Effects and Reactions to Atmospheric and Oceanic Noise

Jonathan Lamont (000357733)
Cody Mitchell (000335973)
Michael Honey (000332287)
Garland Shull (000328790)
David Combs (000233891)

Senior Design Theory
March 4, 2015

Humans are among the most dominant species ever to exist on planet earth, their sphere of influence extends far beyond their own culture and interests to present changes to the entire globe; among these influences is noise. Noise is produced by industry and is further produced by its products, but the noises present now are not characteristic of how nature has developed and evolved. Whereas at one point, a night owl may have heard a crackle of leaves under a mouse's food, delivering the notes necessarily for its meal, a busy highway next to a forest may provide enough noise pollution to destroy this natural process. Both atmospheric and oceanic noise appear to be changing the climate of nature; humans can study their actions, their reactions, and develop strategies to combat the adverse effects of noise pollution.

When engineers design a truck to haul a maximum load for thousands of miles, they naturally focus on reliability, power, and efficiency rather than noise output, but this is having a profound result on animals in forests along the roadside, propagating to affect the entire ecosystem. By monitoring wildlife among large, noisy motors, researchers have found less bird species; these birds act as pollinators and seed spreaders for the rest of the forest. The noise from the motors creates a sphere of influence, pushing away natural life ("Noise Made by Humans" 3). Life requires a vast, nuanced range of sounds to produce a complex network of behavior, one that can easily be droned over by anything from a passing car to a launching airplane. Without people present, nature relies on the sound of roaring rivers for animals to find water resources, chirping birds relaying mating calls, whistling winds indicating weather to come, and an abundance of other noises. Hunters rely on noise to find food; survivors rely on noise to escape capture. With the addition of noise pollution, it is not surprising to find animals and their ecosystems

migrating and adapting, resulting in much less habitable environment and biodiversity overall ("Coast-to-coast Picture" 1-2).

Not only does noise pollution affect nature, it affects the humans who cause it. As urbanization increases the use of road, rail, and airport infrastructures, effects evident in humans include annoyance, sleep disturbance, cardiovascular disease, cognitive impairment, hearing impairment, and tinnitus (Kassomenos 1). Animals likely suffer many of the same effects as humans, but these effects on humans have lead to more notice from the pubic.

These effects of noise pollution have been seen worldwide, and many nations have taken notice and have created steps to reduce it. Noise pollution rules have been established in India under the Environmental Protection Act, enforcing limits in decibels between industrial, commercial, residential, and silence areas, and also help reduce noise at night (Singh & Davar 2). In Europe, the Environmental Noise Directive of 2002 requires European Union Member States to assess exposure to environmental noise pollution, and to react accordingly (Kassomenos 1). Their assessments are publicly released so the public may understand their environment in respect to noise pollution; this data actively affects property value (Kassomenos 1). The United States has also seen political advancements leading to better control of noise pollution. The Noise Control Act of 1972 officially recognized the dangers to the health and welfare of the population and served "to establish a means for effective coordination of Federal research and activities in noise control; authorize the establishment of Federal noise emission standards for products distributed in commerce; and provide information to the public respecting the noise emission and noise reduction characteristics of such products" ("Summary of the

Noise Control Act" 1). The fact that noise pollution affects both humans and animals has not escaped the public ear.

Not only have policy advancements been made in government, technological advances have also reduced noise pollution. The energy crisis and our overreliance on fossil fuels have seen a propagation of electric vehicles; in addition to their other benefits, electric vehicles do not emit nearly as much noise as their fossil fueled counterparts, in fact, they are sometimes criticized for being too quiet ("Electric Vehicles" 1). In some cases, roadways have designed with different noise diffusion techniques, including noise barrier design, pavement selection, and speed limit enforcement (Kotzen & English 2). Noise barriers can help isolate areas by diluting noise using particular structures, pavement selection can reduce the overall volume of the vehicles traveling on it, and speed limit enforcement helps reduce additional noise produced from drag. In aviation, the Federal Aviation Administration has pursued development and adoption of quieter aircraft, soundproofing and buyouts of buildings near airports, and use of flight control planning strategies to reduce noise pollution created by airplanes ("Aircraft Noise Issues" 1). Since noise pollution is a known issue, priority and advancements in technology to reduce noise continues to slowly help alleviate the issue over time.

While not as publicly seen, oceanic noise pollution has to potential to destroy underwater ecosystems. Along a 100-kilometer region in the Bahamas, scientists documented sixteen beached whales over the course of a few days; these discoveries lead to a wild debate to uncover the true cause (Malakoff 576). Many researchers believe the cause of this incident was "the pinging noises produced by some sonars" that can "deafen and daze some kinds of whales, leaving them vulnerable to stranding and shark attack"

(Malakoff 576). Sonar is far from the only form of oceanic noise pollution; shipping lanes can populate large scale ocean basins as frequently as every four to five hours, military exercises and war zones affect mid scale areas scaling tens of kilometers at least bi-monthly, and as well as many other sources affect oceanic noise on seemingly every scale (*Ocean Noise and Marine Mammals* 30). How exactly these noises affect these marine animals is not well understood; oceanic mammals' ears have adapted in a different way than their land based counterparts, making a full understanding difficult. There is a vast range of adaptations in other marine organisms making an overarching, fully supported statement on how noise affects all these animals difficult (*Ocean Noise and Marine Mammals* 89). However, beaker whales frequently become disoriented when presented with multiple high-energy, mid-frequency sonars, and many marine mammals have been found to have behavioral responses ranging from subtle changes in breathing and surfacing to decreasing inner-species communications, as well as avoidance and escape from very high sound levels (*Ocean Noise and Marine Mammals* 89-90). These results have little concrete evidence, but the results appear evident. Still, no significant action appears to be enacted to prevent oceanic noise. Military and ocean mapping require the use of sonar, and there appears to be a greater emphasis on other focus points than on preserving marine ecosystems affected by oceanic noise pollution.

Whether on the surface or in the ocean, noise resulting from human processes evidently affects ecosystems of nearly every type. Animals often appear to be trying to escape noisy zones of human interaction, while humans tend to expand and take advantage of these areas, often inspired by other aspirations. Despite this, humans are aware both of how they affect their environment and the negative effects this noise has on

them, leading to technological and political reform to address these issues. Despite this, noise pollution continues with only minor interruption, as other interests appear to take the forefront of human focus.

Works Cited

"Aircraft Noise Issues." *Www.faa.gov*. Federal Aviation Administration, 20 June 2014. Web. 03 Mar. 2015.

"Electric Vehicles." *Http://www.noiseoff.org/evs.php*. N.p., n.d. Web. 2 Mar. 2015.

Kassomenos, Pavlos. "Critical Issues on Environmental Noise." Editorial. *Www.ScienceDirect.com*. Science Direct, 16 Mar. 2014. Web. 02 Mar. 2015.

Kotzen, Benz, and Colin English. *Environmental Noise Barriers: A Guide to Their Acoustic and Visual Design*. London: E & FN Spon, 1999. Print.

Malakoff, David. "A Roaring Debate Over Ocean Noise." *Science Mag* 291 (2001): 276-78. Print.

Milius, Susan. "A Coast-to-coast Picture of America's Cacophony of Sounds." *Www.ScienceNews.org*. Science News, 16 Feb. 2015. Web. 01 Mar. 2015.

Milius, Susan. "Noise Made by Humans Can Be Bad News for Animals." *Www.ScienceNews.org*. Science News, 9 Feb. 2015. Web. 28 Feb. 2015.

Ocean Noise and Marine Mammals. Washington, D.C.: National Academies, 2003. Print.

Singh, Narendra, and Davar, S. C. "Noise Pollution- Sources, Effects and Control." *Http://www.krepublishers.com*. Department of Commerce, Kurukshetra University, Kurukshetra, 2004. Web. 2 Mar. 2015.

"Summary of the Noise Control Act." *Www2.epa.gov*. United States Environmental Protection Agency, n.d. Web. 03 Mar. 2015.