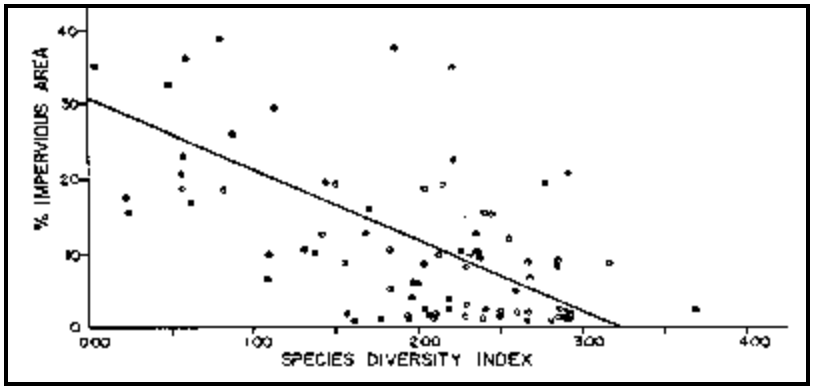
HOW MUCH DEVELOPMENT IS TOO MUCH FOR STREAMS, RIVERS, LAKES, TIDAL WATERS & WETLANDS?

Summary
To preserve the health, diversity, and public uses of aquatic resources, watershed development should not exceed a density of one house for every two acres. If an aquatic resource supports highly sensitive species, then the intensity of watershed development should not exceed one house for every six acres. However, development intensity can be far greater if government agencies in your area have a history of requiring highly effective environmental protection measures ***AND*** of ensuring that these measures are maintained in good working order. Unfortunately few areas of the United States meet both requirements.

Introduction
Converting a farm or forest to a housing project, a mall, or a highway has devastated thousands of streams, rivers, lakes, wetlands, and tidal waterways. In fact, the U.S. Environmental Protection Agency cites land development as the leading cause of recent wetland losses. Development also accounts for 12% of the nation's degraded waters. Though this figure - 12% - may seem small, the impact of growth upon our lives is greatly magnified by the fact that waters degraded by development are generally those located within our most densely populated areas.



Fortunately, measures are available to reduce and even elimi nate much of the impact of growth upon aquatic resources. Unfortunately, few developing areas fully utilize these measures. Thus, each year hundreds of high quality waterways needlessly fall victim to poorly managed growth. But there are impressive examples of how river and watershed protection campaigns have turned this around. In this fact sheet we'll introduce you to measures for gaining the benefits of growth without so many of the growing pains. And we'll also provide examples of how citizens have modified growth in ways that sustains high quality waterways.

How Growth Impacts Aquatic Resources
The first series of growth impacts come during the construction phase. Bulldozing away a forest can increase soil erosion by 1,000-fold. The mud washed from a typical construction site can damage three miles of downstream waters with recovery taking up to a century. Heavy equipment operation in wetlands and channels can exacerbate the impact, particularly if habitat is permanently altered or migration barriers are created.

Once the construction phase is completed and denuded soils are stabilized with lawn, buildings, asphalt, and concrete, another set of impacts are introduced. Covering permeable soils with *impervious* materials such as homes, parking lots, and streets prevents rainwater and snowmelt from soaking into the earth. This infiltrating rain and snowmelt serves as the source of water entering most wetlands and streams during dry weather. Thus as impervious areas increase within a watershed, the volume of groundwater flowing into the wetland or stream decreases. In the Mid-Atlantic states an acre of impervious area may reduce groundwater recharge and groundwater flow to wetlands, streams, and tidal waters by 300,000 gallons per year. Groundwater inflow tends to be of very high quality with cool temperatures that are crucial to many aquatic species. A decline in recharge may also affect the amount of water available to those who rely upon wells.

The water which once soaked into the earth becomes stormwater runoff after impervious areas are constructed. This runoff washes large quantities of pollutants from rooftops, streets, and parking lots. Stormwater pollutants include nutrients, salt, oil, oxygen-consuming materials, and toxics, such as copper, lead, and zinc. Many of these contaminants settle from the atmosphere and accumulate upon impervious areas until the next rain washes them into a nearby waterway. Other sources include: car and truck operation; fertilizers and pesticides applied to lawns; corrosion of metal downspouts and gutters; and a host of other sources.

Converting a forest to homes on one-acre lots can result in a 12-fold increase in nutrient loads. Such a nutrient increase could cause algae to proliferate in a downstream lake or tidal waterway. As algal populations build water clarity declines, which has resulted in the loss of aquatic grasses and a dramatic shift in the species inhabiting the water body. If left unchecked even more serious effects may result such as the release of noxious odors and massive die-offs of fish and other aquatic creatures.

The U.S. Environmental Protection Agency has found that the metals copper, lead, and zinc are frequently present in runoff from impervious area at a concentration which will kill or injure aquatic organisms.

In addition to chemical contaminants, runoff from impervious surfaces also carries other forms of pollution such as heat. Runoff from an asphalt road or parking lot may have a temperature of 83°F or more in the summer. Sensitive species such as trout prefer a temperature of 68°F or less and begin dying when water temperature reaches 77°F.

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How Much Development Is Too Much?

The answer to this question presented at the beginning of this fact sheet comes from a number of studies conducted throughout the U.S. and Canada. One of the first was carried out in 1979 by CEDS president Richard Klein. The graph appearing on the other side of this fact sheet comes from his study. This study served as the basis for a number of state and local laws limiting impervious area in sensitive watersheds.

The graph shows the relationship between increasing watershed imperviousness and the diversity of fish species inhabiting the stream draining each watershed. Diversity is a measure of the overall health of a fish community. The higher the fish species diversity index, the healthier the community. The graph clearly shows that as watershed imperviousness increases, the health of fish communities declines. The data presented in the graph shows that a *significant* decline in stream quality occurred when 10% or more of a watershed was rendered impervious. It was also determined that a stream would lose most of its fish - become dead - at a watershed imperviousness of 25%. A watershed which is 10% impervious would have an average of one house for every two acres or 320 houses per square mile.

Numerous other studies conducted since 1979 have confirmed that this relationship applies to a variety of aquatic resource types throughout North America. These studies have also shown that the threshold of significant impact may be as low as a watershed imperviousness of 4% (one house/six acres) for some highly sensitive species.

Measures to Minimize Growth Impacts

A number of environmental protection measures are available to reduce the impact of watershed development upon aquatic resources. These measures are known as *Best Management Practices* or *BMPs* for short.

Construction site BMPs are designed to keep mud pollution out of nearby waterways. These BMPs generally fall into one of two categories - soil erosion control and sediment trapping measures. Erosion control BMPs are designed to protect exposed soil from the effects of rainfall and runoff. Examples of these measures include covering exposed soil with straw mulch and/or sowing grass seed. Erosion control measures can reduce mud pollution by 90% or more.

Sediment trapping BMPs include the black cloth silt fence erected along the edge of small construction sites as well as settling ponds. These BMPs can keep 50% to 75% of the soil eroded on a construction site out of nearby waterways. However, a recent innovation known as a floating skimmer may allow some sediment trapping BMPs to keep 90% or more of the mud on a construction site.

Several studies have shown that mud pollution from construction sites must be reduced by 90% or more to protect sensitive aquatic resources. In the past, only erosion control BMPs could achieve this goal. Now it appears that sediment trapping BMPs can also fully protect aquatic communities if the floating skimmer is used. However, few (if any) areas of the country routinely require use of this measure.

Measures to manage stormwater runoff from impervious areas also fall into two categories - ponds and infiltration. Ponds can keep 40% to 60% of the nutrients and toxic metals out of nearby waterways. Infiltration measures, which force runoff to flow through sand, soil, or other filtering mediums, can capture 50% to 95% of the metals and nutrients. A reduction on the order of 90% is needed to fully protect the aquatic environment from the toxic effects of metals. Infiltration measures also maintain groundwater recharge and prevent heated runoff from entering sensitive waterways. Ponds cannot maintain recharge and the temperature of runoff stored in ponds can increase through the heating effects of the sun.

Do These Measures Truly Prevent Growth Impacts?

In most cases the answer to this question is no. This is because few counties, cities, or states in the U.S. succeed in getting contractors to consistently use straw mulching and other erosion control BMPs on exposed construction site soils. Again, unless erosion control is used effectively some damage to aquatic resources will occur. This problem is made worse by ineffective use of sediment trapping measures. A North Carolina study found that only half the trapping measures installed on construction sites were properly applied.

Most localities in the U.S. rely upon ponds to control stormwater runoff from impervious surfaces, not infiltration. And even where infiltration BMPs are routionely required, poor inspection and maintenance results in too many failures.

Earlier in this fact sheet it was explained that ponds alone cannot fully protect aquatic resources. Only infiltration measures can fully protect sensitive wetlands, streams, and estuaries. This has been borne out by several recent studies. The researchers found little difference in aquatic communities in streams draining watersheds developed with and without ponds. The ponds failed to prevent the loss of sensitive aquatic species.

Protecting Your Stream, River, Lake, Tidal Waterway or Wetland from Growth Impacts

While few localities manage growth in a way that preserves the health of aquatic systems, this does not mean that this goal is unattainable. In the mid-1980s, 50 Maryland volunteers mounted a campaign that quadrupled the quality of mud pollution control on hundreds of construction sites! Prince George's County, Maryland and King County, Washington are known as having two of the most innovative and effective stormwater control programs in the U.S. These counties achieved this stature in part through the high level of citizen awareness regarding the effects of stormwater upon quality of life.

To protect your favorite stream, river, lake, or tidal waterway you should insist that growth either be:

1) Limited to that which will not exceed a watershed imperviousness of 10% or more; or

2) Local environmental protection programs must be brought up to a level which will ensure full and effective use of erosion control and infiltration BMPs along with limits on the maximum amount of growth permitted within watershed supporting highly sensitive species.

How CEDS Can Help

Mounting a campaign to achieve these two objectives can be a large undertaking. We can show you how to define the watershed of a stream, river, lake, wetland, or tidal waterway. We can also show you how to determine the current area of the watershed which is impervious and how a proposed development project would affect percent impervious area. Next, we can help you determine if highly-effective BMPs are being used and maintained in your area. Finally, we can help you build the public support needed to win limits on watershed development and to upgrade the quality of BMPs used in your area.

Our advice is always available free of charge to citizens and citizen groups. We can also provide you with a free copy of one of our many reports analyzing the effects of a proposed development project upon the aquatic environment. These reports give a clearer picture of how development impacts aquatic systems, how BMPs reduce these impacts, and what an analysis of your watershed might look like. To request a copy or to discuss your effort, just give CEDS a call at 1-800-773-4571. These publications may also be downloaded from our homepage:

http://www.ceds.org