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Global Warming Effects of Motorized Recreation: A Literature Review

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Abstract: Literature review finds that off-road vehicles emit significant amounts of toxic greenhouse gases - ~33% of carbon monoxide output in Maine. Regulation of on-road vehicle emissions has been offset by increase in off-road vehicles.

Despite a 2007 Minnesota law to reduce greenhouse gas emissions the state lacks data regarding snowmobiles, ATVs, dirt-bike motorcycles, four-wheel drive trucks and motorboats. Recommended study should also investigate how Minnesota's gas tax promotion of motorized recreation contributes to global warming. Reducing the number of off-road vehicles to reduce greenhouse gas emissions is indicated.

Global Warming is one of the most serious challenges facing humanity today. Global temperatures have risen about 1°F in the last century. Earth has not experienced such a rapid change in temperature in a thousand years. While we have determined that many factors contribute to global warming, the most significant anthropogenic contribution to date has been the burning of fossil fuels that release heat trapping greenhouse gases (GHG) into the atmosphere. Current policies are pushing toward the reduction of GHG emissions to help reduce the speed at which our climate is warming. For example, the state of Minnesota passed the Next Generation Energy Act of 2007 to reduce GHG emissions 15 percent by 2012, 30 percent by 2025 and 80 percent by 2050 (Press Release 2007).

Transportation is the second most GHG intensive sector in Minnesota after power generation, producing around 24 percent of the state's gross GHG emissions in 2005 (Straight et al. 2008). The transportation sector is broken into two groups: on-road (highway) and non-road (off-highway). Non-road vehicles include snowmobiles, ATVs, off-road trucks, dirt bikes, and motorboats, as well as construction and farm and forestry equipment.

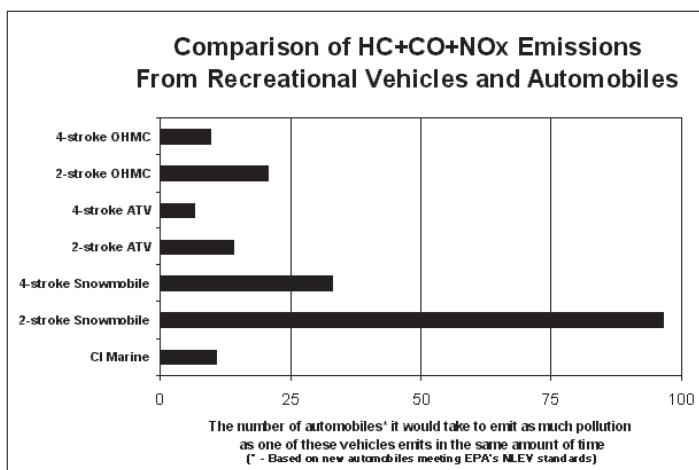
While overall pollution ("criteria" emissions such as nitrogen oxides and sulfur compounds) from on-road sector vehicles in the United States dropped from 1989 to 1999, mostly due to strict regulations, off-road vehicle emissions have increased (Grambsch 2002). For example, carbon monoxide emissions from on-road vehicles decreased 56% during the

past 20 years, but off-road vehicle emissions have increased 42% during the same time period. Similarly, nitrogen oxide (NOx) emissions from on-road vehicles from 1980 to 1999 remained level, yet off-road vehicle emissions of NOx increased 56%. In 2000, non-road vehicles accounted for about 9 percent of national hydrocarbon (HC) emissions, 4 percent of carbon monoxide (CO) emissions, 3 percent of oxides of nitrogen (NOx) emissions, and 2 percent of particulate matter (PM) emissions from mobile sources (EPA 2002).

The most extensive research regarding the air-quality impacts of off-highway vehicle use has taken place within Yellowstone National Park, at the center of the “snowmobile controversy”. In the mid-1990s annual snowmobile visitors to the Park topped 84,000 (Dustin & Schneider 2005). Air quality and visibility issues, as well as health concerns for park employees sparked extensive emissions research within the park (Bishop et al. 2001, Ingersol et al. 1997, Morris et al. 1999). This body of research found that snowmobiles were significant sources of not just smog-forming compounds like (such as NOx), but also of volatile organic compounds (VOCs), such as methane which are major contributors to global warming (Shively et al. 2008).

Although the Environmental Protection Agency (EPA) has calculated annual GHG emissions from these vehicles and determined them to be a significant source of pollution (Figure 1, EPA 2002), the state of Minnesota has not yet made its own calculations. A study at the University of Maine in 2003 showed that recreational vehicles produced 33% of the CO, 60% of the SO₂, 23% of the NOx, 60% of the VOC and 64% of the PM emissions from the state’s mobile sources in 1999 (Bock 2003). It could only be assumed that Minnesota’s off-road fleet could produce the same emissions, if not greater amounts, considering the size of its off-road vehicle population. Rough estimates made by MRR show that based on 2005 data, recreational vehicles in Minnesota produced around 819,000 metric tons of CO₂. Specifically, around 707,000 metric tons were produced from snowmobiles and 65,000 metric tons from ATVs, annually.

Figure 1.



Source: EPA 2002

Recommendations

Reducing the number of off-road vehicles to reduce greenhouse gas emissions in Minnesota is indicated.

Given Minnesota's recent legislative commitment to reduce greenhouse gas emissions and the significant negative air quality and greenhouse gas effects of motorized recreational vehicles, it is recommended that the state of Minnesota, conduct a study like that done in Maine, to consider the contribution of off-road vehicles to its "greenhouse gas budget".

In the past fourteen years over \$188 million in gas tax revenue has been directed to the Department of Natural Resources to promote motorized recreation. A recently legislated increase in the state's gas tax will increase promotion of motorized recreation to ~\$42 million/biennium. Such significant promotion of motorized recreation appears to undermine the state's ability to meet the goals of the Next Generation Energy Act of 2007. In addition to the above, it is recommended that the State of Minnesota investigate how gas tax promotion of motorized recreation contributes to global warming.

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Glossary

Anthropogenic – Caused or influenced by humans.

Global Warming - An increase in the earth's average atmospheric temperature that causes corresponding changes in climate and that may result from the greenhouse effect.

Carbon Monoxide (CO) - A colorless, odorless, poisonous gas.

Nitrogen Oxide (NO_x) – One of many oxides of nitrogen. Known to be present in car exhaust. Nitrogen oxide emissions contribute to ground-level ozone formation. Moreover, at high levels, nitrogen oxides are known to cause lung damage and other respiratory illness, particularly in children and people suffering from asthma.

Hydrocarbon (HC) - Any of numerous organic compounds, such as benzene and methane, that contain only carbon and hydrogen. These substances have been shown to produce harmful effects on the blood, bone marrow, spleen, and lymph nodes.

Particulate Matter - Tiny particles of solid or liquid suspended in a gas, usually measures with a diameter of 10 micrometers or 2.5 micrometers. Health effects include asthma, lung cancer, cardiovascular issues, and premature death.

Volatile Organic Compound (VOC) – An organic compound that can react with nitrogen oxides in the air in the presence of sunlight to form low level ozone, an air pollutant.

Methane (CH₄) – A greenhouse gas with high global warming potential.

Sulfur Dioxide (SO₂) – Chemical compound known to cause acid rain.