

Literariness Journal

A Peer-Reviewed Quarterly
Journal of Literature and Cultural
Studies

P-ISSN: 3108-1614
E-ISSN: 3108-172X

LiterarinessJournal.org

**Vol. 1, Issue 4, September
2026**

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A Literariness.org Project

DOI: 10.67147 literariness.v1i4.008

Entangled Soundscapes: An Ecomusicological Study of Judith Shatin's Selected Works

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Abstract: The growing climate crisis has urged scholars across disciplines to consider new methods of promoting ecological awareness. Ecomusicology has evolved from this dire need as a significant field to study the relationship between sound, culture, and the natural environment. This article explores how American composer Judith Shatin utilizes electroacoustic composition to inspire ecological listening and environmental consciousness. Focusing on two of her environmentally engaged compositions, *Ice Becomes Water* (2017) and *Terra Infirma* (2022), this study delves into the process Shatin employs while composing her works integrating electronic processing and field recordings along with acoustic instruments to encourage immersive sonic depictions of fragile ecosystems.

Drawing on ecomusicology, the article argues that Judith Shatin's musical works go beyond merely depicting ecological themes. By converting glacial sounds, animal and bird calls, and other nature recordings into music, her compositions question human-centred ways of listening and emphasize the relationship between humans and nature. The blending of field recordings, acoustic soundscapes and electronic sounds allows the audience to perceive environmental deterioration not as a distant and abstract scientific issue but as an immediate and emotional reality. By examining acoustic soundscapes, the musical techniques and timbral strategies of these pieces, the article shows how Shatin turns listening into a moral practice of environmental involvement. Ultimately, the study suggests that her music acts as a form of environmental advocacy, inspiring listeners to identify their place within fragile ecosystems and to rethink their relationship with nature during a time of rapid climate change.

Keywords: *Ecomusicology, Acoustic Ecology, Soundscapes, Entanglement, Electro-acoustics*

Introduction

The growing ecological precarity has evolved questions of environmental survival into queries of moral responsibility and awareness. Though the causes and effects of climate crisis, pollution, species extinction and habitat encroachment are explained by academic data, it does not spontaneously develop a sense of obligation and commitment. The environmental humanities have explored different cultural texts that represent, reflect and perceive nature. The relevance of creative responses to environmental deterioration becomes evident through the contention that “the environmental crisis is a failure of culture” (Allen, “Prospects” 414). Music therefore becomes significant not as a replacement for scientific information but as one of the cultural habits that can redefine ecological relationships. Ecomusicology has responded as a significant interdisciplinary field to explore these relationships. It builds on ecocriticism, sound studies, acoustic ecology, musicology and ethnomusicology. Apart from recognizing musical compositions which depicts landscapes, flora and fauna or the natural world, Ecomusicology also examines how music takes part in ecological thought and emphasizes listening as an act that enhances and questions the human perception of the non-human world. The theoretical framework of this article follows the assertion that ecomusicology “considers the relationships of music, culture, and nature” (Allen, “Ecomusicology” 392).

Judith Shatin's compositions constantly interact with environmental and man-made sounds often merging edited field recordings with instrumental music. Instead of using field recordings as mere background fillers, Shatin incorporates them into the integral part of her music. *Ice Becomes Water* (2017) and *Terra Infirma* (2022), are two of her compositions that approach ecological dilemma through diverse sonic environments. Written for electronics and amplified septet, *Terra Infirma* deals with the environmental problems in the Great Lakes region and comprises of acoustic instrumental music blended with the cries of threatened species. *Ice Becomes Water*, composed for electronics and string orchestra, employs the glacial recordings of glaciologist Oskar Glowacki. This piece is described by Judith Shatin as a requiem for the swiftly melting polar ice caps and a plea for action. These works, together, explore the joint repercussions of digital intervention, acoustic instruments, animal cries and natural phenomena within the genre of music.

Literature Review

The existing information on the works of Judith Shatin mainly focus on the programme notes, the themes, commissions and sustainability warnings. Though these descriptions are valuable, they consider environmental meaning as something depicted quite obviously. The production of ecological meaning using sound and acoustic arrangement has been greatly overlooked: how instrumental music mingle with field recordings, how the sonic flow blurs the borders between human and non-human

sounds and how these interactions place the audience within the discourse of environmental crisis. This article deals with this gap by shifting from an analysis of the environmental theme to a deeper study of the musical techniques and the reception of these sonic strategies among musicians who perform or play the instruments or the audience.

The present study proposes the notion called "entangled soundscape" which is defined as a musical composition in which man-made acoustic music, electronic data and other technological additions blend together with natural or environmental agencies so that they cannot be perceived as totally unrelated. This concept relies on the idea of ecological interconnectedness by Timothy Morton and on the notion termed as sympoiesis by Donna Haraway. This study argues that *Terra Infirma* and *Ice Becomes Water* construct entangled soundscapes with electroacoustic conversion and sonic fusion thereby questioning traditional methods of listening and transforming the abstract data-centred idea of environmental degradation to a more concrete and immediate experience.

Academically speaking, there are three overlapping themes around Judith Shatin's environmental music pieces. These themes stem from ecomusicology, acoustic ecology, and ecological theory of entanglement. These three approaches provide an opportunity for the analysis of music as an entity and as a interdependent sound phenomenon instead of mere nature depiction.

Ecomusicology employs the results of music research in relation to ecocriticism and environmentalism. Aaron S. Allen defines ecomusicology as "the study of music, culture, and nature in all the complexities of those terms. Ecomusicology considers musical and sonic issues, both textual and performative, related to ecology and the natural environment." It addresses the nature representations as well as the cultural, historical and political context through which the composition is created, publicized and received. Allen indicates that ecomusicology illustrates the ideas and principles postulated by the ecological crisis as a cultural one and it can be possible due to the capacity of music to strengthen the bonds within communities.

The wide framework of ecomusicology is brought out in *Current Directions in Ecomusicology: Music, Culture, Nature* (2016) written by Aaron S. Allen and Kevin Dawe. They state that "Ecomusicology is the critical study of music/sound and environment" (3). The research provides insights into the use of instrumental music, sound scape, conservation and activism. Rather than developing a single, unified approach, the volume represents ecomusicology as a set of critical practices that relate to each other. Later on, Allen and Jeff Todd Titon's compilation of essays entitled *Sounds, Ecologies, Musics* (2023) continues the relational focus by posing the question of the ecological conditions of possibility of sound and music. However, such an approach not only broadens the scope of ecomusicological analyses, but also raises a problem of analysis itself. As long as any

relation between music and nature can be seen as an ecomusicological relation, studies of such relationships may limit themselves to mere description of ecological themes. Studies on environmental music often identify conservation messages, nature imagery, or the musician's activist goals neglecting the ecological meaning that arises out of the musical techniques used.

Therefore, while adopting an ecomusicological framework as a critical approach, the current article does not use it as an all-purpose method. What this framework seeks to understand is not just the ecological themes of Shatin's compositions, but how their sonic strategies redefine interconnectedness among nature, man-made instruments and audiences.

The second discussion starts with acoustic ecology and, more specifically, with the concept of the soundscape developed by R. Murray Schafer. His book, *The Soundscape: Our Sonic Environment and the Tuning of the World* (1994) regards the sonic ecology as an object worthy of careful attention. Schafer insists that "the soundscape is any acoustic field of study" (7) and different listening practices affect the relations between people and the sonic world around them. His classification of keynote sounds, soundmarks and signals provides us with means to consider how specific sounds give sense and structure to the sonic identity of a landscape. Through acoustic ecology, we widen our consideration of music and expand it beyond the boundaries of traditionally structured compositions to include natural sounds that can be overlooked as noises.

Schafer's method is particularly useful when considering the glacial recordings and animal cries employed by Shatin. Still, her electroacoustic process also challenges the notion of the soundscape as a sonic environment that needs to be recorded and protected. All field recordings are always mediations: they are recorded by means of microphones and speakers, chosen and filtered by humans, shifted from one context to another, digitally processed, and restructured within the composition.

This transition needs a different model of listening, one that goes beyond identification of sound sources. Ecological listening, in the sense in which it is employed throughout this article, is an attention to relationships: relations between a sound and its surrounding landscape, between recorded and enacted materials, and between the audience and the ecological situation made audible. This sort of listening does not consider environmental sound as a passive object presented to an indifferent and unresponsive audience. It invites listeners to consider the technological and cultural processes involved in perceiving nature. Acoustic ecology provides the appropriate focus on soundscape, whereas electroacoustic analysis shows the processes by which Shatin recreates soundscapes instead of simply presenting them.

Denise Von Glahn's analysis "Relational Capacities, Musical Ecologies: Judith Shatin's *Ice Becomes Water*" offers a significant precedent for such relational listening, arguing that "listeners make sense of sounds in relation to each other—sounds to sounds, and sounds to listeners" (Von Glahn 178).

Thirdly, the conversations question anthropocentric archetypes in which the independent human observer represents an outside natural realm. In *The Ecological Thought* (1968), Timothy Morton uses the metaphor of the "mesh" to describe environmental existence, whereby beings are constituted through interconnected relationships rather than surviving autonomously. Morton's *Ecology without Nature: Rethinking Environmental Aesthetics* (2007) similarly challenges the idealized notion of "nature" that maintains an abstract distance between humankind and the environment. Morton's contention that "the idea of nature is getting in the way of properly ecological forms of culture, philosophy, politics, and art" (*Ecology without Nature* 1) reveals the limits of precisely such a boundary.

In Donna Haraway's *Staying with the Trouble: Making Kin in the Chthulucene* (2016), a similar approach is described using the concept of "sympoiesis." As she explains, "Sympoiesis is a simple word; it means 'making-with'" (58). Models of autonomous creation are substituted with processes of collective formation of many creatures, technologies, landscapes and material forces. Such a concept is especially relevant for electronic music, where acoustic agency cannot be attributed exclusively to the musician. Field recordings, microphones, electronic manipulation, musical instruments, concert halls or spaces, and audience are all participants in the process of composition.

It is thus possible, in light of the work by Timothy Morton and Donna Haraway, to think about Shatin's music as entangled soundscapes. The concept entails the following three intertwined processes: entanglement of sonic materials of instrumental, ecological and electronic nature; ecological entanglement of human and non-human world; and ethical entanglement whereby listeners are involved in the environmental crisis made audible. While ecomusicology lays out the relationship between sound and environment, and acoustic ecology provides the language of soundscape and process of listening, the concept of entanglement explains why such a relationship cannot be minimized to mere portrayal. This collective framework lays the foundation for examining *Ice Becomes Water* and *Terra Infirma* as compositions that do not merely voice ecological apprehensions but redefine the audience's place inside fragile sonic environments.

Theoretical Framework

Previous research shows that it is not possible to fully comprehend environmentally engaged music simply by recognizing the themes. While identifying representations of flora and fauna, landscapes, ice caps or climate change clarifies the subject of a piece, it does not explain how ecological meaning is formed. This article introduces the idea of the entangled soundscape as a way to analyse the relationships between sounds in Judith Shatin's *Ice Becomes Water* and *Terra Infirma*. This framework connects ecomusicology with acoustic ecology and posthuman ecological thought, translating these viewpoints into methods useful for analysing music.

An entangled soundscape is a composed acoustic environment where field recordings of animals and birds, digital processing, human interpretation, instrumental performance, and non-human agencies mingle with each other without being separate autonomous entities. Here, "soundscape" does not mean just the original sonic environment or a documented depiction of a specific landscape. It instead refers to a carefully created field of acoustic relations. *Ice Becomes Water* and *Terra Infirma* feature glacial sounds or animals calls taken out of their original settings, captured using recorders and microphones, digitally manipulated and layered with acoustic instruments. Their environmental relevance arises from the interconnectedness between the original source, transition, processing, performance, and reception and not because of their autonomous existence.

This framework challenges the idea that live instruments represent man-made art and culture while environmental recordings represent an outside natural realm. This form of distinction could reinforce the anthropocentric alienation that ecocritical philosophy aims to reject. While there is the intervention of technology during the recording of the glacier or animal calls, acoustic instruments, though man-made, produces sound through physical matter like wood, air, metal, and human motion. The technological aspect should not be seen as a separate force in contrast to nature. In these compositions, technology acts as a bridge through which ecological events enter into newer musical and conceptual relationships. Therefore, it is necessary to analyse how these factors work simultaneously instead of splitting them into different categories.

There are three aspects of interdependent analysis in the framework of entangled soundscape: sonic entanglement, ecological entanglement, and ethical entanglement. These dimensions are not distinct levels of analysis, but intersecting viewpoints through which the same acoustic phenomenon could be comprehended.

Sonic entanglement considers how field recordings, digital processing, and instrumental music relate to each other in the composition. It examines how Judith Shatin combines different sonic sources through register, tempo, texture, timbre, expression, density, and continuity. Moments where the original source of sounds become indistinguishable are given special emphasis. These moments blur the traditional boundaries between natural sound and music. Sonic entanglement is measured not just by the combined existence of recorded and performed sounds, but by how they inspire, mimic, interrupt, assimilate or alter one another.

Ecological entanglement looks at the relationships between human and more-than-human entities represented or expressed in the music pieces. Timothy Morton's notion of the mesh gets relevance here, since it describes environmental existence as a field of interaction without an individual centre. Morton defines ecological thought relationally: "The ecological thought is the thinking of interconnectedness" (*Ecological Thought* 7). Donna Haraway's view of sympoiesis highlights processes of "making-with" whereby ecosystems co-construct and evolve together as opposed to "autopoiesis" where systems follow strict boundaries for their independent creation. These ideas turn the focus away from the composer as the only source of creating music when applied to Shatin's pieces. How we interpret musical form is also shaped by ecological entanglement. Modifications in texture, form, fragmentation, interruption, and accumulation can be seen as correlational processes instead of direct representations of natural occurrences.

Lastly, ethical entanglement, deals with the role assigned to the listener or the audience. The music pieces do not offer scientific evidence of environmental damage, nor does the musical encounter ensure sustainability measures. By conveying abstract, far away, threatened, usually unheard or events as immediate sonic experiences, the compositions confront the listener's separation from ecological crises thus reshaping attention. Listening becomes an ethical process of identifying fragility, dependence and interaction rather than merely watching or listening to the compositions as a new form of aesthetic pleasure.

Ethical entanglement will be assessed through the feelings and perceptions generated by listening to the performance. This includes the friction between closeness and aloofness, continuity and fracture, familiarity and alienation, as well as beauty and tumult.

These three aspects collectively offer the theoretical foundation for the analyses of the two pieces. This framework allows the article to rise above mere nature representation, focusing instead on how the compositional strategies construct ecological interconnectedness through sound.

Methodology

This study uses a qualitative methodology that combines ecocritical analysis with musicological investigation, study of electroacoustic strategies and close reading of the composer's program notes. These are applied comparatively to *Ice Becomes Water* and *Terra Infirma* by Judith Shatin, chosen since both compositions blend instrumental performance with environmental field recordings and explore various forms of ecological fragility.

The principal approach is qualitative musicological analysis of the available audio recordings, by listening closely and repeatedly backed by accessible music scores and performance materials. The analysis looks at texture, articulation, dynamics, timbre, register, rhythmic movement, density, development of form, continuity and rupture. These musical techniques are connected with questions of ecological interdependence, fragility and environmental stewardship by ecocritical interpretation. It relies on the relationship between the sonic phenomenon, its timbral strategies, the ecological and historical context of the piece, and its interaction with the landscape.

The article also ponders deep into programme notes by the composer, catalogue descriptions, composer's stated intention, interviews, and commissioning contexts. These documents offer insights into the source of the environmental recordings and the ecological issues that inspired each work. But they are considered as interpretive texts as opposed to definitive answers. The composer's stated intentions are compared with the musical structure of the compositions to recognize where they align, conflict, or extend their narrative.

Lastly, the study delves into how natural sound is treated in electroacoustic contexts, where it is edited, layered, repeated, transformed, and integrated with acoustic instruments. This approach reflects Shatin's own explanation of her compositional process: "I worked seamlessly between the acoustic and digital worlds, constantly traveling between the two" (Shatin, *Ice Becomes Water*). When specific technical details are unclear, the analysis focuses on audible effects like changes in resonance, duration, density, pitch, duration and recognisability. The comparative analysis further examines the construction of distinct ecological models from the glacial recordings in *Ice Becomes Water* and animal vocalizations in *Terra Infirma*. Through this fusion of electroacoustic analysis, contextual analysis, close reading of the texts, and close listening, the study explores how Shatin's musical works express environmental entanglement in meaningful and emotional ways.

The combined methodology of ecocritical investigation, full orchestral score analysis and electroacoustic analysis shows that it is through the process of composition rather than the study of ecological themes that ecological meaning is attained from Shatin's compositions. *Ice Becomes Water*

and *Terra Infirma* comprises of environmental recordings which are meticulously arranged inside a systematic harmony of dynamics, articulation, rhythm, texture and timbre.

Listening to Melting Glaciers: *Ice Becomes Water*

Judith Shatin employs ten cues of various timed durations and emotive indications for the notational arrangement of *Ice Becomes Water*. This cue-based formal arrangement is important since it enables the digital material sourced from Oskar Glowacki's glacial recordings to directly engage in the composition's rhythmic framework. Acoustic instruments do not evolve separately without accepting the natural sounds as accompaniment. Rather, its shifts are arranged with alterations in the manipulated recordings, leading to a uninterrupted flow of identifiable musical notes to cacophonous reverberations.

Measure 1 begins with the first cue described by Shatin as "Icy" and a tempo marking crotchet at 60. An unusually thin and high-frequency texture is established at the very outset for the first nine measures. Entries of the string instruments, namely, cello, violin and viola comes at different measures with dynamics at pianissimo and slightly mute tones, accompanied by Shatin's indication termed "MW", described as a "light, airy bow on the tremolo, like moth wings" (Shatin, *Ice Becomes Water*). The notes crescendos from niente or silence to pianissimo or soft followed by another decrescendo. In measures 2 and 4, for instance, the violins sustain high register frequencies through low dynamics, whereas the lower strings slowly emerge from the very same harmonic field. These spaced-out entries hinder the formation of a stable harmony consequently making it seem like a changing set of partials whose boundaries are blurred (Shatin, *Ice Becomes Water*, mm. 1–5).

Under these gestures, an edited high-register glacial recording is sustained using electronics. The string ensemble do not mimic a distinctly identifiable glacial sound; instead, it redefines its registral features using weak attacks, irregular bow positions and harmonics. The 7th measure features a quick hastening of notes on the viola followed by an indication for the contrabass to bow on the bridge in the normal placement in measure 8. The high-frequency viola notes and the dissonant bridge noise of the contrabass combine together conflicting musical extremes moving beyond a traditional harmonious arrangement. Thus, the glacier becomes a scene of resonance, tension and fragile activity. From measure 13 to 19, the cue shifts from "Icy" to "Intense." This transition constitutes a sudden shift from piano to forte with all instruments moving together with continuous accented notes. Grouping of the triplets, repetition of notes and the ricochet indication in this part is a drastic contrast to the opening subdued sections. The string ensemble, in measures 14 to 19, gets divided with accented notes. Even when the notes stay at very high frequencies, the rhythm gets highly staggered. The transition from

sustained note arrangement to purposeful repetition converts the texture from vulnerable suspension to tense and unstable activity.

“Lamenting” is the next indication that is shown in measure 20 at the beginning of cue 2. The density of texture quickly slows down and the composition takes a conventional turn. The following measures from 20 to 28 is characterized by a flow of melodic notes that are slurred and sustained, in contrast to the previous staccatoed and accented notes. During this portion, consistent change in time signatures from 4-4 to 3-4, 3-4 to 4-4, then again back to 5-4 which prevents the rhythmic continuity from following a traditional predictable harmonic model. The violins frequently emerge through small slurred movements before taking on the lower registers, while sustained backing notes are played by contrabass, viola and cello. Therefore, the “lamenting” revolves around the acoustic instruments implying that the despair and remorse goes along with the entire ensemble and is not portrayed as an independent melody that provides conventional harmony.

Cue 3 begins at measure 29 with the indicator “Darkening”. The register extends towards the bottom staves as the cello and viola become more conspicuous whereas the higher strings continues with the triplet movements. Bass notes are sustained with highly forced rising gestures in the violins from measures 30 to 37. Repetition of crescendos to forte and the arrangements between division and unison generate a fluctuating sense of dispersion and constriction. Measures 34 to 37 are characterised by fast gestures in the violins that move towards sustained accented notes. The texture appears to gain energy but then become unstable.

“Ominous” is the indication the follows cue 4 which starts at measure 42. Circular bowing of cello and contrabass between *tasto* and *sal ponticello*, which is depicted as T-s.p.-T-s.p., leading to the sustained lower tones shifting from continuous inner change from a normally rich tone to a frail and crumbly, overtone-rich texture. While this takes place, the higher strings employs very strong *pizzicato* gestures. The distinction between smell, drum-like high string attacks and emerging lower strings reverberation produces an acoustic landscape where the fragile stability is weakened from the inside.

The composition's primary cataclysm starts at Cue 5, with the indication, “Wild,” in measure 49. The score substitutes mellow music with cacophonous attacks, irregular triplet patterns, increasing bow pressure, and expanded strategies like “dig,” “chop,” “scratch,” “scrape,” and *molto sul ponticello*. In measure 50, the string ensemble comes together with triplets that are accented parts combine accented triplets with sharp chops close to the bridge. Verbal and written or visible notes are employed in measures 51 and 52. The performers stagger entry, add sporadic breaks, switch between scratches and scrapes and progressively increase density. Simultaneously, the stave of electronics show

verbal indications like “intensifying rumbles and groans” and “sounds of breaking ice” (Shatin, *Ice Becomes Water*, mm. 51–52).

Sonic entanglement is very evident in this portion. The strings no longer predominantly produce pitch, rather they exhibit sonic gestures related to pressure, tension and fracture. Through similar noise characteristics, the glacial recordings and the string ensemble get closer to each other. The strings do not replicate a recognisable recording of a crumbling glacier, demonstrating that their relationship is not founded on mere copying. Rather, the notation incorporates the defiance, scraping, breaking and abrupt release of glacial fracture into the performer’s physical action. This technique is continued from measures 55 to 60 with rich tremolos, scrape noises, increasing bow-pressure movements, and gritty glissandi from *tasto* to *quasi sul ponticello*. The electronics are indicated as “Water sounds, intensifying” at measure 57. The performers are expected to increase the number of breaks in the texture, make dense registered increases and stagger entry. Thus, the transition from glacier to water is represented by a change in acoustic behaviour. More continuous movement replaces solid, impact-based sounds, yet this continuity is still chaotic rather than serene.

The indication “Pensive” Opens cue 6 at measure 67. Even though there are still disruptions and groans, the electronic recordings start to seem “more harmonic”. Slurred triplets, prolonged intervals, and registral exchanges are all examples of the strings’ return to legato melodic compositions. These lines progressively gain energy between measures 71 and 78, peaking at *forte* and *fortissimo* before receding all of which is accompanied by falling glacier sounds. The previous break is not eliminated by the reappearance of pitched lyricism. The melodic sections take place in an electronic setting that is nonetheless characterized by glacial interruption. Because they are both perceived as components of the same aural process, reflection and disaster alternate without turning into opposites.

“Dark rumbles and rushing water” are reintroduced in cue 7 at measure 87. The score links together slow scratches and scrapes, pivot bows, gritty glissandi, and quick cello and contrabass movements. The instruments shift from scarce scratch sounds to prolonged, amplified tones accompanied by lateral bow scrapes from measures 92 to 94. The crashing sounds of broken glacier pieces slowly falling into the waters accompany the scrapes and scratches. This intensity is continued at measure 110 where cue 8 begins. The electronics blend together flowing water, high thin tones, and reverberations, which leads to “increasing, high edgy sounds” and upcoming ruptures. The transitions from *sul ponticello* to *molto sul ponticello*, string smacks, sporadic tremolos and movements created by gliding fingers along the fingerboard are features followed by string instruments. It becomes increasingly difficult to distinguish the glacial recording from the string-ensemble.

The concluding section starts with Cue 10 at measure 127. A “deep glacier drone” which focuses more on pitch than the previous crashes and rushing noises is introduced by the electronics. The texture of the orchestra gets very sparse and gentler, while soft creaking and scraping noises reappear sporadically from measures 139 to 141. The musical score presents the last indication, “Yearning” at measure 148. Prolonged tones rise above the low-register base, mostly at mezzo-forte, before fading to piano and pianissimo. The final measures feature high melodies in the high-strings and cello on a slightly muted contrabass tone. By measure 157, the orchestra recedes to triple piano, while the first and second violins sustain the notes with a difference of an octave, and the low strings create progressively vulnerable resonance.

The composition does not end by reviving the clear high-register tone in the opening. The concluding measures evoke that sound but they are now backed by the deep droning sound of the glacier and the memory of fierce cracking. The closing makes the environmental loss a setback that cannot be undone. Lament is woven into the very nature of the sound.

Sonic Ecologies of Vulnerable Lives: *Terra Infirma*

In *Terra Infirma*, Shatin broadens the concept of entanglement from a single abiotic geological activity of melting glaciers to a biodiverse community of heterogeneous species. The composition is divided into three movements, titled, “Birds”, “Mammals and Fish” and “Reptiles and Amphibians” each divided into emotive indications using English alphabets from A to G instead of the cue-based arrangement seen in *Ice Becomes Water*. Tempo stays at crotchet = 60 throughout the composition, in addition to traditional time signatures alternating between timed durations. This consistent and alternating pulse functions as a combined rhythmic landscape inside which man-made instruments, animal and bird calls and lake sounds interconnect with each other.

The opening movement, titled, “Birds,” rejects conventional time signatures to adopt three measures which are ten seconds long. Lake noises persist throughout from the very beginning accompanied by the instruments that gradually arise from the lake sonorities. The trumpet and saxophone in the opening measures use breath sounds like “s” or “sh” instead of employing mouthpieces. While the string ensemble produces occasional rustling sounds, dread tips are bounced off the drum head to generate a gentle drizzling voice. The volume rises in the second and third measures and recedes to niente in the fourth. This beginning does not deal with a particular environmental theme in the traditional sense. A musical landscape is created from human breath, water, tension and resonance even before regular instrumental tones are introduced.

At section A, titled “Inviting”, ten second measures are replaced with 5-4 time signature. Prolonged notes in pianissimo and triplets are allotted throughout strings, brass and woodwind instruments. Harmonics are emphasized by the percussionist bowing the instrument. The orchestra functions as a combination of independent voices instead of a harmonized chord. This ensemble lays the groundwork for the entry of loon call recordings in the 12th measure. Melodic contour and harmonic rhythm builds up the correlation between the acoustic instruments and loon recordings. Brief triplet gestures are played by brass instruments whereas the lower strings play bowed gestures which quickly accelerate. Loon cries are not merely imitated by these instrumental movements; rather, they embrace its ascending and descending contour, irregularly timed duration and division into separate tonal units. An intermittent, “distant loon” is audible afterwards in measures 20 and 21 under soft instrumental gestures that move from piano to mezzopiano and wire rolls on the drum rims. Distance is thus produced not simply through reduced volume of the digital recording but by softening the instruments with dynamics and enclosing the recording with soft, prolonged resonance.

The environmental interconnection gets more uncertain at section B indicated as “Lively” at measure 27. The previous gentleness of soft dynamics is substituted with abrupt sforzando, pizzicato and forte notes which are attacked with accents and brief textural trills. At the 29th measure, a “loon yodel sweep” is introduced. In place of a simple accompaniment to this yodelling, the instrumental harmonics burst into harshly distinct movements. The call of the loon makes its entry into a congested acoustic setting where it has to struggle against man-made instrumental sounds to be made audible.

A relevant transition takes place with the entry of Sandhill Crane voices at measure 43. There is great activity for the instruments with pizzicato notes which are repeated, syncopated accented attacks and quickly shifting registers. Whooping Crane recordings are introduced at measure 59, indicated as “Distressed”. The woodwinds, brass and String instruments answer with powerful attacks as well as fractured triplet gestures. Measures 63 to 66 features a vivid distinction between calls and alerts of Whooping Crane. These alert recordings are accompanied by repetition of brass tones, high frequency accents, flutter-tonguing and attacks on the drums. The notation transforms the physiological difference between normal vocalisation and unusual alarm into a shift in textural movement.

Towards the close of the first movement, the timbre becomes quite sparse. Distant loon voices and the Whooping Crane’s “anxious breath” are arranged within sustained silences and separated instrumental notes in measures 82 and 83. Therefore, the movement progresses from originally harmonious sonic environment, where instrumental air and rustling blend with lake sonorities, to a landscape where bird calls gradually evolve into warnings of distress. Hindrance is portrayed as reduced amount of sonic space accessible for prolonged connection.

“Fall-Winter: Mammals & Fish” is the title of the second movement marked as “Edgy.” A superball is gradually dragged over the bass drum, creating a low frequency tense resonance accompanied by a combination of water sounds from the lake, ice, waves and vocal recording of drum fish. The call of a moose is introduced from measure 6 and a specific indication to mimic the moose is given to the trombone using a growling raspy tone. Here, one of the most evident examples of interspecies call and response in the composition explicitly demonstrated. The reproduction of the moose sound does not convert it into a traditional melody; rather, it instructs the trombonist to modify and adapt the tone of the trombone to noisy sonorities.

An unnatural juxtaposition of animal and nature recordings occur as the movement progresses forward. A combination of water and ice, crashing ice noises, along with the sounds of elk and round goby is audible from measures 20 to 23. On top of these electronic sounds, the orchestra employs prolonged chords, note repetitions, pizzicato, accented fragments and harmonics. The arrangement thus constructs an intricate combination of the Great Lakes landscape instead of imitating an individual geological phenomenon.

The next indication, “Regretful” at measure 39 features continuous violin repetitions and sustained cello and viola tones that are spaced farther apart. The repetitive movement of violin seems rather unsettling and temporally tenacious, offering that section the behaviour of a grief that cannot attain closure. The relative serenity of viola and cello compels the recurring violin tone seem less like harmonious composition and more like trapped inside a confined area.

From measures 48 to 52, the electronic recordings of elk, wolf and trout together makes the movement sound quite denser. Water, ice, trout, elk, wolf, sturgeon and drum fish sounds are layered against instrumental melodies that are sustained and friction of the superball drawn over the tam-tam in measures 74 to 79. This juxtaposition generates environmental plenitude. However, simultaneous production of multiple sounds makes the original source indistinguishable.

This intensity reaches a climax at measure 87 indicated as “Screaming.” Brutal multiphonics and fierce changes in registers are used by the saxophone; the brass instruments bring together glissandi, denser pedal tones, discordant sounds and trills; violin, viola and cello become denser with overpressure, scratch sounds, bow tremolos, sul ponticello, chops and noise; and the percussion instruments combines together bass down, tan-tam and rustling rolls. In addition to the ensemble, the electronics produce thrashing waves and ice. The second movement therefore does not close with musical harmony but in an overcrowded saturation. Though all instruments of the orchestra and the electronics participate actively, meaningful and relevant jeopardized by the collective and heavy saturation.

The final movement, titled “Spring: Reptile, Amphibians,” at the outset, portrays adaptation as active diversity. Its beginning, shown as “Ominous,” merges the sounds of rattlesnake with wire brushes on timbale, thin wooden dowel shell trills, and lightly subdued bass drum. Spring Peeper sounds make its entry at measure 4 with the accompaniment of accented violin notes, sustained viola tones and cello with ricochet gestures. Wood Frogs are introduced in section A marked “Luring,” together with violin, viola and cello in pizzicato and percussion. Later, emotive markings like “Jaunty” and “Worried” depicts the shifts to accented fragments to frictional and more fragmented relationships. A significant transformation happens at measure 64 indicated as “Struggling”. Triplets and accents become fiercer as the announcement, “End of animal calls” by the electronics and a slow amplification of lake sounds follows. Section G, marked with “Desperate”, features the orchestra reaching fortissimo. The wind instruments undergo a repetition of accented notes and the strings follow chops, pizzicato attacks and rising bow pressure. The ceasing of animal recordings leads to a persistent rise in intensity of the lake sounds.

At measure 71, the indication, “Drowning”, substitutes temporal action with prolonged notes that repeatedly increase and decrease. At measures 74–76, the instruments sustain prolonged notes that move softer towards niente, and are finally instructed advised to sustain and pause on that final gesture. The final measures do not carry any more animal recordings. The orchestra stays visually suspended across the staves and the lake sounds recede and fade in the last measure which is ten-seconds long. Adaptation leads to restraint: the environmental voices are slowly stripped of articulation, movement and finally audibility.

Entangled Listening

The musical score of the two compositions unveils distinct yet different but relevant patterns of environmental degradation. *Ice Becomes Water* is arranged through a sequence of timbral conversion : harmonics evolve into accented frequencies, these pitches turn into scratches, interruptions and groans, and these cataclysmic noise consequently becomes a fragile drone that yearns for harmonious resonance. *Terra Infirma* progresses through interdependence and subsequent constraints on multiple voices. Animal voices that initially promoted responsive instrumental behaviour becomes greatly congested, disturbed, drowned or muted.

Electroacoustic recordings, in the two compositions, are never considered as mere background additions. Digital data is granted their own staves, rhythm markings, time signatures, timed durations, cue numbers, approximate pitches and graphic descriptions. Environmental sound becomes an active subject with agency in the composition as the instruments and electronics own parallel staves on the

score. The visual parallel between electronic and instrumental parts makes environmental sound a formal participant in the composition.

These compositional techniques construct ecological meaning through interdependence. A modification in the digital data stave changes the importance of an instrumental motion, whereas an instrumental response influences the perception of a field recording whether it be that of a geological event or that of biodiversity. The pieces, rather than simply depicting the interconnectedness of ecological systems, demand the musicians and audience to encounter music as a mesh or web where the individual identities dissipate into a fully interdependent identity. They require performers and listeners to experience sound as a network in which no element possesses a completely independent identity.

The detailed study of *Ice Becomes Water* and *Terra Infirma* reveals that Judith Shatin's environmental music cannot be sufficiently explained as the musical portrayal of ecological themes. In spite of being obviously influenced by the impending collapse of ecosystems, both these works prioritize the manner in which geological processes and biotic community participate as agents in the arrangement of musical sound. Shatin's works therefore expand ecomusicological research from questions of what music demonstrates regarding ecology to questions of how music could be arranged ecologically.

This contrast is pivotal to Aaron S. Allen's insight on ecomusicology as a study of relationships among music, culture and environment. In Shatin's pieces, those relations are expressed through the interplay of recordings, digital manipulation, instrumental bodies, scientific and academic data, conservation reports, performers and audiences. The scientific inquiry by glaciologist Oskar Glowacki provided access to the glacial recordings utilized in *Ice Becomes Water* and the animal vocalisations in *Terra Infirma* came from naturalists, conservation activists, academic institutions and sound archives. The ultimate compositions are therefore results of connections expanding beyond the traditional composer-performer relationship. The performance materials bear the historical contexts the landscapes, technologies and organizations through which they were documented and published. The environmental field recordings are dragged into the formal constraints of music while acoustic instruments are required to move beyond the conventional practices to the fragile and multivocal characteristics of natural sound. This reciprocal motion is relevant since both are influenced and transformed by the other.

R. Murray Schafer's concept of Soundscape and acoustic ecology mostly promote closer listening to the acoustic behaviours of a specific landscape and resists against the suppressing or silencing of relevant voices. Shatin acknowledges this concern, particularly in *Terra Infirma*, where the

programme note states that the voices of endangered “animals that call the Great Lakes region home” need to be heard clearly (Shatin, *Terra Infirma* 2). However, her works do not endeavour to duplicate an intact and pristine sonic environment. The glacial recordings and animal calls are extracted from their sources, modified, juxtaposed, amplified and added into inserted into man-made notational frameworks. Certain animal cries that would not normally coexist are purposely placed together, while the glacial sounds in *Ice Becomes Water* shift between fairly identifiable sounds to completely modified and processed electronic data.

The soundscape eventually becomes a space of intervention rather than an untouched natural phenomenon. While this does not result in making natural sounds less original or ecologically meaningful, it imparts the idea that that ecological perception is constantly adapted by technologies, cultural patterns and listening behaviours. A glacier situated beyond an individual’s first-hand observation becomes available through scientific intervention and transmission. The voice of a threatened bird or animal gets to the concert hall through recordings, conservation archives and amplification. Shatin’s compositions, thus, moves acoustic ecology away from the reproduction of an idealised untouched environmental soundscape towards an enquiry into the manner in which ecological facts are communicated and made audible.

This is further clarified by the concept of the entangled soundscape. In *Ice Becomes Water*, sonic entanglement takes place as processed glacial sounds and unconventional string strategies converge around common traits like friction, tension, fragility and fracture. The electronics guide the orchestra, while the ensemble offers temporal structure and physical form to the sonic landscape. In *Terra Infirma*, animal sounds trigger mimicking, response, rivalry, subduing and subsequent fading. The orchestra becomes a fluctuating site which decide whether separate sounds can materialize or become audible.

These relationships reinforce Timothy Morton’s idea of blurred boundaries between human and more-than-human world. The environmental “mesh” is not depicted in Shatin’s works as a site of harmonious concord. Rather, it seems like a condition of interdependence in which disruption involving one factor transforms the behaviour of the whole. The fierce and intense sections in *Ice Becomes Water* redefine the relevance of the rhythmic and melodic matter around them. Likewise, the ceasing of animal sounds in *Terra Infirma* alters the whole sonic environment. Interconnectedness is therefore portrayed as a cause of fragility as well as continuity.

Moreover, Donna Haraway’s concept of sympoiesis makes the collective innovation more evident. In these compositions. Though Judith Shatin stays as the composer who chooses, manipulates and arranges the raw materials, the process of creation does not emerge from an autonomous

individual. The sonic materials evolved through “making-with”: with recording apparatuses, animals, lakes, glaciers, academicians, instrumentalists, electronic devices and concert halls. Despite not being equal collaborators, the nature recordings do exercise material agency on the final product. The process of composing therefore becomes an interaction with pre-existing sound sonorities rather than an anthropogenic encroachment on an inactive nature.

The pieces further reveals that environmental harmony does not always refer to aesthetic fluidity. Their entangled sonic environment features coordination and resonance, but also contains hindrances, saturation, rupture, interruption and silence. *Ice Becomes Water* alternates between contemplative harmony and catastrophic noise, converging the allure of the glacier with the brutality of its impending disappearance. *Terra Infirma* initially portrays a plethora of flora, fauna and instrumental sounds, yet this multiplicity becomes highly crowded and restrictive. Therefore, entanglement is not actually comforting. It reveals how ecological degradation revolves around the network of ecosystems.

This friction is specifically significant to the ethical aspect of the compositions. Shatin’s works do not offer scientific data or information on climate crisis or extinction of species, nor can it ensure sustainable practices. Its ethical power lies in altering the circumstances of attention. The listener is expected to pursue fragile relationships among ecological, digital and instrumental voices rather than considering environment as a passive object of scrutiny. In *Ice Becomes Water*, the boundary between instruments and glacier gets blurred as both enter into a common range of resonance and discord. In *Terra Infirma*, identifying a loon, drum fish, moose, or frog is only the start of environmental listening. The audience is expected to listen for the responses, suppressions, distresses or silences. Listening therefore moves from recognizing separate sources to understand the situations that allow or resist their audibility.

The aesthetic engagement derived from the works is ethically ambiguous. Natural sounds could draw attention due to their unfamiliarity, beauty or emotional effect. There is a constant possibility of the crisis becoming an that ecological crisis will become an object of artistic and cultural consumption. Shatin deals with this risk to some extent by resisting stable natural beauty. Delicate timbres are disrupted, lament does not provide solution to the imminent disaster and multiplicity leads to congestion or silence. The pieces do not allow the listener to stay comfortably inside either aesthetic appreciation or ominous scenario. Aesthetics and disharmony remain interdependent.

Electroacoustic composition is specifically useful to this ethical redirection since it can bring physically distant unavailable event into immediate access. This process cannot fully erase the distance. The electronically processed sounds preserve traces of the distant locations and times even as they enter the performance hall. The audience experiences the glacier and the Great Lakes landscape

through intervention. The comparison further exposes two distinct range of ecological awareness. *Ice Becomes Water* makes prolonged geological transformation comprehensible through temporal material process; and *Terra Infirma* shows ecological degradation through the shifting situation of interspecies interaction. This collectively demonstrates that ecological degradation happens at the same time across geographical, physiological, cultural and technological field.

Conclusion

Collectively, the two works unveil different ranges of ecological degradation: geological phenomenon in *Ice Becomes Water* and heterogeneous species fragility in *Terra Infirma*. In both the pieces, however, field recordings of natural sounds become active agents that participate as primary musical materials rather than background depictions. This encounter backs the article's principal argument that Shatin's works reshapes the process of listening. The audience is inspired to delve not only into separate sounds but also into the disruptions, dependencies as well as the fragilities through which ecological meaning is attained.

The works therefore move beyond representing environmental crisis and instead construct what this study has termed entangled soundscapes. It offers a structure for perceiving this process through three dimensions: sonic entanglement, constructed through the blending of sonic, electronic and natural materials; ecological entanglement, revealed through interconnectedness among human and more-than-human entities; and ethical entanglement, created when listeners are placed inside the environmental situations made audible by the music. The article does not assert that sustainable measures are prompted by such listening. It deals with the perceptual and ethical potentials of Shatin's compositional techniques. Further studies may analyse audience reception, performance practice and compare environmental works by other musicians. Shatin's music ultimately requires audiences not merely to listen to ecological crisis, but to identify that listening itself happens inside the interaction of fragility, accountability and interdependence which forms ecological life.

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