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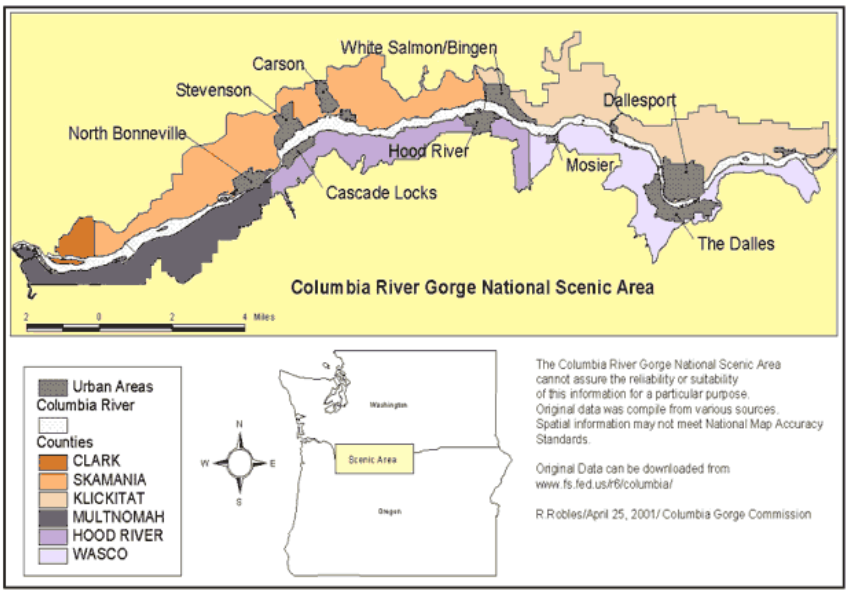
Air Pollution in the Columbia River Gorge

One of the central parts of any ecosystem is air and its condition or quality. As human populations increase, they have an effect on air quality, which has an effect on ecosystems. When people think of the Columbia River Gorge, they might imagine vital habitat, ancient Indian rock art and other cultural and historical sites, forestlands, farmland and orchards, incredible vistas, hiking trails, and fresh clear air. That is not the case, however, as there has been much publicity surrounding the decreased visibility in the gorge. Bob Bachman, a meteorologist and air resource specialist with the U.S. Forest Service, says quite simply, "It's (the gorge) a very polluted soup. If you have a nice green yard and over fertilize it, it turns brown and dies. That's what high levels of nitrogen deposition can do" (Frazier). Nitrogen is the primary are pollutant in the gorge although sulfur, organic and elemental carbon, and fine soil also play a key role in the air pollution.

The Columbia River Gorge National Scenic Area, located along a portion of the Oregon/Washington border, is an area highly valued for its scenic, cultural, and natural resources. The Scenic Area encompasses 85 miles from east of Troutdale and Washougal to the Deschutes River. More than 70,000 people live in the gorge and over two million people visit each year (gorgeair.org). Unfortunately the gorge has also become a conduit of air pollution transport from emissions sources located within the gorge and to the west and east of the gorge. According to Bob Bachman, "air pollution emitted in the basin is trapped by the geographic barriers around the basin and capped by a temperature

inversion which settles over the region preventing vertical mixing or transport of the trapped air mass" (Fenn and Blubough 2). Therefore the geographic nature of the gorge makes it an outlet to stagnant polluted air, which affects our vision to start. This polluted air also causes acid deposition that may have an effect on river biota, human health, and water quality. River valleys are known for having air pollution problems because of poor dispersion characteristics. There are two major highways, two rail lines, barge traffic, several industrial areas, and urban centers within and at both ends of the gorge (Ferguson 23). In other words it is surrounded by possible sources of air pollution.

The National Scenic Area Act of 1986 set out to establish a national scenic area to protect and enhance the scenic, cultural, recreational, and natural resources of the Columbia River Gorge, as well as to protect and support the economy of the gorge area by encouraging growth in urban areas. It established the boundaries for the existing Scenic Area, created the Columbia River Gorge Commission, and created a preliminary management plan. The boundaries can be seen in the attached map below.



The Columbia River Gorge Commission was authorized by the 1986 Columbia River Gorge National Scenic Area Act and created through a bi-state compact between Oregon and Washington in 1987. The Commission works in partnership with a number of groups to implement a regional Management Plan. Partners include Oregon and Washington; the USDA Forest Service; four treaty Indian Tribes -- the Nez Perce, Umatilla, Warm Springs, and Yakama Indian Nations; Clark, Klickitat and Skamania counties in Washington; and Hood River, Multnomah, and Wasco counties in Oregon (gorgecommision.org).

In May of 2000, the Gorge Commission created an amendment to the Gorge Management Plan calling for the protection and enhancement of air quality. This became known as the Columbia Gorge Air Quality Project, which will be the focus of this paper. The first version of this project was issued in 2001 and later revised in 2003 due to funding changes. The first version was developed in cooperation with the Southwest Clean Air Agency (SWCAA), the Oregon Department of Environmental Quality (ODEQ), the Washington Department of Ecology (WDOE), and some grant funding from the United States Environmental Protection Agency. The second version was redesigned after the WDOE withdrew and decreases in funding (gorgeair.org). The mission of the project has changed as well. The original plan was to:

- Provide an assessment of the causes of visibility impairment in the Columbia River Gorge National Scenic Area
- Identify emission source regions, emission source categories, and individual emission sources significantly contributing to visibility impairment in the Gorge
- Provide predictive modeling tools/methods that will allow the evaluation of emission reduction strategies

- Provide an initial assessment of air quality benefits to the Gorge from upcoming state and federal air quality programs

- Refine or adapt predictive modeling tools already being developed for visibility or other air quality programs, including but not limited to Regional Haze

(gorgeair.org)

The redesigned and current plan had to eliminate some of the above goals with the available funding. The focus shifted mostly to visibility and the emission sources that contribute to haze in the Scenic Area. The funding does not allow for an evaluation of air pollutant effects on human health, native plants, fish, and other natural resources. Rather its main goals are to provide:

- Additional measurement data to support the development of a conceptual understanding of the causes of haze in the Gorge

- Additional measurement data to evaluate the predictive numerical model's ability to mimic and predict haze in the Scenic Area

- Predictive numerical model results for a future year (presumably 2018) to determine what trend, if any, is apparent for haze in the Scenic Area that can be attributed to the implementation of new state and federal programs

- Enhanced knowledge and understanding of the complex processes that lead to the formation of haze in the Scenic Area so that informed management decisions can be made regarding any needed future measurement and modeling tasks;

(gorgeair.org)

In December of 2003, equipment was purchased and deployed at the Wishram site, Towal Road site and Bonneville Dam site along the Columbia. Data was collected through the end of February 2004. The second intensive monitoring period was scheduled from July 1, 2004 through February 2005. Draft results of the monitoring phase will be released for peer and public review in December 2005. The ambient monitoring data will be summarized in a report referred to as Causes of Haze in the

Gorge. The air quality modeling will be summarized in a separate report. These reports and the Redesigned Technical Study Plan are expected to be complete in early 2007.

The measurements will determine optical, chemical and meteorological properties of air in the Scenic Area and lead to the development of a conceptual understanding of the causes of haze. Nephelometers were be used to characterize ambient light scattering, aethalometers were used to measure light absorption through a filter tape, and speciated aerosol measurements were taken for identifying which chemical components were changing in time or space. Wind speed, direction, temperature, and relative humidity of the air were measured at all the sites as well (Redesigned Tech. Study 39).

Sulfur and nitrogen play an integral role in the formation of acid rain and fog water that may damage cultural resources, primarily Native American rock art, and natural resources (including culturally significant plants). The Forest Service (under recommendation by the Gorge Commission) funded an independent special study to perform an initial assessment of the chemistry of fog water that could damage these historic and culturally valuable resources (Redesigned Tech Study 4). As mentioned above, the results of the Columbia Gorge Air Quality Project study won't be available to the public until December of 2005, however the Forest Service fog water study has been completed. The purpose of this study was to determine the level of nitrogen, sulfur and acidic deposition occurring in precipitation, fog or cloudwater. The deposition of nitrogen and sulfur in wet and dry forms was also estimated from throughfall measurements. Throughfall is the measurement of nitrogen and sulfur washed from tree canopies during precipitation and fog events. Atmospheric deposition samples were collected at eleven sites along the Columbia River Gorge, with a focus on the National

Scenic Area in the eastern end of the gorge. Nitrogen deposition inputs in throughfall were “surprisingly” high with nitrogen deposition fluxes ranging from 11.5 to 25.4 kilograms per hectare. Ammonium deposition in throughfall was higher in the more easterly sites. This was thought to be due to agricultural emissions of ammonia and possibly industrial emissions. The pH of fog and bulk deposition varied temporally, but pH values were commonly between 4.0 and 4.5 and lower than 4.0 in some instances. Two interesting facts the authors mentioned was that nitrogen deposition was highest under pine trees because tree canopies serve as collection surfaces for deposition in fog and dry deposition. The higher levels of nitrogen deposition they found were said to very likely have significant impacts on nutrient cycling and on plant, soil and aquatic chemistry due to soil acidification. The authors also say that ionic concentrations in rain or snow are typically very low, while ionic concentrations are many-fold higher in fogwater or cloudwater, which are prominent in the gorge. The study concluded that further studies are needed to figure out the impacts of this acidic deposition on our natural resources (Fenn and Blubough 9).

The article mentions pollution sources to be concentrated along the river including a number of recently constructed power plants. Most of those power plants are natural gas plants, but the Boardman Coal Fired Power Plant (about 100 km east of the Scenic Area) was identified as the largest point source. The article continues to describe how several proposed new plants are under construction or are waiting for the energy market to boom before construction. Two inactive aluminum smelters are in the gorge at The Dalles and Goledendale, along with a pulp and paper mill, fertilizer plant, and food processing plants (Fenn and Blubough 2). There is no doubt that with the large number

of plants and proposed facilities, along with urban emissions (mostly from transportation), the Columbia River Gorge has become storage for a lot of this air pollution.

The Fenn article refers to another study, by Geiser and Neitlich, that used lichens as a bioindicator for air pollution in the Columbia River Gorge. The study found that lichen species sensitive to high sulfur concentrations were largely absent even though these species are common to the area, and that weedy lichen species known to thrive on nitrogen rich polluted environments were abundant. Compared to other parts of the Pacific Northwest, the nitrogen and sulfur samples collected in lichens were exceptionally high (Geiser and Neitlich). Of course this study was noted for its cheap testing procedure compared to other means of chemical testing.

Although the "Causes of Haze in the Gorge" report is not yet completed, there is plenty of data to suggest that there is a major air pollution problem in the Columbia River Gorge. As demonstrated by the fog water and lichen studies, sulfur and nitrogen are primary pollutants that have potential harmful effects on aquatic life, plant life, and even human health to name a few. According to the executive director of the Columbia River Gorge Commision, Martha Bennet, "Studies suggest it (air pollution) is getting worse" (Frazier). She also mentions that the gorge acts like a giant funnel with pollution coming as far south as Eugene and as far north as Tacoma, and with wintertime inversions, it all comes through the Columbia River Basin. Bob Bachman has said that the Forest Service plans to undertake more studies this winter and will include more work on soil, but there are no quick fixes. "We could study this for 20 years and still not fully understand it," he said. "Every time we get an answer it leads to more questions. We need to decide today

what we can do that is doable, to set modest goals that are possible to reach. The hard stuff will have to wait" (Frazier).

Why wait? What I don't understand is that the Columbia River Gorge Commission is spending all of its time, effort, and money on getting a better understanding of air pollution that is affecting the view, when what they need to be concerned about is the immediate and possible long-term effects this pollution might have on the environment at the gorge. Of course the Commission recognizes this as a problem, as it originally proposed a comprehensive and exhaustive evaluation of all air pollution effects on scenic, cultural, natural, and recreational resources. For example, this study would have evaluated air pollution impacts on the full range of possible ecosystem issues, such as Columbia River fisheries and native plants. However, due to funding issues, the focus of the study was strictly diverted to visibility problems and the emission sources that contribute to haze in the Scenic Area. Even though this data will prove to be very valuable in determining pollution patterns and specific point sources, it will take until 2007 for these reports to have any impact.

I propose that the Columbia River Gorge Commission divert their funding directly to studies that show the detrimental effects that air pollution has on resources such as aquatic biota, plant life (soil acidification and nitrogen deposition), and rock erosion. These studies along with possible impacts on human health, would hopefully divert the focus of the Commission from analyzing how the problem is occurring, to showing the public that there is an immediate problem that requires more funding to be fixed. These reports could then be advertised in TV commercials, news reports, and radio talk shows. Of course patterns and sources of air pollution in the Columbia River

Gorge must be researched sometime to get an understanding of how to eliminate haze, but while this research is going on the haze is getting worse as more plants are being built and urban populations increase. I think there is a more immediate impact of this pollution than the general public think. Bob Bachman said pollutants such as acidity is destroying Indian petroglyphs, as the Forest Service fog water study showed acidity in the fog/cloud water to be equal to that of vinegar (Frazier). If the public were more aware of the serious environmental implications of this air pollution were with research, there is a good chance they would push for legislation supporting increased funding to protect the Columbia River Gorge.

According to Associated Press writer Joseph B. Frazier, two substantial contributors to air pollution in the gorge are Portland General Electric's coal-fired generating plant at Boardman and Three-mile Canyon dairy farm. Emissions at the PGE plant can be brought in line but at a high price of about $100 million. In response to PGE's possible clean-up, Bill Bachman said, "Eventually they will have to control it anyway. We would like to see it done sooner rather than later" (Frazier). Obviously the air resource specialist with the U.S. Forest Service recognizes the want for immediate results, but doesn't see any possible solutions. As with most environmental issues, funding will be a central problem. According to the most recent Columbia Gorge Air Quality Project progress report (August 9th, 2005), the Oregon DEQ "We agree that further studies are needed to better understand the potential ecosystem and cultural resource impacts of acid deposition. That information will help inform the development of goals and necessary strategies." The report continues on to mention that the data they are monitoring will help them to predict future trends in haze as well as a better

understanding of the processes that lead to the production of haze. This will enable them to predict what might happen if new federal programs and/or restrictions were issued. Current restrictions include federal clean car standards (implemented in 2004). In 2006, ultra-low sulfur diesel fuel will be required nationwide, and in 2007 all new trucks will have to meet tighter emission standards. Restrictions like these are the only hope for a clear Columbia River Gorge (Frazier).

The Columbia River Gorge is naturally prone to air pollution as it collects in this natural "funnel." Unfortunately it was not until recently (2000) that the public took any concern in air pollution, as a result of decreased visibility in the Scenic Area. Because of this, the Columbia River Gorge Commission created the Columbia Gorge Air Quality Project in 2001, along with a fog and cloud water study under the United States Forest Service. The results of the Forest Service study demonstrated some of the possible harmful effects of air pollutants as well as possible point sources. The Columbia Gorge Air Quality Project will publish reports about causes, patterns, and sources of haze in the gorge in 2007. I believe the mind set of the Commission is in the right place, however, they need to divert more funding to immediately relevant research in order to increase public awareness, and therefore receive more funding from the DEQ. Although air pollution will always be a problem, the Columbia River Gorge is in exceptional danger of air pollutants. "Visibility in the gorge is impaired 90 percent of the time and significantly impaired 15 percent of the time" (Frazier). If it takes haze for us to realize we have a problem, what will be the next noticeable event to behoove us to take drastic action? Will it take dying fish, destroyed Indian petroglyphs, loss of natural vegetation, or human

health problems? Hopefully we can pass legislation sometime soon that will address the air pollution problem before it gets any worse.

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