

Ecological Literacy Programming for Digital Planetariums and Beyond

A nationwide collaboration of scientists, artists, and educators developing best practices for using immersive virtual environments to increase ecological literacy using live presentations, interactive scientific visualizations, and community sustainability dialogues

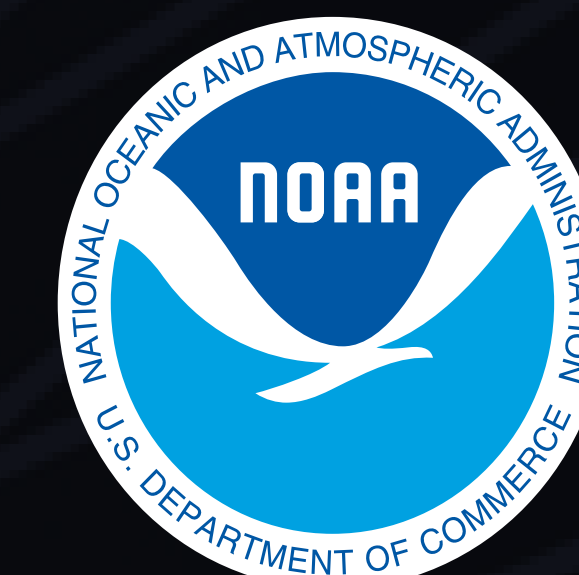
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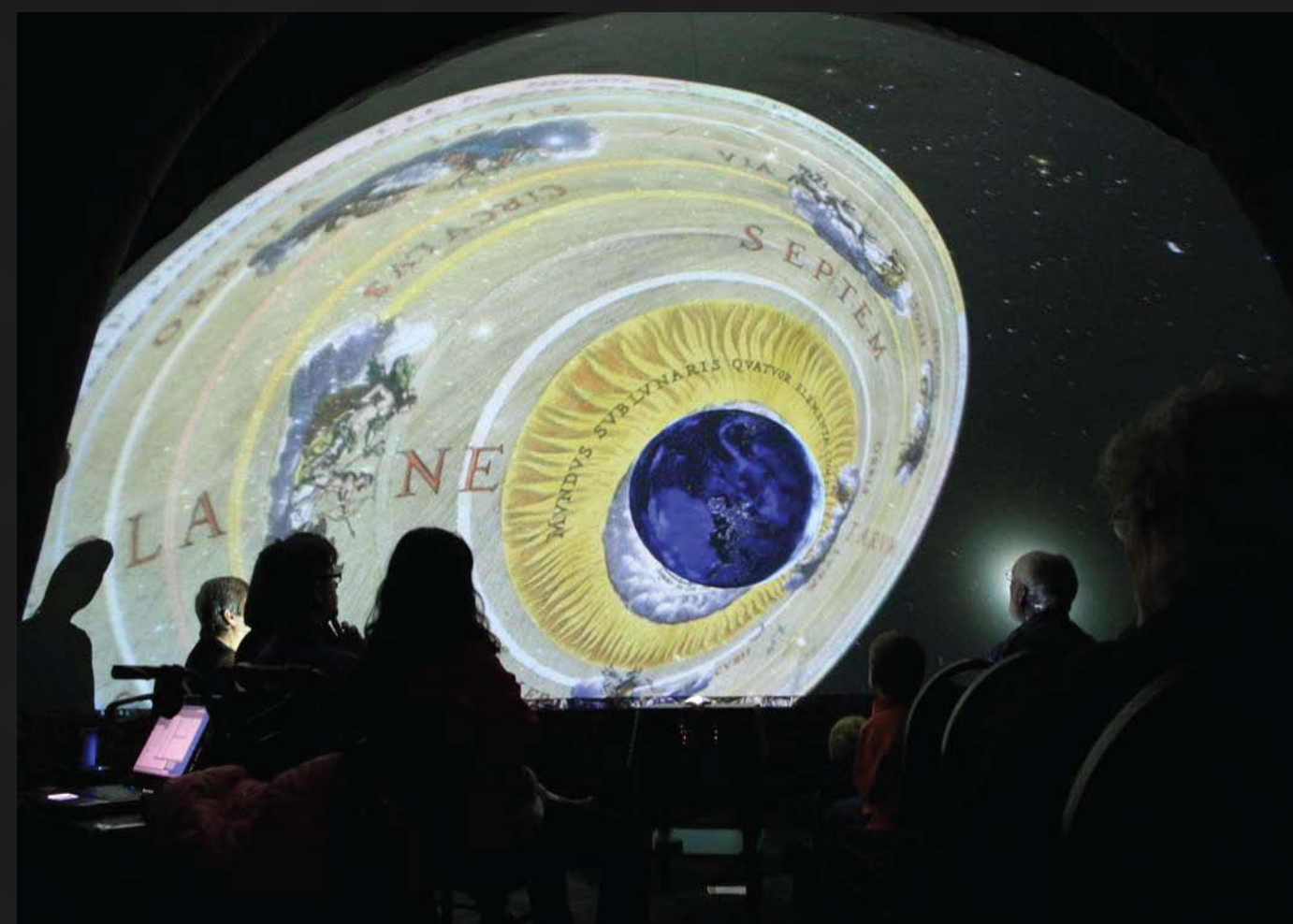
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Learn more at worldviews.net

SEEING

View visualizations about Earth and space systems science that tie large-scale processes to regional environmental issues and **show** the complexity of global changes.

1. Background

- Human-driven global change is occurring faster than ever.
- Technologies for delivering bio- and geospatial information is also advancing rapidly.
- Information deficit models for educating the public about global change have not been successful.

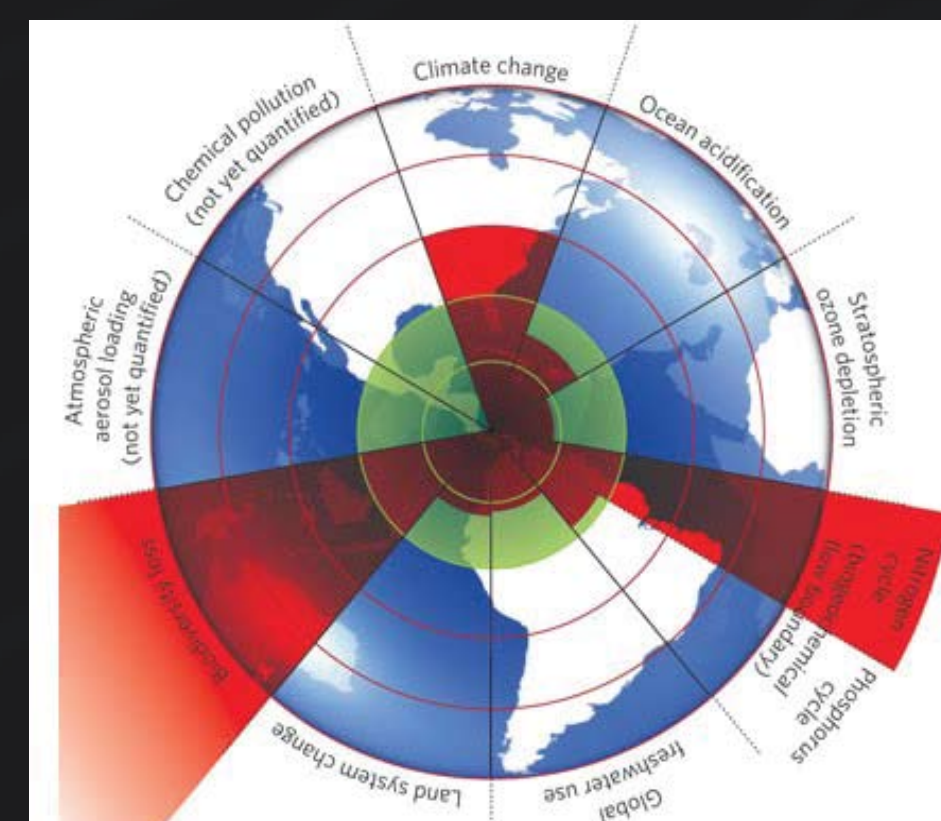


A Worldviews Network presentation showing a Ptolemaic Earth-centered cosmography, before the shift to a Copernican one. The project aims to shift visitor perspectives about the role and impact of humans on Earth at both regional and global levels. (Picture credit: Mike Pohl)

2. Goals

- Develop a unique approach to ecological literacy that integrates:
 - Seeing** : The power of *Visual Thinking*
 - Knowing** : The depth of *Systems Thinking*
 - Doing** : The practicality of *Design Thinking*
- Help audiences to visualize, comprehend, and address complex issues from a whole systems perspective.
- Train planetarium professionals in Earth systems science and the *Seeing-Knowing-Doing* approach to ecological literacy education.
- Renew the role of informal science institutions (ISIs) to inspire communities in engaging in and understanding global change issues.
- Empower ISI audiences with processes that lead to informed decisions.

3. Education Guiding Principles



- Climate literacy principles³
- Earth systems science education recommendations^{2,4}
- Informal science education recommendations¹
- Planetary boundaries: identifying the “safe operating space for humanity” for different Earth systems⁵
- Bioregional perspectives that connect participants cognitively and affectively with global issues

KNOWING

Comprehend the scientific understanding of Earth systems interactions and **understand** how they operate and influence each other using culturally relevant ways.

4. Technology

- The Worldviews Network uses digital full-dome planetariums that are increasingly prevalent in informal science institutions (N>700 worldwide).
- Portable GeoDomes™ are used for outreach and professional development.
- The *Uniview* visualization platform is employed across our network for showing data at multiple spatial scales using Open Geospatial Consortium (OGC) standards to share datasets.
- “Domecast” technology is used to simulcast presentations to partners.



A map showing how domecasting technology allowed the DMNS water story to be shared live with partner sites across the country.

Domecasting is made possible by *Uniview*'s Octopus feature, which gives remote audiences the same visuals on their domes as the local audience.

In addition to simulcasting public events, this virtual network is also used for professional development training and connecting participants and public audiences in real-time, thereby reducing the project's carbon footprint.

5. Quarterly Bioregional Community Dialogues (BCDs)

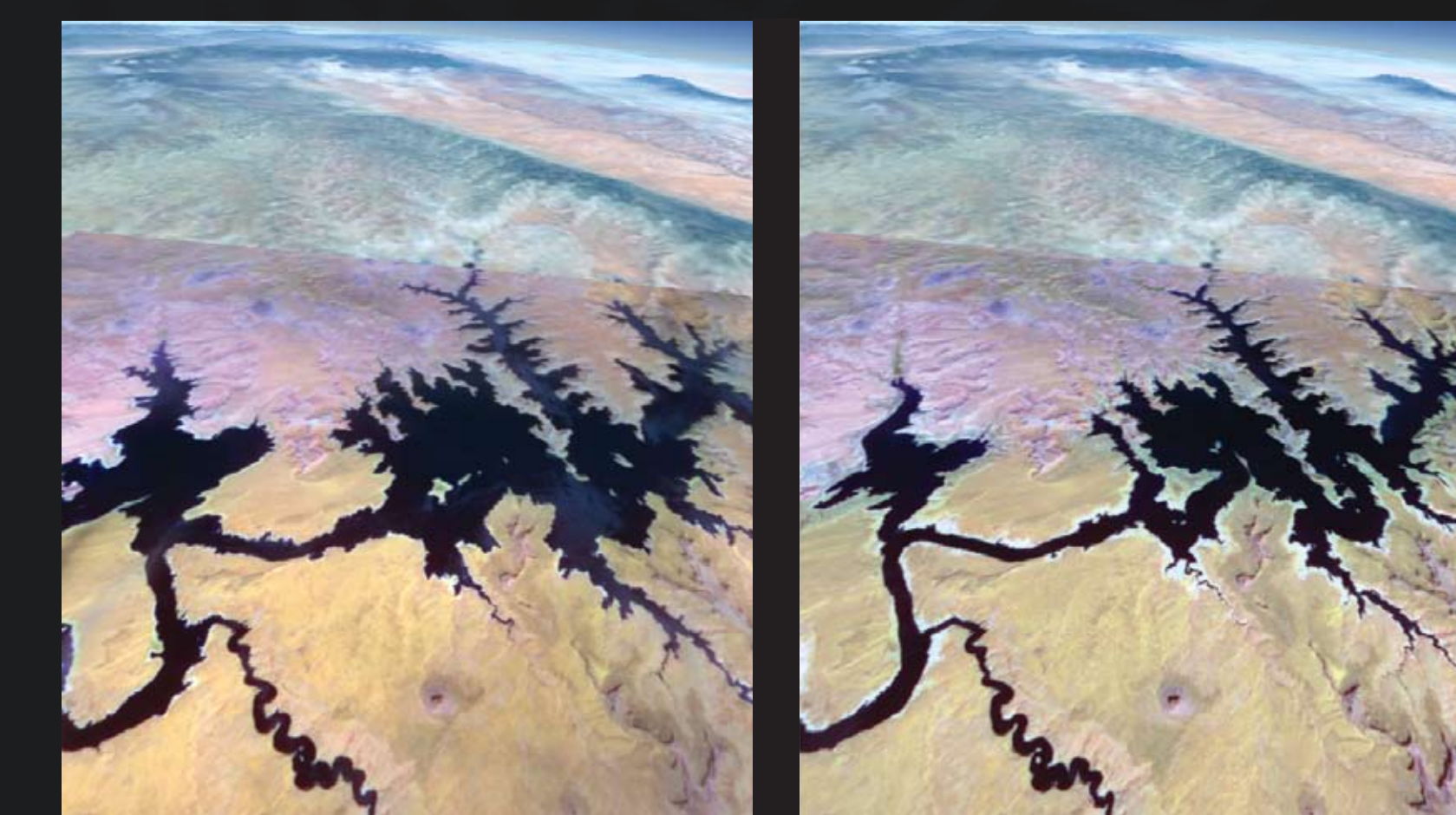
- Each partner ISI works with researchers, the private sector, governmental / non-governmental organizations, and community based organizations to develop their own BCD.
- Each ISI develops strategies with their local partners for engaging local audiences with bioregionally relevant narratives.
- Public audiences can attend the local BCD or remotely via domecasting technology.



A presentation given in a GeoDome by The Elumenati during the COP15 United Nations Climate Change Conference with 360.org in December 2009 in Copenhagen, Denmark. Worldviews Network BCDs have evolved out of the experience of this and other similar presentations by the PIs. (Photo Credit: Jack Lenik)

DOING

Address global change issues from a whole systems perspective by engaging local organizations that can help **facilitate** ongoing dialogues to identify appropriate regional solutions.



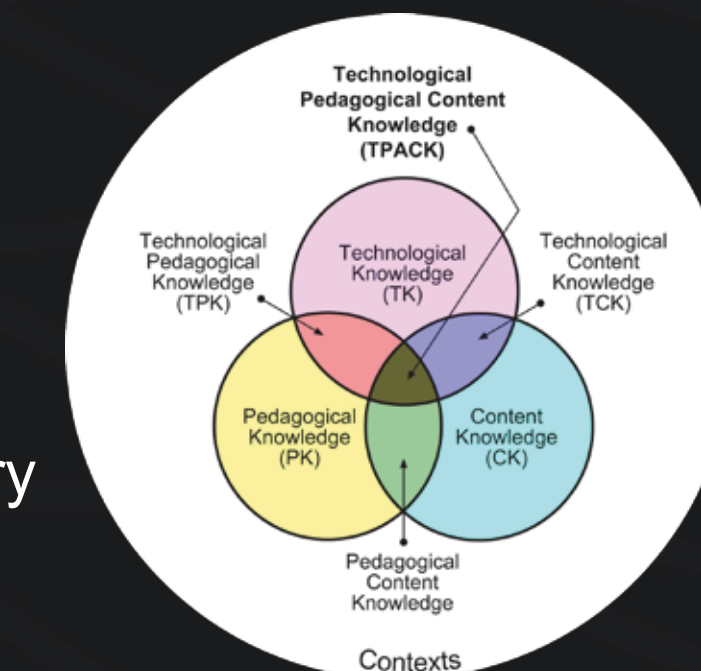
Landsat 7 imagery loaded into *Uniview* showing Lake Powell in May 2000 at the beginning of a prolonged drought (left) and six years later (right). The first BCD took place at the Denver Museum of Nature & Science on May 24, 2011. It covered global water challenges - specifically water issues in the western United States. By introducing a topic that has direct impact on Colorado residents, climate change and its effect on precipitation patterns were made more relevant for audience members.

(Credit: Landsat imagery courtesy of NASA Goddard Space Flight Center and U.S. Geological Survey.)

6. Professional Development

We adopt the Technological Pedagogical Content Knowledge (TPACK) framework in all Worldviews Network training activities, which will target these areas:

- Technological Knowledge**: using real-time immersive visualizations and “domecasting” capability for presentations.
- Pedagogical Knowledge**: increasing presentation skills of planetarium educators to effectively teach ecological literacy concepts using immersive visualizations.
- Content Knowledge**: increasing understanding of the Planetary Boundaries framework, climate and ecological literacy, and content knowledge underlying multi-scalar visualizations.



Other products: roadmaps for producing BCDs, instructions for initiating collaborations with CBOs and NGOs, and guidance for incorporating multi-cultural perspectives into presentations.

7. Evaluation

We anticipate cognitive, attitudinal, and behavioral outcomes from this project, that correspond to NRC Strands 2, 5, and 6 for informal science learning goals¹. We are working with the Institute for Learning Innovation to evaluate audiences who attend BCDs as well as our professional network that engages in CBO partnerships.

8. Future Steps

Engage audiences with design tools to develop strategies for mitigating and adapting to regional environmental challenges.

9. REFERENCES

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2. Hoffman, M., & Barstow, D. (2007). *Revolutionizing Earth System Science Education for the 21st Century: Report and Recommendations from a 50-State Analysis of Earth Science Education Standards*. Cambridge, MA: TERC.

³ NOAA (2009a). *Climate Literacy: The Essential Principles of Climate Sciences* (Second Version). Washington, D.C.: National Oceanic and Atmospheric Administration. <http://downloads.climate-science.gov/Literacy/Climate%20Literacy%20Booklet%20H-R.es.pdf>

⁴ NOAA (2009b). *National Oceanic and Atmospheric Administration Education Strategic Plan 2009-2029*. Washington, D.C. http://www.education.noaa.gov/plan/09_NOAA_Educ_Strategic_Plan_Color.pdf

⁵ Rockstrom, J., Steffen, W., Noone, K., Persson, A., Chapin, F. S., Lambin, E. F., Lenton, T. M., et al. (2009). “A safe operating space for humanity.” *Nature*. 461(7263), 472-475.