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## Silence: A Novel Co-Produced Experience To Build Community Awareness Of Biodiversity Loss

**Kristen Bellisario, Christie Shee**

**ABSTRACT** The current sounds of our world are under threat of disappearing. Undergraduate students and interdisciplinary university teams are at the forefront of generating collaborative research opportunities to create community awareness of biodiversity loss and conservation practices. Recent conservation research has focused on how local communities can begin to reverse the trends of biodiversity loss by using private residences and urban spaces. The inclusion of native plants in backyard gardens is an accessible way to promote ecological restoration. In this co-produced instructional exhibit, “Earth Day Celebration: Silence,” we introduce a novel experiential event that connects instructional design with community collaboration. The event was designed to explore the ways in which society can become engaged in the preservation and protection of biodiversity and our sonic world.

**KEYWORDS** biodiversity loss, co-production, community conservation, experiential sound, sonic world

The current sounds of our world are under threat of disappearing—a sonic warning announced in an earlier generation by the profound book “*Silent Spring*” by Rachel Carson. This pivotal book detailed how the application of the insecticide dichlorodiphenyltrichloroethane (DDT) contributed to a trophic cascade of silence: poisoned insect equated poisoned bird. Today, scientific evidence indicates that we have or will soon enter Earth’s sixth period of mass extinction, and it is predicted that three quarters of today’s animal species will vanish within 300 years (Ceballos et al., 2015). The protection of biodiversity, as well as our sonic world, is not just a problem for scientists. Intergenerational approaches, linking the conservation efforts of our university campus and community backyards, and collaboration between undergraduate students and interdisciplinary university teams are each in their own ways at the forefront of, and critical to, community awareness of biodiversity loss and conservation practices. Integrating all of these elements in tandem is an opportunity to build community awareness and local action from multiple paths. The absence of naturally occurring sounds can be attributed to biodiversity loss (Pijanowski et al., 2011) and to increased human disturbances by noise and light pollution (Barber et al., 2015; Ditchkoff et al., 2006). Land-use change—for agriculture, forestry, and urbanization—is the primary driver of biodiversity loss (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019). Urbanization is projected to expand,

increasing noise and light pollution (Sordello et al., 2020), and exacerbating biodiversity declines (Simkin et al., 2022). To reverse declines in biodiversity, there are increasing calls for conservation efforts to move beyond historical efforts that exclude humans from natural areas to grassroots efforts that enable humans to live with and conserve nature in human-altered landscapes (Wiederholt et al., 2015). Recent conservation research has focused on how local communities can begin to reverse the trends of biodiversity loss by using private residences and urban spaces to provide food, shelter, and wildlife corridors between fragmented landscapes (Delahay et al., 2023; Lerman et al., 2023).

Individuals and communities can contribute to conservation by incorporating native plants in residential landscaping and urban green spaces. Urban landscaping frequently uses non-native ornamental plants (Wania et al., 2003) that do not share a co-evolutionary history with local fauna. Because the majority of plant-feeding insects have evolved to feed on specific plants, using non-native plants subsequently contributes little or not at all to local food webs (Tallamy, 2007; Burghardt et al., 2009). Thus, incorporating native plants in backyard landscaping can increase biodiversity, particularly that of insects and birds (Tallamy, 2004; Burghardt et al., 2009) that contribute to backyard soundscapes. The inclusion of native plants in backyard gardens is an accessible way to quickly restore ecosystems (Beckwith et al., 2022). Although the uses of native plants in landscaping brings many benefits, there remain challenges with using native plants in residential landscaping, including residents' sometimes insufficient horticultural knowledge, a lack of commercial availability for many native plants, and low social acceptance of native plants in landscaping (Beckwith et al., 2022). Public education on the ecological value of native plants can increase the attractiveness and adoption of native plantings (Beckwith et al., 2022; Anderson et al., 2021), and public engagement can have broad and immediate impacts on both wildlife and society (Rudd et al., 2002; Callaghan et al., 2023). Here, we describe how we used first-year seminar courses on sound, habitat loss, and biodiversity loss to design an educational community outreach event around backyard conservation, native plants, and soundscapes to foster connections to nature and promote cultural change within our community.

### Methods and Data Collection

The John Martinson Honors College at Purdue University was the location for our "Earth Day Celebration" event. The event took place in the residential hall lobby and corridor from April 14-22, 2023 and was open to the public. Event planning, content creation, engagement, and advertising was co-developed by faculty (Nov 2022-Apr 2023, n=7), student leaders (Nov 2022-Apr 2023, n=5), and first-year students (Jan-Mar 2023, n=74). The event was designed



*Figure 1.* Electrical impulses of ephemeral plants were recorded and converted to beautiful sounds that were played in recessed alcove listening stations along the northside corridor (see Figure 2)

to explore the ways in which society can become engaged in the preservation and protection of biodiversity and our sonic world. Our primary research question was, “how does the study of silence manifest from interest to cultural change?” The event contained five educational stations: a portable biome museum with QR codes for engaged listening and videos; a station playing MIDI sounds representative of ephemeral plants; student-curated pieces from first-year experience courses; a spatial audio experience; and a call-to-action prompt.

*1) Portable biome museum with QR codes for engaged listening and videos*

The portable biome museum consisted of two standing 11x17 displays that described various ecological communities (e.g., temperate forest, desert) and provided QR codes to invite the participant to listen and learn about each through video and audio.



**Figure 2.** A community visitor sits in an alcove listening to the “silent sounds” of the Wild Geranium.

*2) MIDI sounds representative of ephemeral plants*

Faculty members took live recordings of electrical impulses from four native ephemeral plants using a magnetometer-based device. The electrical impulses were converted into MIDI representations to emulate the “life” of a silent object. Student leaders translated this data and messaging into signs and activities that contained the name and picture of each native plant, as well as information about them. Each MIDI representation was played in a separate listening alcove.

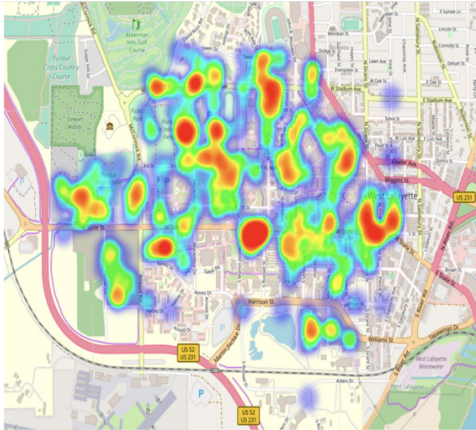
*3) Student-curated pieces from first-year experience courses*

The HONR 19901: First-year Experience is an 8-week introductory course for first-year Honors students in the John Martinson Honors College. Each faculty member chooses a theme for their course that is embedded into the overall learning objectives of the introductory seminar. The themes of the three courses involved with the Earth Day Celebration event focused on different aspects of biodiversity loss, but all focused on fostering connectedness to nature and reversing biodiversity loss trends through backyard conservation. The theme for the first course was “Habitat” (Shee, Fall 2022, 69 students), which followed the text *Nature’s Best Hope* by Doug Tallamy (2019). Rachel Carson’s *Silent Spring* (1962) was used in both the second course’s theme, “Silence” (Bellisario Spring 2023, 74 students) and the third course’s theme, “Life” (Shee, Spring 2023, 71 students). Each week consisted of a lecture related to biodiversity loss followed by a student-led recitation activity that included a post-recitation reflection. For the culmination of each course was a final project generated by students that was incorporated into the Earth Day Celebration. For “Habitat,” student groups chose and researched an endangered insect species to learn about their life cycles and habitats, the causes

not only are the conseQuences far reaching  
 places of beaUty, where countless birds  
 the new environmental health problems are multiple  
 caught in its vioEnt crossfire  
 poisons in the kiTchen  
 the area a straNge blight crept over  
 whitE granular powder  
 a grim Specter  
 what has already Silenced the voices of spring...?

**Figure 3.** Acrostic poem on display at Earth Day Celebration created by group collaboration from a First-year Experience class.

of their decline, and ways to preserve their chosen species. Students then created educational posters from their research. For “Silence,” students generated creative works such as acrostic poems about silence (Figure 3). Students also measured noise pollution by collecting decibel readings at 74 locations across the Purdue University campus, from which faculty constructed a noise map based on the readings (Figure 4). For “Life,” student groups created educational materials related to biodiversity loss using a medium of their choice, such as games, posters, videos, and art (Figure 5).



**Figure 4.** Student decibel data collection points interpolated on map using Leaflet in R Studio was on display at the Earth Day Celebration.



**Figure 5.** Student designed game for Earth Day Celebration participants to demonstrate how changes in our behaviors can replenish biodiversity and support sustainable ecosystems.

#### 4) *Spatial audio experience*

We designed and constructed a spatial audio experience (Figure 6) within the John Martinson Honors College residential hall lobby. Bench seating was created from maple saplings and the overhanging branches at the back of the bench simulated a forest. Speakers were embedded



throughout the construction at varying heights to provide an immersive experience. The audio incorporated positive and calming natural sounds emanating from an approximation of their occurring locations—insect sounds played beneath the seats while bird sounds played from the canopy above the natural sitting position. While seated, participants could hear these incidental sounds while watching a 16-minute video displayed on a VisionPort system. The video contained eight moving picture scenes with simple messaging about biodiversity loss and silence in backyards.

### 5) A call-to-action prompt

Each participant was invited to participate in an informal survey to assess knowledge and perceptions of biodiversity loss before and after the event. Participants were also able to plant a tree through a student volunteer organization that restores habitats around the world. In addition, participants were given a seed packet of native plants to bring biodiversity to their backyard.



**Figure 6.** Front (left) and rear (right) views of the VisionPort 3D spatial audio experience located in the main lobby of John Martinson Honors College residential hall building.



**Figure 7.** Student visitors to the Earth Day Celebration exhibit and event stations

## Results

The Earth Day Celebration was a culmination of integrated student-designed products and faculty research contributions in a week-long self-directed experience with a one-day volunteered experience (Figure 7). We found that student engagement with the topic material led to an outreach event that resulted in positive reflections for students and visitors.

### *Student Reflections:*

Overall, 55% of student reflections in the “Silence” course had a positive tone. In reflecting on their poem (Figure 3), a student captured how readings from class were incorporated into a meaningful contribution about silence in the environment and its societal implications:

[w]e decided to build one [poem] together by taking lines from *Silent Spring* (most of the lines from this week's reading) using the word quietness. Each person picked a letter and found a line from *Silent Spring* that has that letter. Our poem ended up being pretty good even though each line was created separately. Creating art in such a way, almost a collage done out of a book instead of pictures, was cool, and we had a consistent flow even though we did not discuss each line together because we used the same source material. The poem carries a similar message as the full reading.

Other student reflections supported the learning objective of connection: “[a]s a group, we discussed the ideas of noise and silence conflicting in the world around us and how we could make a representation of this.” Another student reflection demonstrated awareness and change in their experience at a national park:

[t]he different perspectives on silence were interesting, and as someone [who will be] (soon) studying Environment and Ecological Engineering, I appreciated the connection to nature ... Speaking of nature, I visited Death Valley National Park over spring break, and it was surprisingly absent of almost all light and noise pollution. I got to see the stars and I got my family to be quiet for a minute (somehow) to record a decibel level of 28.8 [decibels]. It was one of the quietest environments I've ever been in, and I only really appreciated it because of your class.

#### *Visitor Reflections:*

Nearly 350 visitors, ages 6-70, participated in the Earth Day Celebration. An informal pre and post survey of participants (n=4) at the event indicates that the exhibits increased visitor areas awareness for each of the following statements: 1) Plants in my yard contribute to the sounds of birds and wildlife in my yard; 2) Native plants can help keep streams and waterways clean; 3) I want to find ways to reduce noise pollution where I live; 4) Silence in your backyard can be an indicator of an unhealthy ecosystem; 5) I am concerned about local habitat loss (e.g. cutting down a forest to make space for a new community); and 6) I am concerned about noise pollution. The event was well-received by university stakeholders, who considered the spatial audio experience an innovative addition to the John Martinson Honors College and asked if the display could continue past the dates of the Earth Day Celebration.

#### **Discussion**

The Earth Day Celebration team set about developing a new model of community engagement which bridged the university classroom and community engagement. Our intention was to enhance the curriculum of a first-year seminar by providing a sense of purpose and applied focus. The pilot project launched from design to implementation in six months of scaffolding. The project examined the complex global issues of habitat and biodiversity loss and connected

these issues with regional awareness of nature and backyard conservation through listening and activities (Public Purpose Institute, n.d.).

The event was a culmination of intergenerational paths converging in a single space for a critical moment where undergraduate students, interdisciplinary university teams, and community members each contributed and acquired knowledge through interacting with experiential attractions. To encourage community action to reverse biodiversity loss, we gave away over 100 packets of milkweed and native plant seeds to visitors to plant them in their own backyards. We germinated ideas from student projects to broaden the connection between generations through sound, spatial, and visual moments to hopefully generate local change through community backyards. Although we are unable to assess the long-term impact of our event and if participants planted the seed packets or produced changes in their own backyards, we feel confident that building awareness through innovative exhibits and experiential designs that incorporate sound is an effective introduction to a complicated topic. Educators must continue to develop engaging events that build upon university knowledge about societal grand challenges and provide meaningful experiences for student learning and personal change.

### About the Authors

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