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Computational and Data Management Considerations Integrate Theory and Social Value of Earth's Critical Surface in New Science Frontiers

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Start anywhere, add comments (use post-its) and, ideas to the lists; add name with your interest for future follow-up.

As a researcher, you can start anywhere when considering how to make the research you lead matter to more than a small fraction of professional peers. There are choices throughout the process, and the more aware of the possibilities ahead of time, the more intentional you are about making a difference with the science to human life, the more aligned the collaborations, advisement, mentoring, the funding requests, and the communications with the university and the public. Your basic philosophy of your science is revealed in the choices you make, and it shows to those who are interested, but integrating value does not mean your work is less scientific. Knowing and teaching the social value of your science is "next- level science."

WHAT (DIMENSIONS and SCALES)

Defining the scale and dimension of space and time recognizes and distinguishes the effects, impacts and relationships of processes not captured in other scales and dimensions. Demonstrates diversity and inclusion.

Human, Life

Social systems
Identities
Skills
Knowledge
Cultures
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Earth System

Geology (solid earth, water, atm)
Landscape/ Landform
Soil (developed) vs regolith
Climate
Dimension Concepts: spatial, epistemological, observational/ instrumental, empirical, physical, numerical, any combination

Diversity

HOW

CHOICE of Methods, approaches, for organizing the who, what, where, collecting and sharing data

Knowing that there are multiple possibilities differing from the conventional can compel new science questions, methods for collecting and validating data, and for sharing it.

- Numerical
- Mechanical
- Computational
- Statistical
- Spatial
- Causal/ Correlational
- Deductive/ Inductive
- AI

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- Collaborator roles, responsibilities, and transparency
- Software platforms
- Educating participants, sponsors, rights-holders about the value of proposed work
- Openness protocols/ limitations

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Message preparation a part of the scientific enterprise:

Seek messages, teaching, talking points with commonalities to integrate science with social value from the start, so that the theoretical and technical aspects, through the physical processes that are measured, monitored, and analyzed can be tied to something that will transparently explain effect or impact on diverse communities.

Target Audience Table – Seeking Common Messages/Science Teachings?

Inhabitants	**Impacts of research on native communities**
Scientists	**Defining/solving a problem(s), multiple time/spatial scales**
Intermediaries	**Land/resource managers, communities**
Public at large	**Effects on life and property – shorter/ smaller scales**
Politicians/ business	**Economic impact (connecting dots)**

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WHY

Answering why you are doing what you are doing in science/modeling and transparency in communicating it. Discovery is defined by the question(s) considered worth answering by someone. How can/will the solved problems matter?

WHO
SOCIAL DIMENSION

Leaders	Scientists/Researchers
Collaborators	Knowledge co-producers
Trainees/Staff	Inhabitants
Students	Teachers, trainers, mentors/mentees
Communities	
Inhabitants	Sponsors

Equitability

WHERE
Geographic Dimension

- Spatial gridding
- Temporal intervals
- Geo-locating
- Scale(s)

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- Relating places, processes, and people
- Co-locating

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Inclusivity

DATA-MANAGEMENT

Sharing, accessibility, curation, ownership, and sovereignty

FAIR: findable, accessible, interoperable, reusable
CARE: sovereignty and tribal governance of tribal data
Repository selection: unification of standards

Data management is key…

problem or inquiry-centered science needs

- to presuppose interconnectedness of heterogeneous components AND
- address system questions

as a priority in relating different data sets, field sites and methods, and motivated to apply FAIR and CARE* principles.

Philosophy

Metaphysics: what you are talking about; what assumptions you are making about what exists in what you are talking about.

Epistemology: how you know what you are talking about; methods you are using to warrant new knowledge in your work

Observed vs Modeled or Generalized: how do models, generalizations, averages compare with instances, which ones, and how do you know?

Take-Home Message

Space and time enough to include a host of DEI and social values within research, from selection of investigators, students, staff, to communities impacted, to comparative data sets, past to present, to models, scales, and regions, to problems to address.

Prepare

- Outlining the "who, what, where, and how" ahead of time
- Ongoing considerations of data management
- Messaging, transparency, communications, e.g. when presenting research to various audiences.

Reference
*https://www.gida-global.org/care Global Indigenous Data Alliance