

## Intersection of arts and science: a conceptualization of motives, approaches and practices

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Combining arts with science is not a new idea, but it seems to attract growing attention in different arenas, including bioeconomy and forest conservation. Reasons behind that trend may be several, but it is likely that the complex nature of today's scientific and societal problems calls for using diverse knowledge and communication domains. However, science may be linked with arts in various ways and for different purposes. This contribution proposes a conceptual framework for understanding, evaluating, and designing arts and science mixes. The framework is multidisciplinary, because it contains concepts adopted from philosophy, cognitive and social psychology, communication sciences, futures studies, and behavioral economics. The suggested dimensions of the framework are: ethical commitments; contributor balance; expected impact logic; performative nature; collaboration; and mode of creativity. As an illustrative example, a recent arts and science blending process from Finland is described and decomposed according to the framework's dimensions. The example, "Encounter on the Top" was an innovation workshop organized in collaboration between Human Security Finland, Greenpeace, and Eastern Finnish culture festivals in June 2017 at Koli Hill, Finland's national scenery. The event incorporated tens of artists as well as environmental and forest scientists, to collaboratively design a performance, an event, or a piece of art that communicates recent scientific research on climate change to relevant audiences in a fresh and impactful way. After analyzing the example, the potential value of the proposed conceptual framework will be summarized, and amendments and refinements will be queried from the audience.

## The confluence of art, music and science fosters scientific discovery and conservation at long-term ecological research stations in the United States

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Human societies in the 21<sup>st</sup> century are faced with increasingly broad, complex and connected social and environmental conservation challenges. An example is the competing need to provide a growing world population with food, water, and fiber, while at the same time maintaining the health, vitality and cultural values of the natural ecosystems that provide these very services. The integration of science, which provides knowledge on how humans impact the natural world, with the arts (writ large), which imbue scientific knowledge with empathy, provides a powerful unified approach to solving the inter-related ecological and social issues of the 21<sup>st</sup> century. Here we describe a program of research which integrates art, music and science to foster new scientific discoveries while simultaneously promoting education, conservation and shared stewardship of natural resources at long term ecological research stations in the United States. Focused on "Water in a Changing World," this program: (1) uses real-time environmental sensor data to create artistically-inspired data visualizations and musical sonifications of the water cycle (available online at <https://waterviz.org>), (2) employs neurobiological tools and theory to provide a mechanistic understanding for why the integration of arts and science can increase understanding of pattern and process in ecological data; and (3) uses the data visualizations and sonifications as an innovative and inviting approach to educating and connecting the public with water science and environmental literacy. Taken together, the program offers a model for the integration of art, science and education to address pressing contemporary socio-ecological and conservation issues.

## Potential contribution of socio-environmental educational and communicative activities to Sustainable Development Goal 15, Life on Earth / Perspectivas de contribuição das práticas educacionais socioambientais para o objetivo do desenvolvimento sustentável, ODS-15 Vida na terra

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Integrar ciências, artes e culturas não é iniciativa recente. Cientistas renomados estabeleceram conexão entre a ciência e a arte, ao desenvolver suas pesquisas e comunicar os resultados, seja para a disseminação científica ou a popularização da ciência. Em âmbito mundial, a Agenda 2030, em seu ODS 15-Vida Terrestre, objetiva "Proteger, recuperar e promover o uso sustentável dos ecossistemas terrestres, gerir de forma sustentável as florestas [...] e deter a perda de biodiversidade". Uma mobilização planetária que requer a participação social. Originalmente, a produção coletiva de narrativas audiovisuais e vídeos ambientais em oficinas é uma prática educacional socioambiental, desenvolvida e aplicada a partir de 2007, em projetos do Núcleo de Pesquisa Florestal da Embrapa Rondônia, como estratégia para produção coletiva de informação a partir da interação entre diversos atores sociais. Consiste no uso do discurso de músicas de artistas da Amazônia para a sensibilização ambiental, sendo a oficina o espaço de interação e de diálogo entre comunicadores, pesquisadores, artistas autores da música e a sociedade representada pelos participantes das Oficinas. A metodologia baseia-se na concepção de linguagem (Bakhtin) na qual a interação caracteriza-se pelo diálogo, entre a arte (discurso literário da música) e o cotidiano dos cidadãos. Foram realizadas oficinas com diversas temáticas e contextos, cujo resultado é a elaboração coletiva de um novo discurso. Atualmente a prática faz parte da proposta de capacitação de técnicos da extensão, professores e alunos de escolas rurais, no Projeto Manejo Florestal e Extrativismo (Fundo Amazônia), com enfoque na valorização de produtos da biodiversidade amazônica.

## Scouting in Bolivia through forest planning, the scouting method of learning by doing: consolidating the restoration and recovery of