Music Streaming Services and Their Effect on the Environment

Human-induced carbon emissions and their impact on global warming have become increasingly pressing concerns in recent years. Over the last century, human activities releasing greenhouse gas emissions (GHG) have been the most significant contributor to the earth's global temperature increase of 1° C, with accelerated warming in the past two decades. While natural GHG maintains warmth in the atmosphere to sustain life, human-induced carbon emissions catalyze warming beyond what would occur naturally. Although 1° C may seem negligible, it has resulted in melted ice in the Arctic Ocean and rising global sea levels by 4-8 inches. In addition, worldwide precipitation has increased by 1%, and extreme rainfall has become more frequent throughout the United States.[1] Consequently, governments and policymakers worldwide have attempted to implement regulations and fines to curb these emissions and counteract global warming. Nevertheless, these efforts have not been adequate, and without strict policies counteracting climate change, it is projected that by 2050, global GHG emissions will increase by 50%, furthering the effects of global warming.[2] In recent years, however, an unexpected mass producer of carbon emissions has emerged—the music industry. The commercialization and commodification of music have been primarily seen as ideological issues in the past by scholars like Theodor Adorno, but the environmental issues have been largely overshadowed and must be addressed. The art industries are generally considered harmless, but cultural industry scholars and I reject this notion and argue for a critical consideration of the role of cultural activities, such as music, in this environmental crisis.[3]

Before recording and reproducing music, it was only available live and considered a luxury because of the resources required to create and perform it. These resources were often

[1] Miller, "Inside global warming," 56.
[2] Marchal, "Climate Change" 15.
[3] Oakley and Banks, "Cultural Industries and Environmental Crisis," 1.

expensive and exclusively accessible to the wealthy. However, the accessibility of music to a wider audience through commercialization has come at a significant environmental cost beyond just monetary and resource expenses. The music industry has faced environmental issues in the past, such as live music festivals, but the accessibility and popularity of music streaming services pose a unique environmental concern. Since 2018, the number of paying streaming service users has increased yearly by 24% in the United States, soaring to approximately 92 million users in 2022.[4] The popularity of music streaming services like Spotify or Apple Music can be mainly attributed to their accessibility and affordability. Adjusted for inflation, an average vinyl LP album cost around $28.55 in 1977, while music streaming services like Spotify offer individual plans of unlimited music for a monthly fee of $9.99.[5] Additionally, because music is now at the fingertips of the user on their mobile devices, there has been a decline in traditional music formats such as CDs, cassette tapes, and vinyl records. The Recording Industry Association of America (RIAA) reported that in 2022, 84% of the recorded music revenues in the United States came from streaming services, while only 11% of the revenue came from physical formats.[6]

The shift from physical formats to digital files has led to music becoming dematerialized, fostering the misconception that streaming music is more environmentally friendly due to the lack of material waste. In reality, music streaming services depend on data centers to download, store, and process music, which consumes significant energy. This process increases carbon emissions and raises concerns regarding the digital age's environmental consequences. With digital music becoming a mass producer of carbon gasses, the question arises: can the shift of music from physical to digital formats be accurately characterized as dematerialization? Additionally, should music streaming services be held accountable for their substantial carbon

[4] Friedlander and Bass, *2022 RIAA Revenue Statistics*.
[5] Brennan, "The Environmental Sustainability of the Music Industries," 42.
[6] Friedlander and Bass, *2022 RIAA Revenue Statistics*.

footprint, and if so, how? In this paper, I will argue that the transition to digital music has resulted in an increased materialization of music and that it is necessary to hold music streaming services accountable for their environmental impact.

Although all recording formats historically have had environmental and human costs, analyzing the transition from physical to digital formats can shed light on why music streaming services particularly pose an ethical concern. The invention of the phonograph by Thomas Edison in 1877 marked the beginning of the recorded music era and the commodification of music. Edison's phonograph used a cylinder, which was made of hard wax and the earliest commercial medium for recording and reproducing sound. At the turn of the 20th century, inventor Emile Berliner developed a biodegradable disc using a natural resin called shellac, harvested and processed by exploited women and children in colonial India. Despite the ethical concern, shellac's ability to make multiple copies from a single recording quickly made Berliner's design more popular than Edison's cylinder. However, with the advent of plastic recording formats in the mid-1900s, which were more durable and capable of holding longer recordings, shellac became obsolete.[7] The transition from shellac to plastic marked a turning point in the evolution of music formats and the industry's environmental footprint.

Plastic allowed the production of innovative formats such as CDs, cassette tapes, and vinyl records like LPs and 45s. However, this also led to significant amounts of plastic waste. In a 2020 report, it was revealed that in 1977, at the height of vinyl record usage, the music publishing industry produced 58 million kilograms of plastic in the United States. As the industry shifted towards cassette tapes and CDs, plastic production remained high, with 56 million kilograms produced in 1988. The peak of CD usage in 2000 saw the industry produce 61 million kilograms of plastic. Since the turn of the millennium, digital music has become the

[7] Devine, *Decomposed,* 41-164.

primary means of listening to music, reducing the use of traditional plastic formats. As a result, plastic production plummeted yearly to just 8 million kilograms in 2016.[8]

Although the amount of plastic used in the music industry has decreased significantly over the years, the plastic waste from traditional music formats still has a lasting impact on the environment. Fossil fuel-based plastics last hundreds of years and disintegrate into smaller pieces but never fully degrade.[9] Consequently, waste generated by traditional music formats will never completely decompose and will continue accumulating. Although plastic accumulation from previous formats still harms the environment today, certain types of plastics that are used can be recycled, and used CDs and vinyl records can be sold in secondhand markets. In contrast, GHG emissions are irreversible and an imminent threat to our environment that can exacerbate the effects of climate change.

In order to compare the environmental impact of different music formats, researchers Matt Brennan and Kyle Devine converted plastics to GHG emissions and factored in the amount of GHG produced by music streaming services. In 1977, the music industry in the United States produced 140 million kilograms of GHG, followed by 136 million kilograms in 1988, and 157 million kilograms in 2000. In 2016, the music industry produced a staggering 205 million kilograms of GHG, including GHG emissions from downloading and streaming digital files.[10] Another study estimates that the actual amount could be even higher, up to 350 million kilograms of GHG per year, in more than fifteen different countries.[11] However, it is worth noting that this statistic only represents the GHG emissions produced by the music industry in the United States when there were only 22.6 million users of paid music streaming services,

[8] Brennan and Devine, "The Cost of Music," 52.
[9] Kantai, "Confronting the Plastic Pollution Pandemic," 1-2.
[10] Brennan and Devine, "The Cost of Music," 53.
[11] European Commission, *GHG emissions of all world countries.*

compared to 92 million users today.[12] It is also noteworthy that the researchers overlooked the GHG emissions produced by music video streaming platforms such as YouTube. Though Spotify is the most popular streaming service, 47% of all music streamed in North America and Western Europe is through YouTube. 75% of online music listeners have also stated that they have used YouTube for music in the past month, which could indicate that it is used more often on average by online music listeners than audio streaming platforms.[13] Considering the popularity of YouTube for music streaming, the actual amount of GHG emissions produced by the entire music streaming industry worldwide could be even higher than what Brennan and Devine's study estimates.

The rapid growth of music streaming services in recent years should raise concern about the future impact of GHG emissions, as the higher demand for digital files will increase the use of energy-intensive data centers. In 2022, Spotify had 489 million monthly active users worldwide, a 20% increase from the previous year.[14] This example of just one streaming service alone demonstrates the projected growth of the streaming industry and the scale of GHG emissions produced by the global music streaming industry.

In 2015, Greenpeace, a leading global environmental organization, released a report on internet consumer data that evaluated the environmental impact of various websites, including music streaming sites. The report aimed to assess the eco-friendliness of these websites based on their transparency and commitment to sustainable environmental practices. Spotify received an 'F' grade for using fossil fuels such as coal and gas and for lack of transparency in their energy use.[15]

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[12] Friedlander, *News and Notes on 2016 RIAA Shipment and Revenue Statistics*.
[13] Beuscart et al., "Listening to Music Videos on YouTube," 2.
[14] Spotify, *Sustainability & Social Impact Report 2022,* 4.
[15] Pomerantz, *Clicking Clean Scorecard,* 52.

Music streaming companies are not oblivious to their poor ratings or their effect on the environment. In response to their substantial energy use, Spotify and Apple have attempted to take steps toward sustainability. Spotify has released comprehensive annual reports on its energy use, while both companies claim to have invested in environmental projects and promise a net-zero carbon footprint by 2030.[16] These initiatives include carbon offset projects such as forestry projects, which include planting trees and restoring forests worldwide.[17] While these projects can contribute to global carbon reduction efforts, they are not a substitute for direct efforts to reduce emissions and transition to renewable energy sources. It is noteworthy that investing in renewable energy projects neither reduces energy use nor ensures the use of renewable energy. These projects are intended as offset projects where companies purchase or invest in renewable energy at a rate that equals or matches the energy they use. This only balances out a company's carbon emissions rather than directly reducing or eliminating the carbon footprint. In addition, the World Wildlife Fund (WWF) claims that afforestation and reforestation efforts such as that of Spotify and Apple often minimize the ecosystem complexity, which can result in trees being more prone to natural disasters. This leads to a high risk of carbon reversals, where carbon is re-released into the atmosphere after being sequestered, undermining the purpose.[18] Because of carbon offset's inefficiency, Professor Kathleen McAfee at San Francisco State University has argued that carbon offset projects only allow companies to present themselves as "carbon neutral," creating the illusion of climate progress while distracting the attention from continuing emissions.[19]

[16] "Apple Commits to Be 100 Percent Carbon Neutral."
[17] Spotify, *Sustainability & Social Impact Report 2022,* 11.
[18] Aguilar-Amuchastegui et al., *Forest Carbon Credits*, 7.
[19] McAfee, "Shall the American Association," 171.

Research conducted on other methods of carbon offset approved by the Clean Development Mechanism (CDM), the world's largest carbon offset program under the United Nations, revealed that several projects approved by the program are inefficient uses of resources and may even lead to increased GHG emissions. The study estimated that at least 52% of approved offset wind farms in India were directed toward projects that would have been built regardless of CDM approval and outside investment. This is equivalent to at least 25.4 billion kilograms worth of carbon offsets allocated to projects that were already going to be built, leading to a waste of resources. If this value were extrapolated to every CDM-approved offset program, it is estimated that the program inadvertently led to an increase in global GHG emissions of 5.5 trillion kilograms, equivalent to running 20 one-gigawatt coal power plants for 50 years.[20]

The music streaming industry's proposed solutions to address this environmental issue are neither practical nor sustainable. It is concerning to see carbon reduction efforts by the companies have actually led to an increase in global GHG emissions. This should raise questions about the effectiveness of carbon offset programs and demonstrate the need for more stringent regulations and accountability from the companies.

In order to truly achieve dematerialized music, the industry and consumers must be held accountable and explore alternative solutions. This is a challenging task as it requires us to consider what we are willing to sacrifice—money, accessibility, or environment—to continue enjoying the luxury of listening to music. I do not think it is practical either to completely regress back to traditional formats due to the culture that has developed around mobile music in recent years. It is unlikely that people who enjoy the convenience of an unlimited music library on their

[20] Calel et al., "Do Carbon Offsets Offset Carbon?" 30.

phones and AirPods would want to return to the hassle of carrying around a bulky Walkman with a CD holder.

Instead of reverting to traditional formats, it is necessary to work towards developing data centers that are more energy-efficient and run entirely on renewable energy sources in order to make progress towards music dematerialization. However, there is not a solution that can achieve that yet, but until then, awareness can be spread around this issue, sparking public and scholarly discussion. It is worth mentioning that the environmental consequences of music streaming services are not widely recognized by consumers of these services. A survey measuring public awareness of this issue revealed that the respondents have never considered environmental factors in their streaming platform choice. Most said they were unaware of the environmental consequences of music streaming, yet they voiced concerns about everyday actions such as recycling, reducing car use, and meat consumption. The respondents' lack of awareness about the environmental impact of music streaming reflects a broader lack of discussion around this issue. If people are more educated on the topic, consumers can be warier about online music use, as many are when using gas cars or shopping from fast fashion. Though this does not solve the problem, it is a start to spreading awareness which can evoke scholarly discussion and, eventually, solutions.

Additionally, consumers can play a part in reducing the amount of energy used in their music-listening experience. One way to achieve this is by choosing more environmentally-friendly methods of music streaming. For example, consumers can download music to their local files on devices or buy physical copies of an album they listen to frequently, which would be more energy efficient in the long run. Additionally, when listening to older albums, they can buy used vinyl and CDs, which provide unique sound qualities that digital

music does not offer. Listening to vintage music formats can also provide a sense of nostalgic and sentimental value for some listeners, which some people may find more engaging than digital formats. For example, my first car only had a CD reader, so the only way to listen to music in the car was to listen to my Brittany Spears' "...Baby One More Time" CD, which I listened to on repeat. This experience created a sentimental attachment that could not have been replicated digitally. By making choices such as these, consumers can mitigate the environmental impact of the music industry while preserving the sentimental value of physical music formats. However, I would continue to argue that it is not fair for the consumers to bear all the responsibility and give up the luxury of mobile accessibility when the streaming services should be held accountable for their carbon footprint.

The luxury of music listening has always had an expense, but with the rise of music streaming services, the popularity and accessibility has come at a serious cost to the environment. What may seem like a dematerialized transition from plastic manufactured in fuming factories to data held in the mysterious cloud tells a story contrary to common belief. Though greening the music industry poses a complex challenge with no easy resolve, the solutions currently provided by the industry are not sustainable and only delay the problem. Without an answer, food and water shortages, species extinctions, and droughts are expected in the coming years.[21] Until a viable solution can be found, consumers can choose more environmentally-friendly music listening methods. Additionally, spreading awareness about the environmental impact of music streaming and promoting stigmatization of this behavior, similar to what has been done for recycling, is necessary. No matter which direction the industry chooses to go moving forward, it is important to acknowledge that music will always be considered a luxury, and there will always be a cost, whether it be the environment, money, or accessibility. It

[21] Miller, "Inside global warming," 58.

is up to the consumers and the industries to decide how much they are willing to give up. As the music industry progresses, I advocate for a truly dematerialized industry, which is essential in addressing climate change and promoting a green future.

Bibliography

Aguilar-Amuchastegui, Naikoa, Jason M. Funk, and Maria José Sanz-Sánchez. *Forest Carbon Credits: Separating the "Good" From the Merely "Good Enough."* WWF, 2021.

"Apple Commits to Be 100 Percent Carbon Neutral for Its Supply Chain and Products by 2030." Apple Newsroom. Apple, March 30, 2023.

Beuscart, Jean-Samuel, Samuel Coavoux, and Jean-Baptiste Garrocq. "Listening to Music Videos on YouTube. Digital Consumption Practices and the Environmental Impact of Streaming." *Journal of Consumer Culture*, (2022).

Brennan, Matt. "The Environmental Sustainability of the Music Industries." in *Cultural Industries and the Environmental Crisis*, edited by Kate Oakley and Mark Banks, 37–49. Switzerland: Springer, 2020.

Brennan, Matt, and Kyle Devine. "The Cost of Music." *Popular Music* 39, no. 1 (2020): 43–65.

Calel, Raphael, Jonathan Colmer, Antoine Dechezleprêtre, and Matthieu Glachant. "Do Carbon Offsets Offset Carbon?" *Centre for Climate Change Economics and Policy Working Paper,* no. 398, (2021).

Devine, Kyle. *Decomposed. The Political Ecology of Music*. Cambridge: MIT Press Ltd, 2019.

European Commission. *GHG emissions of all world countries.* Luxembourg: Publications Office of the European Union, 2021.

Friedlander, Joshua P. *News and Notes on 2016 RIAA Shipment and Revenue Statistics*. RIAA, 2017

Friedlander, Joshua P. and Matthew Bass. *Year-End 2022 RIAA Revenue Statistics*. RIAA, 2023.

Kantai, Tallash. "Confronting the Plastic Pollution Pandemic." International Institute for Sustainable Development (IISD), 2020.

Marchal, Virginie. “Climate Change.” In *OECD Environmental Outlook to 2050*. Paris: OECD, 2012.

McAfee, Kathleen. “Shall the American Association of Geographers Endorse Carbon Offsets? Absolutely Not!” *The Professional Geographer* 74, no. 1 (2021): 171–77.

Miller, Roxanne G. “Inside global warming.” *Science Scope* 30, no. 2 (2006): 56-60

Oakley, Kate and Mark Banks. “Cultural Industries and Environmental Crisis: An Introduction.” in *Cultural Industries and the Environmental Crisis*, edited by Kate Oakley and Mark Banks, 1-10. Switzerland: Springer, 2020.

Pomerantz, David. *Clicking Clean Scorecard: Key Findings & Scores Explained.* Washington, DC: Greenpeace Inc., 2015.

Spotify. *Sustainability & Social Impact Report 2022.* Stockholm, Sweden: Spotify, 2023.