Annex D

Final Technical Report: LEQSF-EPS(2022)-RAP-40
Assessing NASA's Open Science Outlook for Environmental Justice and Resilience of the Louisiana Gulf Coast (OSO-LoGiC)

In this annex, you will find presentations give at **Papers: Responses to request for information and contribution to NASA working papers & draft manuscripts:**

1. Morrow, N. (2022). People-centered design in Open Sourced Science for enhanced use of Earth observation in equitable engagement, empowerment for collective action, and meaningful measurable impact. Open Sourced Science (OSS) for Earth System Observatory (ESO) Mission Science Data Processing Study. https://doi.org/10.5281/zenodo.5932699
2. Morrow, N. (2022). Open Sourced Science Geospatial Data Responsibility by Design. Open Sourced Science (OSS) for Earth System Observatory (ESO) Mission Science Data Processing Study. https://doi.org/10.5281/zenodo.5932699
3. Draft of literature review of EJ data in LA

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SCHOOL OF PUBLIC HEALTH AND TROPICAL MEDICINE

Department of International Health and Sustainable Development

January 31st, 2022

RE: Response to JPL Open Sourced Science (OSS) for NASA Earth System Observatory (ESO) Mission Science Data Processing Study Request for Information (RFI)

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Name and Description: Tulane University is one of the most highly regarded independent research universities (R-1) in the United States, with more than $100 million of research funded each year. Tulane's School of Public Health and Tropical Medicine brings expertise in evidence-based applied research, decision support, and long-standing relationships with public health and research institutions across the world. The role of information systems in sustainable human development, and the transfer of human capacity and technology are core research interests for faculty that helped found the original USAID FEWS NET (FEWS-net) project and remain engaged in a wide variety of multilateral and international organizational research and capacity building activities.

Dr. Nathan Morrow began mapping/remote sensing decision support as an intern for FEWS-net in Niamey Niger in 1995. Dr. Morrow has since led efforts for food security and disaster resilience decision support along the Gulf Coast and in more than 20-countries. He has designed, implemented and evaluated decision support systems for many organizations and reviewed SDG target indicator 2.1.2 for Zero Hunger. He has supported the Food and Agriculture Organization's global resilience capacity development efforts, personally led geospatial technology learning events including for the Government of Rwanda, and helped the World Food Program's Resilience Analysis and Mapping function to adopt mobile surveys, engage in big data/social media and blockchain-related innovations. In a joint initiative of the previous Office of Food for Peace, Office of Foreign Disaster Assistance and the Department of State East Africa mission, Tulane University was selected to lead each of three pilots for resilience measurement with international organizations in Somalia, where Dr. Morrow served as PI to CARE and co-PI to World Vision. Relevant peer-reviewed includes MODIS landuse product research, geospatial modeling of multitemporal remotely sensed agro-meteorology and longitudinal socio-economic-agricultural data, and food security decision support systems. He currently is a co-investigator Learning Partner for the Mercy Corps-led USAID-funded SCC project.

Included in this submission:

1. Response to Topic Area 4: People-centered design in Open Sourced Science for enhanced use of Earth observation in equitable engagement, empowerment for collective action, and meaningful measurable impact.
2. Response to Topic Area 5: Open Sourced Science Geospatial Data Responsibility by Design
3. Links to Publically Available Publications and Resources

Topic Area 4 Response: Downstream Interoperability

People-centered design in Open Sourced Science for enhanced use of Earth observation in equitable engagement, empowerment for collective action, and meaningful measurable impact.

By focusing on technology, design processes can produce systems for managing large amounts of high quality data. Significant challenges persist, regardless of quality or amount of data, to making better informed and more evidence-based decisions from Open Sourced Science. NASA satellite images inspire awe in everybody. Time-series visualizations such as the annual greening of the African Sahel can make complex climate phenomenon tractable to audiences across all demographics. Yet, major challenges remain to making measureable impact from collective action building on the power of observing our planet across spatial and temporal scales to reveal the extent of poor air and water quality or threats and damage to land and infrastructure. People-centred design begins instead by focusing on specific user needs and how they differ for the public sector, private industry, civil society and a diversity of communities that have a stake in the science, data analysis and recommendation outputs of the techno-political systems shaping decisions and trade-off choices. Enhanced use of Earth observation in equitable engagement, empowerment for collective action, and meaningful measurable impact begins with systematic inclusion of underserved alongside traditional stakeholders in a demand, rather than data, driven Earth System Observatory (ESO) design process.

Informed by decades of NASA data use to inform food security assessment and famine early warning, a shift towards demand- from data-driven decision support systems signalled both a reversal and complexification of the data value stream (Mock, Morrow and Papendiek, 2011). The focus on strengthening feedback loops of multi-user groups and multi-level engagement becomes the driver of value rather than observational infrastructure for data capture alone. Heavy lifting for analysis shifts to end-users as has been seen with the increasing effectiveness of citizen science initiatives. Integration via open standards and decentralized collaborative platforms overtake centralized databases. Rather than increased precision in data capture, design effort focuses on integration with social, big data and non-traditional data streams. Multimedia presentation, spatio-temporal change identification, and dynamic visualization allow users to integrate data for presentation customized to audience, policy forum or decision process. Technology is evolving to support the demands of unstructured data across streams and disciplines. Approaches such as Natural Language Processing allow integration and spatial integration that supports improved outcomes by understanding what evidence, decision, policy and implementation work well (Morrow et al., 2022).

Five system aspects should be investigated with a people-centred design approach for “Downstream Interoperability” NASA EOS Data Processing Study. 1) Relevant spatio-temporal structure of the data; social scientists often require point based data that can be matched to individual, household or structure record over time. Data must be disaggregated in meaningful ways to compare groups, *ad hoc* enumeration units, political units such as census tracts and their non-universal coordinate systems. 2) Systems informed design would include baseline information on diversity, spatial organization and observable hierarchies; change products for infrastructure, resource stocks, policy innovation, etc… 3) Art-based learning, art integration, visualization and storytelling to reach diverse audiences. 4) Policy aligned by design through policy and enabling environment informed products. 5) Fit for end-user mobilization in underserved and hard to reach communities by understanding communication channels and overcoming barriers to meaningful engagement.

Response to Topic Area 5: Open Sourced Science Geospatial Data Responsibility by Design

Mishandling location data threatens individual privacy in similar ways to ways to mismanagement a person's name in an information system. Geospatial and location tracking data can be recombined with other publically available, open source and big data to expose personal information just as sensitive, and including, health records or social security numbers. Irresponsible location data management can be more dangerous than name alone for vulnerable people. This is particularly serious for those living in areas threatened by conflict or high levels of insecurity.

Feedback from end users, sensors that collect location, participation of citizen scientists, and engagement of underserved and marginalized communities are system design parameters emerging from the first Earth System Observatory (ESO) design conference. Even as these innovations are essential for ESO to be fit for purpose, they may pose new data responsibility challenges for NASA and Open Sourced Science (OSS) researchers and professionals in disciplines that do not typically include research with human subjects or include active participation from people and a diversity of communities.

NASA applies better practice with data it collects in research involving space flight related human subjects, official communications with a variety of partners in private sector and academia, those requesting access to NASA resources and web site users (link to policy notice on next page). Privacy Impact Assessments (PIAs) are undertaken for a variety of new records systems. It is unclear if PIA and other standard good practice has been applied to the types of high frequency two-way interactions implied by engaging end-users, citizen scientists, and the tools like mobile Apps that are tracking locations.

Two areas of protection concern require dedicated investigation. 1) Increasing spatial and temporal resolution of data streams may enable tracking that reveals individual identities and privacy protected health or behavioral information. 2) Apps on mobile devices, wearable technology, and other potential two-way exchange channel technology raise additional privacy concerns again related to tracking and recombination of individuals' digital signatures.

Privacy protections in the United States are a patchwork that differ across States and the type of data collected. This poses a significant design problem for any EOS data system processes that collect, store, analyze or share personal, location and potential geospatial data that can be recombined by domestic partners. Internationally, stricter privacy regulations usually apply. General data Protection Regulations (GDPR) standards in the European Union enshrine two concepts that may be useful to consider for geospatial data responsibility. 'Data protection by default' means that any service needs the user permission to 'opt in' to data collection and that no more data than necessary is collected. Most important for the EOS design, 'Data protection by design' means that a foundational principle at every stage of information system design favors enabling technology and design choices in favor of privacy and security. UN data protection principles serve as another source of standards to enable engagement across international borders.

OSS Geospatial Data Responsibility by Design, if adopted by ESO, would identify better practice and establish a protocol to ensure all data and derivative products from Open Science partners take a minimum set of precautions with location and geospatial data.

Links to Publically Available Publications and Resources

Links for Topic Area 4 Response: People-centered design in Open Sourced Science for enhanced use of Earth observation in equitable engagement, empowerment for collective action, and meaningful measurable impact.

Mock, N., **Morrow, N.**, & Papendieck, A. (2012). From complexity to food security decision-support: Novel methods of assessment and their role in enhancing the timeliness and relevance of food and nutrition security information. *Global Food Security*, *2*(1), 41–49. https://doi.org/10.1016/j.gfs.2012.11.007
Link: https://tinyurl.com/f5ynzesk

Morrow, N., Mock, N. B., Gatto, A., LeMense, J., & Hudson, M. (2022). Protective Pathways: Connecting Environmental and Human Security at Local and Landscape Level with NLP and Geospatial Analysis of a Novel Database of 1500 Project Evaluations. *Land*, *11*(1), 123.
Link: https://doi.org/10.3390/land11010123

Morrow, N., Mock, N., Bauer, J.-M., & Browning, J. (2016). Knowing just in time: Use cases for mobile surveys in the humanitarian world. *Procedia Engineering*, *159*, 210–216.
Link: https://doi.org/10.1016/j.proeng.2016.08.163

Morrow, N., Mock, N., Papendieck, A., & Kocmich, N. (2011). *Independent evaluation of the Ushahidi Haiti Project.* Development Information Systems International.
Link: https://www.alnap.org/help-library/independent-evaluation-of-the-ushahidi-haiti-project

Links for Response to Topic Area 5: Open Sourced Science Geospatial Data Responsibility by Design

Privacy Notice from Nasa:
Link: https://www.nasa.gov/about/highlights/HP_Privacy.html#pasor

Privacy Impact assessment at NASA:
Link: https://www.nasa.gov/content/privacy-impact-assessment-pia-summaries

General data Protection Regulations (GDPR)
Link: https://gdpr.eu/what-is-gdpr/

United Nations Principles on Personal Data Protection and Privacy
Link: https://unsceb.org/principles-personal-data-protection-and-privacy-listing

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