Introduction

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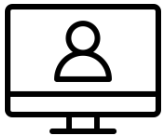
Measuring and Assessing the Socioeconomic Value of Earth Science Data

September 4, 2018 | Webinar #3

Background



Third webinar in our series, "The Socioeconomic Value of Earth Science Data, Information, and Applications"

Main points

- Explore approaches and techniques that are being used and developed to measure and assess the socioeconomic value
- These methods are invaluable for demonstrating the return on investment of data products and information systems, so future investments can be better prioritized

Structure for the webinar

- Panel presentations
- Questions in chat box

Panel Presentations

Moderator: Dr. Jay Pearlman, Technical Director, FourBridges

Dr. Yusuke Kuwayama
Resources for the Future & VALUABLES Consortium
"Quantifying the socioeconomic benefits of EO in decision-making"

Dr. Robert R. Downs
Columbia University
"Assessing the Value of Integrated Geospatial Data Products and Services"

Miriam Murambadoro
Council for Scientific and Industrial Research
"Qualitative methods to assess the value of climate information to users"

Quantifying the Socioeconomic Benefits of Earth Observations in Decision-Making

Yusuke Kuwayama
Resources for the Future

ESIP Webinar
September 4, 2018

RESOURCES FOR THE FUTURE

VALUABLES
CONSORTIUM

Advancing methods to value applied benefits linked with Earth science

- Convenes over 20 social and Earth scientists, other experts
- Advancing formal methods in the science of value of information (VOI) through impact assessments across different application areas
    - Case studies to apply existing methods and develop new methods
    - Building the literature on impact assessments on EO for decisionmaking
- Building a community of practice of valuation experts and Earth scientists
    - Materials to build awareness about terms, concepts, methods
    - Interdisciplinary networking and collaborative opportunities
- Conveying the value of applied benefits of Earth observations to new stakeholders in government, universities, NGO community, interested public

Why value Earth observations?

Using the Value of Information (VOI) approach, we can

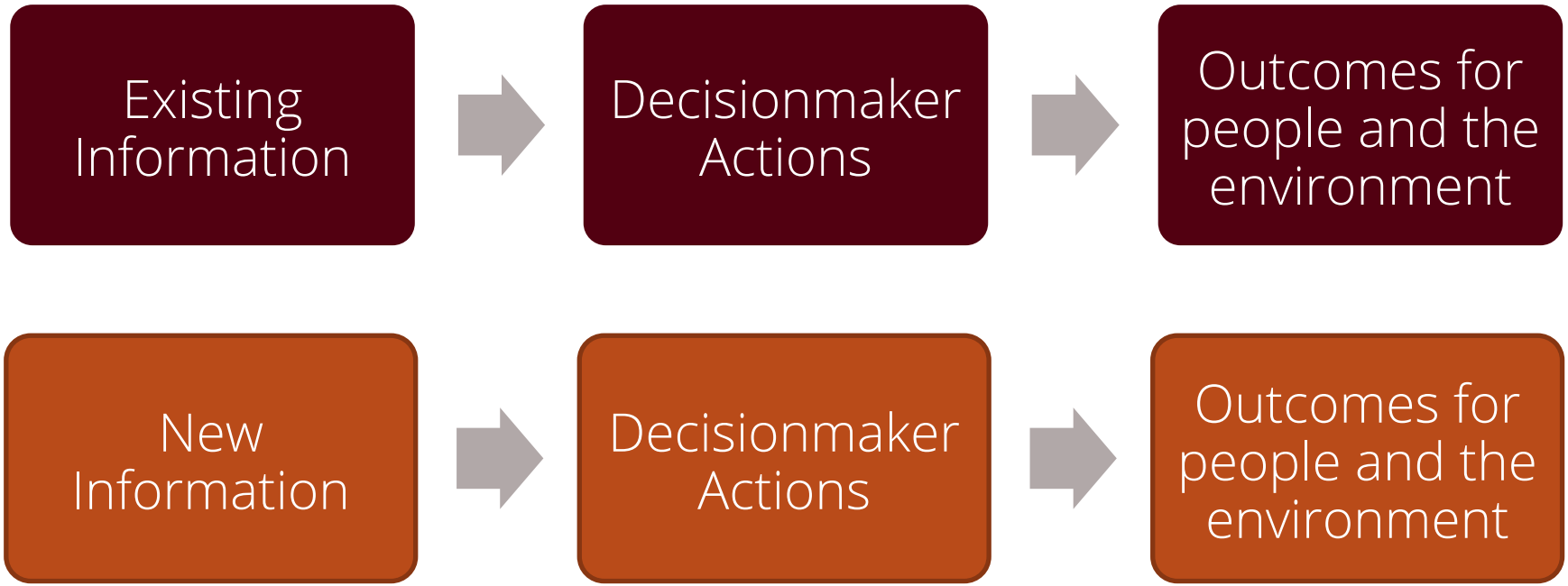
- Demonstrate return on investment in satellites and data products
- Give Earth scientists an effective tool for communicating the value of the their work in socioeconomically meaningful terms
- Make informed choices about how to invest limited resources
- Increase the likelihood that a satellite or satellite data application produces socioeconomic benefits by thinking about how to evaluate outcomes during the planning phase

RESOURCES FOR THE FUTURE

What do we mean by “value”?

- VALUABLES aims to quantify improvements in socioeconomically meaningful outcomes that result from the use of Earth observations in decisions.
- What is a socioeconomically meaningful outcome?
  - One that matters to people or to the environment.
  - Some examples:
    - Number of lives saved
    - Percent increase in firm profits
    - Acres of forest conserved
    - Percent increase in crop yields

Identifying a theory of change

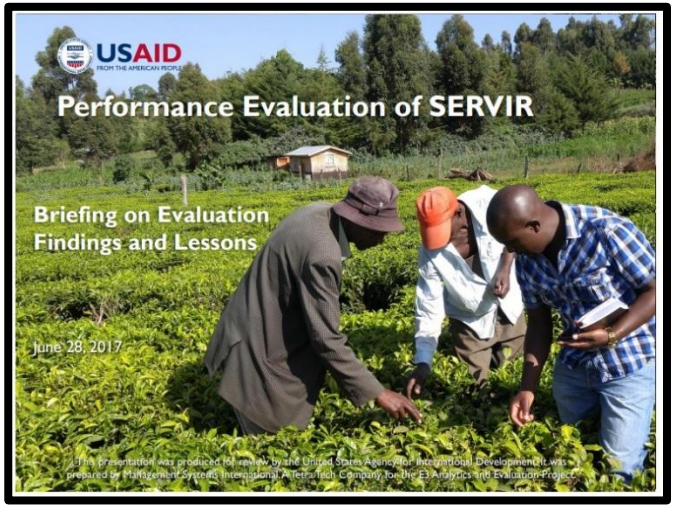


Impact (VOI) = Outcomes - Outcomes

Example 1: Morrison et al. (2017)

What is the VOI from a frost prediction tool for Kenyan tea farmers?

- SERVIR is developing a tool that can provide 72-hour warnings for frost events.
- Impact assessment included a survey of 400+ Kenyan tea farmers.
- Available actions:
  - Early harvesting;
  - Skiffing (light pruning).
- Annual value of reduced frost damage losses is $80.47, equivalent to 25 days of household food spending.
- Source: *Performance Evaluation of SERVIR – Briefing on Evaluation Findings and Lessons.*



Example 2: Nagaraj (2017)

Figure 1. **Variation in Mapping Coverage**

Panel A: Landsat "Blocks" and Years First Mapped by Landsat

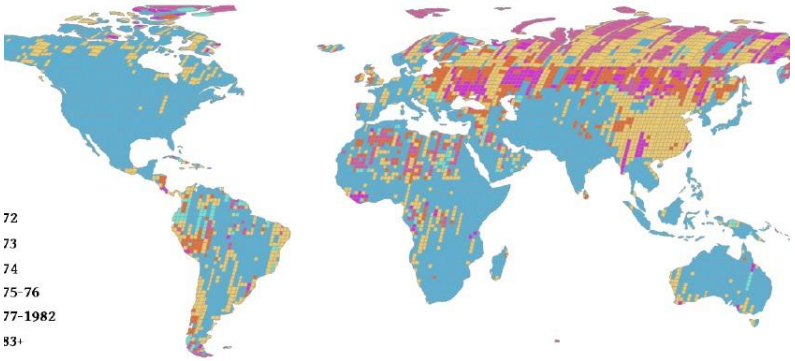
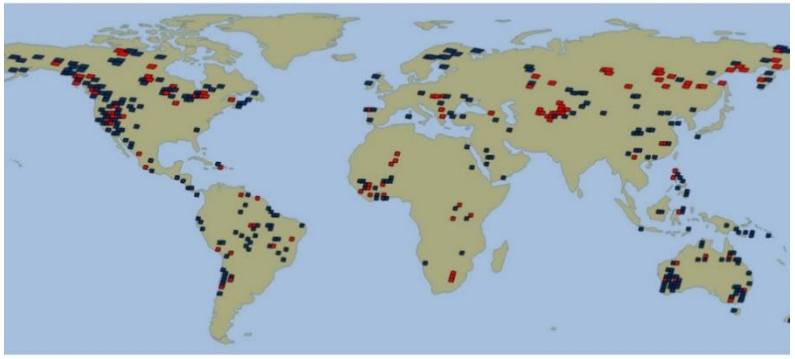


Figure C.1. **Blocks with Gold Discoveries**

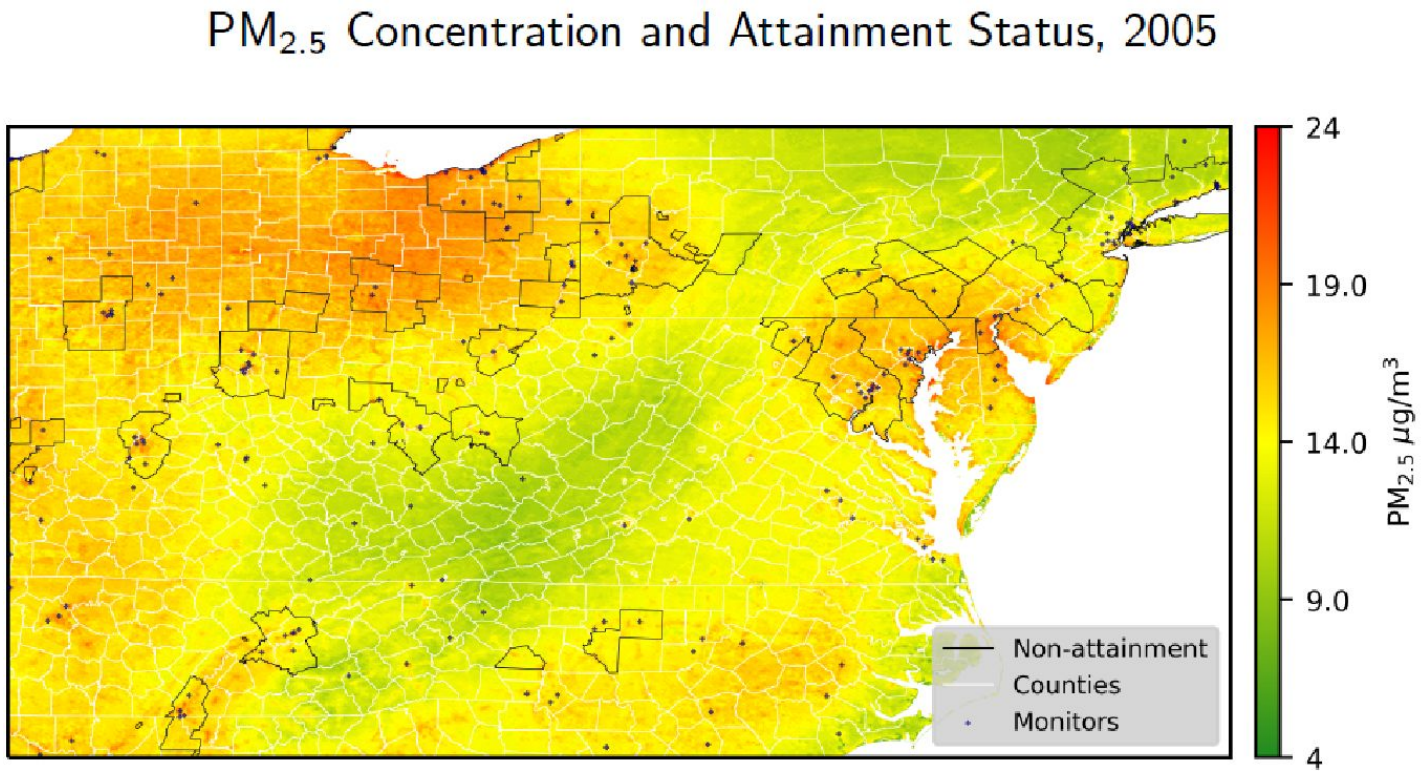


Key– 1958-1973: Red and 1973-1988: Blue

- What is the value of Landsat imagery in the gold mining sector?
- Landsat imagery is sometimes not available as a result of technical failures and cloud cover.
- This provides a "natural experiment" that allows one to compare innovation in the gold mining sector with and without Landsat information.
- Bottom line: Regions mapped by Landsat were almost twice as likely to report the discovery of new gold deposits.
- For a country the size of the US this translates to additional gold reserves worth about $6.4 billion USD that can be attributed to information from the Landsat program.

Example 3: Sullivan and Krupnick (2018)

What is the potential societal value (from improved health outcomes, lower regulatory costs, etc.) of using remotely sensed PM2.5 data instead of ground-based monitoring?



Connect with VALUABLES

Yusuke Kuwayama, VALUABLES Director of Socioeconomic Studies, kuwayama@rff.org
Bethany Mabee, VALUABLES Community Manager, mabee@rff.org

Sign up for emails

Sign up to receive email updates at **www.rff.org/valuables**.

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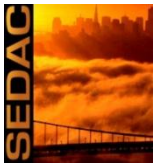
Center for International Earth Science Information Network
EARTH INSTITUTE | COLUMBIA UNIVERSITY



Approaches for Assessing the Value of Integrated Geospatial Data Products and Services

Robert R. Downs

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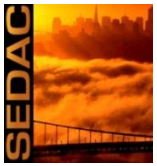
NASA Socioeconomic Data and Applications Center (SEDAC)
Center for International Earth Science Information Network (CIESIN)
The Earth Institute, Columbia University

Webinar Series:
The Socioeconomic Value of Earth Science Data, Information, and Applications

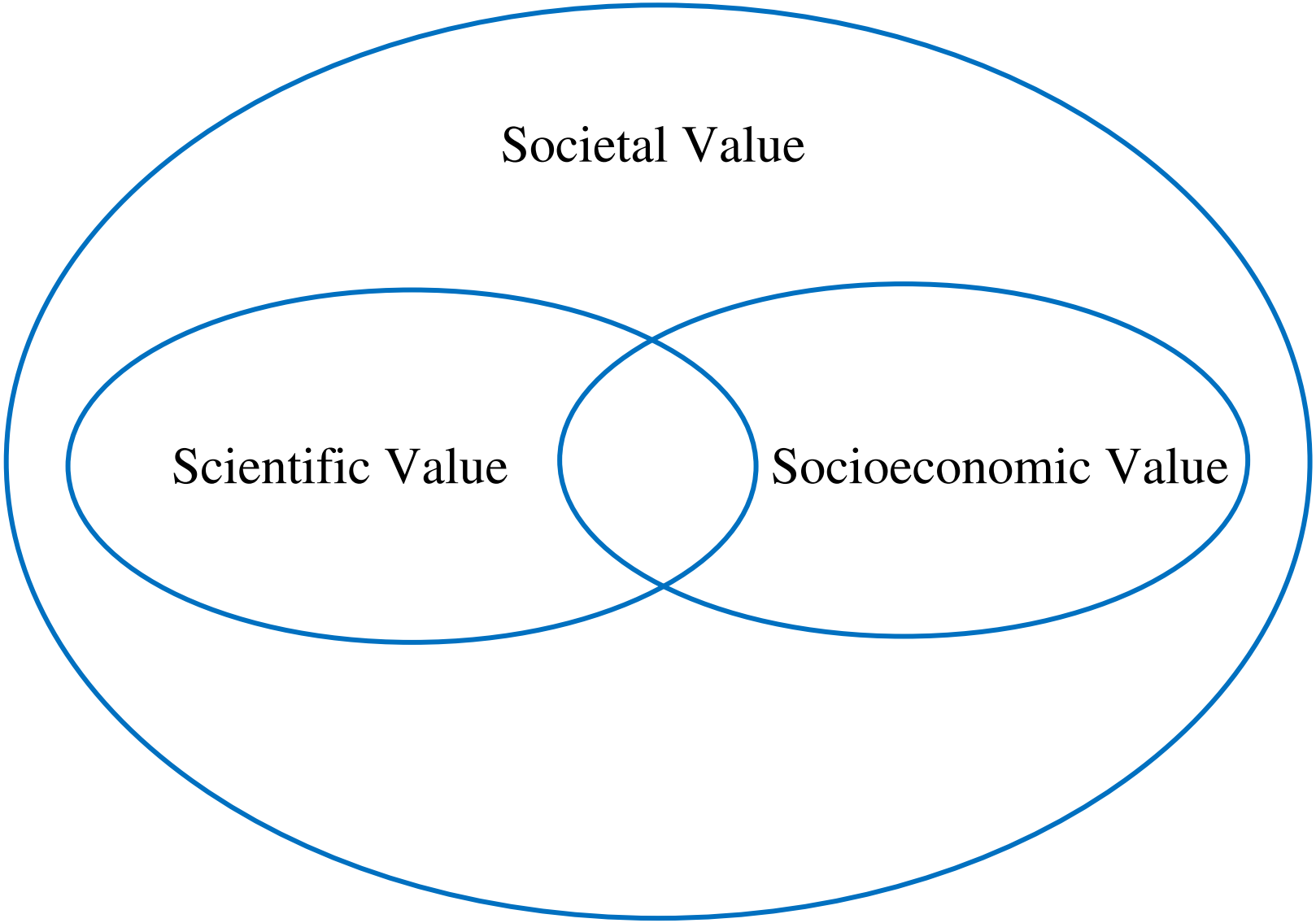
Session: Measuring and Assessing Socioeconomic Value
Tuesday, 4 September 2018, 12:30 p.m. - 1:30 p.m. ET

Abstract



Various methods are used to study the socioeconomic value of data products and services. In particular, assessments of citations of data products and services in studies published in the scientific literature and other media can be an indicator of the value of data for research and development, as well as for part of the downstream value of data. From the perspective of a scientific data center that offers a variety of data products and services, assessing citations of data provides insight into the scientific and societal value attained from the development, curation, and dissemination of data. Approaches are described for assessing citations of data products and services that are available from SEDAC, the NASA Socioeconomic Data and Applications Center.

Value of Scientific Data Use

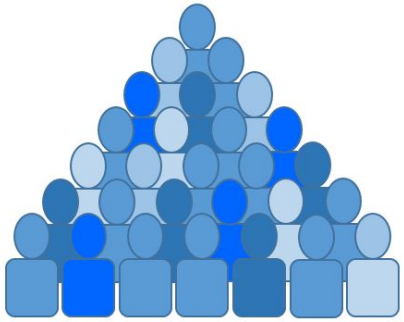


Value from Use of Geospatial Data

- Scientific Value
  - Use for testing new hypotheses, discovery, comparison, verification, replication, integration, methodology development, etc.
  - Use by specific disciplines or by multiple disciplines or levels of expertise
  - Value of repository as data curator and distributor
  - Relative use of specific data products, services, or collections
  - Scientific contributions of collection teams, data curators, data stewards
- Socioeconomic Value
  - Potential downstream adoption for applications, products, services, etc. (not necessarily discoverable if part of trade secrets for competitive advantage)
- Societal Value
  - Demonstrated adoption to inform the public about current or past conditions, as well as future projections
  - Potential downstream adoption by decision makers for planning and developing policies and guidelines, etc.

Value of Data Depends on Use

- Value is realized from initial data use
  - Methods and findings from the team of data producers
  - Knowledge within the field(s) represented by the data producers



- Enduring value comes from continuing data use
  - Subsequent studies of data analysis and new findings
  - Integration with other data products and services
  - Potential for contributing to knowledge across disciplines
  - Potential for increasing understanding across societal sectors

Measuring Data Use to Assess Value

- Observed data use
  - Visits to collection or data landing pages (number of users, time spent, etc.)
  - Data set downloads
  - Data services used
  - Websites that redistribute data products or services
  - Limitations: Unreported, yet salient, critical operational uses can be missed (e.g. emergency responders); web hits can be distorted (e.g. bots); decision-making and planning uses might not be reported publicly (e.g. proprietary commercial or government information)
- Published reports of data use
  - Scientific peer-reviewed journal articles
  - Books and book chapters
  - Newsletters, blogs, etc.
  - Popular media (television, magazines, etc.), online discussions, tweets
  - Limitations: Data citations might not correctly appear in bibliographies and the type, extent, and value of use might not be reported

Limitations of Linking Value to Data Citations

- Aggregated data citations do not necessarily reflect usefulness
  - Type or quality of use may be described in narrative, if described at all
- Data citations do not accurately reflect all uses
  - Absence of data citations when attribution of use is not provided
  - Some authors may only cite the original article and not cite the data
  - Improper and inconsistent data citation practices (e.g. not in References section)
- Attribution might not reflect downstream uses of data
  - Citations of integrated data products can obscure use of input data
  - Some commercial decision-making may not include attribution to data
  - Some government decision-makers may not provide attribution to data

Data Citation Use Cases

- Data collection planning
  - When planning to collect data to study a phenomenon of interest, the data collection team searches for citations of related data products and services to identify whether similar data have been collected and how those data have been used, to inform the data collection planning.
- Data center collection development
  - When assessing a proposal to develop a new data product for an existing collection, the data manager analyzes citations of similar data products of that collection to determine the potential users and uses of the new product by the user community.
- Choosing data for a planned study
  - When considering which data set among several candidate data sets to use for a planned study, the potential data user reviews the data citations of the candidate data sets to see whether any have been used for studies that are similar to the planned study.

Collecting Citations of SEDAC Data

- Enable and encourage data citations
  - Display recommended data citation on data landing page, documentation, and metadata
  - Include a Digital Object Identifier (DOI) within each recommended data citation
  - Assign open licenses and rights to data, maps, and documentation
  - Provide guidance for citing SEDAC data products and services
- Receive citation alerts for search terms, SEDAC or CIESIN
  - Publishers and bibliometric databases (Scopus)
  - Google Scholar alerts received for SEDAC DOIs
  - Notifications received from some authors
- Review citation and publication and create a database record
  - Examine each citation and obtain the publication
  - Verify use of SEDAC data in the publication
  - Enter citation into database containing all citations
  - Database fields capture values for publication type, authors, collection, data set, etc.

Derived from Downs, Chen, and Schumacher, 2017.

Finding Citations of SEDAC & Remote Sensing Data

- Identify articles citing both SEDAC data & RS data
  - Obtain articles and verify SEDAC data citation
  - Search each article for remote sensing terms and instrument names (conducted routinely by the same person on a weekly basis), e.g., "remote sensing", "satellite"
- Verify use of RS data and SEDAC data within each article
  - In some articles, it is obvious that no satellite imagery was used
  - Articles that appear to be using remote sensing data are examined closely if search terms produce no results
  - Articles that mention an instrument or general satellite imagery without any data use reported are not coded as also citing remote sensing data

Derived from Downs, Chen, and Schumacher, 2017.

Approach to Assess Papers Referencing SEDAC Data and Remote Sensing Data

- Purpose:
  - Characterize the ways in which SEDAC data are being used in conjunction with remote sensing data
  - Begin to move beyond anecdotes of integrated use to a quantitative framework for assessing scientific value of data
  - Assess how the research community cites data in published work, including ways to improve search procedures to ensure identification of citations
- Approach:
  - Identified 49 papers published in 2012 that contain co-citations of SEDAC data and remote sensing data
  - Created a **taxonomy** of data use and integration
  - Conducted content analysis of papers to apply taxonomy by reviewing all in-text citations, mentions, and references to both SEDAC and remote sensing datasets (up to 2 each)

Derived from Chen, Downs, and Schumacher, 2013

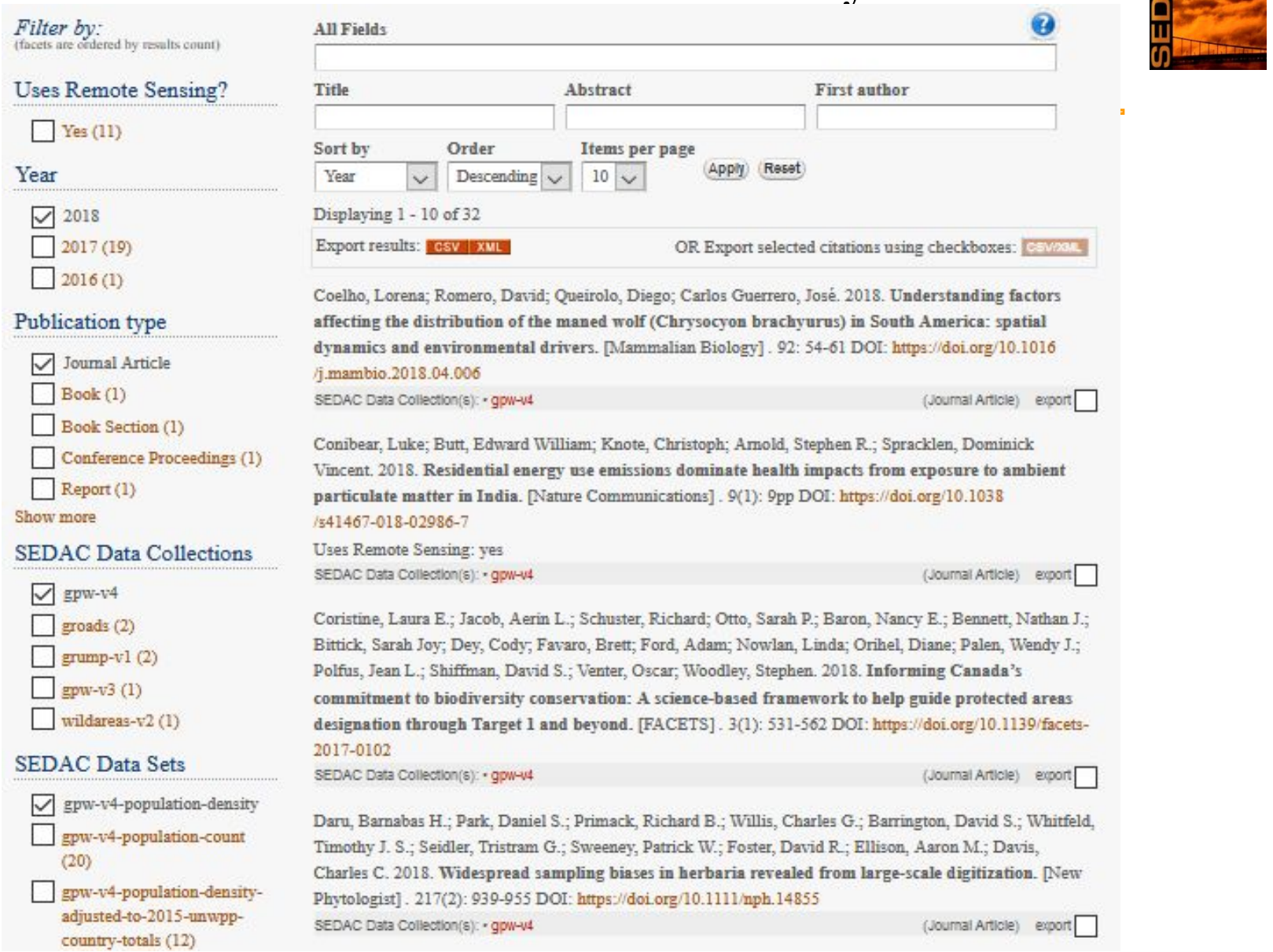
Taxonomy of Data Citation
Cited but not used
Used as background or context
-- Used in figure only
Used in study design
-- Hypothesis/theory development
-- Sample selection
-- Other
Used in trend or spatial analysis
Used in statistical model
-- Statistically significant?
-- Total number of variables
Used in simulation model
-- Key component or variable
-- Minor variable or parameter
-- Baseline or boundary condition
Used for validation purposes
Used in research translation
-- Making results relevant to policy
-- Enabling use in applications
-- Cited in conclusion/discussion

Methodology for Assessing Extent of Interdisciplinary Data Use in the Scientific Literature

- **Classifications to identify disciplines of each citing journal**
  - Obtained Web of Science® (WoS) Category assignments for journals
  - Obtained Web of Knowledge® Subject Classification of WoS Categories (WoK5.3) and Equivalent General Categories and Subject Areas
  - Obtained ScienceWatch® Field Definitions of Major Fields
- **Identified multidisciplinary use of Co-cited data**
  - Identified WoS Categories assigned to journals citing SEDAC data, and used Scopus®, journal titles, and publisher sites when Categories were not assigned
  - Paired assigned WoS Categories to Equivalent General Categories and Subjects
  - Identified Major Fields corresponding to assigned WoS Categories and Subjects
  - Normalized journals with WoS Categories, (WoK5.3) and Equivalent General Categories and Subject areas, and Field Definitions of Major Fields
  - Identified Categories, Subjects, and Major Fields of journals citing SEDAC data

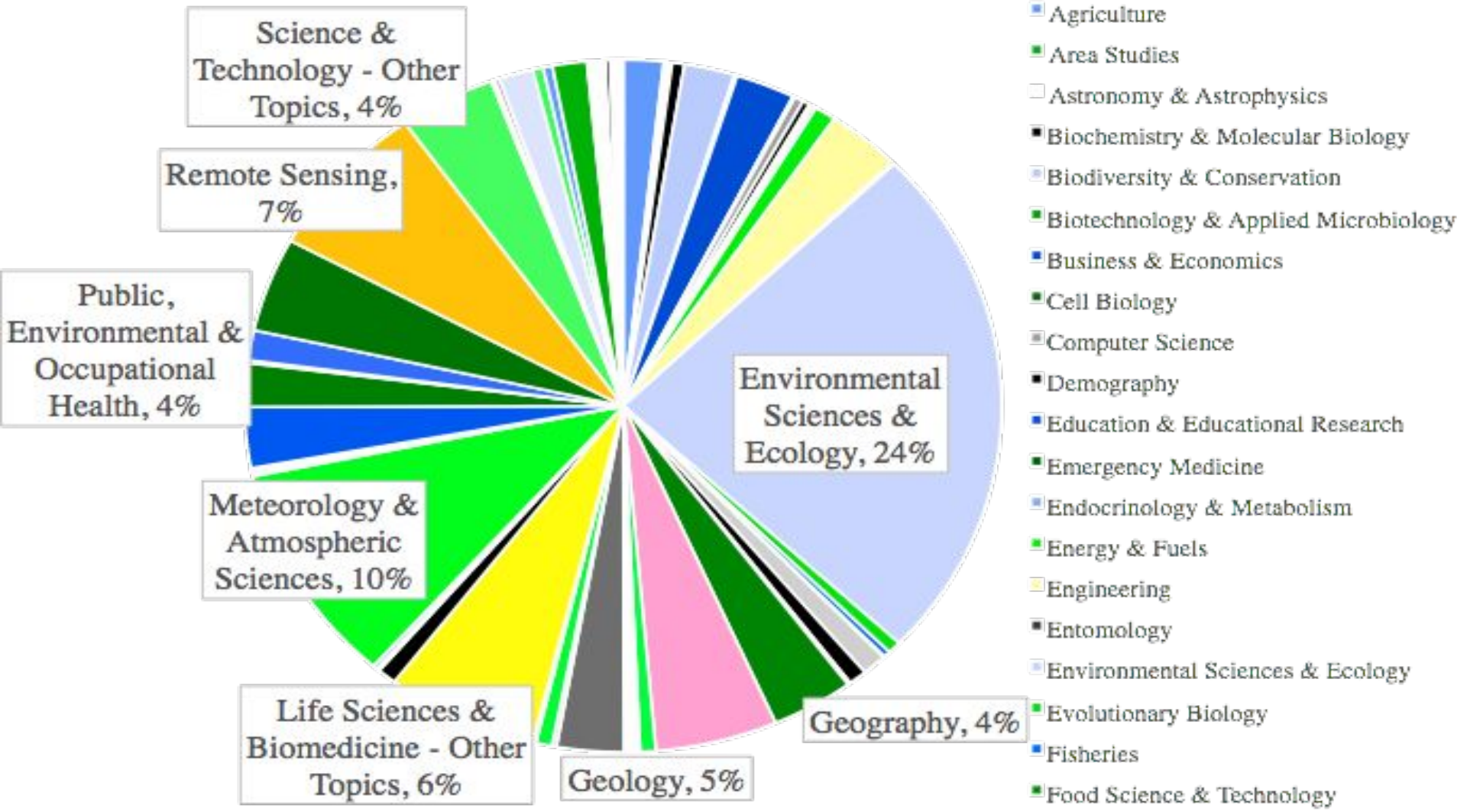
Adapted from Downs and Chen. 2015

SEDAC Citations Database – Publicly Accessible



http://sedac.ciesin.columbia.edu/citations-db

63 Subject Areas of Journals with Articles Co-Citing SEDAC Data with Remote Sensing Data, 2007-2016



Source: Downs, Chen, and Schumacher, 2017.

Panel Presentations

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Qualitative methods to assess the value of climate information to users at local government level

Miriam Murambadoro
Council for Scientific and Industrial Research

our future through science

Why should local governments value climate information?

- Climate change has the potential to derail social and economic development
- There is the risk of disasters increasing with the potential to magnify the uneven distribution of risk of both the poor and those with wealth
- Climate change has the potential to surge current challenges to water security in water stressed countries
- The local level is where the impacts of climate change are felt hence local authorities are central in addressing these
- *NB: Local government officials have knowledge and epistemic resources at their disposal which influence what they value. Most of this does not originate from the scientific elite*

CSIR
our future through science

What is qualitative research?

"It is a research approach that allows one to examine people's experiences and perceptions in detail"(Hennick et al., 2011:8)

Interviews, focus group discussions, observation, content analysis, life histories and biographies

Why do perceptions matter?

- They influence ;
  - How people plan and make decisions e.g. proactive vs reactive disaster management
  - How people react when new information is provided
  - Individual as well as group values

Studies show we worry less about risks that we don't think can really happen to us.

Participatory approaches to assess perceptions on climate information

Participatory approaches are exploratory and provide rich data (narratives) on particular meanings/experiences that reflect a dynamic reality

- Focus group: "*a carefully planned discussion designed to garner the views of a selected group of people regarding a defined topic*" (Wilson, 2005)
  - Hierarchy trees
  - Influence towers
  - Appreciative inquiry

In depth interviews

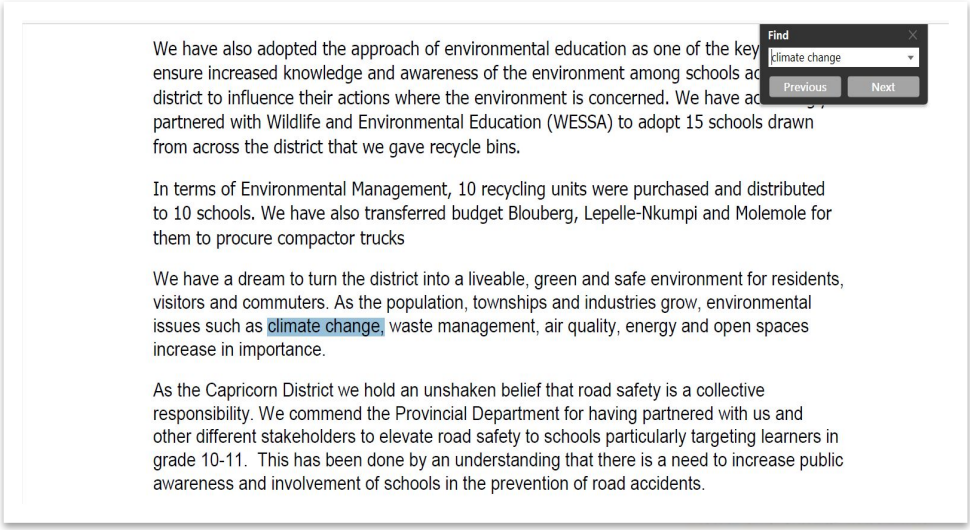
- These are guided discussions facilitated by an interviewer who uses a set of key questions to solicit information from respondents in relation to the study (Yin 2016).

"e.g. What do you perceive to be the most effective source of climate change information?"

- Allows participants to identify sources of information that are valuable to them
- Probing can be used to get more information

Content analysis

- Systematic analysis of content with reference to the meanings, contexts and intentions contained in secondary data
- content of the message forms the basis for drawing inferences and conclusions about the content (Nachmias and Nachmias, 1976).
    - Review of municipal reports and planning documents
    - Review of policies



Capricorn District Case Study: Interesting quotes

Most officials want to deal with immediate problems that have immediate benefits and recognition - climate change seems distant to many people because projections talk of changes that will happen in rainfall and temperatures for timescales beyond our current lifetime e.g. 2050 some people just want to know about the short term not more than 5years [Extract from a workshop discussion]

Municipal reports are more useful as they guide us on which projects to implement and have background information on the district that we can easily relate to (Direct Quote from an Interview).

Most of the earth science is not communicated in a way that would convince people to change by demonstrating how what you are recommending actually works. (Direct Quote from an interview)

Challenges with changing perceptions

- CCA requires a shift in human behaviour
- Human behaviour is very resistant to change
- People do not necessarily respond well to “being told” what to do.
- Individuals have different value systems that inform the way that they perceive any new information
- Local perspective vs global perspectives on climate change
- Local government officials operate in complex systems where political philosophies of anarchy and fascism exist and influence the individual and group values

Conclusion

- There are multiple social realities through which scientific and non-scientific communities perceive climate change
- There are many conflicting perceptions of risk.
- Non-scientific communities learn about climate change from sources of information which are interpreted through a lens of localised personal experiences (social learning).
- Uptake of earth science information is constrained by the dominant conceptualisations of climate change which focus on its physicality
- Qualitative approaches allow for the creation of knowledge on and understanding of the social phenomenon of climate change

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Q & A

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Final Remarks

Erin Robinson
Executive Director, ESIP
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The Information Pathway for Earth Science Data: Between Supplier and User

August 7, 2018 | Webinar #2

Socioeconomic Value of Data Webinar Series

Webinars are held from 12:30 - 1:30 PM ET.

Jun. 5:	Does it matter? The Socioeconomic Value of Earth Science data, information, and applications
Aug. 7:	The Information Pathway for Earth Science Data: Moving Between Supplier and User
Sep. 4:	Measuring and assessing socioeconomic value
Oct. 2:	The Value of Earth Science data for Agriculture and Climate Change Planning
Nov. 15:	Managing disasters through improved data-driven decision-making
Dec. 4:	TBD

Series is recorded and available on the ESIP YouTube Channel

Ways to stay involved

Webinar series

- Add your email to the sign-in sheet (goo.gl/97f3dS)
- Follow the series on the ESIP YouTube channel

ESIP:

- Join the Monday Update
- Find active collaboration areas
- ESIP Winter Meeting in Bethesda, MD in January, 2019; See details at meetings.esipfed.org
- Check out one of our latest publications about the ESIP community:

  Virapongse, A., R.E. Duerr, E.C. Metcalf (2018). Knowledge Mobilization For Community Resilience: Perspectives From Data, Informatics, And Information Science. *Sustainability Science.*

Ways to stay involved

GeoValue:

- Join the GeoValue community! http://www.geovalue.org/
- Check out the GeoValue book:
  Kruse, J., J. Crompvoets, and F. Pearlman, editors (2017) GEOValue: The Socioeconomic Value of Geospatial Information. CRC Press/Taylor and Francis, Boca Raton, FL, USA.

Other literature resources:

- NASA (n.d). Measuring Socioeconomic Impacts of Earth Observations: A Primer. NASA, Washington D.C.

Around the community:

- The Value of Information in Decision-Making, IEEE SSIT, November 13-14 2018 in Washington DC

Thank you!

For more information about the webinar and series, contact:

Arika Virapongse: av@middlepatheco.com

Webinar series coordinator, ESIP