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## Sonified Hudson Valley Landscapes and the Influence of Industry

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Sonified Hudson Valley Landscapes and the Influence of Industry

Senior Project Submitted to  
The Division of the Arts and Social Studies  
of Bard College

by

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Thank you to professor Touloumi for pushing me through this process, enriching my research,  
and teaching me how to advocate for myself and my art

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## **Table of content**

<b>Introduction .....</b>	<b>4</b>
<b>Methods and Approach Toward a Sonic Environmentalism.....</b>	<b>6</b>
<b>Soundscape in Perspective .....</b>	<b>10</b>
<b>Environment in Music.....</b>	<b>21</b>
<b>An Aural Hudson Valley.....</b>	<b>27</b>
<b>A History of the Hudson Valley.....</b>	<b>31</b>
<b>Compositions .....</b>	<b>34</b>



## **Introduction**

For the past few years, I have kept an old Sony dictaphone sitting on my shelf. This piece of equipment sitting, seemingly casually amongst other trinkets, has been with me for over eighteen years. Initially, my speech pathologist, Pia, had me carry a dictaphone to practice exercises that I had been prescribed to combat speech and articulation issues. Looking through

the old recordings there are moments of speech practice, my young self struggling to pronounce a passage about the “Baltimore Orioles” is remarkably sweet and bone-chilling at the same time, however, these recordings are found amongst a sea of audio I had continuously collected. I can only imagine Pia’s response to being presented with a recorder full of myself speaking in gibberish, howling into the microphone, and recording crude guitar renditions of the main riff to Black Sabbath’s “*Iron man*” over and over again; recordings which drowned the presence of the Baltimore Orioles passage. I was enamored by the power of the dictaphone, I was able to capture sound for the first time in my life, I documented everything. A recording of my father pleading with my brother and me to give him an idea of what we wanted for dinner ended up on the recorder; these were the moments I recorded. Amongst myself creating noise, singing, yelling, and being rambunctious, were candid recordings; windows where I just recorded because I was curious about the function of the recorder and the ability to store sounds, detaching these moments from ephemerality. While I couldn’t pronounce certain syllables, the observation and collection of sounds held my attention.

Growing up in a city, I grew accustomed to the sonic landscape. My parent's house sat near a flight path so the hum of commercial aircrafts moving by faded in and out of consciousness. I remember this clearly because I had begun to consider this sound as being novel, tied to the house's location. Another sound that I found distinct was the presence of blue jay calls which I could hear emanating from the back of the building, where several apartments and townhouses shared a courtyard. These sounds began to formulate my interest in the historical environment, as well as, geographic and sonic connections to the landscape. Additionally, I began to consider sound information, contemplating sound maps of my neighborhood or

reconstructions of the sonic environment throughout history; I was curious about the built environment and the passage of sound throughout the city. As I started to study both sound art and environmental sciences during my time at Bard, both disciplines proved to continually inform each other. As I moved onward in my studies, the realization that sound processing could aid in cultivating a greater understanding of a shifting environment and further, long strings of data, became transparent.

Throughout my project, I have considered the Hudson Valley and audio processing means of data interpretation to curate sound art pieces that are reflective of the current, and historic, industrial, and agricultural context of the region. Utilizing Ableton, max msp, my field recorder, and Bard college's Serge modular synthesizer, I've composed pieces that are tonally guided by environmental phenomena. Further, many of the field recordings included in the project frame timbral qualities of sound found in the Hudson Valley which allude to agricultural or industrial practices shaping the landscape. In addition, I have investigated the informational qualities of sound. Whilst researching the connections between the environment and the history of electronic music, I've contemplated how this connection is reflected in the work of many musicians who have studied the soundscape such as Barry Traux, R. Murray Schaeffer, Annea Lockwood, and Hildegard Westerkamp. Studying Musique Concrete ideology, field recording, and considerations of the built environment led me to realize that environmental observation was embedded in much of electronic music's history; further, helping me realize the great precedent there is for a project which expresses environmental information by utilizing electronic music. Throughout the time working on the pieces within this project, I employed my readings on field

recording and sound theory to attempt and mold pieces that felt meaningful and sensitive to the reality of the environment.

### **Methods and Approach Toward a Sonic Environmentalism**

Utilizing sound to consider the natural environment is alluring for a multitude of reasons. For many, the sound is a means of navigation and perception, however, it is often under-represented in academia as a scientific data source. There is a disconnect between the informational weight sound can carry, its greater accessibility, and the actual frequency of use in environmental studies. The excitement in further studying auditory stimuli to make conclusions about the environment is underscored by sound being a readily accessible, intangible phenomenon that has the potential to illuminate the function of ecosystems and human activities' impact on the environment. Further, many art pieces addressing the Hudson Valley, help navigate and consider historic narratives which radiate throughout the landscape. Sound is also a meeting point, which illustrates the confines of the constructed landscape and its encroachment of ecological spaces: listening to these dueling sound sources, better exemplifies the importance of recognizing that there is no room for delineating man-made noise from naturally occurring sounds within the environment.

Sound illustrates human additions to the world within a greater composition, and categorically separating sound denies the implication of impact and consequence. Per Murray Schafer pointing out the history of delineating sounds through the construction of concert halls,<sup>1</sup> and Pierre Schaeffer noting the categorical inclination by many to delineate sound based on

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<sup>1</sup> Torigoe, Keiko. "A STUDY OF THE WORLD SOUNDSCAPE PROJECT." York University, Toronto Canada , 1982.



whether it is emanating from musical bodies or non-musical objects.<sup>2</sup> Researchers should be wary of categorically placing importance to sound based on whether it is or is not emanating from a musical context. Often soundscape theories emphasize sound being a form of information. Sounds taken out of context, curated through field recordings, emphasize this idea. Capturing sound occurrences draws attention to its quality and context, differently than hearing in real-time. Often details are missed, as deep listening is not regularly achieved in passing. Further, timbres take on differing connotations, while some sounds are easily recognizable, others are not as clear. The recorder's ability to store musical recordings, adjacent to found soundings, allows for a more nuanced cross-referencing of sound and listening practices.

Morphing musicality together with naturally occurring environmental sound allows for a greater vocabulary to express the nuances of the soundscape. Additionally, in the circumstance of composition, the manipulation of sound poses many possibilities of ecological expression. Where pollution might be equated to distortion other metaphors can be made, for instance, small grains of sound could be synonymous with particles in turbid water. While conventional compositions utilize harmony and rhythmic information as forms of expression, modern technological approaches allow musicians to utilize data as source material. For instance, characteristics such as variation in timbre can be mapped to data, allowing for phenomena that are not sonically acknowledged within the environment, to take on new forms and meanings.

While considering the ecological history of the Hudson Valley, there has been a clear industrial force impacting the area. Agriculture has historically influenced local landscapes and

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<sup>2</sup> “Pierre Schaeffer an Interview with the Pioneer of Musique Concrete,” Sound Art Zone, accessed November 2021, <https://soundart.zone/pierre-schaeffer-an-interview-with-the-pioneer-of-musique-concrete/>.

ecology. Considering how this industry impacts the land, poses whether sound can be a medium to investigate the agricultural influence on the landscape and ecological diversity. Notably, the Hudson Valley is home to tributaries of the Hudson. The aquatic landscape of the Hudson Valley, and the ongoing impacts of soil and land use, is a clear connection without an obvious soundscape to study. This topic raises poignant questions such as: what sound does porous soil make? What does conductivity in the Sawkill sound like? How can conductivity data be realized through synthesized sound? How does one capture the ecological sound world which agricultural runoff impacts? Because searching for sound in this instance is particularly elusive, studying this topic by utilizing field recordings, sonification, and composition is particularly intriguing from a sound art point of view. Exploring agriculture's impact on the tributaries of the Hudson River by molding and curating recordings proposes intriguing sound practices.

Throughout my studies, I consider both field recordings and sonification as strategies to study the environment. Whilst some of my pieces aim to provide contextual information, others utilize data to amplify less visible environmental happenings, in some cases exploring data from the molecular changes in soil or water. Other pieces try to consider how environmental sound is experienced. further, aim to explore the communal and cultural significance of sounds that emanate through the landscape. Many of my pieces hope to consider different farming practices like cover crop's utilization to stabilize soil health, or considering agriculture's impact on the movement of water through land. I hope to provide a lens to consider the sound environment of Hudson Valley, and further to provide a nuanced view of land use and environmental impacts on agricultural practices.

Many of my pieces are composed of sonified data. Ironically, I find that sonification can be a pretentious artform. I am particularly drawn to it, however, because I do believe electronic composition is an informational artform in many cases. Electro-acoustic pieces throughout history explore and uncover, resonance, feedback, and space. In the case of sonification, the electronic composition becomes a form of communication, making long strings of data easier to grasp. One of my main hopes is to highlight the intersection between environmentalism and the arts, and the impact sound theory may have in providing insight into environmental science. Further, sound and music are communicational, and spreadsheets for many are... draconian. Sonification and field recording are, in my beliefs, a way to ease the difficulty, which for some, arrives in tandem with traditional scientific interpretations.

### **Soundscape in Perspective**

Many of my recordings and compositions attempt to highlight the environment as a whole using the soundscape as its guide. The overwhelming feeling I want to express is that the delineation within sound sources—man-made industrial and environmentally occurring—can actually do a disservice in accessing the current environmental soundscape. Categorically isolating these sound sources, strays from the grey area and the in-between. What is the sound of the impact resource degradation and pollution makes? Sounds do have implications attached to them, but how do these implications sonically manifest themselves? My approach while composing and collecting field recordings is to put forth the assertion that categorically delineating, gives the impression of two different actors working independently. Further, having these two categories dampens the understanding that the environment is a working and breathing organism with human determining inputs.

Many composers and sound theorists, in particular, have studied the environment and sound environment through their artistic and academic pursuits. For many, questions regarding the delineations between noise and music, have furthered the conversation which aims to reevaluate the boundaries between music and environmental noise; naturally electronic music is a medium that enables compositional pursuits that blur these lines. One electronic music artform which is prevalent amongst environmental sound theorists throughout the 20th and 21st centuries is field recording. Groups such as the World Soundscape Project—founded by R. Murray Schafer—and the project's affiliates, study and consider the “soundscape” through field recording.

By the early 20th century, futurist scholars had already started to think about environmental and human relationships to sound throughout the landscape. In 1913, Italian futurist painter and composer Luigi Russolo penned *The Art Of Noise*, a futurist manifesto which, similar to many sound theories, placed emphasis on the cultural significance of noise and sound artifacts of a morphing landscape.<sup>3</sup> Russolo was a composer, as well as a painter. Additionally, he invented, in collaboration with artist Ugo Piatti, instruments such as the *Intonarumori*.<sup>4</sup> The *Intonarumori* was a box with a crank in the back and a gramophone horn shaped output in the front. Inside, the differing boxes housed noise making structures, which were excited by the instrument's crank. The instruments also included a lever on top which

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<sup>3</sup> Russolo, Luigi, and Robert Filliou. *The Art of Noise (Futurist Manifesto, 1913)*. New York, NY: Primary Information, 2007.

<sup>4</sup> Ibid.

provided variations in tonality.<sup>5</sup> Russolo and musicians who recreated the instruments, often play them in group settings, multiple *Intonarumoris* being played together. The instruments, procured to explore characteristics of noise, are particularly consistent with many of Russolo's beliefs about noise as a futurist aesthetic in music.

In Russolo's manifesto, *The Art Of Noise*, the composer argues that the sonic stimulus of machinery and new technologies have dulled the excitement audiences gain from more traditional musical forms. Russolo argues that experiencing sound has changed drastically per the advent of machinery informing non-musical ambience, such as environmental sounds, "But our ears far from being satisfied, keep asking for bigger acoustic sensations. However, musical sound is too restricted in the variety and the quality of its tones."<sup>6</sup> Russolo's instruments particularly resonate with the sentiment he expresses in his writing. The instruments aim to achieve timbres which are more reminiscent of auto-mobile and train engines than common orchestras. Russolo's beliefs consider new conceptions of noise as a force which should direct the trajectory of music, as listeners have come to experience greater ranges of timbre than "The ear of an eighteenth century man..."<sup>7</sup> Futurist inclinations to consider new environmental timbres and draw from the sounds of machinery, is further explored throughout the history of electronic music.

Field recordists, as well as genres such as *musique concrete* commonly utilize naturally occurring sounds, often exploring and recontextualizing environmental stimuli. Early electronic

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<sup>5</sup> Maina, Claudia. "The 'Scoppiatore'. the Intonarumori by Luigi Russolo • Digicult: Digital Art, Design and Culture." Digicult, November 2, 2020. <http://digicult.it/digimag/issue-065/the-scoppiatore-the-intonarumori-by-luigi-russolo/>.

<sup>6</sup> Russolo, Luigi, and Robert Filliou.

<sup>7</sup> Ibid.

music and *musique concrete* pioneers, such as Pierre Henry and Pierre Schaeffer, used commercial audio equipment, such as radios, record players, and tape machines to realize their work. Many musique concrete composers utilized tape to arrange recordings, splicing together segments, looping, and distorting the dynamics of environmental sounds. In 1948, during his time as an audio engineer for “Radio Television Francais”<sup>8</sup> Schaeffer broadcasted his musique concrete works, this likely served as an introduction to the genre for radio listeners.<sup>9</sup> Similarly to Futurist, Luigi Russolo, *musique concrete* compositions often drew inspiration from mechanical noise.

In an interview from 1986, Schaeffer shares his own noise and sound theory responding to futurist ideals, tying the environment to the practice of *musique concrete*. Pierre speaks about the humanist connection to sound and noise, in doing so, he explains the informational side of sonic happenings, “Sound is the vocabulary of nature. When we hear the wind, the wind says 'I'm blowing'. When we hear water, the water says 'I'm running'... Noises have generally been thought of as indistinct, but this is not true.”<sup>10</sup> Pierre is responding more specifically to broader questions about the role of the machine in studying noise, and the connection humans have to differing sound sources. Within this conversation lies discrepancy and questions regarding how we categorically think of sound; further exploring the differences between the “world of sound [and the] ...world of musical entities...”<sup>11</sup> Schaeffer argues that sounds, from non conventional music bodies, still are comparable between each other, similarly to making comparisons between

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<sup>8</sup> “Pierre Schaeffer an Interview with the Pioneer of Musique Concrete,” Sound Art Zone, accessed November 2021, <https://soundart.zone/pierre-schaeffer-an-interview-with-the-pioneer-of-musique-concrete/>.

<sup>9</sup> Harley, James. “The Electroacoustic Music of Iannis Xenakis.” *Computer Music Journal* 26, no. 1 (2002): 33–57. <http://www.jstor.org/stable/3681399>.

<sup>10</sup> Sound Art Zone

<sup>11</sup> Ibid.

orchestral instruments. The point which Schaeffer makes, unveiled a certain symmetry between the sounds categorically considered within the convention of music, and sounds which naturally occur within the landscape and from machinery. Further this question regarding symmetry, and duality of noise and musical sound, is heavily tied to futurist and theoretical thought regarding the machines role in inspiring music. The interview outlines dueling attitudes toward the machine as written about by futurist Luigi Russolo. Tim Hodgkinsons, compares attitudes toward the role of the machine in music creation:

It seems to me that there are several possible attitudes to the machine. There is something which we can trace to a kind of puritan tradition, where the machine represents a kind of purification, or perfection, which we in ourselves cannot achieve, and is therefore an escape from the human. Then there is another point of view which retains a humanist perspective and sometimes a kind of projection of human qualities onto the machine... I would place the Futurists, for example, in this second point of view.<sup>12</sup>

Hodgkinson's refers to the machine being separate from qualities of organicism. Further, contrasting this attitude to a more sentimental view of sounds with a humanistic quality.

Hodgkinsons asks where *musique concrete* overlaps with these two views. Schaeffer responds by placing *musique concrete* closer to a humanist and futurist perspective.<sup>13</sup> However as opposed to Russolo, whose instruments imitated the dynamics, bellows, and textural characteristics of

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<sup>12</sup> "Pierre Schaeffer an Interview with the Pioneer of Musique Concrete," Sound Art Zone, accessed November 2021, <https://soundart.zone/pierre-schaeffer-an-interview-with-the-pioneer-of-musique-concrete/>.

<sup>13</sup> Ibid.

evolving technology, *musique concrete* composers often utilized field recordings of such sounds and noises; utilizing techniques to reconfigure tape and unconventionally operate audio equipment, *musique concrete* composers sought new timbres and tones from naturally and mechanically occurring sound sources. Many *musique concrete* composers had differing objectives for their pieces. Whilst some wanted to highlight recognizable sounds, other composers aimed to distort and reconfigure sound to offer new unfamiliar sounds to the listener. In addition to sounds from the landscape, many composers included sounds from varying sources of media.<sup>14</sup>

In turn, composers were able to expand the spectrum of cultural sound-noises experienced by the listener. In the documentary, “*The Art of Sounds*” (2007) which is about Pierre Henry’s career, the composer directly references the environment and landscapes as being an early influence in his career. In the film Henry says, “I think nature was my first influence, and the sounds I heard during my childhood...I listened to them a lot, and they remained a part of my inner landscape...”<sup>15</sup> Henry follows this quote by considering his manipulation of field recordings and compositional pursuits being reflective of the sounds from his childhood, finding “...analogies...” between his work and the sounds he heard outside in nature.<sup>16</sup>

Both early pioneers of *musique concrete*, Pierre Schaeffer and Pierre Henry, have compositions which utilize sounds from nature and constructed landscapes. In certain cases,

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<sup>14</sup> “Tapeheads: The History and Legacy of Musique Concrète - Tidal,” accessed November 2021, <https://tidal.com/magazine/article/musique-concrete/1-78792>.

<sup>15</sup> Geeta Dayal, “The Life and Work of Pierre Henry, Ceaseless Sonic Explorer,” NPR (NPR, July 8, 2017), <https://www.npr.org/sections/therecord/2017/07/08/536046909/the-life-and-work-of-pierre-henry-ceaseless-sonic-explorer>.

<sup>16</sup> *ibid.*



compositions often directly addressed environmental sound phenomena; Pierre Schaeffer's piece "*etude aux chemins de fer*" translates to "study at the railways". In "*etude aux chemins de fer*", Schaeffer arranges differing sounds and timbres recorded from the trains in the railways, this piece in particular was one of the first *musique concrete* pieces, composed in 1948.<sup>17</sup> The title's translation, "*etude aux chemins de fer*" to "study at the railways", highlights the sounds heard throughout. Framing the composition as a study, accentuates the informational quality of sound; it is implied there is something to glean from the varying recordings. Further, the piece's title and arrangement, primes the listener to pay deeper attention to the sound quality of the railway sounds, sounds which are often heard passively.

There are many other *musique concrete* composers throughout history who provide different perspectives on sound and the relationship between noise and the environment through their pieces. In many cases, pieces are directly referential to a space, exploring how sound occupies varying structures and landscapes. Two particularly well known pieces which do this is Alvin Luciers, *Vespers* or *I Am Sitting In a Room*.<sup>18</sup> *Musique concrete* pieces have similarly explored the acoustic of a space. One example of this is the piece, *Concret ph* a *musique concrete* piece composed by Xenakis in 1958. Xenakis composed this piece when working for architect Le Corbusier. *Concret ph* was showcased at the Philip's Pavilion, a pavilion and building designed by Le Corbusier for the 1958 world's fair. Xenakis who worked for Le Corbusier was appointed to handle much of the building's project management, as Corbusier was working

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<sup>17</sup> Need to find again

<sup>18</sup> *Vespers* by Alvin Lucier is a piece in which the performers were blind folded and given echoing noise making machines. The performers utilize the contraptions exploring the resonance which bounces off of the varying surfaces for the performance space, similar to a bats use of echolocation. In the piece *I am sitting in a room*, Lucier continually re-records the same recording of his voice in a room, until the resonances of the room reinforce themselves in the recording. The result is bellowing smooth feedback reinforced by the tones of the room.

steadily on the planning of Chandigarh at the time. When the structure was showcased during the world's fair, Le Corbusier envisioned installations including auditory installations as part of the building's design. Additionally to *Concrete ph* by Xenakis, music composed by Edgard Varèse was also featured within the building. The building featured speakers in the wall which were covered with asbestos, from the speakers these compositions rang out from the walls. The sound of asbestos covering the speaker, after hardening, is cited as sounding cavernous.<sup>19</sup> Xenakis processed one second recordings of charcoal crackling to create the piece. Xenakis's piece was showcased at the entrance and exit of the building, sonically the building's acoustics were showcased, this was done by design. Varès's piece was composed considering the spacing of the three hundred loud speakers within the structure of Philip's Pavilion, taking advantage of the building's acoustic qualities. One of the more eye opening aspects of this historic multimedia installation, is the significance of *musique concrete* compositions being played within the installation. The multimedia installation was symbolic of a changing technological landscape, further inspired by the ethos of the world's fair: "Commissioned by electronics manufacturer Philips, the pavilion was designed to house a multimedia spectacle that celebrated postwar technological progress"<sup>20</sup> *Musique concrete* being part of this installation, is perhaps symbolic of the national presence and appreciation the art form had garnered by this point. The multimedia installation, and the composers featured, helped cultivate a sound environment which accentuated evolving technological advancements in the arts.

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<sup>19</sup> "Philips Pavilion," Architectuul, accessed November 6, 2021, <http://architectuul.com/architecture/philips-pavilion>.

<sup>20</sup> Ibid

Barry Truax, who has worked within the intersections of electronic music and environmental art throughout his career, worked intimately with R. Murray Schafer and the World Soundscape Project. In an interview for the *Computer Music Journal*, Barry Truax explains the nuances he found between working on highly concentrated sound in the studio, and his findings when studying the sound of the city center. In particular, Truax notes a feeling of stark contrast, "... the computer and in the studios in the middle of an extremely noisy European city, the contrast between the refinement of sound, all of the abstract thinking that we were doing in the studio, and how crude the sound was in the actual center of the city was to me pretty shocking."<sup>21</sup> Truax, notes this realization as being the inspiration to start working with Schafer. Truax explains that the noise of the city center served as a refreshing source of sound to study in comparison to the analytical sound studies he was doing in the studio. Murray cites Schafer's interest in outdoor ambience as an inspiration during the interview. In particular, Truax describes interest in environmental sound sources, guiding parts of his practice, "...here was somebody who was ... saying we should be not just in the studio, we should be educating the ears of everyone who experiences the impact of noise... that adds the other element that's been very important for me... environmental sound."<sup>22</sup> Truax was inspired to join the world soundscape project.

Further in the interview, Truax highlights the importance of overlapping these two fields, computer music and environmental thought: "...students...they can bridge these kinds of barriers... there's a crying need for artistic sensibility applied to the environment, applied to the

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<sup>21</sup> Iwatake, Toru, and Barry Truax. "An Interview with Barry Truax." *Computer Music Journal*, vol. 18, no. 3, 1994, p. 17., doi:10.2307/3681181.

<sup>22</sup> Ibid.

media, applied to education. And yet the schools are still training people in very traditional ways...”<sup>23</sup> Truax makes a case for new perspectives, explaining that new approaches to environmental information, such as the arts, provides a new lens; in the same passage Truax says, “...old traditional disciplines just cannot answer the kinds of questions we face today...”<sup>24</sup> The importance of multidisciplinary study which Truax advocates for, harkens back to dilinations between sound sources and musicality. In this interview, Truax remembers Schafers outlook towards environmental sound as an inspiration, putting forth that the environmental soundscape should be listened to with the same care that more traditional music pieces are. Further, scholars such as Murray Schaeffer call attention to the delineation between noise and music, allowing for overly selective listening and an unbalanced sense of sonic importance.

This sentiment is echoed in a thesis about the World Soundscape Project. Summarizing a passage from Schafer, Keiko Torigoe writes: “Since music moved into the concert hall, the musician has been concerned simply about the sound inside of the concert hall or its equivalent, and has become indifferent to the sound outside.”<sup>25</sup> Schafer connects our delineation of importance of sound to industrialization and the advent of architectural structures which were designed to suppress outdoor noise. Because these structures were meant to showcase sounds emanating from musical objects, outdoor sound sources become unbalanced in appreciation. Ultimately, these composers and scholars are all highlighting listening attitudes which have been sculpted by man made circumstances. Schaefer’s sentiment in this case is congruent with his

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<sup>23</sup> Ibid

<sup>24</sup> Ibid

<sup>25</sup> Torigoe, Keiko. “A STUDY OF THE WORLD SOUNDSCAPE PROJECT.” York University, Toronto Canada , 1982.

concept of the “Sound mark”. “Sound mark” is a term which was coined by R. Murray Schafer in reference to: “...a community sound which is unique or possesses qualities which make it specifically regarded or noticed by the people in that community.”<sup>26</sup> The concept of the “soundmark” highlights the collective reception of sound, in many cases sounds are designed to be recognizable by humans such as a siren or a car alarm. In actuality sound marks are all around, despite not always drawing attention, whereas sounds with musical timbres do.

In the *Book of Noise*, composer Murray Schafer defines noise as “...unwanted sound.”<sup>27</sup> He also considers the impact man made sound sources have had on the sound environment in varying communities. Schafer's analysis of noise pollution directly ties the sound environment to industrialization and imperialism and suggests this correlation as an ongoing danger that continues to develop. *The Book of Noise*, situates the sound environment directly inline with human consumption of resources thus further conjuring connections between varying geographical soundscapes and the more tangible degradation and exploitation of the environment. In Schafer's definition of noise, he greatly considers context, “Noise is the wrong sound in the wrong place. This makes noise, to be sure, a relative term,” he claims.<sup>28</sup> Here Schafer contemplates the amount of industrial and anthropogenic noise that is often accepted as naturally occurring. One example which quickly comes to mind is the circumstance of public transportation being embedded into geography. For instance, when I take field recordings of the shoreline in Tivoli, I expect to hear the train come by or a tug boat sailing, though when listening

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<sup>26</sup> Stephen Benson and Will Montgomery, *Writing the Field Recording: Sound, Word, Environment* (Edinburgh: Edinburgh University Press, 2018).

<sup>27</sup> “What Is Noise?” *The Book of Noise*, by R. Murray Schafer, Arcana Editions, 1998, p. 4.

<sup>28</sup> “What Is Noise?” *The Book of Noise*, by R. Murray Schafer, Arcana Editions, 1998, p. 4.

back to the recording, these sound artifacts are more surprising. Furthermore, I was brought to consider the vast amount of noise differing communities are conditioned depending on geographical context. Echoing much of Schafer and the World soundscape projects' sentiment, I started to question: at which point are human-made sound sources accepted as part of the natural environment? What are the conditions which delineate how sound is perceived? These questions are further reflected in my field recording efforts.

The World Soundscape Project is more concerned with noise pollution's impact on human wellbeing on a sonic level. Though this is something I care about in my considerations, I am much more interested in the meaning behind sounds and their underlying implications on the ecological landscape. For instance, the impact behind the drone of a tractor tilling, when prefaced with concerns about carbon dioxide pollution, the droning motor is met with a more nuanced outlook; as a sound with implications for the soil and greater climate. I am curious about the domino ecological impacts that noises signify. This being said, I find a great interest in the connection the world soundscape project has made between industrialization and listening attitudes. Schafer pointing to concert halls as playing a role in sound perception delineating between the environment and music, makes me further consider how the soundscape is molded by geographical planning, architecture, landscaping, and industrial practices.

## **Environment in Music**

When considering the significance of field recording in my own work, one particular piece of theory and text that comes from Pauline Oliveros has served as an inspiration toward my

approach. Oliveros is a composer and sound artist who wrote the score “*Open Field*”. The pieces written directions state:

*“When a sight sound, movement, or place attracts your attention during your daily life, consider that moment an ‘art experience’. Find a way to record an impression of this momentary ‘art experience’ using any appropriate means or media. Share these experiences with each other and make them available to others.”*

This piece, when read as a score, highlights the action of field recording. Further, as argued in the essay, *Field Recording as writing: John Berger, Peter Gizzi and Juliana Spahr*, Redell Olsen puts forth that an emphasis should be made towards Oliveros’s distinction “...any means or media.”. Olsen argues the composition is referring to all forms of recording, including writing.<sup>29</sup> This attitude toward field recording, highlights the informational depth to sound, as a vast and continuous sea of stimuli which should be catalogued and shared. In my interpretation Oliveros’s “*Open field*” can be read similarly to a manifesto passage.

Agnes Denes, sculpture, poet, and philosopher, is known for her grand sculptural works which utilize and take into account environmental thought. Denes’s pieces often use environmental materials to re-contextual the landscape, and further challenge conventionally accepted geographical standards. Her piece *Wheatfield - A Confrontation: Battery Park Landfill, Downtown Manhattan* addresses the symbolism geographical landscapes hold, as the wheatfield itself is juxtaposed with the World Trade Center, calling into question the priorities these differing spaces evoke. Notable works of hers include sculptural land art pieces and writing,

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<sup>29</sup> Olsen, Redell. “Field Recording as Writing: John Berger, Peter Gizzi and Juliana Spahr.” In *Writing the Field Recording: Sound, Word, Environment*, edited by Stephen Benson and Will Montgomery, 169–88. Edinburgh University Press, 2018.

which morph naturally occurring phenomena, thus constructing a new lens that re-contextualized spaces as well as environmental stimuli. One written piece of hers which has informed my own practice has been a manifesto she wrote in 1970. The manifesto asks its readers to start: “...defining the elusive...communicating the incommunicable...living for a fraction of a second and penetrating light years...”<sup>30</sup> These declarations have helped me analyze my own research of varying artworks and artists, further helping me critique, better understand and analyze my own practice, motivations, and findings.

Composers have often alluded to a broader conception of the environment. Alvin Lucier's “I Am *Sitting in a Room*”, and John Cage's “4’33” are “...communicating the incommunicable...”<sup>31</sup>. Lucier’s piece utilizes the feedback of a repeated vocal recording to uncover the resonant frequencies of a space. The piece intentionally uncovers auditory phenomena within the environment which is always present but not fully realized without the performance of the piece. Further, the piece calls into question how man-made structures impart themselves on auditory stimuli. In 4’33 by John Cage, the performer provides a framework of silence, causing the viewer of the piece to more attentively consider naturally occurring environmental sound sources, coming from other audience members, the room the piece is being performed in, or outside auditory sources. Both these pieces fit very effectively toward addressing the portions of Denes’s manifesto I have drawn from. When considering the statement

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<sup>30</sup> “EVO1: Agnes Denes.” Streaming Museum, Streaming Museum, 27 May 2020, [www.streamingmuseum.org/post/evo1-agnes-denes#:~:text=ARTIST'S%20STATEMENT,-My%20work%20ranges&text=I%20plant%20forests%20on%20abused,generations%20with%20a%20meaningful%20legacy.&text=In%201998%20I%20planted%20a%20forest%20in%20Melbourne%2C%20Australia.](http://www.streamingmuseum.org/post/evo1-agnes-denes#:~:text=ARTIST'S%20STATEMENT,-My%20work%20ranges&text=I%20plant%20forests%20on%20abused,generations%20with%20a%20meaningful%20legacy.&text=In%201998%20I%20planted%20a%20forest%20in%20Melbourne%2C%20Australia.)

<sup>31</sup> Ibid



from Denes's manifesto: "...living for a fraction of second and penetrating light-years..."<sup>32</sup> both these pieces hold weight. Cage and Lucier have managed to compose pieces that will contextually throughout time, continue to evolve, and be applicable in observing varying environments. Though similarly matched in how the pieces hold observational weight, the composers differ in the environments they address. While Cage directly draws attention to the immediate sound environment, Lucier exposes characteristics of sound as it reverberates and is fed back in a given space. Further, as Cage's sound sources are organically found, Lucier utilizes feedback to arrive at the piece's conclusion, overtones composed by the room's resonant frequencies. *I am Sitting In a Room* asks the viewer to consider man-made structures' ability to sculpt sound. Whereas John Cage's piece asks to confront the more obvious occurring audible soundscape. Though both of these pieces are examining similar environments, Lucier is more focused on what auditory findings can be coaxed from the manipulation of sound sources.

By organizing the soundscape to exclude audio that emanates from the city of Vancouver, Hildegard Westerkamp is able to temporarily alter the piece's locational context. "*Kits beach soundwalk*" (1989) utilizes bandpass filters and EQs to isolate more intimate sounds stemming from the beach, filtering out sounds emanating from the city of Vancouver. "*Kit beach soundwalk*" (1989), is particularly notable, as an example of a sound walk. The sound walk is a acoustic ecology field study approach which Westerkamp is often accredited as pioneering.<sup>33</sup> The title of Westerkamp's piece refers to Kitsilano Beach in British Columbia. Kitsilano Beach is situated just west of downtown Vancouver and two miles from the city center. Vancouver's skyline overlooks the sandy shore. The beach's proximity to such a prominent urban center

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<sup>32</sup> Ibid

<sup>33</sup> Holger Schulze, "The Corporeality of Listening," *Soundscape of the Urban Past*, 2013, pp. 201, <https://doi.org/10.14361/transcript.9783839421796.195>.

allows for different sound sources, which in this case continuously meet and overlap. Hildegard displays the sonic material of the shoreline and the natural world despite the proximity of the shore to the constructed environment of Vancouver; by altering perception in this way, she draws attention to the city's contributions to the soundscape. Westerkamp's piece highlights very intimate fragments of the soundscape emerging between the Kitsilano beach shore and Vancouver urban soundscape. Without Westerkamp's audio processing the listener can hear motors and horns, as well as the shoreline and the feeding of barnacles. The listener hears these sounds as she narrates, "The city is roaring around these tiny sounds, but it is not masking them."<sup>34</sup> (1:27) Westerkamp separates these sound sources in her narration. For the viewer, this utilization of sound provides a new perspective about the ecology of Kitsilano Beach and Vancouver. The listener is given the opportunity to hear the differing sonic and tonal qualities of the constructed environment and the ecological sounds embedded in the landscape; this allows the listener to conceive of the spatial qualities of this location differently. For myself, a listener who has never stepped foot in Vancouver, the piece imparts a highly intimate lens to consider the space. I'm left feeling as though I know something about where the shore is, what it sounds like, and further what the shore would sound like if Vancouver was farther away—inaudible.

Westerkamp isolates high frequencies found on the shore: the sound of barnacles feeding as Westerkamp narrates. Towards the end of the piece, Westerkamp references Xenakis's "Concrete Ph" (1958). Both Westerkamp and Xenakis draw attention to natural auditory occurrences, magnifying and isolating phenomena that sonically occupy high frequencies. Westerkamp compares these recordings' textural qualities to each other. "*kits beach soundwalk*"

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<sup>34</sup> *Kits Beach Soundwalk*, n.d.

highlights ecological sound artifacts such as the sound of barnacles feeding, whilst Xenakis records the sounds of charcoal crackling.

Westerkamp's piece beautifully illustrates the malleability of field recordings and soundscapes. Westerkamp utilizes filters and equalizers to manipulate the audible frequencies of the Kitsilano beach sound environment. In "*kits beach soundwalk*" Westerkamp narrates as she eliminates the low ambient hum echoing onto the shore stemming from the city of Vancouver, which is at a distance from the shoreline. Hildegard slowly eliminates the lower frequencies, leaving the listener to hear the higher frequency range in closer proximity. In processing the audio in this manner, she harnesses sounds to study both the environment and its soundscape.

The Kitsilano shoreline is full of sound stimuli and information. Being able to hear differing sounds, some from a great distance away, illustrates how sound emanates throughout the landscape. Hildegard's soundscape in this particular recording includes car horns and sounds from the city in addition to the sounds of the shore. The diversity in sound sources provides a spectrum of timbres, illustrating the landscape's structural surroundings. Ultimately, the recording of the Kitsilano beach shore is deeply involved. Westerkamp is an admirer of field recordings. Throughout her career, Westerkamp utilizes field recording, citing her work with the world soundscape project as one of her first experiences truly appreciating field recordings. On her website, Hildegard Westerkamp credits her fascination with field recording from her work with R. Murray Schafer and the World soundscape project. Westerkamp describes working for the world soundscape projects research group as impacting her developing relationship to the city of Vancouver, "Vancouver revealed itself through its soundscapes and connected me - a relatively new immigrant - to this city in entirely new ways." Westerkamp credits field

recordings as being an introductory force, introducing her to the sound environment of the cityscape. Though the soundscape, is often referred to as a straightforward concept, there are many theories and criticisms that circulate within “soundscape” studies, while some scholars reject the concepts of the soundscape, and the meaning behind soundscape recordings, others muse after taking field recordings and listening back to the tones of the environment.

### **An Aural Hudson Valley**

Currently, venues such as Dia Beacon and Basilica in Hudson are two prominent platforms within the Hudson Valley which host a myriad of artists. Throughout the Hudson Valley, there are sculpture parks, such as Art Omi, and installations, such as Opus forty, which mark the valley’s prominent historical presence within the arts. The Hessel museum at Bard College serves as an educational building equipped with a library, in addition to the functioning museum which brings various exhibitions to campus. Additionally, Wave farm in Catskill broadcasts a radio station from their campus which hosts a number of environmental sound installations, as well as a library audio and book library. The overwhelming number of art and music venues in the Hudson Valley, is reflective of the area's artistic history. Further the Hudson Valley has been the subject of films, as well as, the site of many sculptural land installations.

In the mid 19th century, an emergence of painters musing after the landscapes of the Hudson Valley became a prevalent trend; the group of painters whose work was within a similar canon, all painting pastoral and landscape images of the Hudson Valley, garnered the denomination, “The Hudson River School”. Painter Thomas Cole has particularly been singled out as one of the initial artists within the school. Other artists within the school include Frederic

Edwin Church, Asher B. Durand, and Albert Bierstadt, amongst many others.<sup>35</sup> The Hudson Valley school often painted utopic imagery of the mountains and pastoral views, in many cases, reinforcing the agrarian ideal. The agrarian ideal is a term coined by author Margaret Gray. She cites the romanticism of the landscape, in this case through painting, as a major driving factor throughout the region's industrial history, "World-famous for the achievements of Hudson River School painters... arts contributed to the establishment of a high-profile cultural identity ... helped create the pastoral rural vernacular that defines the region as a whole."<sup>36</sup> Gray considers the romanticism of the region's cultivation of tourism and the impact tourism has had on agriculture throughout history. She connects the role these themes have played in influencing the agritourism and labour issues.

The confluence of the natural environment and industrialization within the landscape is a theme of Peter Hutton's 1995 film, *"Study Of a River"*. The film is composed of long shots which are from the vantage point of a boat in the river. Claudia Costa Pederson writes about the film's utilization of imagery to construct a narrative, "'Study of a River' conveys awe through the juxtaposition and movements of natural and industrial forms."<sup>37</sup> The forms she refers to include shots, tug boats and bridges, amongst more naturally occurring forms such as ice formations in the river or mounds of snow floating in the water. Pederson continues to investigate the qualities of Hutton's work which investigate and further amplify the duality of the landscape. She continues by addressing the sonic impact of the film, "The absence of sound further reinforces the spatial focus of 'Study of a River,' an allusion to landscape painting as well as meditation...

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<sup>35</sup> "The Hudson River School." Metmuseum.org. Accessed November 8, 2021.  
[https://www.metmuseum.org/toah/hd/hurs/hd\\_hurs.htm](https://www.metmuseum.org/toah/hd/hurs/hd_hurs.htm).

<sup>36</sup> Margaret Gray, in *Labor and the Locavore the Making of a Comprehensive Food Ethic* (Berkeley: University of California Press, 2014), p. 68.

<sup>37</sup> [https://www.loc.gov/static/programs/national-film-preservation-board/documents/study\\_river2.pdf](https://www.loc.gov/static/programs/national-film-preservation-board/documents/study_river2.pdf)

Hutton examines how mimesis<sup>38</sup>... intersects with national identity.”<sup>39</sup> Pedison makes the comparison between the images in Huttons film and the paintings of the Hudson River School. The silence, bridging the history of landscape paintings with Huttons film, amplifies the differences between the pastoral romanticism of the Hudson Valley School and Hutton’s study of Forms; many of which call back to agrarianism’s influence on tourism, industrialization, and concentration of capital in the Hudson Valley. Further, Pedison alludes to this, writing about the Hudson Valley Schools influence in concentrating wealth in region: “...depictions of the American sublime were instrumental for popularizing the ‘American grand tour,’ where wealthy European and native city dwellers traveled from the Hudson River...along the Erie Canal to Niagara Falls, and back through the White Mountains and Connecticut valley.”

In *Study of a River*, silence accentuates the narrative. In the last remarks of her essay, Pedison remarks that Hutton’s work illustrates a whole view of the landscape through the capture of industrial forms, “...Hutton refrains from depicting the American landscape as wild, empty spaces...industrial ships plow the Hudson River, reminders that landscape is always an interplay between nature and capital.” (need a hook for this into next paragraph)

Fascination with the Hudson Valley’s landscape, and it’s prevalence in art, perhaps informs the prevalence of sculptural installations and museums in the region. Art Omi, Dia beacon, Wave Farm, and most notably Storm King are examples of museums and sculpture parks which curate installations within and throughout the landscape. In many cases, artists reconfigure the environmental forms and expectations through sculpture or sound art. Artist and architect Maya Lin, is someone who utilizes environmental data to inform her sculptures and installations.

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<sup>38</sup> Synonymous with mimicry or intended resemblance in art

<sup>39</sup> Claudia Costa Pederson , “Study of a River - Loc.gov,” accessed October 2021, [https://www.loc.gov/static/programs/national-film-preservation-board/documents/study\\_river2.pdf](https://www.loc.gov/static/programs/national-film-preservation-board/documents/study_river2.pdf).

In her piece, *Storm King Wavefield*, (2009), Lin replicated the dimensions of waves from the ocean in land formations which simulate the feeling of looking out into the ocean, toward waves approaching the shore. The grassy hills span in height from ten to fifteen feet. One significant characteristic of the piece, is the plot of land's prior life as a gravel pit utilized for thruway construction.<sup>40</sup> Lin's *Wavefield* is a form of environmental reclamation, working with the The New York State Department of Environmental Conservation to reconstruct the land. The sentiment of repurposing the plot for *Wavefield*, is echoed in Lin's piece "*Map of Memory: Hudson River Timeline*" in this piece, Lin constructs a map of the Hudson River utilizing multimedia to tell a narrative of the river's history and ecological change. In addition to historical and scientific facts, Lin asks viewers of the piece to contribute by adding to the piece an account of "'What Is Missing' from their surroundings"<sup>41</sup>. In turn, the piece aims to garner a collective and personal narrative, illustrating the changes in the environment and biodiversity. Additionally, the piece also highlights potential and ongoing remediation efforts, through timelines. The timelines illustrate historical circumstances of degradation and how remediation efforts and legislation have been effective in combating these issues, restoring habitats and species.<sup>42</sup> The amalgamation of data which constructs Lin's piece, is a deep example of the arts and humanities ability to inform conservation efforts and the sciences. Many artists utilize sonification, embedding data is sound manipulation, to build similar awarenesses of shifts and changes in the environment.

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<sup>40</sup> Holland Cotter, "Where the Ocean Meets the Mountains," The New York Times (The New York Times, May 7, 2009), <https://www.nytimes.com/2009/05/08/arts/design/08lin.html>.

<sup>41</sup> "Map of Memory: Hudson River Museum." MAYA LIN STUDIO. Accessed October, 2021. <https://www.mayalinstudio.com/memory-works/hrm>.

<sup>42</sup> Ibid.

Wave Farm, located in the Catskills, houses a number of sonification and field recording projects, which monitor and translate environmental phenomena into listenable sound, which they often broadcast online. One such piece which addresses perceptions of the changing environment is titled *Weather Warlock* (2016). *Weather Warlock* is a synthesizer installed by an artist named Quintron at Wave Farm. The analogue synthesizer utilizes data from the wind, rain, sunlight and temperature in order to automate parameters on the synthesizer. The synthesizer omits a drone which changes and shifts in timbre throughout the day, according to the environmental shifts. The piece is particularly intriguing when considering sound as a form of communication. The synth is broadcasting through the wave farm site, allowing for the ability to transmit sound information outside of the Catskill and the Hudson Valley entirely. When considering this piece, tracking the synths activity over time, might allude to new ways of presenting the changing climate within the region over greater spans of time.<sup>43</sup>

Throughout the artistic past of the Hudson Valley, there is a clear narrative considering industrialization and capital's impact on the region. This dialogue is furthered by the impact of agriculture, impacting the environment as well as culture within the region throughout history. While many artist's address environmental change in their work, many pieces are tangled in this long industrial past. Some pieces, such as Peter Hutton's "*Story of a River*", and Margaret Gray's book *Labor and Locavore*, draw to the cultural impact of the Hudson Valley School, in Hutton's case drawing attention to the landscape which is partly molded by the agrarian ideals environmental and spatial impacts.

## **A History of the Hudson Valley**

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<sup>43</sup> "Transmission Art Archive," Wave Farm | Weather Warlock, accessed October 2021, <https://wavefarm.org/ta/archive/works/g7yqrm>



Throughout the Hudson Valley's history, agriculture within the valley has continually shifted. Initially, the land was inhabited by native people such as the Lenape, Iroquois, and sub-tribes such as the Munsee. Native tribes utilized rich soils often to grow maize, the Esopus Valley, in particular, was one location of land which was stewarded by native agricultural practices. Shifts in agricultural practices occurred after Henry Hudson arrived on the land in 1609 and the consequent Dutch colonization. The Dutch largely farmed grains such as wheat and oats. Initially, the Dutch bought land from the Lenape, however, as Dutch settlement grew Lenape and Dutch relations declined. The Dutch began pursuing Lenape land, effectively pushing the Lenape off their land and attempting to commit genocide. The Dutch utilized tactics such as depleting the Lenape's resources, burning and destroying the maize fields near the Esopus. As the land shifted over time, the impacts of industrialization changed the landscape.

Per the influence of industrialization, the Hudson Valley has developed over time to reflect spatial development and environmental changes tied to the industrial and agricultural identity of the region. For instance, molecular changes in soil, or the building of infrastructural characteristics shaping the landscape, echo the cultural and environmental impacts of industrialization. The river has been heavily relied on throughout history, agricultural and industrial pursuits have historically been tied to the Hudson River and its tributaries. In a passage about Hudson Valley being one of the oldest industries in the region, Lankevich considers the passage of the Hudson impacting designations of land use, "...Dutch and English governors gave away vast tracts of land... in the expectation that grain for export and sustenance would flow

down the river to Manhattan.”<sup>44</sup> The milling industries' utilization of land, in addition to the river, phased towards new territories as agricultural focuses evolved.

One instance of this is the milling industries' farming practices guiding the space allocated for crop production; this is noted in George J. Lankevich's book *River of Dreams: The Hudson Valley in Historic Postcards*. Lankevich writes, “New York farmers knew little of crop rotation... the conservation practices Europe's agricultural reformers were advocating... Hudson Valley farmers simply used up land fertility, and when it returned depleted yields they moved on to other acreage. The process caused a gradual westward movement of the agricultural frontier...”<sup>45</sup> Lankevich reflects on the industries land use being fanned west in the Hudson valley, pursuing fertile soil. Lankevich argues that the circumstance increased the amount of land which was cultivated for milling, eventually moving away from the Hudson valley towards Rochester.<sup>46</sup> While the Milling industry moved west, the Hudson River remained to be utilized for transportation of wheat from the Erie Canal to the ports of Manhattan; the Hudson Valley gradually continued to move away from wheat as its primary export.

Another major industry which formed the region's landscape is the whaling industry, which largely formed the city of Hudson. The city of Hudson notes its historical past as a whaling town (1783). Initially Hudson was known as Claverack landing.<sup>47</sup> Additionally, the Hudson valley's proximity to the ports of Manhattan, helped establish the Hudson river being considered a means of passage to fuel commerce, “Hudson began its urban existence as a

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<sup>44</sup> George J. Lankevich, *River of Dreams: The Hudson Valley in Historic Postcards* (New York: Fordham University Press, 2006).

<sup>45</sup> Ibid.

<sup>46</sup> Ibid.

<sup>47</sup> “Hudson Valley Whaling Industry: A History of Claverack Landing (Hudson), NY,” Hudson Valley Magazine, November 27, 2019, <https://hvmag.com/life-style/history/hudson-valley-whaling-industry-a-history-of-claverack-landing-hudson-ny/>.

whaling port... Incorporated by 1785, it had a population of 1,500 within a year, boasted an urban grid by 1787, and was a United States port of entry by 1795.” The Whaling industry can be considered as having an influence on the current built environment of Hudson. For instance, Lankvich cites Mansions built by sea captains still sitting on Promenade Hill looking towards the river.<sup>48</sup>

## Compositions

The pieces I’ve worked on for this project all aim to consider ways of framing the landscape, further exploring historical, industrial, and agricultural cultivation of land. Through field recording, I try to explore the timbral qualities which include sonic artifacts of industrial development’s past in the region. Further, I attempt to make sonic matter from less transparent environmental phenomena, for instance, pieces that use analogies between measurements in water quality and audio processing techniques; this piece is entitled *Sawkill Quintet*. Another piece with a similar approach is *2018-Covercrop-2019*. In this piece, I utilize microtones to show the shift in soil health after the planting of cover crops. Other pieces are field recording focused, considering different "sound marks" within the Hudson Valley.

### *Sawkill Quintet*

One of the first sonification pieces I approached for this project is *Sawkill Quintet*. The piece utilizes data from existing water monitors in the Sawkill. The monitor is located just above the lower dam on the Sawkill, walking down toward the river from Bard’s campus. The piece was made utilizing the software max msp. I scaled and assigned Sawkill data from two periods

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<sup>48</sup> George J. Lankevich, *River of Dreams: The Hudson Valley in Historic Postcards* (New York: Fordham University Press, 2006).

of time to different audio parameters. For instance, the highest data point between the two data sets and the lowest, indicate the span of a given audio effect. The two pieces show the Sawkill under differing contexts, one file utilizes data from after the Nor'ester storm which occurred at the end of October 2021. Whilst the other file is an interpretation of data from March of 2021. The max msp program applies effects to the Sawkill field recordings I took. In the piece, the sonified metrics include depth, turbidity, conductivity, rain, and oxygen percentage.

Conductivity which indicates Sawkill's ability to carry an electrical current is illustrated by distortion. Conductivity is synonymous with salinity which is an indicator of dissolved pollutants such as agricultural runoff. Turbidity guides the triggering of grains which are fed through a delay that is also being scaled to the data. Grains are little pieces of audio from an initial sound source, in this example grains are being used to symbolize particles floating in the water. The analogy felt poignant as turbidity indicates the number of particles inhibiting the water to be clear, this alludes to the amount of sediment and dissolved material in water. Depth controls a lowpass filter which causes high frequencies to be filtered out of the initial recording being processed. The low frequencies left by the filter are meant to provide a sense of depth below the water's surface. The percentage of dissolved oxygen controls the volume of a hydrophone recording I took where the listener can hear bubbles passing the hydrophone. Additionally, I sourced rain data, which causes a rain field recording to play according to the date and time that it rained.

Comparing the two tracks, the listener can hear the differences in timbre between these two different time spans. In the track from October, there is a clear peak in turbidity following the nor'ester storm, whereas the other recording features rain events but not as heavy of a

downpour; peaks in turbidity are present but not as dynamically intense as the first. Further, the water is more steadily conducive in the October track. Each data point is 15 minutes apart in the data, and in the pieces, the clock changes the data every 200 milliseconds second over 8:28 minutes. One important acknowledgment is the data I sourced for the rain was from the Dutchess County Airport in Wappinger falls which is 32 miles away from the Bard campus. Additionally, scaling effects to a greater range of data might provide greater nuance in sound, and less exaggeration. For instance, more conducive data would sound more similar to the highest number between the data sets I utilized, which is 448 ms/cm. Per this consideration, the piece still illustrates shifts in dynamics and relationships between the metrics sonified. Please mind your listening volume, as these pieces get quite loud.

These two tracks are accompanied by pieces made with the serge synthesizer. In the serge interpreted pieces, the isolated tracks from the initial two pieces were fed into the serge through its eq. From there I patched an envelope follower utilizing the duel slope generator and a VCA (voltage controlled amplifier). Envelope followers determine the dynamics of a given recording, often superimposing the dynamics of another recording onto the original. For the turbidity track, I patched a resonant tone utilizing one of the Serge's filters, and for the oxygen, percentage made a patch that would follow the bubbles. For the conductivity stem, the less dynamic recording of the distorted water was difficult to make an envelope following patch with so I applied, in addition to tonal shifts with the serge, envelope follower in max msp.

### *2018-Covercrop-2019*

In this piece, I utilized soil data from Rosehill Farm in Red Hook, New York. Looking at soil data over two years from 2018 to 2019. Within this time span, Kevin Clark the farm manager

utilized cover crops to improve the soil health, providing nutrients to aid tree growth within this process. In 2019 the soil test indicates more balanced presences of different minerals and elements, each closer to the target percentages indicated for apple tree growth. In the piece I mapped each mineral to a different textural voice in a microtonal chord. The piece shows two different points in time, before and after Kevin planted cover crops, the crops Kevin planted included, sudan grass in the summer, buckwheat in late summer and early fall, Austrian peas, forage radish, and rye. The voices grow closer to target unified tone which was mapped to the mineral target percentages in base saturation. Base saturation is an indicator of the soils ph, indicated by the exangability of positive cations in the soil. The increase of base saturation also influences the positive influence of ph levels.<sup>49</sup> The minerals mapped were magnesium, calcium, potassium, sodium, and exchangeable hydrogen. By the end of the piece the minerals are much closer to the unified note F. Similarly I referred to the characteristics of each data point to assign timbres to each voice.

Calcium I considered synonymous with the creation of flocculated Clay and thusly aeration within soil.<sup>50</sup> Flocculated clay in a soil helps make the soil more porous allowing for water and air absorption.<sup>51</sup> Calcium additionally helps provide strength to the crops cell walls, giving them a better chance of fighting off disease.<sup>52</sup> Because of this, Calcium is the Bass note in my piece, laying a foundation. Per Calciums role in developing a porous soil I used a recording

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<sup>49</sup> Pioneer, "Soil Fertility - Base Saturation and Cation Exchange Capacity," Soil Fertility - Base Saturation and Cation Exchange Capacity | Pioneer® Seeds (Pioneer, December 17, 2019), <https://www.pioneer.com/us/agronomy/Base-Saturation-Cation-Exchange-Capacity.html>.

<sup>50</sup> "Focus on Calcium: Its Role in Crop Production," Grains Research and Development Corporation, accessed December 2021, <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2013/02/focus-on-calcium-its-role-in-crop-production>.

<sup>51</sup> Bryant Mason, "13 Soil Mistakes to Avoid," Soil Doctor (Soil Doctor, November 7, 2019), <https://www.soildoctorconsulting.com/pro-tips/13-soil-mistakes>.

<sup>52</sup> Grains Research and Development Corporation

of a hydrophone is soil which was absorbing water. I applied a filter and two equalizers to find a specific resonance away from the target of F and then automated towards F depending on the change in soil.

Magnesium helps plants create chlorophyll, which aids in photosynthesis.<sup>53</sup> For the voice in the recording, I utilized a field recording of leaves rustling in the wind. I then utilized the soil data for magnesium and followed the same processes as in the first voice.

For potassium, I focused on its ability to help crops become more drought resistant by improving a plants root elongation and cell membrane strength. Cell membrane stability, in particular, has been shown to determine a crops drought resistance. Drought has been shown to significantly decrease the strength of the cell membrane, however crops with a fortified cell membrane have a better chance at surviving drought.<sup>54</sup> For this voice, I utilized a recording of rain I took in september. I processed the rain recording in the same fashion as the first two voices.

High levels of sodium can be an indicator of sodic soil, which is particularly undesired in regards to soil health. Further, too much sodium in contrast to calcium and magnesium can cause dispersion. Dispersive soil contrasts flocculated soil, it is often a indicator of non-porous soil. Dispersion refers to the clay particles in the soil breaking down when wet as they disperse into water. Because the soil is less porous, there is less water absorption.<sup>55</sup> The data I utilized shows

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<sup>53</sup> Daniel E. Kaiser, "Magnesium for Crop Production," UMN Extension, accessed November 2021, <https://extension.umn.edu/micro-and-secondary-macronutrients/magnesium-crop-production>.

<sup>54</sup> Min Wang et al., "The Critical Role of Potassium in Plant Stress Response," *International Journal of Molecular Sciences* 14, no. 4 (February 2013): pp. 7370-7390, <https://doi.org/10.3390/ijms14047370>.

<sup>55</sup> "Identifying Dispersive Soils - Agric.wa.gov.au," accessed December 2021, <https://www.agric.wa.gov.au/sites/gateway/files/Farmnote%20386%20Identifying%20dispersive%20soils.pdf>.

sodium levels decreasing in the base saturation of the soil. For the recording, I utilized a hydrophone recording of salt dissolving in water.

The last voice I mapped is exchangeable hydrogen. Hydrogen is used in photosynthesis; plants combine hydrogen and carbon, releasing oxygen into the atmosphere. For this voice, I utilized a hydrophone recording of carbonated water and the recording of leaves swaying in the wind. The voices resonating closer notes by the end of the piece symbolizes better exchangeability and balance of cations. The piece resolves in its final state by minute three.

### *Weaving Tractor*

In this piece, I explore the sound of farm vehicles such as tractors and the characteristics of sound emanating from their engines through the landscape. The piece reframes the roar of tractors, distancing the machinery from its utilitarian connotations when heard. Similar to other pieces in the project, it is also a consideration of the tractor as a “sound mark”, further exploring how the landscape shapes a given sound’s dynamics. Another reason I chose the tractor is because of the vehicle's history. Hearing the sound of the engine radiating through the landscape is reminiscent of living organisms, such as birds, people, or livestock. The advent of the tractor replaced horses pulled vehicles. This change in the sound environment for instance signifies an impactful industrial shift in agriculture. Additionally, tractors are often associated with tilling soil, a process that releases carbon dioxide into the air and atmosphere.

Similarly to the Sawkill Quintet, I utilized the Serge and Max Msp to create a reinterpretation of this field recording. The result is a bellowing chord that follows the dynamics of the tractor as it weaves through rows of apple trees on an orchard.



### *Soundmarks of the Hudson Valley*

This is a piece inspired by the musique concrete piece “etude aux chemins de fer” in which Pierre Schaeffer studied the sounds of the train yard and R. Murray Schaffer's consideration of the “sound mark”. In the piece, I utilize field recordings from the Hudson Valley which are reminiscent of the areas defining environmental past such as the Hudson River schools influence in perpetuating the agrarian ideal, as well as the impact of the milling and whaling industry on current day commerce and the constructed landscape within the Hudson Valley. In many cases, the technologies which accompanied these developments still exist but are influenced by different operations, such as Amtrak and the presence of tugboats and ships within the river. The piece particularly highlights the past industries' influence on current communications and travel within the region. Additionally, the piece explores field recordings taken within the Hudson Valley which explore the cultivated, constructed, and unconstructed landscapes of the region. additionally, the piece features animal species and a notable bird call passing overhead.

### *Cornfield recording*

Driving through the Hudson Valley in the fall, it is remarkable how much land is allocated to corn production. The roads in many cases are lined on either side with cornfields. Corn production within the united states is particularly nuanced and difficult. The commerce surrounding corn, largely due to the crop's versatility, has led to it dominating the agricultural landscape; thus great amounts of land use is allocated to corn production. Though the visual of cornfields is something that the country has grown accustomed to, this circumstance has many growing impacts on the environment and the life of American citizens. In an article written by

environmental scientist and author Jonathan Foley, he highlights the uses of corn that have led to such massive amounts of corn production:

... it can be turned into a staggering array of products. Corn can be used for food as corn flour, cornmeal, hominy, grits or sweet corn. It can be used as animal feed to help fatten our hogs, chickens and cattle. And it can be turned into ethanol, high-fructose corn syrup or even bio-based plastics...For corn-fed animals, the efficiency of converting grain to meat and dairy calories ranges from roughly 3 percent to 40 percent, depending on the animal production system in question. What this all means is that little of the corn crop actually ends up feeding American people.<sup>56</sup>

In the article, Foley argues that the economic costs of corn production outweigh the crops utilization in actually feeding the public. Further, corn helps fuel the cattle industry by producing feed, thus taking up more land. This idea is enforced in the article “A model for 'sustainable' US beef production”:

... estimates of beef’s resource intensity reflect the modern (see SI) U.S. beef industry, which relies not only on rangelands (pasture and locally produced hay) but also on grains, hay and silage grown on prime croplands where most environmental costs are incurred.<sup>57</sup>

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<sup>56</sup> Jonathan Foley, “It's Time to Rethink America's Corn System,” *Scientific American* (Scientific American, March 5, 2013), <https://www.scientificamerican.com/article/time-to-rethink-corn/>.

<sup>57</sup> Gidon Eshel et al., “A Model for ‘Sustainable’ Us Beef Production,” *Nature Ecology & Evolution* 2, no. 1 (April 2017): pp. 81-85, <https://doi.org/10.1038/s41559-017-0390-5>.

The impacts of corn production land use are echoed in Foley's article. In 2013, Foley wrote that 97 million acres house corn in the United States; he equates this size to the area of California, roughly. Foley additionally cites water and fertilizer use; "5.6 cubic miles per year of irrigation water ... from ... rivers and aquifers... over 5.6 million tons of nitrogen is applied to corn each year through chemical fertilizers, along with nearly a million tons of nitrogen from manure."<sup>58</sup>

One of the major impacts of fertilizer use is runoff.

This piece frames the sonic qualities of land utilized for corn production. The recording features the stalks of corn plants swaying in the wind. The recording draws attention to a sound so present in the landscape of the country, with certain exceptions, largely goes unnoticed.

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<sup>58</sup> Foley, "It's Time to Rethink America's Corn System,"

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