



In Partial Fulfillment of the Requirements for the Degree of

**Doctor of Philosophy**  
**Cyrus Hester**

Will defend his dissertation

**Diagnosing the “Silent Epidemic”:  
A Historical Ecology of Metal Pollution in the Sonoran Desert**

**Abstract**

My research investigates the biophysical and institutional mechanisms affecting the movement and distribution of the metals in the Sonoran Desert. Metals represent a dilemma for modern society. They are integral to many industrial technologies—while also being linked to carcinogenesis, neurological degeneration, and similar afflictions. Globally, metal poisoning is considered to be severe enough for some to label it a “silent epidemic” affecting millions. The Sonoran Desert has a long history of metallic mining, but recent research suggests that the air and soils of our cities have become enriched with metals, as well. Unfortunately, a long-term perspective on metal pollution has thus far been lacking. This limits our capacity to identify the ultimate causes of the silent epidemic.

To address this gap, I integrated perspectives from environmental chemistry, historical geography, and institutional economics. First, by analyzing the chemistry embodied in the sequentially-grown spines of long-lived cacti, I created a proxy record of metal pollution in the Desert. These data suggest that metal pollution is not simply a legacy of early industrialization. Instead, I found evidence of recent metal pollution in both the heart of the city and a remote, rural location. To understand how this process may have unfolded across the Desert, I next explored the distribution of metals in aerosols from across the southwest. After delineating hot-spots of airborne metals, I used a mixture of historical reports, maps, and memoirs to reconstruct the industrial history of these landscapes. In the process, I identified three key transitions in the energy-metal nexus that drove the redistribution of metals from mineral deposits to urban communities.

Finally, to determine how political and economic forces may be affecting the fate of metals, I studied the evolution of rights and duties associated with metals in their various forms. This allowed me to track changes in our governance of metals from the mining laws of the 19th century through their treatment as occupational and public health hazards in the 20th century. In the process, I show how the problems of one generation tended to arise from the “solutions” employed by previous ones and that Arizona’s institutions were often shaped by extra-territorial concerns. Ultimately, this created an institutional system that compartmentalizes metals into separate legal categories which fail to appreciate their capacity to mobilize across such boundaries and accumulate in the environment.

Monday, March 25, 2019

9:00 a.m.

Wrigley Hall, Rm. 401

Faculty, students, and the public are invited.

Supervisory Committee:

Kelli Larson (Co-Chair)

Manfred Laubichler (Co-Chair)

Joshua MacFadyen