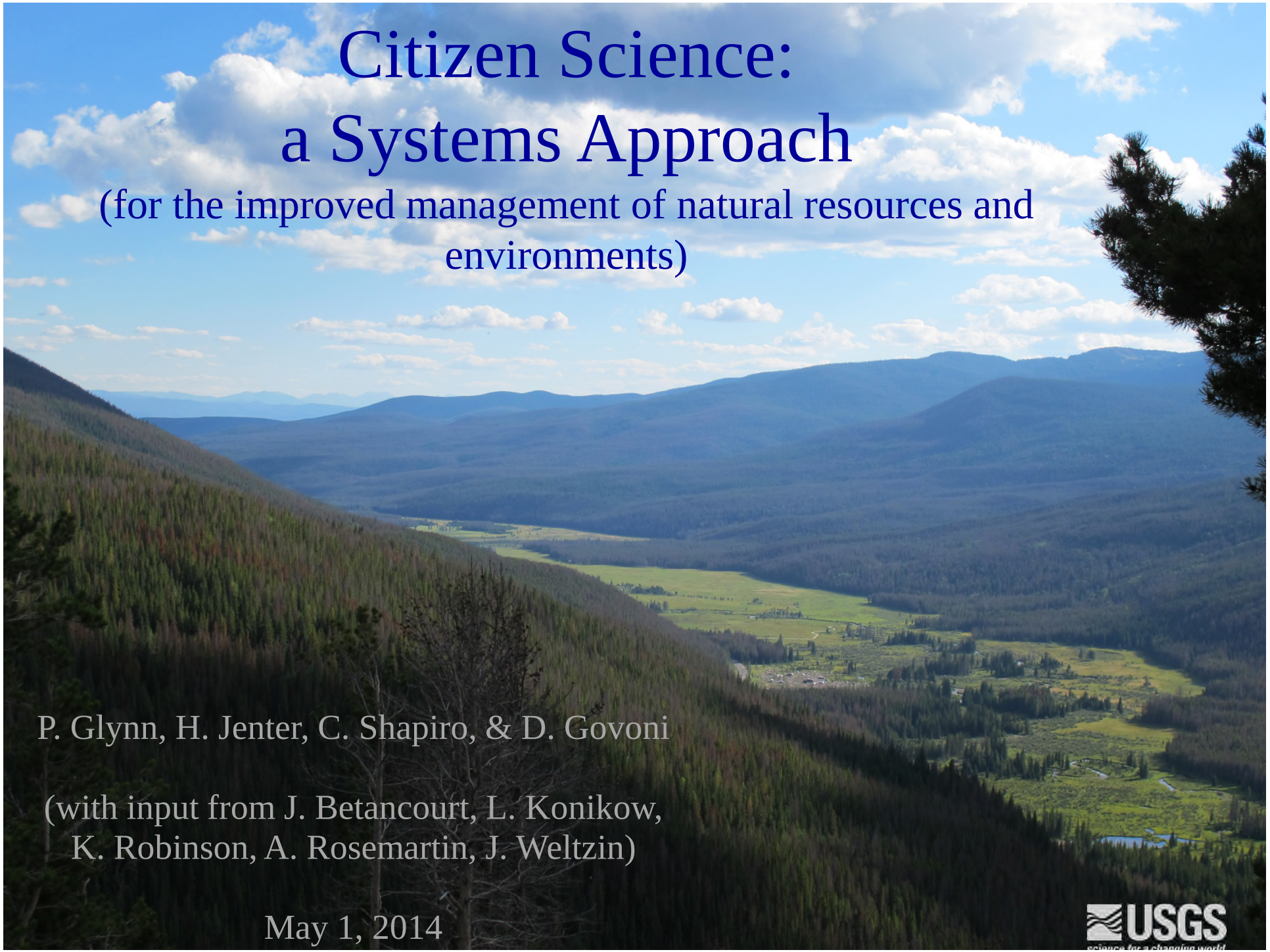

Citizen Science: a Systems Approach

(for the improved management of natural resources and environments)

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(with input from J. Betancourt, L. Konikow, K. Robinson, A. Rosemartin, J. Weltzin)

May 1, 2014

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Outline

1) Why Citizen Science?
2) Some Needed Elements
3) Benefits & Challenges of a Systems Approach
4) Some Implementation Principles

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Why Citizen Science?
A personal story

- My talks on ecosystem connections at Rocky Mountain National Park... Our increasing disconnection from the observation of Nature...
- Importance of science education in avoiding “The Tragedy of the Commons”...(Hardin & Oström)
- Maintaining long-term research & monitoring of complex, dynamic systems (e.g. USGS WEBB program)
- Engaging citizens in Integrated Environmental Modeling (IEM)

We Need a New Science to Manage Our "Commons", that

Reinvents Discovery & Syntheses of Knowledge

Mental Models Matter!

Odilon Redon (1840-1916): Butterflies. c. 1910.

Oil on canvas, 29 1/8 x 21 x 5/8" (73.9 x 54.9 cm). Gift of Mrs. Werner E. Josten in memory of her husband. The Museum of Modern Art, New York, NY, U.S.A. Digital Image © The Museum of Modern Art/Licensed by SCALA/Art Resource, NY

Understanding and managing complex dynamic ecosystems for the long term

- Simplification, by itself, is not an answer
- Neither is increasing the knowledge divide between professional expertise and the public

- Increasing engagement & knowledge base of the broader public is critical.

- Also essential:
  - Seeking primary information and “objectivity”
  - Open, transparent, models to increase our global knowledge base
  - Expanding our human perspectives
  - Improved adaptations to our failures

My Definition of Citizen Science

- An engagement from members of the public, often in collaboration with credentialed technical experts, to observe, analyze, and/or understand natural resources and environments for the benefit of science and society.

- The members of the public are usually, but not always, volunteers.

- The engagement has a scientific basis: participants seek honest pursuit of greater knowledge.

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Some Needed Elements for Citizen Science

- Broader demographics
- More & better partnerships
- Multidisciplinarity... Avenues for fuller scientific engagement of volunteers into all aspects of science…
- Interdisciplinary linkages, including w/ built environments
- Knowledge transfer to different scales and systems
- Long-term perspectives and temporal contexts
- Translation to societal actions
- More coordination, broader scope, resilience…

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Science Needs for Societal Action

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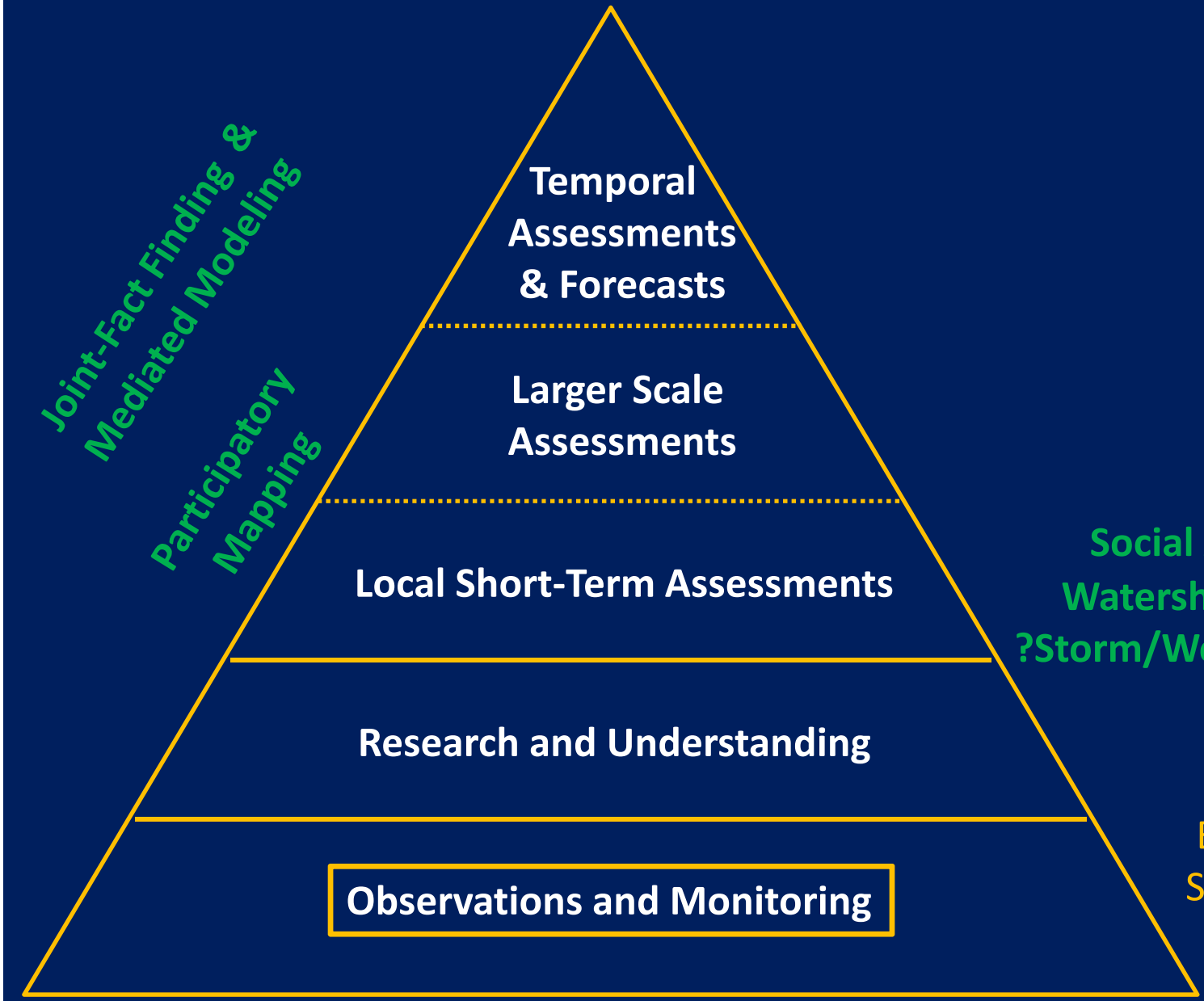
Existing Citizen Science Activities



Benefits

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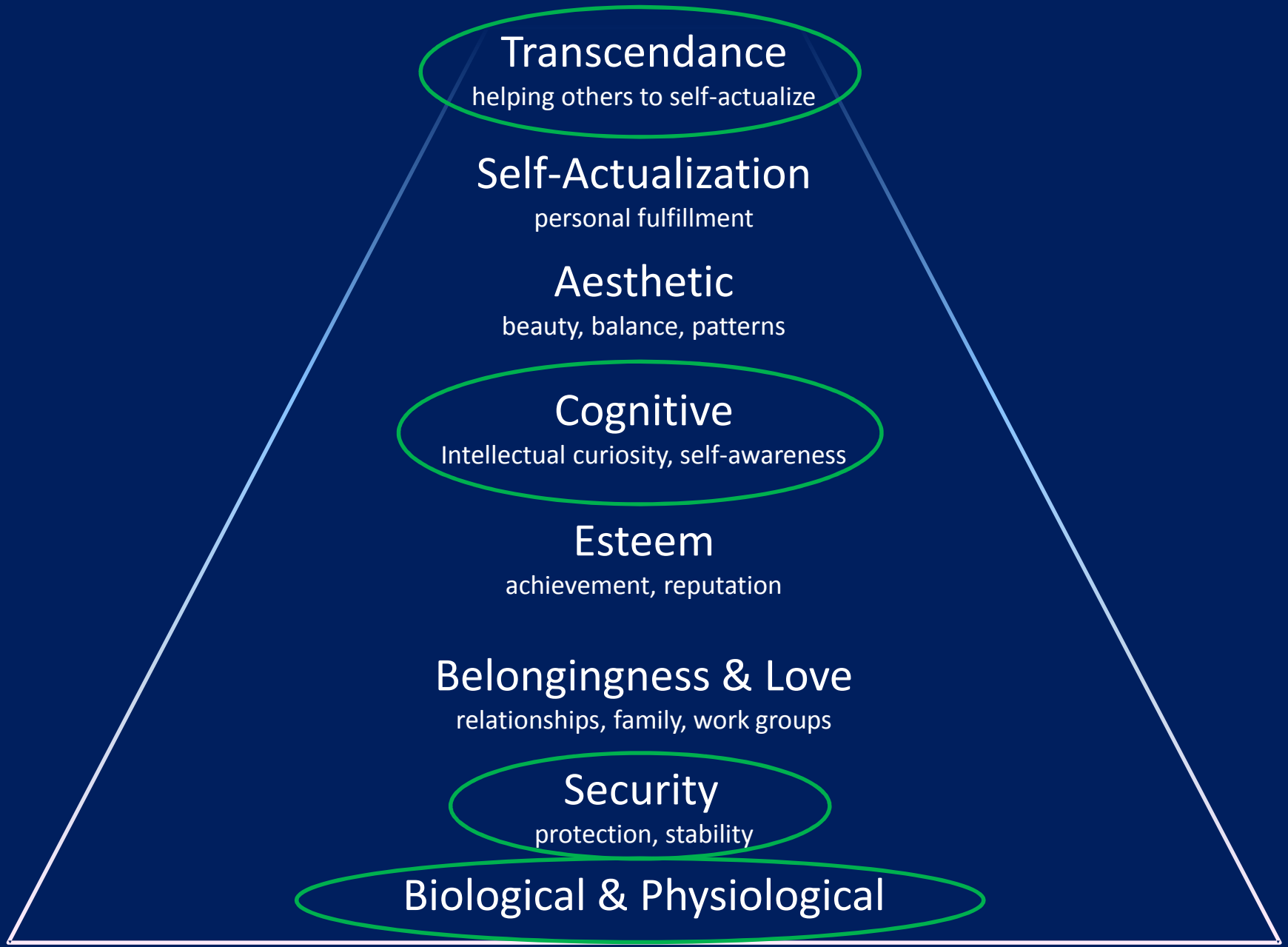
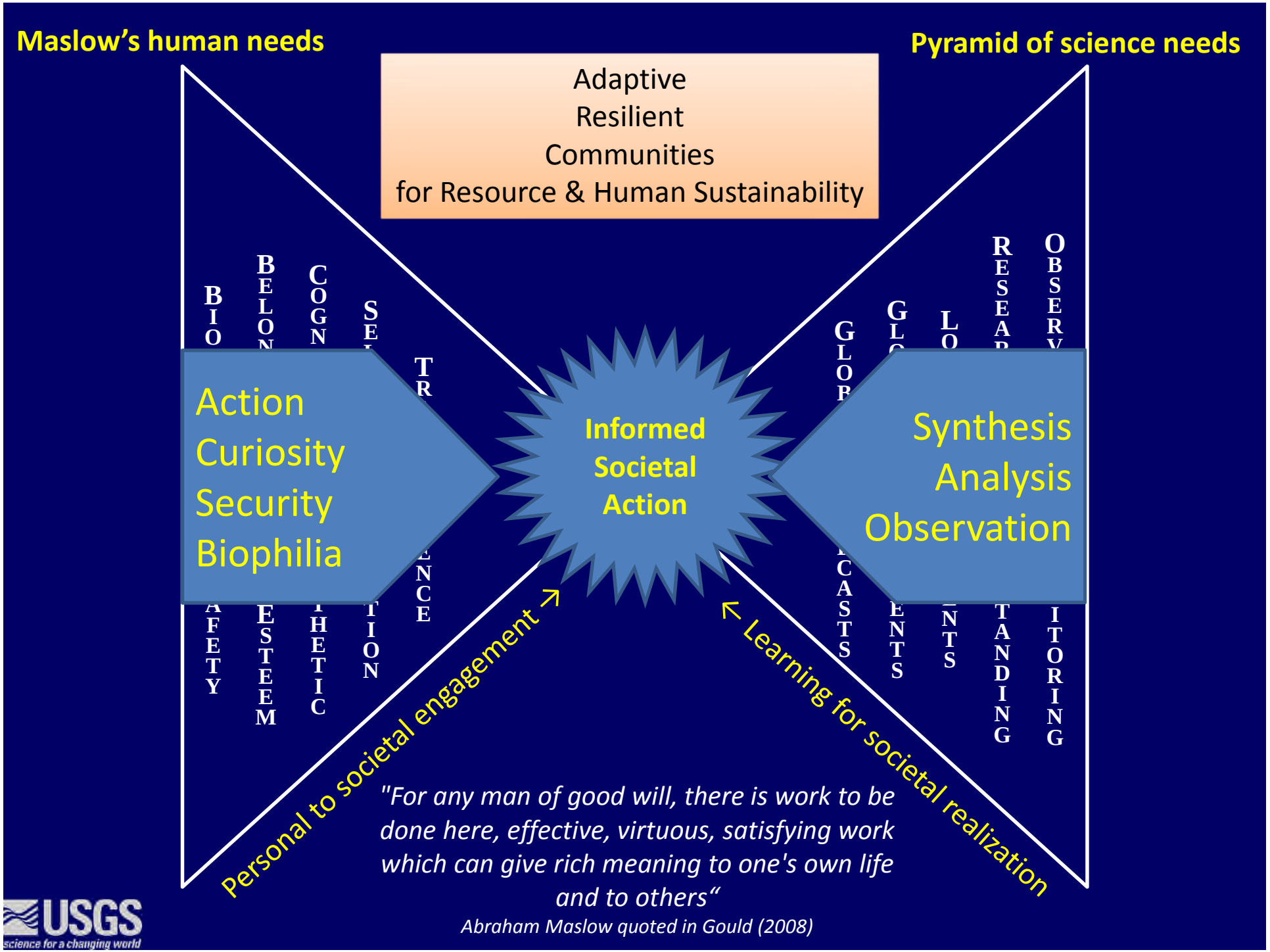
- **Science** (monitoring, research, assessments, modeling)
  - More science and better accessibility
  - More sharing of results (& cross-system use)
  - Better sharing of science resources
- **Education**
  - Better connects people to their resources & environments
  - Challenges people & formal & informal educational systems
- **Policy**
  - Translation of scientific knowledge into improved societal actions
  - More engaging & inclusive
  - Considers an individual's view of the "here & the now", but seeks the benefit of entire communities, for the larger scale & the longer term.

Maslow's Pyramid of Human Needs (revised in the 1990's)




Maslow's human needs
Pyramid of science needs
Adaptive
Resilient
Communities
for Resource & Human Sustainability
Action
Curiosity
Security
Biophilia
Informed
Societal
Action
Synthesis
Analysis
Observation
Personal to societal engagement
Learning for societal realization
"For any man of good will, there is work to be done here, effective, virtuous, satisfying work which can give rich meaning to one's own life and to others"
Abraham Maslow quoted in Gould (2008)
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Challenges

- Quality & Consistency, Archival & Access
- Study design, scientific method, assessment tests, audits, followups…

- Credibility…
- Human biases & cognitive limitations…

- Legal constraints and ethical considerations

- Costs & organizational constraints
- Recruitment & retention

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Initial thoughts on implementation (1)

- Science, education, and policy aspects should not be divorced from each other

- Formal education systems need to participate

- Regulatory/management agencies need to participate

- “Honest advocacy” needs to be present

- Credible science and policy brokers are needed

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Initial thoughts on implementation (2)

- Professionals (including scientists and engineers) need to engage:
  - Step off the pedestals!
  - Engagement needs to be rewarded
  - “Active Learning” of both professionals and volunteers needs to be encouraged

- Recruitment/retention of professionals and volunteers needs to be based on an understanding of basic human motivations

- Engage with the Social Sciences to understand our human biases and drivers!

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Concluding thoughts

- Integrative Organizations are Essential

- So is Taking Cognizance of Human Motivational Drivers, Biases and Heuristics. We Need a New Area of Science: "the Behavioural Biogeosciences" (Glynn, 2014, IEMSs)

➢ Managing our "Commons" Requires Public Engagement and Transdisciplinary, Trans-Institutional, Science & Education.

➢ We Need Structure, Depth, Breadth & Persistence in our Science!

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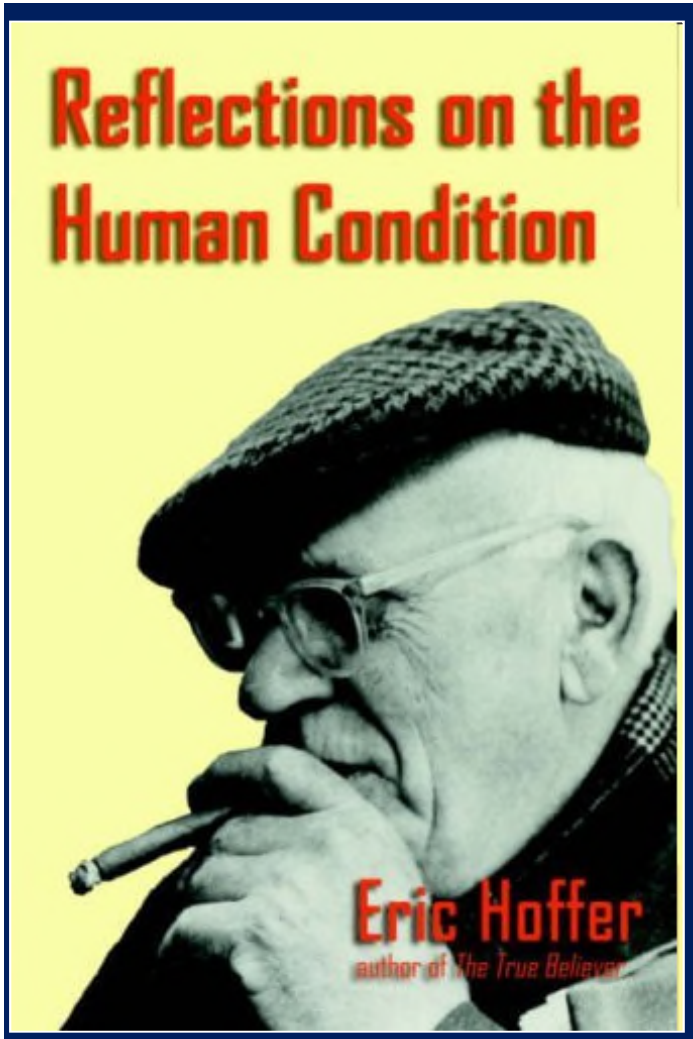

“In a time of drastic change it is the learners who inherit the future. The learned usually find themselves equipped to live in a world that no longer exists”

Eric Hoffer (1902-1983; migrant worker, longshoreman, philosopher)

Courtesy of Julio Betancourt (USGS scientist, co-founder of the USA National Phenology Network)


Comments? Email: pglynn@usgs.gov
The End
There is always more than one perceived reality