALLATION, Rotterdam, Holland 2012** 

## 3. FORESTS PROVIDE NUMEROUS ECOLOGICAL BENEFITS TO TERRESTRIAL, AQUATIC, & MARINE NEARSHORE ENVIRONMENTS

INCLUDING: - Terrestrial detritus

- & nutrients to the marine waters
- Water quality improvement & pollution control
- Wildlife & fisheries habitat
- Shade for beaches
- Mutualistic relationships





"The intimate relationship between the forest and the sea is perhaps demonstrated better in the Puget Trough than in any other region of the United States. Although altered and under stress, both the terrestrial and marine environments are still extremely productive."

> Washington Department of Fish and Wildlife. from Ecoregions: Washington's Ecoregional Conservation Strategy (2005).

A RICHLY LINKED TERRESTRIAL & MARINE LANDSCAPE ECOLOGY HAS EVOLVED

**Species Dependent on <u>Puget Sound Marine</u> Environments** 170 + birds 200 + fish 3,000 + marine invert. 20+ marine mammals 9 + terrestrial mammals\* 6 + reptiles & amphibians (Gaydos and Pearson. 2011)

\* humans should, most emphatically, also be included in this list



http://amygulick.com/

**Old-Growth Forests** many layers <u>created</u> a redundant *"FAIL-SAFE"* system which reduced runoff & provided numerous ecological <u>benefits</u>

conifers (evergreens trees)

mid-canopy

snags

lower canopy

shrubs

epiphytes

upper forest canop

hardwoods

deciduous

trees)

mosses

nurse logs groundcovers <mark>forest floor & organic soils fung</mark>i

#### **THERE HAVE BEEN PROFOUND CHANGES IN SHORELINE FOREST COVER OVER THE PAST 200 YEARS**

from mature, stable, predominantly coniferous forest.....

to younger, more unstable, deciduous forest

Conifers are more efficient than deciduous trees during the winter

http://www.greenbeltconsulting.com/articles/asummaryof.html



#### young alder forest; indicative of de-stabilized bluffs



Old-growth Red Cedar stump 'dropping out' of eroding bluff

This change in forest cover has resulted in: reduced hydrologic benefits in winter Inferior rooting slope instability accelerated erosion rates adverse effects on terrestrial & *marine ecologies* 

Puget Sound Lowland bluffs are like a complex layer cake many strata *(layers of sediment)* have been deposited & deformed by past glaciations, water, volcanism & seismic upheaval

BEDROCK

CANIC ASH

**PSO** 

SOILS ON SLOPES ARE DIFFERENT THAN ON UPLANDS

## **TREES ON SLOPES & SHORELINE BLUFFS GROW DIFFERENTLY THAN UPLAND TREES**



**INFLUENCES:** • gravity •exposure • geologic conditions •slope hydrology • slope processes

FORT TOWNSEND ST. PARK, JEFFERESON COUNTY

#### **TYPICAL ROOTING HABIT OF TREES ON SLOPES**

#### UP-SLOPE ROOTS (long & <u>lateral</u>)

DOWN-SLOPE ROOTS (deep & <u>vertical</u>)

**LEDGEWOOD BEACH, WHIDBEY ISLAND** 

✓ <u>LATERAL</u> ROOTS HOLD SOIL & VEGETATION ✓ <u>VERTICAL</u> ROOTS ANCHOR TREES

note the influence of this single trees lateral roots on slope stability, soils & vegetation





*lateral roots may extend more than 50 ft. into the uplands, permeating & reinforcing soils and reducing the severity of erosion & landslides.* 

## TREES ARREST LANDSLIDES & HOLD SLIDE DEBRIS ON THE SLOPE

creating terraces & reducing landslide impacts

**LUMMI MARINE PARK, WHATCOM COUNTY** 

LARGE DRIFT LOGS AND FALLEN TREES ON THE BEACH BUTTRESS SLOPES

Trees shade beaches. Logs protect beaches from wave attack & erosion.

## natural bulkhead

SARATOGA PASSAGE, CAMANO ISLAND



#### **TREES ALSO ADAPT TO SITE DISTURBANCES**



it will often survive & adapt to changed conditions



On moderate-energy beaches, tree roots can resist wave attack & shore erosion

> The roots of this cedar are growing faster than the beach erodes

**DRAUGHTON HARBOR, WHATCOM CO.** 

## SHORELINE TREES ADAPT TO HARSH CONDITIONS

#### salt tolerance

**Bigleaf Maple** 

**CAMANO ISLAND** 

#### **SHORELINE TREES ADAPT TO SALT-LADEN WIND**

"GUARDIAN TREES" are deformed & sculpted by wind

Douglas Fir, Ebey's Bluff, Whidbey Island

## WIND-DEFLECTIVE "BARRIER" FOREST CANOPY Protects the leeward forest from wind effects

#### barrier forest

## protected timber stand (or home-site)

#### guardian trees



#### **SLOPE-STABILIZING EFFECTS OF TREE ROOTS**



## **STABILIZING EFFECTS OF TREE ROOTS** Dependent on Species, Soils, Geology, Hydrology & Slope

**Moderately Deep Soils** 

**Shallow Soils** 



Potential failure plane is reinforced by roots. Anchoring: High

Soil Cohesion: High

Adapted from Vegetation Influences on



Individual trees are stable without dependence on adjacent trees.

Anchoring: *High* Soil Cohesion: *High* 

Debris Slide Occurrences on Steep Slopes in Japan, Y. Tsukamota , et al. 1984

# STABILIZING EFFECTS OF TREE ROOTSShallow SoilsVery Deep Soils(Impermeable strata below)(Deep unstable soils)



Moderate if not compromised. Tends to become rapidly unstable when disturbed. Anchoring: Minor Soil Cohesion: High Reality of the second s

Unstable soils are deeper than rooting level.

Anchoring: Minor Soil Cohesion: Moderate

http://www.greenbeltconsulting.com/articles/treessoilgeo.html

#### **LIMITATIONS OF VEGETATION**

vegetation is unlikely to provide benefits

**MAXWELTON BEACH, WHIDBEY ISLAND** 

Where past mgmt has destabilized the slope

- Where the bluff is over-steepened
- On feeder bluffs
- Where there is deep-seated instability
- Where stormwater saturates bluff soils
- Sites with active erosion
- Where invasive plants have become dominant

WHEN SLOPES ARE PRONE TO DEEP-SEATED FAILURE

STRUCTURAL SOIL REINFORCEMENT BY TREE ROOTS WILL BE NEGLIGIBLE HYDROLOGICAL BENEFITS MAY STILL BE SIGNIFICANT



from A Modeling Platform for Landslide Stability; A Hydrological Approach; 2019



### - LIVING ON THE EDGE IS DIFFERENT

## - WHAT IS REALLY IMPORTANT?

**SLIDES 67-80** 

#### IT IS APPARENT THAT DIFFERENT RULES APPLY ON THE SHORE

#### LEDGEWOOD BEACH, ISLAND CO.





## VIEWS ARE IMPORTANT TO PEOPLE

NORTH CASCADES FROM CLINTON, ISLAND COUNTY

The cost of clearing for a great view may be too high

North of Bush Point, Whidbey Island

## **BEACH ACCESS IS IMPORTANT TO PEOPLE**

#### but beach stairs can cause landslides



#### explore low-impact alternatives\*

#### NOTE: NOT ALL SLOPES ARE \*thou SUITABLE FOR BEACH ACCESS togethe

\*though wiring extension ladders together may not be the best solution


http://www.shorefriendly.org/

THEY GIVE A FALSE SENSE OF SECURITY BUT DON'T ALWAYS PROVIDE PROTECTION OR PREVENT EROSION -- AND MAY BE UNNECESSARY

# LAWNS ARE IMPORTANT TO PEOPLE lawns can also cause <u>serious</u> problems





# soil saturation & high run-off

lawns over compacted soils contribute to soil saturation, stormwater run-off, erosion & landslides

**CHUCKANUT BAY, BELLINGHAM, WA** 

turf installed over graded, compacted & amended soils



**LANDSCAPING IS IMPORTANT TO PEOPLE** 

...but conventional landscape practices may not be appropriate or prudent when you live on the shoreline.

LANDSCAPING ON THE EDGE NEEDS TO BE DIFFERENT



You may need to curb your landscaper's enthusiasm

### **SLOPE VEGETATION IS IMPORTANT TO PEOPLE** (though they may not realize it)

DUGUALLA BAY, WHIDBEY ISLAND



#### SAFETY & SECURITY ARE IMPORTANT TO PEOPLE

subject to

shallow

landslides

Upland clearing often results in de-stabilized slopes

> inherently unstable slope

POOR DEVELOPMENT PRACTICES MAY HAVE PUT YOU IN HARM'S WAY

#### **CHAPTER 4**

- POOR DEVELOPMENT PRACTICES Creating Tomorrow's Crisis

- EFFECTS & IMPACTS OF POOR DEVELOPMENT

**SLIDES 81-97** 

# THIS IS WHAT POOR SITE DEVELOPMENT LOOKS LIKE

Hydrological & structural benefits of native forests are lost. Soils are compacted RESULTING IN STORMWATER RUNOFF

organic forest floor, groundcovers, understory plants, trees & roots are lost

**COUPEVILLE, WHIDBEY ISLAND** 





SOURCE: NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

# THIS IS WHAT EXCESSIVE STORMWATER RUNOFF LOOKS LIKE



## erosion & gullies

https://www.cwp.org/reducing-stormwater-runoff/

SOIL COMPACTION During Development further reduces the soil's water storage capacity & contributes to stormwater runoff



Undisturbed forest soil





**SQUEEZES THE SPONGE** 

#### SOIL COMPACTION & RUTTING CAN DESTROY SOIL **STRUCTURE & RESULT IN SOIL SATURATION**

#### **REDUCED SOIL VOLUME & REDUCED SOIL POROSITY CONTRIBUTE TO HIGHER RUNOFF**



Compaction



#### SITE DEVELOPMENT, WHATCOM CO.

### Soil Saturation saturated soils are heavier, less cohesive, more plastic, and more prone to slope failure

Sheet-flow runoff causes surface erosion

note rills & gullies from flowing water & silt

Soil saturation & stormwater runoff also result in increased flooding



https://ecology.wa.gov/Water-Shorelines/Puget-Sound/Issues-problems/Toxic-chemicals

A Health

# There is a lot at stake when you live on the edge .....or near it



# 30% runoff

# developed

- <mark>locjejec</mark>l

- <mark>cleared</mark>

graded
graded
soils are compacted
lawns installed
views cleared

# about 1% runoff

# undeveloped forested lot

POOR LAND DEVELOPMENT PRACTICES CONTRIBUTE TO STORMWATER EFFECTS, INCREASED EROSION & LANDSLIDES and costs the landowner time, money & peace of mind

http://www.greenbeltconsulting.com/articles/lowimpactdevelopment.html

### THE CUMULATIVE RESULTS OF POOR SITE DEVELOPMENT CAN BE UNFORTUNATE



This Iandslide could easily have been prevented

The forested bluff lot & slope were stable before it was developed

http://www.greenbeltconsulting.com/articles/howtopreventinjury.html

**HOOD CANAL, JEFFERSON COUNTY** 

**HUGH SHIPMAN PHOTO** 

**IF YOU LIVE** BELOW **A STEEP SLOPE PAY SPECIAL ATTENTION TO UP-SLOPE DEVELOPMENT** & MANAGEMENT

The impacts can be DISASTROUS to you **NEW HOME** 

note rills & gullies from runoff

**OLD CLINTON BEACH, WHIDBEY ISLAND** 

The less we alter & impair watershed hydrology during development

#### It pays to develop carefully!

the less we need to spend for stormwater management, erosion control & slope stabilization



#### - IMPROVING CONDITIONS -

- LEARN YOUR SITE
- IDENTIFY PROBLEMS
- **DOs & DON'Ts**
- IMPROVE STORMWATER MANAGEMENT
- IMPROVE VIEW & LANDSCAPE MANAGEMENT

#### **SLIDES 98-137**

# YOU'VE JUST BOUGHT A PREVIOUSLY DEVELOPED SHORELINE HOME, SO WHAT CAN YOU DO NOW?

THE FOREST IS GONE ONLY THE STUMPS REMAIN

Freeland, Whidbey Island

#### <u>Unique</u> <u>Site Characteristics</u>

- Topography
- Aspect
- Geology
- Soils
- Unconsolidated Fill?
- Hydrology
- Drainage Patterns
- Vegetation
- Shore Processes
- Signs of Erosion
- Slope instability
- Off-Site Influences

#### <u> 1<sup>st</sup> THING – KNOW YOUR SITE!</u> Evaluate your property



**DARLINGTON BEACH, SNOHOMISH CO.** 

# **READING THE LAND** landscape & vegetative indicators can be used for site assessment & evaluation

http://www.greenbeltconsulting.com/articles/readingtheland.html

old-growth cedar stump: INDICATES STABLE?

dense, mature alder: INDICATES OLD SLIDE?



vegetative & other indicators must be interpreted in context with other available site-characterization information

#### THE WA COASTAL ATLAS IS A GOOD SOURCE OF HELPFUL INFORMATION ABOUT YOUR SHORELINE



#### Make a coastal map

Map public beaches, biology, slope stability and more.

#### Go to coastal map

## THE MORE YOU LEARN ABOUT YOUR SITE, THE HAPPIER YOU WILL BE

and the better your future management choices will be

# Map Your Property's Landscape & Environmental Characteristics



Adapted from Kathy Settevendemie & Madeline Mazursk

# **IDENTIFY & ASSESS POTENTIAL PROBLEMS**

Upland - Slope - Shore stormwater? •impervious surfaces? site drainage? soil erosion? hydrology? slope instability? -fill failure? Iandslides? wave attack? •invasive plants? off-site influences?





#### **Deep-seated instability?**

#### Shallow landslides?



CLINTON, WHIDBEY ISLAND June 2003

January 2004

SAME SITE — 7 months later

Yes, it is a problem.

# SOME GENERAL MANAGEMENT TIPS TO MAKE YOUR PROPERTY LESS TEMPORARY

#### There are usually things you can do to improve conditions

**BURIEN, KING CO.**
# **PRESERVE & ENCOURAGE NATIVE VEGETATION AT BASE OF MARINE SLOPES**

**overhanging trees = shade & cool beaches** https://wdfw.wa.gov/fishing/management/marine-beach-spawning

backshore vegetation & drift logs provide habitat

CLINTON, WHIDBEY ISLAND PHOTO: SANDY MENASHE

# RETAIN TREES & OTHER NATIVE VEGETATION ON UPLANDS & SLOPES





carefully consider the effects of any tree removal

## FACTORS TO CONSIDER



#### Slope characteristics

- Geology & Stratigraphy
- Soils (Sand? Silt? Clay?)
- Hydrology (Seeps? Sheet-Flow? Runoff?)
- Nature of Erosion
  & Slope Failures
- Tree Species & Age
- Hazard Potential AND DON'T FORGET TO DETERMINE IF THE TREES ARE ON YOUR PROPERTY!



http://www.greenbeltconsulting.com/articles/treeremoval.html

UNNECCESSARY TREE CUTTING CAN CONTRIBUTE TO LANDSLIDES







#### DO NOT TRENCH FOR FRENCH DRAINS & UTILITIES WHERE THERE ARE LARGE TREES!

conventional trenching can seriously damage structural roots & increase tree hazards consider tunneling or directional drilling

# **BAD FOR TREES!** (bad for slope stability & **YOU**)



TOPPING TREES TO 'IMPROVE' VIEWS IMPAIRS ROOTING HOLMES HARBOR, WHIDBEY IS.



TOPPING TREES ON SLOPES REDUCES STABILITY



**CAUSES ROOT DIE-BACK** 

https://washingtondnr.wordpress.com/2011/03/07/trees-blocking-your-view-prune-instead-of-topping/

#### **TOPPING WILL NOT IMPROVE YOUR VIEW FOR LONG**







TOPPED DECIDUOUS TREE

**ONE YEAR LATER** 

#### **3 YEARS LATER**







**TOPPED CONIFER** 

2 YEARS LATER

**5 YEARS LATER** 

**COURTESY OF CASS TURNBULL** 

## **TOPPED THE PREVIOUS YEAR**

one year's growth

**Bigleaf Maple** 

# THE SAME VIEW 6 YEARS LATER

Bigleaf maple can put out up to 60 sprouts after being topped, which can grow10 feet per year

5 YO G



alternative pruning for conifers

# pruning broad-leaved

trees



remove no more than 20% of the live crown\*

don't prune again until the tree has recovered (between 3-6 years, depending on species & site)

**BURIEN, W** 

\*shrub species can be pruned more heavily

# A WELL-PRUNED TREE CAN ENHANCE VIEWS & HELP STABILIZE SLOPES

## think **BIG** Bonsai

FROM LUMMI ISLAND

photo: JOE ROCCHIO

Reputable arborists do not use climbing spikes when climbing & pruning live trees

#### NO climbing spikes



Tree work on the edge calls for special skills and care

JIM FOX, FOX'S TREE SERVICE, WHIDBEY IS.

Work with an arborist to improve the view use annotated 'view-scape' photos for clarity





# No trees No buffer No good

AVOID EXTENSIVE CLEARING & LAWNS TO THE EDGE OF YOUR BLUFF

This slope has become destabilized due to soil compaction & view clearing

LANGLEY, WHIDBEY ISLAND



#### **CONSTRUCTION & CLEARING DEBRIS & YARD WASTE CAN CONTRIBUTE TO SLOPE FAILURE**





how the results of our (OR THE PREVIOUS OWNER'S!) actions will affect us later

#### **IMPROVE DRAINAGE & LANDSCAPE MANAGEMENT**

reduce areas of bare soil

SHRINK YOUR LAWN control drainage

control invasive plants

REPLACE THE FUNCTIONS & VALUES OF NATIVE FORESTS LOST DURING DEVELOPMENT

#### PLANT BUFFERS

**RESTORE SLOPE VEGETATION &** IMPROVE VIEW MANAGEMENT

the cumulative benefits <u>will</u> help protect YOUR PROPERTY & PUGET SOUND

#### shrinking your lawn provides PASSIVE & FREE STORMWATER MGMT.



There are many ways to make a large lawn more 'shore friendly'

https://kingcounty.gov/services/environment/stewardship/nw-yard-and-garden/shrunk-lawn.aspx

# **ESTABLISH OR ENHANCE SHORE BUFFERS**

reduce

storm

water

run-off

Swordfern & Oregon grape

DINES POINT, WHIDBEY ISLAND

increase rainwater interception & evapotranspiration

OAK HARBOR, WHIDBEY ISLAND

Salal

# plant slopes when appropriate

#### **SARATOGA PASSAGE SLOPE RESTORATION**



# **POOR DRAINAGE CONTROL** cheap system components = false economy!





#### deteriorating drainpipe concentrates runoff

# Invest in a high-quality surface-water drainage pipe material like HDPE

diffuser

## High-Density Polyethylene (HDPE)

standard corrugated drain pipe

a poor investment in slope stability

Edmonds, Snohomish County



#### RAIN GARDENS ARE A GREAT IDEA BUT THEY ARE NOT ADVISED NEAR STEEP SLOPES OR SHORELINES

How does a rain garden work?

Infiltration is not a good idea near bluffs Native Plants Native plants are

Native plants are adapted to local conditions and are easy to maintain once established. Plus, they attract birds, butterflies and other pollinators.

#### Gutters & Down Spouts

Assist with directing rain water from your roof to your rain garden. Deep Roots

Plants with a deep root system encourage infiltration and help absorb nutrients.

Berm A berm holds water in the garden during heavy rains.

# AVOID PLACING UNCONSTRAINED BARK, MULCH, WOOD CHIPS, OR OTHER LOOSE MATERIAL ON SLOPES

The material tends to wash down-slope & cause problems

STRAW SHREDDED COMPOST STONES OR WOOD BARK PEBBLES CHIPS



#### **INVASIVE PLANTS**

- IDENTIFICATION

- MANAGEMENT

- CONTROL

**SLIDES 138-145** 

https://www.wnps.org/invasive-species

# CONTROL INVASIVE PLANTS!

# BAD NEWS For slopes!

English Ivy

Scot's Broom

Thistle

Butterfly Bush

Himalayan

Blackberry

INVASIVE PLANTS PROVIDE INFERIOR STORMWATER & EROSION CONTROL

#### Eradicating English ivy & other invasive plants can be difficult, complicated, & expensive

BE AWARE THAT more effective native vegetation can't be restored without controlling invasive plants. WORK WITH YOUR NEIGHBORS

**City of Shoreline, King County** 

# **KEEP CLIMBING VINES OFF THE TREES!** Wisteria **English Ivy Clematis**



# **BAMBOO:** A GROWING CONCERN

First year sleeps. Second year creeps. Third year LEAPS!



DON'T PLANT BAMBOO WITHIN 150 MILES OF A STEEP SLOPE



Vashon Island, King County, WA

300 species sold in the Pacific NW 'Running' varieties are fast-spreading Roots 18-24 inches deep can create <u>severe</u> problems for shoreline landowners. <u>BAMBOO ROOTS FORM</u> <u>AN IMPERVIOUS BARRIER</u>

Spreads by Rhizomes 18"-24" deep



#### they often include invasive plants & noxious weeds


# FOR INFORMATION ABOUT NOXIOUS PLANT IDENTIFICATION, MANAGEMENT & CONTROL

Noxious Weeds That Harm Washington State

Western Washington Field Guide



Washington State Noxious Weed Control Board www.nwcb.wa.gov There are many species of concern

# CONTACT YOUR LOCAL NOXIOUS WEED CONTROL BOARD

Washington State Noxious Weed Control Board

 Identification
 Education
 Technical assistance

### **CHAPTER 7**

#### **PLANTS & PLANTING**

- ZONAL LANDSCAPING APPROACH
- DESIGN CONSIDERATIONS FOR PUGET SOUND SHORELINE LANDSCAPES
- NATIVE SPECIES AS LANDSCAPE CHOICES
- SELECTION CRITERIA
- BIO-STRUCTURAL EROSION CONTROL & SLOPE STABILIZATION
- CONCLUSION

#### **SLIDES 146-177**

LINK TO RESOURCE POSTINGS - "LANDSCAPES ON THE EDGE"

https://botanicgardens.uw.edu/about/blog/2016/09/22/landscapes-on-the-edge

**CONSIDER A ZONAL LANDSCAPING APPROACH** 

Formal near house (lawn, ornamentals)

Transitional (natives & ornamentals)

"Wild" away from house (native plants)

> Slopes & Buffers (native plants)

wild S Lawn/formal PLANT BUFFERS PLANT SLOPES if practical\*

wild

transitional

\*planting slopes is not advised if there are severe active landslides

### **ADJUST YOUR AESTHETIC IN THE 'WILD' ZONE Don't Water or Mow Your Entire Lawn in Summer**

# Why is grass taller here? THIS AREA IS DESIGNATED A **GROW ZONE**

WE ALLOW GRASS AND NATURAL VEGETATION TO GROW TO: \* Increase habitat for insects and wildlife \* Save energy and reduce CO<sub>2</sub> emissions by not using mowers and equipment \* Promote sustainable landscapes \* Encourage native plant growth

**REDUCE HYDROLOGIC LOADING OF BLUFF STRATA** 

#### LEARN TO EMBRACE THE APPARENT 'SLOPPINESS' & 'DISORDER' OF NATURAL LANDSCAPES



#### **RETAIN SNAGS AND NURSE LOGS IN THE 'WILD' ZONE**

### snags are wildlife apartment buildings

**SNAGS** 

Nurse logs contribute to organic soil-building processes & control runoff

time-release fertilizer

**NURSE LOGS** 

**DON'T RAKE LEAVES IN THE "WILD" ZONE** 

decomposing "leaf litter" (leaves, twigs, bark, etc.) provides numerous ecological benefits

Protects soil
Resists runoff
Prevents erosion
Fertilizes soil
Nutrient return
Provides habitat
Natural mulch

ADJUST YOUR AESTHETIC

# LEAVES ARE NOT LITTER

THEY 'RE FOOD AND SHELTER FOR BUTTERFLIES, BEETLES, BEES, MOTHS, AND MORE. TELL FRIENDS AND NEIGHBORS TO JUST

**#LEAVETHELEAVES** 



#### **LEARN TO LOVE THEM.....tolerate them?**





# Suit landscape design & plantings to fit existing site conditions





#### **ORCAS ISLAND**

#### **TO PROTECT SHORELINE HOMES FROM SURFACE** WATER RUNOFF, EROSION & LANDSLIDES

### LANDSCAPING SHOULD PROVIDE

# 1. Hydrological Benefits

- 2. Mechanical Soil Reinforcement
- 3. Ecological Benefits



http://www.greenbeltconsulting.com/articles/restoringnative.html

# **PUGET LOWLANDS ECOZONE**

#### adjacent ecozones have different characteristics

Clallam Bay

Hon Queets

Bumptulips

Raymond

A rich & *complex* mosaic of native plant communities have developed over the past *6,000* + years

**Biological Resources Division of the US Geological Survey (BRD-USGS) 1996** 

North Ben

# What is a "Native Plant"?

A plant which occurs naturally in a region, eco-zone, or habitat without direct or indirect human influence.
A species which evolved over time with the other plants in its biotic community.



# A species which has not been genetically altered.



WHEN PLANTS ARE GENETICALLY ALTERED (such as varieties, hybrids & cultivars) they are grown for specific selected characteristics such as new floral color, leaf shape or color, enhanced fragrance, form, or other traits......

However, they may lose important shoreline survival characteristics in the process, such as drought tolerance, resistance to salt-spray, cold-hardiness, adaptability, and rooting strength. https://www.nwf.org/Garden-for-Wildlife/about/native-plants

## USE <u>NATIVE</u> PLANTS IN YOUR LANDSCAPING WHENEVER & WHEREVER POSSIBLE

https://www.wnps.org/native-gardening

LANGLEY, WHIDBEY ISLAND

 Better stormwater & erosion control
 More drought-hardy than ornamentals
 Resistant to climate change
 Requires less water & pesticides than lawns or ornamentals

Why not create a regionally distinctive landscape style?

# There are hundreds of very 'ornamental' native species in the Puget Lowlands





#### Nootka Rose







#### Huckleberry



# SOME NATIVE GROUNDCOVERS FOR SHORELINE BUFFERS

- SWORDFERN
- LOW OREGON GRAPE
- SALAL
- TRAILING BLACKBERRY

Swordfern

Trailing Blackberry

Salal

Oregon Grape



Consider native mosses as a landscape alternative to grass & lawns in moist shady areas

https://www.arthurleej.com/a-mosses.html

# SOME NATIVE SHRUBS FOR LANDSCAPING, EROSION CONTROL & SLOPE STABILIZATION

- Red Flowering Currant
- Mock Orange
- Indian Plum
- Native Roses (3 species)
- Western Serviceberry
- Black Twinberry
- Pacific Ninebark
- Common Snowberry
- California Wax Myrtle
- Tall Oregon Grape
- Oceanspray
- Red Osier Dogwood
- Beaked Hazel



# **NATIVE TREES**

- Douglas Fir \*
- Pacific Madrone \*
- Shore Pine \*
- Sitka Spruce \*
- Western White Pine
- Grand Fir
- Western Hemlock
- Western Red Cedar \*
- Bigleaf Maple
- Cascara \*
- Garry Oak \*
- Red Alder
- **Bitter Cherry** SMALL TREES:
- Vine Maple \*
- Douglas Maple \*
- Scouler Willow \*

\* BEST FOR SLOPE STABILIZATION (all species are useful for shoreline restoration)



**DOUGLAS SQUIRREL & DOUGLAS FIR** 

# **PLANT SELECTION CONSIDERATIONS**

- native to area
- appropriate to site
- ( sun-shade, soils, hydrology & drainage requirements)
- mature size of plant
- favorable spread & reproductive capability
- erosion-control value
- superior root architecture & high tensile strength
- drought tolerance (once established)



# FOR EROSION CONTROL & SLOPE STABILIZATION PROJECTS PLANT IN NATIVE SOILS

Amended soils or mulch, nutrient-rich potting soil,

- manure, etc. will:
- Constrain rooting
- Discourage deep rooting.
- Necessitate more frequent watering.
- Reduce drought tolerance of plants.



# PLANT FOR MULTIPLE CANOPY LAYERS

#### GOOD FOR EROSION CONTROL & SLOPE STABILITY

### tree crown layer

## **GOOD FOR WILDLIFE**

# tall shrub layer

## GOOD FOR YOU!

groundcovers

forest floor layer

**GOOD FOR WATER QUALITY** (and marine life!)

### **THERE ARE MANY RESOURCES AVAILABLE**



SECOND EDITION, REVISED AND ENLARGED

## Gardening with Native Plants

OF THE PACIFIC NORTHWEST



Arthur R. Kruckeberg

#### Encyclopedia of **Northwest Native Plants** for Gardens and Landscapes

KATHLEEN A. ROBSON, ALICE RICHTER, & MARIANNE FILBERT

MISC0273

**Grow Your Own** Native Landscape Written & Edited by Michael Leigh

A Guide to Identifying, Propagating & Landscaping with Western Washington





Native Plants

**By Michael Leigh Published by WSU Extension** 

WASHINGTON STATE UNIVERSITY



#### **THERE ARE SEVERAL USEFUL & INFORMATIVE WEBSITES**

Washington

**Native Plant Society** 



APPRECIATE, CONSERVE AND STUDY OUR NATIVE PLANTS AND HABITATS

#### Native Plants for Western Washington Gardens and Restoration Projects

Home > Native Plants for Western Washington Gardens and Restoration Projects



Providing Washington citizens with tips about using native plants has long been a role of WNPS. The interactive native plant herbarium that follows will help you find native plants suitable for a place in your western Washington garden or restoration project. Over 200 species of native plants are covered in the lists below.

The <u>Starflower Foundation</u> whose mission was to assist with the creation, rehabilitation and stewardship of Pacific Northwest native

plant communities developed these plant lists as part of the Starflower Image Herbarium. Additional information was compiled by WNPS Native Plant Steward Marcia Rivers Smith.



President Charles Star Star

#### **EDUCATION, GUIDANCE & INCENTIVES PROGRAMS ARE READILY AVAILABLE THOUGHOUT PUGET SOUND**

**Your Marine Waterfront** 

WA DEPT of FISH & WILDLIFE

A guide to protecting your property

while promoting healthy shorelines

#### 

#### GREEN SHORES FOR HOMES







Marine Shoreline Design Guidelines



#### Guide for Shoreline Living WSU EXTENSION



## *Keep in mind that replacing the lost functions of vegetation takes <u>time</u> to become effective*



RED-FLOWERING CURRANT & TALL OREGON GRAPE The good news is that vegetation becomes <u>more</u> effective over time (unlike conventional engineered structures)



so plan ahead, <u>BEFORE</u> problems occur!

#### **BE PROACTIVE!**

An ounce of prevention is worth a ton of concrete, steel, rock & \$\$\$

> DON'T WAIT UNTIL IT IS TOO LATE

## But when it IS too late to employ simple planting to avoid erosion and slope instability

## **CONSIDER A "BIO-STRUCTURAL" APPROACH**

WOODWAY PROJECT, SNOHOMISH CO.

**PHOTO: CHRISTINE TASSEFF** 

# **BIO-STRUCTURAL EROSION CONTROL** & SLOPE STABILIZATION APPROACH

provides an effective long-term, integrated solution

"the <u>intentional</u> use of <u>desirable</u> native plant species as an <u>integral</u> component in engineering applications, projects and structures"

https://fourthcornernurseries.com/bio-structural-erosion-control/

# WHY ARE BIO-STRUCTURAL METHODS DESIRABLE IN GEOTECHNICAL ENGINEERING?

 plants provide additional: ✓ water runoff management ✓ pollution abatement ✓ sediment control ✓ erosion control ✓ shallow landslide resistance provide many other ecosystem services





FROM: <u>Valuing Puget Sound's Valued Ecosystem Components</u>, 2007. Technical Report 2007-07. Thomas M. Leschine, A. W. Petersen, UW YOU CAN PROTECT YOUR PROPERTY & HELP PRESERVE THE HEALTH OF PUGET SOUND THROUGH IMPROVED MANAGEMENT



COMMENTS ABOUT THIS PROGRAM CAN BE DIRECTED TO

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visit our website at: www.greenbeltconsulting.com

**PACIFIC NINEBARK**