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Music and Environment:
Registering Contemporary Convergences

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Introduction

From the ancient Greek's harmony of the spheres (Pont 2004) to a first millennium Babylonian treatise on birdsong (Lambert 1970), from the thirteenth-century round 'Sumer Is Icumen In' to Handel's *Water Music* (Suites HWV 348–50, 1717), and from Beethoven's Pastoral Symphony (No. 6 in F major, Op. 68, 1808) to Randy Newman's 'Burn On' (Newman 1972), musicians of all stripes have long linked 'music' and 'environment'. However, this gloss fails to capture the scope of recent activity by musicians and musicologists who are engaging with topics, concepts, and issues relating to the environment.

Despite musicology's historical preoccupation with autonomy, our register of musico-environmental convergences indicates that the discipline is undergoing a sea change — one underpinned in particular by the1980s and early 1990s work of New Musicologists like Joseph Kerman, Susan McClary, Lawrence Kramer, and Philip Bohlman. Their challenges to the belief that music is essentially self-referential provoked a shift in the discipline, prompting interdisciplinary partnerships to be struck and methodologies to be rethought. Much initial activity focused on the role that politics, gender, and identity play in music. Engagements with social concerns have now broadened to include a desire on the part of some musicologists (and others in the humanities) to respond to issues of climate change, sustainability, and environmental degradation.

In this article, we review contemporary music makers and scholars who connect music and environment in their many guises. In the process, we use this survey to briefly draw together and highlight recent *JMRO* articles (authors' names are flagged with *) that were first given as conference papers at the Music and Environment Symposium convened by the authors and Tony Mitchell at the University of Technology, Sydney, in 2013[1].

The flashpoint that concerns us has a heterogeneous history, partly because both music and environment are remarkably complex in denotation and connotation. In his *Oxford Music Online* entry for the word, 'music', for example, ethnomusicologist Bruno Nettl tellingly avoids supplying a definition, suggesting instead that:

> … each society uses its culture to structure and classify the world in its own way, based on its view of nature, the supernatural, the environment, society (Nettl 2007: 14).

Likewise, 'environment' has a multiplicity of nuances and ambiguities. It could mean locale, surroundings, part or whole of the natural world, living conditions, or even technological milieu. While most often thought of as physical, environment also includes social and cultural forces. For example, we might refer to a political environment. Although the environment and things socio-cultural have historically found themselves at opposite ends of the nature-culture binary, nature-culture is increasingly seen as a continuum. (It is worth pointing out that our own species does not lie outside nature.)

Our conference delineated five themes of activity and enquiry that link music and environment:

(i) music as commemoration or evocation of place;

(ii) soundscape studies and sound art;

(iii) acoustic ecology, ecomusicology, and the links between music and environmental activism;

(iv) environmental ethnomusicology, archaeomusicology, zoömusicology, and biomusicology; and

(v) music and its technological environment.

Such analytic divisions are useful although provisional: the sound making under consideration often spans two or more categories, which speaks to the interplay of musical, social, cultural, political, and technological forces at work in these pursuits. Our intention is not to try to set boundaries, but rather to focus on what people claim their work is about. Rather than amassing a comprehensive catalogue of musical outcomes, we invoke a minimal list of exemplars, each being a placeholder for any number of related activities. Similarly, in identifying the width and breadth of scholarly research, our key consideration is to briefly define a node of activity and to suggest the questions and nature of the tasks that researchers have to date set for themselves. Such restrictions seem necessary for the purposes of a short introduction such as this, especially given the explosion of activities in musico-environmental convergences.

Music as Commemoration or Evocation of Place

Franz Liszt invented the expression, 'programme music', in 1855 to describe instrumental music suggesting a pictorial scene or narrative description (in contrast to 'absolute music'). As in the past, an infinite number of contemporary songs and art music compositions commemorate or evoke a place. American musicologist Richard Leppert has noted:

> … the rampant increase of interest, in all of the arts—literature, visual art, and music alike—in representations of nature and place … In music the list is virtually endless: Haydn, Beethoven, Schubert, Schumann, Wagner, Debussy, and, God knows, virtually every note that Mahler composed; Ives, Messiaen, Pauline Oliveros, Alan Hohvannes, R. Murray Schafer, and so on. And musical modernity is similarly obsessed with place (if not always precisely 'nature'): The Pines of Rome, The Fountains of Rome, The Grand Canyon Suite, An American in Paris, maybe even 'I Left My Heart in San Francisco,' and 'By the Time I Get to Phoenix' (Leppert 2002).

The confluence of 'music' and 'place' is indeed awash with musical works. Granted, some seem to merely bear a place's name, but, other times, place is more than a seemingly extraneous component, and many contemporary sonic results move well beyond programme music. In *Singing in the Wilderness: Music and Ecology in the Twentieth Century*, music critic, musicologist, and composer Wilfrid Mellers provides a useful survey of '… composers who explored place, landscape, nationalism as grist in their mills' (Mellers 2001: viii). His thematic approach covers chapters on the forest, jungle, city, mountains, and deserts, following, among others, Villa-Lobos in Brazil, Harry Partch in the deserts of California and Arizona, and Steve Reich in Ghana and Bali.

In her monograph, *The Sounds of Place: Music and the American Cultural Landscape*, musicologist Denise Von Glahn is more narrowly focused (Von Glahn 2003). She details fourteen American composers who commemorated iconographic places, including *Harlem* (Duke Ellington), *The Housatonic at Stockbridge* and *From Hanover Square North* (Charles Ives), and *Cimarron* (Roy Harris). Von Glahn notes

a shift from valorising unspoiled nature or asserting nationalism to acknowledging the human impact on the environment. Musicologist Brooks Toliver limits his attention (Toliver 2004: 367) to the best-known composition about a national park, Ferde Grofé's *Grand Canyon Suite* (1931). Like Von Glahn, Toliver is attuned to human impact, proposing in his analysis 'several ways of hearing in the work a simultaneous celebration and conquest of the Grand Canyon':

> [Grofe] sometimes argued for an explicit connection between his musical language and the landscape, one manifest in his disconnection from the European tradition ... (Toliver 2004: 348). ... he brought to his suite a way of appreciating nature that was theoretically incompatible with leaving it alone ... (Toliver 2004: 327).

Place signification is well known in popular and folk music as well, including hip-hop[2]. Anthropologist Mark Pedelty describes how music is put to work:

> Music may be just as important as law (e.g., legal ownership of physical space) when it comes to creating spaces for meaningful action. At the very least, music imbues shared places—public squares, parks, or protest encampments—with greater meaning. In semiotic language, music 'encodes' space with cultural meaning (Pedelty 2012: 40).

Feld describes the poetic song texts of Kaluli people in Bosavi, Papua New Guinea, 'where singing a sequence of named places takes listeners on a journey that flows along local waterways and through local lands' (Feld 1996: 91). A number of other monographs, chapters, and articles tease out 'place' in the musical experience, and more are on the way, like the Indiana University Press series, 'Music, Nature, Place'[3].

Both audience and performer have a relationship to place and space. Music festivals in particular can be understood as not only sound, but as 'situated performance' (Ronström, Malm, and Lundberg 2001: 50). Until World War II, music festivals were typically regional or national gatherings (Baumann 2000: 125), but even an international festival is nonetheless a local affair[4]. Adam Krims' monograph explores how music is mediated in the urban environment (Krims 2007), while Alyssa Critchley ponders the effects that physical space might have on the concert-going experience — in particular, the autonomous performance places of Sydney's alternative music cultures (Critchley 2013). Meanwhile, Elina Hytonen-Ng's work on 'flow' in jazz performance contemplates the significance of the physical environment on the act of music-making: she looks at how the space of jazz clubs is or is not conducive to flow (Hytonen-Ng 2013).

It is within music's power to attract or repel. When it comes to social engineering, much ink has been spilt on music's ability to communicate and touch the emotions: music to relax to, go to sleep and wake up to, move to, and celebrate with. Less well considered is music that induces mental or physical distress. Youth hangouts can be rendered unsuitable when classical music is played, while fast-food customers can be inspired to limit their table time by the choice and volume of music. Catherine Hoad, among others, has chased the confluence of music and place right to its edges. In an exploration of the manner in which music torture works to transform environments, Hoad traces how a song's reception can modulate across different places. She concludes that psychological warfare via music 'does not represent a purely sonic assault, but is rather underpinned by complex biopolitical issues' (Hoad 2013).

Musical evocations of place have long propped up nationalism, from military bands to communist Balkan folkloric orchestras. (Even musical instruments have achieved the status of national icons, like the gamelan of Java and Bali, the pan flute of Peru, the alphorn of Switzerland, the didjeridu of Australia, and the bagpipe of Scotland (Baumann 2000).) However, musical genres are, on the one hand, not respecters of national borders and, on the other, might even speak more of a local region than of a nation: some genres evoke a place without any accompanying aspiration to build a nation. For example, in popular music, localised terms like 'Seattle', 'Liverpool', 'Perth', 'Motown', or 'Dunedin' imply a certain 'sound' where a 'scene' has been created. However, it is not only natives who refer to certain places or styles, as the example of Reich in Ghana and Bali illustrates. Hudson catalogues how self-identifying as a 'music city' can be a significant part of a city's branding and post-industrial development strategy (Hudson 2006).

Travel, immigration, recordings, the internet, and the transnational imagination can influence music. In 'world music' (a marketing category with an intrinsically geographical label), various Caribbean islands, West Africa, India, the Balkans, the Maghreb, and Celtic regions

come to mind as place names having achieved a genre-like distinction, although any such list demands an accompanying statement of its incompleteness. While world music for musicians might be considered an expressive project, some have critiqued its 'simplistic celebrations of geographical diversity and remoteness' (Connell and Gibson 2004: 342).

Music making can also relate to a more abstract concept of place. Musicologist Richard Vella's manual for creative music-making, *Musical Environments: A Manual for Listening, Improvising and Composing,* understands environment as the nature of sounds in space (Vella 2000). In his monograph, he explores time, space, mass, structure, texture, energy, and aural depths of field as they relate to the musical environment. Much music today is crafted in a transcultural workshop, and thus musico-cultural identity no longer refers merely to the local (Baumann 2000: 11). The waxing and waning of Vietnamese refugees' traditional and pop music outside that country concerns musicologist Trân Quang Haï, reminding us that the concept of place is not a fixed and essentialised one (Haï 2001). Interest in music and place is not limited to musicologists: cultural geographers have produced a number of recent analyses of how places are constructed and commodified, claimed and contested through music (Cohen 1995; Connell and Gibson 2004; Hudson 2006; Leyshon, Matless, and Revill 1998; Power and Jansson 2004; Stokes 2004; Waterman 1998).

Finally, the music of nature may find its way into human musical outcomes[5]. Perhaps no sound is more evocative of place for composers than birdsong. While the music of nature turns up in our next three sections as well, it is worth noting here a gradual transformation in the appropriation of the sonic constructs of birds in some arenas:

> Composers have sought to absorb avian idioms in a wider sense than melody, particularly in the twentieth and twenty-first centuries. In the birdsong-derived music of Messiaen and his student Mâche, among others, deeper structures are incorporated. Increasingly, birdsongs are thought of as compelling models on a number of fronts and are called upon by some to evoke mystery and spirituality as well as to provoke ecological insights and a dialogue between nature and culture (Taylor 2011a: 3).

While birdsong appropriation no longer automatically implies a light-hearted excursion into nature, this is dependent on who is listening and sounding. Feld (2000: 272) laments the disparity between global pygmy pop as a 'varied and complex corpus of musical practices' versus its caricatured image as a 'sonic cartoon'. Likewise, birdsong continues to be pertinent in its complexity for some and in its clichéd abbreviation for others.

Soundscape Studies and Sound Art

Soundscape Studies

In his seminal work, *The Tuning of the World*, composer and environmentalist R. Murray Schafer (to whose work we return under the rubric 'Acoustic Ecology') was among the first to employ the term 'soundscape', alerted readers to the planet's changing environmental sounds, and charted the course for soundscape studies (Schafer 1977). He charged researchers to apply themselves to the key question '… what is the relationship between man and the sounds of his environment and what happens when those sounds change?' (Schafer 1977: 3–4)

In a more recent monograph, *Spaces Speak, Are You Listening?*, Barry Blesser and Linda-Ruth Salter describe how to plan for effective built environments, employing the term 'aural architecture'. They thereby draw a distinction between aural architecture and a soundscape:

> With a soundscape, the sounds are important in themselves, as for example, birds singing … Aural architecture emphasizes sound primarily as illumination, whereas a soundscape emphasizes sound in itself (Blesser and Salter 2007: 16).

However, writer and critic Steven Connor cautions that sound is not enough to constitute a soundscape, returning to Schafer's trope of relationship '… soundscape is sound plus relation, and that relation need not be fully and in itself sonorous' (Connor 2013: 5).

Expanding on the relational, Connor singles out animals, not just for their sounds but also for the other points of audition that they imply:

> A polyvocal soundscape is one that is not merely laid out for a particular listener but listens and replies to itself. A soundscape is a disposition of points and sounds that is referable to a particular point of audition: a soundscape populated by animals is polycentric, a disposition of dispositions ... The urban animals that live in closest proximity to us listen out for us so intensely, that hearing them is the sound of our own silence, and their silence the sound of our approach (Connor 2013: 3–4).

Schafer's suggestion of the relationship between the soundscape and both language and music deeply influenced Feld, who took Schafer's monograph to the Papua New Guinea rainforest, where he transformed himself 'from an ethnomusicologist to an echo-muse-ecologist' (Feld 1994).

Other concerns raised by Schafer, of noise pollution and environmental collapse, have been taken up by musician, soundscape recordist, and bioacoustician[6] Bernie Krause. He coined terms like 'biophony', the collective sounds created by a habitat's more-than-human animals, and 'geophony', the non-human natural sounds such as waves, streams, wind, thunder, rain, earthquakes, and avalanches, which he contrasts with 'anthrophony', the human contribution to the soundscape (Krause 2002: 152). In his most recent monograph, *The Great Animal Orchestra*, Krause urges musicians to abandon the habit of picking and choosing sounds of the most charismatic animals and to instead establish holistic connections to the entirety of wild soundscapes, which he argues have scarcely been tapped as sources of inspiration (Krause 2012)[7].

Krause collaborates with others in soundscape ecology, which marshals the concerns and methodologies of scientists to investigate what sound can tell us about the natural environment, in particular animal diversity (Pijanowski et al. 2011). Krause has also collaborated with soundscape ecologist Almo Farina, who understands the soundscape to be both 'a perceptual construct and a physical phenomenon' (Farina 2014: 4). With sound understood as a significant source of information, metrics for capturing, storing, and processing sound files are the primary aspiration of this field, although it does have a conservation ethic as well. Soundscape ecology is not to be confused with the related field of bioacoustics, which investigates 'how animals use sound to communicate' (Stap 2005: 4)[8].

Sound Art

American composer and sound artist Nicolas Collins distinguishes music from sound art thus:

> That which we call 'Music' is judged by the full weight of history and fashion; substitute 'Sound Art' and most of these preconceptions fall away (Collins 2013: 1).

'Sound art' serves as a catch-all term for the work of soundscape recordists, performers, artists, and composers. Academic interest in work that is sound-based rather than note-based has increased substantially in recent times. Sound artists typically concern themselves with more than commemorations or evocations of place. Their intention is often the sonification of place. For aboriginal Australians, every feature of a landscape is associated with an historical episode or a sacred verse in their cosmology — and not only those worthy of sightseers' attention; in their songlines, nothing existed without being sung, with cultural information (including site-specific knowledge for survival in the Australian outback) being embedded in song (Rose 2013: 37)[9]. Although sound artists have not set for themselves such a sweeping agenda, we find a not unrelated counterpart in 'acoustemology' (Steven Feld coined the term in 2003 but contemplated multisensory linkages beginning in the 1970s), which unites acoustics and epistemology in order to 'investigate the primacy of sound as a modality of knowing and being in the world' (Feld 2003: 226). Feld understands our experience of place to be grounded in an acoustic dimension, since 'space indexes the distribution of sounds, and time indexes the motion of sounds' (Feld 1996: 97).

Recent precursors to sound art, in the sense of a music that is predominantly thinkable within a specific environment, include 'furniture music' (the Dadaist sonic explorations of composer Erik Satie); 'elevator', 'waiting room', 'piped', and 'supermarket music'— or Muzak – meant to be mildly stimulating but pleasingly uninteresting (and played to an audience the members of which are not free agents); and 'ambient music', which its early proponent, Brian Eno, describes in liner notes to *Ambient 1: Music for Airports* thus:

> My intention is to produce original pieces ostensibly (but not exclusively) for particular times and situations with a view to building up a small but versatile catalogue of environmental music suited to a wide variety of moods and atmospheres. … Ambient Music must be able to accommodate many levels of listening attention without enforcing one in particular; it must be as ignorable as it is interesting (Eno 1978).

Another of ambient music's pioneers was Luc Ferrari, who worked with environmental sounds on tape to suggest a dramatic narrative. His *Presque Rien No. 1, - Lever du Jour au Bord de la Mer* (1967–1970) was formed from a day-long recording (at a Yugoslavian beach) that was then whittled down to twenty-one minutes. In 1958, Ferrari co-founded the Groupe de Recherches Musicales with François-Bernard Mâche and Pierre Schaeffer. Schaeffer introduced the concept of 'acousmatic listening' (listening to sonorous objects without reference to their sources) in the tape montages of his *musique concrète* (Schaeffer 2007). Schafer (1977: 88) coined the term 'schizophonia' to describe the challenges to our aural perception (and the concomitant changes in behaviour) when we are confronted with a recorded sound split off from its original source via electro-acoustic reproduction.

Sonic arts practitioners may work with plants, bridges, fences, waterways, and other environmental artefacts[10].For example, musician Jon Rose has been sounding the world's iconic and border fences for over three decades (Sayej 2013). Professor of media and innovation Douglas Kahn's *Earth Sound Earth Signal* charts further areas for sounding: electricity, electromagnetism, brainwaves, telegraphy, telephony, and the aeolian (Kahn 2013). Various institutions now offer a Master of Fine Arts in Sound Arts, where students might explore sound through sculpture, performance, installation, writing, film, new media, and technology.

CDs with nature and environmental themes abound, from birdsongs to ocean waves, and from insects to church bells. Other such recordings find their way into full-blown installations, like Leah Barclay's *Sound Mirrors*, an interactive sound installation that responds to specific rivers worldwide (Barclay 2014), and like Annea Lockwood's *A Sound Map of the Housatonic River*, which is constructed from both surface and underwater recordings of the Housatonic River (Free Music Archive 2010).

Paul Walde's *Requiem for a Glacier* memorialises British Columbia's Jumbo Glacier area, now under threat from global warming and resort development (Walde 2013). The project has three outcomes:

> … a) a site specific outdoor sound performance; b) an exhibition/installation featuring audio/video footage of the performance; and c) a multimedia indoor sound performance. The centre piece, a four movement oratorio scored for orchestra and choir, converts information such as temperature records for the area into music notation and features a Latin translation of the BC government's press release announcing the approval of a year-round resort community at the site that borders a nature conservancy (Walde 2013).

Articles in a recent special issue of *Leonardo Music Journal* on sound art detail, among others, sound engineer Jos Mulder's sound installation near an abandoned mining works with a solar-powered, motion-sensor-cued system that dropped chunks of coal from a reservoir (Mulder 2013); composer, performer, and musicologist Llorenç Barber's bell tower improvisations (Barber 2013); artist Mike Blow's solar-powered sound artwork 'that responds to the sun, creating a field of small sounds and drawing visitors into the physical and sonic landscape' (Blow 2013: 10); and musicologist Gascia Ouzounian's survey of recent sound art in Belfast, in which she credits sonic art with the capacity to 'redraw boundaries in a city historically marked by myriad political, socioeconomic, religious and sectarian divisions' (Ouzounian 2013: 47).

Acoustic Ecology, Ecomusicology, and Environmental Activism

Acoustic Ecology

'Acoustic ecology' concerns itself with thoughtful, artistic, and activist responses to human sonic detritus (or sound pollution) that would rebalance and restore degraded acoustic ecosystems. When Schafer initiated the World Soundscape Project in 1971, he brought together individuals like Barry Truax and Hildegard Westerkamp to conduct sound and acoustic studies and to speculate on sociological and environmental implications of urban sound pollution and the intrusion of human sonic detritus. In his 1978 *Handbook for Acoustic Ecology*,

Truax compiled the major terminology from the fields of acoustics, psychoacoustics, environmental acoustics and noise measurement, electro-acoustics, music, linguistics, and soundscape studies. Two decades later, he edited a CD-Rom version, adding environmental sound examples to illustrate many of the database's entries (Truax 1999). Reflecting on the artistic outcomes of acoustic ecology, Truax writes that 'the real goal of the soundscape composition is the re-integration of the listener with the environment in a balanced ecological relationship' (Truax 2006).

Hildegard Westerkamp is a prolific composer and sound ecologist whose creative output spans installations, CDs, radiophonic works, soundscapes, mixed media sculpture, and music for film (Westerkamp n.d.). Her subjects range from British Columbia ghost towns to electronic seascapes, with a particular interest in listening strategies that ponder opposites like noise-silence, internal-external, worldly-sacred, and loud-subtle. Environmental attributes unquestionably impact the act of listening: as such, they are relevant to all five themes we have set out.

Landscape architect Anthony Magen designs 'soundwalks' to inspire awareness of sounds and space and as a tool to promote acoustic ecology to the wider public (Magen 2009). With reference to her own soundwalks, sound artist Janet Cardiff finds an intrinsic sense of narrative associated with walking, and that walking and thinking go hand in hand (Clover 2013: 21). However, there is surely an aural selection process that takes place in the invisible ecosystem of sound. According to New Zealand sound artist and composer Dugal McKinnon (2013: 71):

> Acoustic ecology is open to all sound in principle only. In practice some sounds and soundscapes are desirable and valued while others are not.

Others working in the field are more inclusive. A case in point is the British artist, musician, and acoustic ecologist Peter Cusack, whose field recordings 'as sonic journalism' target supposedly undesired sounds to stunning effect (Cusack 2014). *Sounds from Dangerous Places* features recordings made at Chernobyl (with tracks like 'Cuckoo and Radiometer') and the Caspian Oilfields ('Drilling') and in various UK sites, like 'Snowdonia Woodland' (with its landfill waste gases), 'Swallow Trapped in Ancient Church', and 'Bradwell Nuclear Power Station' (Cusack 2012). His aural journeys underline the significance of 'the information that environmental sound provides to [concerned] citizens' (Cusack 2012: 75).

With the help of Greenpeace, composer David Monacchi travelled to the equatorial Amazon to record in an old-growth rainforest:

> I had the intuition that the biophony of untouched forest ecosystems should exhibit a more structured behavior, maximizing efficiency within diversity. … my hypothesis was immediately confirmed by finding extremely balanced acoustic systems produced by hundreds of species of insects, amphibians, birds and mammals neatly vocalizing within stunningly regular circadian cycles (Monacchi 2013: 23).

Monacchi's work focuses on how to learn from a primary ecosystem and to compose within the same laws that have shaped these ancient acoustic environments, as well as how to use compositional tools to reveal and enhance existing configurations of species (Monacchi 2013: 24). The Finnish research collective Acoustic Environments in Change stays closer to home: its interdisciplinary approach combines music studies and anthropology as the members visit five local villages (Järviluoma 2013).

Most acoustic ecologists view their endeavour in moral terms. Contending that the 'capacity to hear the soundscape as music is simultaneously one of the most archaic ways of listening and the most modern', Dunn insists that interactions with the environment bring social and musical responsibilities (Dunn 2008). He reflects:

> … awareness of the historical moment — signalled through extensive loss of biological diversity, global climate change, and the impacts of human over-population — will demand an even further shift in how the sonic arts move beyond purely expressive concerns, or documentary and sensory heightening strategies alone, towards participation in both scientific research and subsequent interventions

> in growing environmental dilemmas. This is just another stage in how music has always congruently evolved with human needs. While no one can predict the exact outcome of the changes we bear witness to, it occurs to me that one of the best uses of our time as musicians is to find creative ways to listen to some of nature's changing messages and pass them along to others (Dunn 2008).

Ecomusicology

The discipline of 'ecomusicology' purports equally activist goals as acoustic ecology. Ecomusicologist Aaron S. Allen defines this new field as 'the critical study of music and environment' (Allen, Titon, and Von Glahn 2014: 5). Allen understands the prefix, 'eco', as referring not to 'ecological' but rather to 'ecocritical': ecomusicology equals ecocriticism plus musicology (Allen 2011a: 393). In an article setting down disciplinary parameters for ecomusicology, he asks a series of key questions, including:

> What role does musicology play in the welfare and survival of humanity? How does nature inform music, and what can the study of music tell us about humans, other species, the built environment, the natural world, constructed 'nature,' and their connections? … Is the environmental crisis relevant to music — and more importantly, is musicology relevant to solving it? (Allen 2011a: 392)

Von Glahn has asked how a warmer world might sound, including 'Who gets to control our immediate soundscape, our regional one, the global one?' (Allen, Titon, and Von Glahn 2014: 12).

Ethnomusicologist Jeff Todd Titon has also borrowed from the terminology of conservationism and ecology. He contrasts the sustainability discourses of conservation ecology with developmental economics, and he theorises the concept of 'sustainable music' in both the natural and human worlds (Titon 2009a: 5–15; 2009b: 119–37). He conjectures:

> If we think of music as heritage, primarily a thing of the past, we are immediately in a defensive posture of collecting, preserving, safeguarding, protecting, and mediating music, through proclamations and set-asides, special spaces and sanctuaries. But if we think of a music culture as something here, living, a renewable daily resource among us, we move into a discourse of sustainability, people in partnership, taking on the privilege and excitement and reaping the rewards of stewardship (Titon 2009b: 135).

While he understands ecomusicology as 'the study of music, culture, sound and nature in a period of environmental crisis,' Titon urges ecomusicologists to 'confront a more problematized nature' rather than the nature of scientific realism (Titon 2013: 8–9). Other resources for ecomusicology include Pedelty's *Ecomusicology: Rock, Folk, and the Environment*, a forthcoming monograph: *Current Directions in Ecomusicology: Music, Nature, Environment*, edited by Aaron S. Allen and Kevin Dawe, and an online newsletter (Ecomusicology n.d.)[11].

Musicologist Brent Keogh* enters the debate by exploring the development of the ecology trope vis-à-vis music, problematising contemporary discourse on musical sustainability (Keogh 2013). He challenges Titon's argument that we can count on a music culture to behave like an ecosystem, and details the limitations of applying naturalistic tropes to support the conservation of human cultural forms.

A considerable number of musical traditions and sensibilities are now at risk due to degraded, indifferent, or even hostile environments, whether cultural, political, or other. For example, ethnomusicologist Ros Dunlop has catalogued the traditional musical instruments of East Timor and their place in the social and cultural mores of that society, concluding that much of this music is a 'hidden culture and its survival is precarious' (Dunlop 2013).

Musicologist David Huron frames the potential collapse in diversity not just as a loss of musical constructs but also a loss of musical minds:

> The casual listener hears a wealth of variety; the musicologist detects a rapidly spreading monoculture … What do we risk losing? Well, suppose that we find a musical behaviour present in all the world's cultures. This could reveal some universal in human behaviour. But if all the world's musics are influenced by a single dominant culture, universals become uninterpretable. A behaviour might be

> an innate cognitive disposition, or just an artefact of westernization. We won't be able to work out, for example, whether people in different cultures perceive dissonance — an unpleasant combination of notes — in a similar way, or whether similar responses arise from exposure to Western music (Huron 2008: 456).

Environmental Activism

Sound (and scholarship on it) has an increasing role in generating environmental awareness. The United Nations Environment Programme's 'Music & Environment Initiative' aims to address pressing environmental problems facing the planet, including climate change, species extinction, freshwater crises, and other environmental issues:

> Music is one of the most powerful media to communicate environmental messages to billions of people worldwide — irrespective of race, religion, income, gender or age (United Nations 2013).

One can simultaneously applaud billions receiving environmental messages and lament the subsequent universalism that Huron has critiqued.

Ethnomusicologist Robin Ryan* observes that:

> The 'greening' of music — the adoption by composers and musicians of caring and respectful environmental values — works to circumvent aspects of commodity culture that marginalise nature and place (Ryan 2014: 42).

For example, Ear to the Earth has created an international network of environmental sound artists with a 'green' agenda of communicating the economic, social, and political complexities of climate change and other environmental concerns (Ear to the Earth 2014). Similarly, Allen makes a case that ecomusicology is one of the best-positioned disciplines for tackling the current environmental crisis, which he argues:

> … is not only the fault of failed engineering, bad science, ecological misunderstanding, poor accounting, and bitter politics. It is also a failure of holistic problem solving, interpersonal relations, ethics, imagination, and creativity. In short, the environmental crisis is a failure of culture. … musicologists have perspectives and insights to offer, especially because of the ubiquity of music, the importance that most people accord to it, and the communicative and emotional powers associated with music and the communities who make, enjoy, and consume it (Allen 2011b: 414).

Meanwhile, ecofeminist Heide Göttner-Abendroth has meditated on 'matriarchal art' vis-à-vis feminism and ecology:

> It is beauty but not a commodity. It seeks to dissolve the divisions within the aesthetic and so aestheticise the whole of society. This means creating a meaningful social life together (Göttner-Abendroth 1985: 94).

Although it seems possible that the humanities might be able to rewrap and retell science's narrative in a more acceptable and imaginative way, exactly how to effectively communicate social critiques beyond disciplinary boundaries remains a challenge. Pedelty has mined the ecological role and carbon footprint of musical performance, from Sheryl Crow's aim for carbon neutrality in her 2010 tour to musical mega-events like Live Earth (Pedelty 2012). In the process, he grapples with whether 'audiences use the resulting knowledge and inspiration to make meaningful changes in their individual or collective lives' (Pedelty 2012: 47–8). (On the other hand, he documents how 'the smallest music imaginable, a guy and his guitar … together helped ruin a river' (Pedelty 2012: 85).) Popular music is a significant site of commodity production, and there is inevitably a certain tension between touring bands and the marketing of their merchandise on the one hand, and sustainability on the other.

While some approach sustainability from a cultural-theoretical standpoint, others address the topic from a more practical perspective. In her article on sustainability issues surrounding didjeridus, Robin Ryan (2015) asks what kind of role the instrument might play in

rethinking our environment. In comparing the sustainability of various highly sought-after didjeridu tree species, she explores whether, should they succumb to global warming, eucalypt sonorities could be satisfactorily replaced by alternative recyclable materials.

Other instrumentalists have recently been forced to consider the sustainability issue, with declining supplies, restrictions, and bans in place. The premises of Gibson Guitar were raided in 2010 and 2011, with US Fish and Wildlife Service agents impounding ebony and rosewood imported from Madagascar and India (Black 2012). Brazil has placed an export ban on pernambuco *Caesalpiniaechinata*, the premier wood for string family bows. Meanwhile, string players entering or leaving the United States are now required to have a passport for their bow if it has elephant ivory or a tortoiseshell frog. Instrument pegs may also contain ivory. Guitarists, likewise, must concern themselves with rosewood, ivory, and any other protected species and will need to obtain proper legal documentation before crossing international borders[12].

Environmental Ethnomusicology, Archaeomusicology, Zoömusicology, and Biomusicology

This section briefly reviews a miscellany of other fields of enquiry with relevance to the interface between music and environment. Not all have sought or received formal recognition as sub-disciplines of musicology.

Environmental Ethnomusicology

With their commitment to sustained personal observation in the field, ethnomusicologists were some of the first to draw attention to the function of music in relation to cultural practices. Their work typically involves situated ethnographic encounters and might even include contributing to habitat conservation. Musician and anthropologist Tina K. Ramnarine (2009) has written about issues of climate change, including polar warming and environmental degradation, from an indigenous (Sámi) perspective. In related work, she developed the concept of 'ecologies of listening', which:

> … tune audiences in to the sonic environments of landscapes, technologies of musical production and cross-species creativities that reconfigure musical meanings and values. They broaden the theoretical frameworks of acoustic ecology in which humans are responsible for the composition of landscapes, of ethnomusicology in which music is 'humanly organized sound' (Blacking 1976) and of an anthropology of sound focused on human perception (Ramnarine 2013a: 242).

Ramnarine's concern is to find ways in which music researchers can engage with contemporary issues and challenges, including environmental activism (Ramnarine 2013b).

Ethnomusicologist Angela Impey focuses on selected regions in Africa. One research project builds on narratives inspired by the Jew's harp revival, exploring 'how meanings given to gendered mobilities through sound, song and performance inflect local experiences of land, spatiality and belonging' (Impey 2015)[13].

Archaeomusicology

Iain Morley describes archaeomusicology's multidisciplinary approach as synthesising evidence beyond archaeology to also include palaeoanthropology, ethnomusicology, neuroscience, developmental and social psychology, and evolutionary biology (Morley 2003: 2). Insofar as it relates to questions of environment and place, archaeomusicology 'tries to discover features or traces of ancient musical culture [that are] still extant in the more recent musical life of the society living in the same geographical area' (Hickmann 2007: 14). Archaeomusicology may also conduct reconstructions of the acoustic properties of prehistoric sites (Espi-Sanchis and Bannan 2012: 176).

Zoömusicology

The emerging field of zoömusicology is concerned with sounds of the more-than-human. Composer François-Bernard Mâche (1983/1992) coined the word, 'zoomusicologie', which zoösemiotician Dario Martinelli imagines as the study of the 'aesthetic use of sound communication among animals' (Martinelli 2002: 7). Zoömusicologist Hollis Taylor (2011b) argues that the discipline inevitably must entail the human

analysis and valorisation of the aesthetic qualities of non-human animal sounds and the human assignment of cultural meaning. In 1963, musicologist Peter Szöke (1963) published an article on 'ornitomuzikológia', although the term sees scant contemporary use[13].

Biomusicology

'Biomusicology' has several accepted meanings. The usual sense of the discipline is that it concerns the biological and evolutionary origins of human music-making (Arom 2000; Bickerton 2000; Monge-Nájera 1998). Neuroscientist Nils L. Wallin (1991: xx) argues that music's essence can be found in our biological inheritance, not in our cultural heritage. He sees biomusicology's brief as:

> ... to establish the neurophysiological and evolutionary prerequisites for the origins and the primordial purpose of music, thereby sketching the foundation of a synthetic (unified), bio-socio-cultural field theory of music (Wallin 1991: xvii).

This passage captures the substantial challenge that continues to face those who would search for the origins of music. Like archaeomusicology, biomusicology analyses environmental and acoustic features that may have stimulated the development of human musical responses (Espi-Sanchis and Bannan 2012: 176).

Others have employed the term, 'biomusic'. Behavioural biologist Henrik Brumm writes:

> Biomusic is a particular form of sampling, but in contrast to reusing a section or sample of a sound recording from another musical piece, samples from naturalistic recordings are used (Brumm 2012: 25).

In addition, 'biomusic' has been employed to describe music created by biofeedback of a heartbeat or brainwaves (Rosenboom and Paul 1986; Eaton 1973).

Music and its Technological Environment

In this final section, we turn to another interpretation of environment as examined in our symposium. Our intention is to sketch a few environments, from among many, where technology shapes music. This brevity is not to discount the enormity of aesthetic and ontological changes resulting from the growing reach of new technologies in recent decades. Musicking (Small 1998) enjoys a vast array of outcomes. In some, studio engineers and producers — along with their multi-track digital workstations, samplers, digital processors, drum machines, and devices capable of rhythm quantisation and pitch shifting — may find themselves elevated to the status of co-creators.

We hear technology in action not just in the sound of popular music recordings, but also in the very structure of the music. Technologies allowing quantitative performance measurement facilitate both individual music practice sessions and empirical studies of music performance. Audio and video documentation and analysis, sensor devices, and visual feedback systems for assessing matters of intonation and timing all play a part in this.

It would be too simple an observation to state that technology has had an effect on composition, its production, and its reception: the three have even combined in novel ways. For example, in their critique of top-down canonisation in the Western musical tradition, neurobiologist Paul F.M.J. Verschure and mathematician and composer Jônatas Manzolli called for a shift:

> ... from the single genius of the single composer to the tightly controlled production pipeline of the conductor and the orchestra to a paradigm where musical structure emerges from the interaction between music systems and their environment (Verschure and Manzolli 2013: 394).

They detailed how new technologies allow for the design of a physical space of musical expression where the piece is synthesised in real time and realised through the interaction between a music system and its environment (Verschure and Manzolli 2013: 394). Instead of generative grammars, they believe that musical forms can emerge from simpler local rules. Their composition system, named RoBoser,

relies in part on the use of biosignals. Their work sees the role of a composer as the designer of a space of musical expression that can then be explored by an active observer-performer.

Smartphone apps now facilitate the use of mobile technology to interact with a soundscape. Walk with Me and Urban Remix employ urban sounds to create music compositions and sound installations, quite the opposite goal from acoustic ecology. Other apps, like Earth Sound and 4'33", showcase global ambient sounds. Recho allows the user to record a sound and stitch it to where it was recorded. Similarly, Record the Earth plays from a library of sound sources, with a location of the sound shown on a map; with goals in soundscape ecology, its developers urge us to 'become a citizen scientist!'[15]. American composers Ryan and Hays Holladay create site-specific sound installations that they release as a smartphone application. Their GPS-based 'location-aware music' works via geo-tagged segments of sounds that only play when a listener is physically nearby (Holladay 2013).

While concertgoers may be transformed into active observers-performers, they may equally play a role behind the scenes. New media environments offer fresh models of fan-oriented music production and marketing to musicians, a topic Claire Coleman* takes up. In turning her analytic focus to the nexus of crowdfunding and online identity, she enumerates the complexities of how popular musicians navigate issues of authenticity, intimacy, and proximity on social media platforms (Coleman 2015).

Technologies of consumption are impacting the reception of music, especially in relation to space and place. For instance, musicologists Arild Bergh and Tia DeNora point out that while our opportunities for listening are increasing in both spatial locations and existential situations, such listening is declining in focus. In their words, new media platforms allow for 'ubiquitous listening', where 'it is possible to speak of music ''choosing'' listeners as well as the opposite' (Bergh and DeNora 2009: 115). We can now carry our Muzak with us, replacing, or at minimum masking, the ambient sounds of our environment. Andy Bennett returns us to where we began, examining musical evocations of place. In an examination of how internet technologies are reshaping the concept of a 'music scene' via globally dispersed fans, he chronicles how the Canterbury Sound has been woven into the city's tourist gaze: a 'transformation of a landscape into a mythscape' (Bennett 2002: 89). A music scene has become a virtual scene.

Conclusion

The intersection of 'music' and 'environment' provide new opportunities and challenges to creators, new sonic experiences to audiences, and new objects of study (requiring fresh methodologies) to musicology, as well as prompting revised perspectives on earlier works. A multitude of music makers and scholars now focus on music and musicology's potential to be relevant in discourses on new technologies, social engineering, climate change, environmental degradation, hostile environments, sustainability (both planetary and musical), and other species' sonic constructs. While music has been pertinent to a host of environments and their transformations through the ages, our contemporary examination into recent musico-environmental convergences has charted in the discipline a rich, diverse, and dynamic opening out.

ENDNOTES

1. Conferences, books, articles, compositions, and concerts increasingly speak to the entanglement of music and environment. For example, papers in a recent session of the American Musicological Society national meeting entitled 'Musical Landscapes and Ecologies' all meditated on how art, environment, and attitudes toward nature intersect (Toliver 2004: 330), while *Music & Politics* featured a 2014 special issue entitled 'Sound, Environment, and Action' (Kinnear 2014). Arizona State University in Tempe hosted a 2014 symposium on Acoustic Ecologies of the American Southwest Deserts. Inspired by the themes this article reviews, a conference entitled *Music and Environment Symposium* was held at the University of Technology Sydney on 26 April 2013.

2. See Pedelty (2012) for a far-reaching discussion of rock, pop, and folk environmentalism, sustainable music, and music's role vis-à-vis environmental movements.

3. See, for example, Adams (1994, 2004, and 2009); Bandt, Duffy, and MacKinnon (2007); Feld and Basso (1996); Knight (2006); Pedelty (2008); Rice (2003); and Rose (2013). Also see <http://www.iupress.indiana.edu/index.php?cPath=1037_3130_7132>.

4. For more on music festivals, see Stimeling (2014) and Pedelty (2012).

5. Philosopher David Rothenberg has penned a series of books on the music of nature and the musical constructs of other species (see Rothenberg and Ulvaeus 2001; Rothenberg 2005, 2008, 2011, and 2013).

6. Bioacoustics entails cross-disciplinary research in the fields of biology and acoustics, studying sound production and reception in animals (including humans).

7. American acoustic ecologist, philosopher, and composer David Dunn makes a similar critique (Dunn and van Peer 1999: 64).

8. See also the definitive monograph on this subject, *Acoustic Systems in Biology* (Fletcher 1992).

9. See also Bradley (2010); Marett (2005); Marett, Barwick, and Ford (2013); and Stubington (2007).

10. Those working with living systems find a corollary in the Land Art movement of the 1960s, 1970s, and 1980s in which landscape and a work of art were closely linked.

11. See also Bocast (2012); Galloway (2014); Guy (2009); Mark (2014); and Perlman (2014).

12. See e.g. US Fish and Wildlife Service, Musical Instruments. <http://www.fws.gov/international/permits/by-activity/musical-instruments.html>.

13. See also Impey (2013b, 2007).

14. More recent research in the field includes Doolittle and Brumm (2012); Merker (2012); Taylor and Lestel (2011); Mundy (2010); Martinelli (2009); Ouellette (2008); Fitch (2006); and Mâche (1983/1992). Also see < http://www.zoömusicology.com>.

15. See <http://www.walkwithme.net/cms/>; <https://itunes.apple.com/us/app/urbanremix-recorder/id424756883?mt=8>; <https://itunes.apple.com/us/app/earth-sound/id650631757?mt=8>; <http://johncage.org/4_33.html>; <https://www.recordtheearth.org/>; and <http://www.recho.org/>.

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ABSTRACT

We take stock of engagements occurring between 'music' and 'environment' and what this heralds for current and future music making and musicology. We consider five contemporary and emerging fields of interest that variously connect these two keywords: 1) music as commemoration or evocation of place; 2) soundscape studies and sound art; 3) acoustic ecology, ecomusicology, and environmental activism; 4) environmental ethnomusicology, archaeomusicology, zoömusicology, and biomusicology; and 5) music and its technological environment. Intersections of the two concepts are on the increase, particularly as composers, performers, and musicologists attempt to respond to matters of climate change, sustainability, and environmental collapse in novel and meaningful ways.

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Keywords: music, environment, soundscape, sound art, acoustic ecology, ecomusicology, zoömusicology, biomusicology

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