Preserving Native Vegetation to Reduce Stormwater Impacts

INTRODUCTION

This paper focuses on the value of vegetation in reducing stormwater impacts on rural lands undergoing development. Preserving native plant communities protects the hydrologic functions of watersheds and provides a wide array of other valuable benefits. Preserving vegetation on construction sites is a cost-effective alternative to wholesale clearing and subsequent need for mitigation and engineered hydrologic control measurers. Incorporating vegetation retention efforts in site development planning is a crucial element in reducing the cumulative adverse impacts of urbanization.

An understanding of the impacts of past land use on current environmental conditions is necessary to guide efforts to preserve ecological functions and minimize future development impacts.

A SHORT HISTORY OF THE PACIFIC NORTHWEST:

Primary plant succession began after the retreat of the most recent glaciation (about 15,000 years ago) and developed into the dynamic climax forested community that awed early explorers and sustained indigenous native tribes.

Human influences were relatively minimal until the mid-1800s when large-scale logging of old-growth forests began. Subsequent clearing, grading, settlement and farming, roadbuilding, introductions of exotic plants, surface water modifications, and other activities had a dramatic cumulative effect on the landscape. Original forested complexes, which had effectively maintained the stability of slopes, minimized surface water runoff, and reduced erosion, were severely fragmented or gone by the 1930s in the Puget Sound region.

Resultant increases in surface erosion, slope failures, and sedimentation were generally ignored. Despite these environmental impacts, a new balance between plants, land, and water occurred and interrupted forest succession resumed, resulting in the second growth forests and brush fields we see today. By the 1960s the second-growth forests were being logged and increased settlement and development was occurring.

PART OF THE PROBLEM: URBANIZATION

Over the last several decades, the extent of urban and suburban incursions into timberlands has been substantial. Each year, thousands of acres of prime forest are lost. While timber harvest activities adversely influence watershed functions, the effects are relatively short term compared to the impacts of conversion and urbanization. Processes impaired by responsible logging eventually recover as new forests develop. The changes associated with development are more significant and permanent. The rate of conversion of forestland to developed uses is accelerating.

The impacts of watershed urbanization have been accelerating as well. They include increased stormwater runoff, accelerated erosion, sedimentation, degraded water supplies, and severe disturbance of aquatic and marine systems. The recent listing of several salmonid species under the Endangered Species Act has focused attention on the causes and impacts of watershed degradation in urban and urbanizing areas. Efforts to reduce adverse impacts and minimize their causes in urban areas are made problematic by complex socio-economic and political factors. Meanwhile, in rural areas, we are creating tomorrow's crisis today by continued high-impact development practices. Critical area buffers are inadequate. Wetlands, streams, estuaries, and marine waters continue to be degraded as conversion logging and development proceed.

PART OF THE SOLUTION: EDUCATION

Preserving effective native vegetation complexes is a simple, effective, and easily implemented measure that can be employed immediately at any scale. Educating landowners, equipment operators, contractors, builders, landscape architects, and others should be a high priority. Education relating to the benefits of low impact development practices can be implemented independently of other efforts.

WHY PRESERVE NATIVE VEGETATION?

Vegetation protects soil from erosion and reduces surface water runoff in many ways (see figure 1, Effects of Vegetation in Minimizing Erosion). Live plant foliage and forest litter reduce the impact of rainfall and increase the absorptive capacity of the soil. Stormwater is held onsite and released slowly. Groundcovers intercept and slow rainfall and their roots hold soil particles in place. Groundcovers reduce runoff velocity and filter out suspended soil particles during storms. Shrub and tree roots, especially fibrous feeder roots, provide a restraining web that increases soil cohesion and stabilizes soil. Tree anchoring roots often penetrate deeply into soil blocks, increasing soil shear strength and resisting shallow mass soil movement. Roots also promote soil porosity and permeability. Evapotranspiration by plants reduces soil moisture and delays the onset of saturation and runoff. Native plant communities represent a complex interrelated biotic association of plants, animals, and microorganisms which have adapted to our region's ecological conditions over thousands of years. The ability of these plant communities to provide "passive" watershed protection is phenomenal. Vegetated watersheds exhibit lower peak flows, lower total discharge volumes, and increased lag-time between rainfall and runoff than do watersheds with a high percentage of forest cover removal and impervious surfaces. (See figure 2, Impacts of Urbanization on Stream Flow).

Vegetation also provides wildlife habitat, sight and sound screening, recreational opportunities and

FIGURE 1. EFFECTS OF VEGETATION IN MINIMIZING EROSION (MENASHE, 1993)

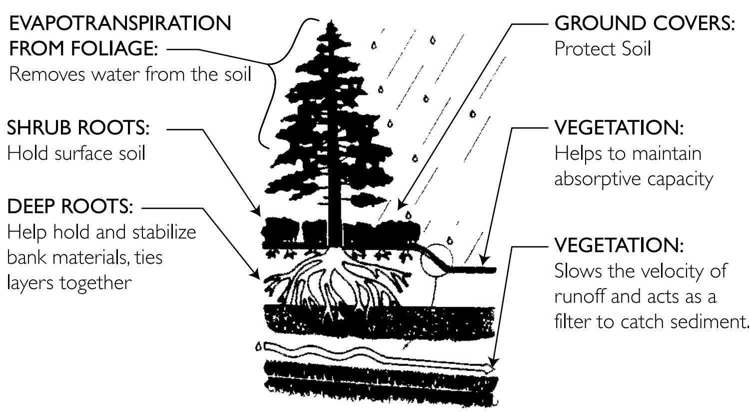
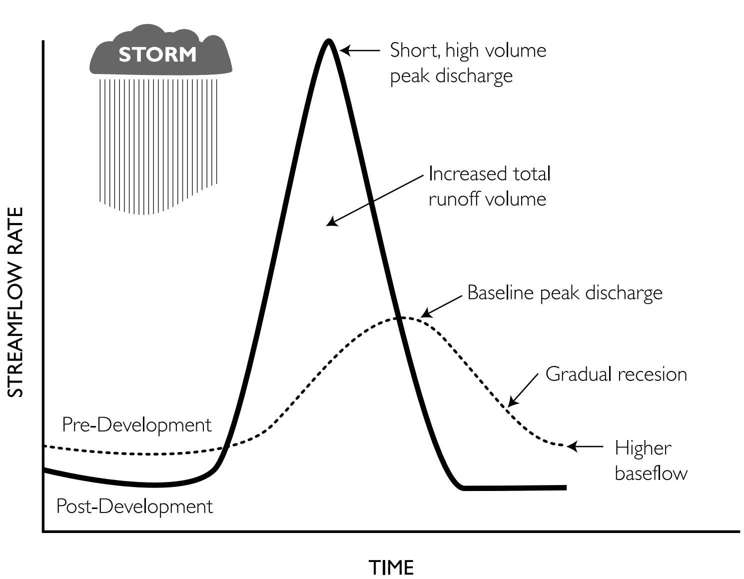


FIGURE 2. IMPACTS OF URBANIZATION ON STREAMFLOW (SCHUELER, 1987)



aesthetic amenities. Site development, landscaping and maintenance costs are lower when vegetation is preserved. Reduction in slash and burnpile volumes contributes to improved air quality and minimized disposal costs.

WHAT VEGETATION IS MOST EFFECTIVE?

The most effective plant communities are multi-age forested assemblages which have a high structural and species diversity. High value sites include those with a wide variety of evergreen and deciduous trees, shrubs and groundcovers. Absence of invasive exotic plants is a plus. The presence of large downed wood is a valuable asset. Valuable understory species include swordfern, salal, evergreen and red huckleberry and Oregon grape.

The least effective plant communities are characterized by minimal structural and species diversity and a high incidence of invasive exotic plants, such as Himalayan blackberry, English ivy, Japanese Knotweed, and Scot's broom. Not all native vegetation provides effective erosion control. Forest lands dominated by red alder and stinging nettle are often indicative of degraded sites and provide few hydrologic benefits.

It is important to "read the land" and at least qualitatively assess the value of the vegetation present. Previous management and land use history often determines what is growing where. Obvious signs of past or recent clearing, grading, soil compaction, and erosion usually indicates a degraded site that may have reduced value in preservation efforts.

Physical characteristics of the site will also dictate what plants are present and the extent of potential runoff problems. Soil, geology, slope, aspect, topography, site hydrology and off-site influences are important factors to evaluate when assessing the value of vegetation's influence on stormwater management.

HOW TO PRESERVE VEGETATION?

Each site is different and offers unique challenges and opportunities for preservation efforts. It is critical to evaluate the site with preservation in mind during the planning stage. Identify high-value natural areas. Locate buildings, roads and infrastructure to avoid impacting valuable areas. During site development, retain healthy, windfirm trees. Fence or otherwise limit entry into preservation areas during construction. Salvage valuable native plants and nurse logs from areas to be cleared. Avoid grade changes near large, well-established trees. Reduce hydrologic modifications. Reduce impervious surfaces and lawn areas. Prohibit dumping of concrete washout and other chemicals on the site.

CONCLUSION:

Extensive clearing and grading are common practices associated with urbanizing areas. Replacement of existing naturally vegetated areas with impervious and semi-impervious surfaces increases stormwater runoff and adversely impacts developing watersheds in a variety of ways. The hidden environmental and economic costs to society of this on-going process of watershed degradation are poorly understood by the general public. Conventional "best management practices" (BMPs) and engineered hydrologic controls are ineffective in mitigating development influences. They are, at best, only a tool in mitigating adverse watershed impacts. They are not a solution.

Preservation of naturally vegetated areas can be a "passive" stormwater management tool that effectively reduces cumulative watershed function deterioration while providing other benefits and amenities.

SELECTED REFERENCES

- Booth, D., 2000. Forest Cover, Impervious-Surface Area, and the Mitigation of Urbanization Impacts in King County, WA. Prepared for: King Co. Water and Land Resources Division, Seattle, WA.
- Burroughs, T. and Weller, C. 1996. Linking Land Use and Water Quality: How Development and Stormwater Runoff Affect Our Streams, Rivers, Bays, and Lakes. Prepared for: 1000 Friends of Washington, Seattle, WA.
- Dissmeyer, G. E., and G. R. Foster. 1981. Estimating the Cover – Management (C) in the Universal Soil Loss Equation for Forest Conditions. Journal of Soil and Water Conservation. 36(4):235-240.
- EPA, Office of Water 1997. Urbanization and Streams: Studies of Hydrologic Impacts. Publication 841-R-97-009. Washington, DC.
- Franklin, J. F. and Dyrness, C. T. 1973. Natural Vegetation of Oregon and Washington. GTE-PNW-8. PNW Research Station, USDA, Forest Service, Portland, OR.
- Kittredge, J. 1948/1973. Forest Influences: The Effects of Woody Vegetation on Climate, Water, and Soil, With Applications to the Conservation of Water and the Control of Floods and Erosion. Dover Publications, New York.
- Maclean, C.D., and Bolsinger, C.L. 1997. Urban Expansion in the Forests of the Puget Sound Region. Resource Bulletin PNW – RB – 225. USDA, P.N.W. Research Station, USDA. Forest Service, Portland, OR.
- Meehan, W. R., editor. 1991. Influence of Forest and Rangeland Management on Salmonid Fishes and Their Habitat. American Fisheries Society Special Publication 19. Bethesda, Maryland.
- Menashe, E., 1992. Protecting Riparian Area Values on Rural lands Undergoing Development. Prepared for: WA. Sate Dept. of Ecology Workshop Series, Streambank Protection Using Vegetation, Olympia, WA.
- Menashe, E., 1993. Breaking New Ground: A Landowner Guide to Rural Development. Unpublished draft manuscript.
- Menashe, E. 1993. Vegetation Management: A Guide for Puget Sound Bluff Property Owners. Shorelands Program, WA. Dept. of Ecology, Olympia, DOE Pub. 93-31.
- Menashe, E. 1998. Vegetation and Erosion: A literature Survey. In: Proceedings of the Native Plants Symposium, Oregon State University, Forestry Sciences Lab., Corvallis, OR. 1998 Dec. 9-10: 130-135.
- Reid, L. M. 1993. Research and Cumulative Watershed Effects. G.T.R. PSW-GTE-141. P.S.W. Research Station, U.S.D.A. Forest Service, Albany, California.
- Schueler, T., 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMP's. Metropolitan Washington Council of Governments, Washington, DC.
- Sidle, R. C., et al. 1985. Hillslope Stability and Land Use. Water Resources Monograph No. 11, American Geophysical Union, Washington, D. C.
- WA. State Dept. of Natural Resources, 1998. Our Changing Nature: Natural Resource Trends in Washington State., Olympia, WA.
- White, R. 1980. Land Use, Environment, and Social Change: The Shaping of Island County. University Press. Seattle, WA.
- Wischmeier, W. H. 1975. Estimating the Soil Loss Equation's Cover and Management Factor for Undisturbed Areas. In: Proceedings, Sediment Yield Workshop, Oxford, Miss-ARS-40. New Orleans, LA: U.S.D.A., Agricultural Research Service, Southern Region. Pg. 118-124.

AUTHOR BIOGRAPHY

Elliott Menashe has been a private, natural resource management consultant since 1987. He is the owner of Greenbelt Consulting on Whidbey Island. Menashe received a degree in Forest Management from University of California at Berkeley in 1975 and attended the School of Fisheries at University of Washington in 1986-7. He is the author of Vegetation Management: A Guide for Puget Sound Bluff Property Owners, published by the Washington Department of Ecology in 1993. His firm specializes in low-impact forest and riparian management, reducing adverse effects of rural development, and restoration of degraded sites. Visit his webpage at www.greenbeltconsulting.com for more information on the services he provides.