Analysis of Locally Flooded Areas with Environmental Justice Communities (ALFA-EJC)

Gulf Coast Climate Justice (CJ) and Environmental Justice (EJ) communities engage in Open Science analysis and mapping that leverages high resolution remote sensing assets to better measure and monitor localized flooding

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2.1 Relevance to A.44 Program Element and Proposed New Capabilities Building on Equity & Environmental Justice (EEJ) Program's "Assessment of the Gulf Coast Environmental Justice Landscape for Equity"

Analysis of Locally Flooded Areas with Environmental Justice Communities (ALFA-EJC) is a standalone project to leverage high resolution remote sensing assets of CSDA that will immediately build upon the currently funded A.49 project, Assessment of the Gulf Coast Environmental Justice Landscape for Equity(AGEJL-4-Equity). AGEJL-4-Equity is led by Tulane University International Health and Sustainable Development faculty and the Deep South Center for Environmental Justice. Localized flooding in underserved communities is the EJ & CJ community priority identified in AGEJL-4-Equity's engagement with four EEJ networks that convened to map Southern Gulf Coast, primarily African American, underserved EJ communities and their priorities: the National Black Environmental Justice Network, the Historically Black College and University-Community Based Organization Gulf Coast Equity Consortium, the Deep South Center for Environmental Justice (DSCEJ) Community Advisory Board, and the Environmental Justice Forum. Although an on-going threat to vulnerable households and underserved communities, localized flooding is too often unacknowledged, poorly documented, and not analyzed with scientifically valid evidence. ALFA-EJC will multiply the impact of research objectives through further engagement and communications with a growing network of Open Science for Environmental Justice researchers, data scientists, and frontline communities that came together during a Louisiana Board of Regents and NASA supported EPSCoR project: Assessing NASA's Open Science Outlook for Environmental Justice and Resilience of the Louisiana Gulf Coast. Tulane University continues to invest in research and special capabilities to advance equitable environmental health outcomes and resilience under climate change, engaged capacity development for Open Source Science, and necessary data education infrastructure to ensure maximum impact from learning about application of CSDA data to pressing Environmental Justice priorities.

The ESD Applied Science Program promotes measurable social benefit from NASA research and information products with the aim to improve decision making and related policy solution implementation. Akin to the A.49 Earth Science Applications: Equity and Environmental Justice program element, ALFA-EJC seeks to align with recent executive orders that advance equity by focusing programmatically on underserved communities in White House Executive Orders 13985, 14035, and 14008. Accordingly, ALFA-GC will not only produce top quality research products as an evidence base for decision making but will have user-friendly capacity development, technical assistance and consultation that fully engages and possibly is co-led by underserved and EJ communities (WHEJAC, 2021). The proposed work will have contributed to NASA applied science program focuses including effects of extreme weather, inequality in access to water security and protection from water-related hazards.

2.2 ALFA-EJC Research for Advancement Objectives

CSDA assets present an unprecedented opportunity for scientifically valid analysis at a scale -- local community and neighborhood -- that matters most to creating credible evidence about issues faced by CJ & EJ communities. Environmental damage and climate change related hazards are unequally distributed in communities on Earth in patterns that are often observable from space. Inequity and environmental injustice occurs when the uneven distribution of any of the broad range of environmental ills is coincident or collocated with marginalization of groups of people and increased vulnerability of underserved communities. Unfair exposure to hazards, harm to health and wellbeing, and systemic barriers to participation in life and livelihood-affecting decisions may be mitigated, remedied, or avoided -- at least in part -- through improved capabilities and recognition of affected people to use Earth science, including NASA open science, as an evidence base to frame EEJ decision making and solutions in an inclusive and scientifically valid way.

The overall goal of the ALFA-EJC project is to leverage CSDA data assets to advance EEJ and those that work to advance EEJ on the Gulf Coast by engaging underserved community networks in geospatial technology-assisted participatory mapping and analysis of localized flooding. We will employ the tried and true “Communiversity” model that safeguards against a potentially extractive or exploitative process by ensuring EJ communities are equal active participants in research (Bullard & Wright, 1993). This autochthonous equity-focused participatory process, that interconnects with NASA Open Source Science through the previous AGEJL-4-Equity NASA EEJ project, makes community voices heard through engagement, capacity development, and recognizing diverse knowledge contributions with the support of university-based experts to present environmental justice problems and policy solutions in a scientifically valid way. ALFA-EJC has identified three Research for Advancement Objectives (RAOs).

RAO1: **Advance actionable information on localized flooding in EJ communities** – In the first year, engage and capacitate EEJ community members in four study sites to map and analyze localized flooding. In the second year, analysis and mapping will focus on extreme and other events to better measure near real-time approach to community engaged monitoring of localized flooding.

RAO2: **Advance capacity for Open Source Science for EJ organizations to leverage CSDA data for analysis and mapping**—Convene EJ/CJ community members, through existing EJ networks, in a minimum of four open science mapping and analysis of localized flooding events that explore and document opportunities to increase community resilience. Multiply opportunities to present policy-relevant community-led analysis in a scientifically valid way with at least four novel community-led investigations using CSDA data.

RAO3: Advance integration of research and learning through Open Source Science – Creatively advance the use of CSDA derived products with at least two engaged open science events at community level each program year. Synthesize

learning on analysis and mapping of flooding hazards at fine scale and next steps to advance EJ organizations in an open science format useful for EEJ network communications each program year and in one open access peer-reviewed publication.

2.3 Technical Approach to Community-engaged Mapping of Localized Flooding

2.3.1 Geographic focus of ALFA-EJC & the Open Source Science CEJST

Southern institutions and organizations were underrepresented in the first NASA Equity & Environmental Justice Listening Workshop (NASA ESD, 2021). As Catherine Coleman Flowers, member of WHEJAC, noted:

> "There is a need for additional discussion about how to work together and collaborate more broadly around a movement toward climate and environmental equity and justice in the South. The South offers lessons about some of the worst environmental challenges and most severe disasters in the nation." (NAS, 2021).

ALFA-EJC's study site includes the lowland Gulf Coast communities and rural areas of Louisiana, Alabama, Mississippi, Florida, and Texas. The unit of analysis will be the sub- census tract as relevant socio-economic and health data are collected at local level for both local decision making and federal government climate fund resourcing decisions using the CEJST. The CEJST using the agreed thresholds "… identifies communities that are marginalized, underserved, and overburdened by pollution" (WHCEQ & UDS, 2022). Figure 2 displays locations of disadvantaged communities in gray.

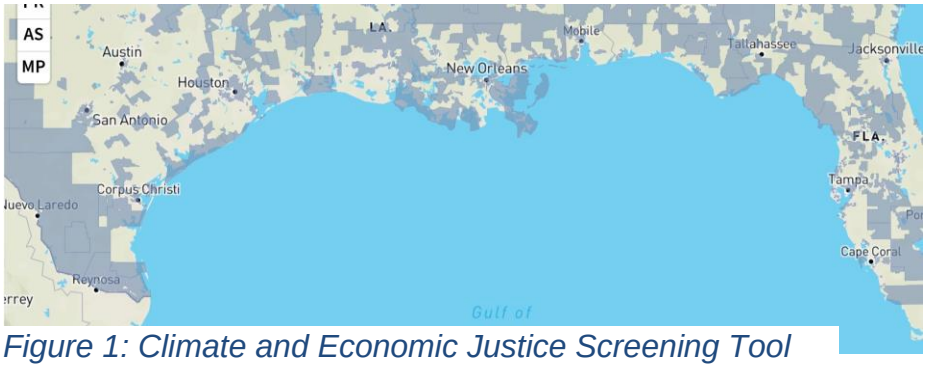

Figure 1: Climate and Economic Justice Screening Tool

Gulf Coast adjacent lowlands are identified using Environmental Protection Agency's bioregions designated "coastal" or "river plains" (Omernik & Griffith, 2014). All Gulf Coast lowlands census tract will be included in ALFA-EJC mapping and results. This will provide an opportunity for policy-relevant comparative analysis of the impacts on community health for populations both inside and outside of CEJST identified 'disadvantaged' census tracks.

Final selection of the four primary study sites will be undertaken in consultation with the EJ networks. Likely sites where community engagement and local hazard mapping have taken place include EJ communities near Pensacola Florida, Houston Texas, Saint James or Lower 9th Ward Louisiana and Africatown outside Mobile Alabama.

2.3.2 Communiversity – Ground truthing with EJ community science partners

CJ networks and their underserved EJ community representatives will fully participate as community science partners in an approach adapted from the tried and true DSCEJ Communiversity model. While flexible enough to reflect on the potential of NASA Open-source Science and data products, the "Communiversity" model safeguards against a potentially extractive or exploitative process by ensuring EJ communities are equal active participants in research (Bullard & Wright, 1993). CJ community partner scientists will contribute beginning with the earliest project tasks of ground truthing of methodological assumptions and key indicator selection. Causal pathways of of occurrence and changes in localized flooding will be the subject of a process of community-led ground truthing. Frontline communities' lived experiences will have the team's full appreciation in discussions and analysis as congruent sources of knowledge.

Beginning in the 1990's, DSCEJ pioneered the Communiversity model for participatory data collection and assessment processes that focuses on capacity development and empowering context specific community advancement of CJ&EJ (DSCEJ, 2022). The model has five action research activities to co-create or investigate:
1) Environmental hazards proximity analysis and/or community-based mapping;
2) Risk and harm assessment of toxic exposures, place and group based vulnerability, and disaster resilience;
3) Inventory of existing environmental knowledge and identify gaps to be addressed;
4) Rights and duties of communities and governmental agencies; and
5) Capacity requirements to advance evidence-based strategic advocacy.

Formal qualitative tools will be used alongside participatory techniques such as resilience storytelling to develop localized flooding timelines that match the historical flooding assessment period of 2017-2022. As flooded areas are identified in the, CJ community partner scientists will follow a ground truth protocol to validate, refine or reject potential causal explanations. The Communiversity model will then inform the activities and potential use of results by CJ networks and EJ communities to be used in capacity development and advocacy activities.

2.3.3 CSDA Earth observations for analysis and mapping

ALFA-EJC's technical approach will leverage **CSDA Earth observations** to analyze and map localized flooding events at decision-relevant local scales. Furthermore, high-resolution measurement of flooding extent and duration will reveal highly localized patterns that may be lost in data interpolated from existing flood maps that may or may not take into account infrastructure and maintenance in underserved communities. EJ community members during AGEJL-4-Equity discussions pointed out that flood maps do not take into account the flooding effects of on-going and extensive grey infrastructure improvements. Also, it was noted that cumulative effect of increasing impervious surfaces contributes to more frequent and deeper flooding. Previously approaches, that had lower spatial and temporal resolution or had been interpolated to try to improve coverage do not necessarily capture this local context. CSDA data at applicable scales

to be integrated with local knowledge to deepen understanding of EJ/CJ community flooding, but have not previously been reprocessed and made available to community engaged scientists from the Gulf Coast in a format that facilitates open science for EJ.

Passive multispectral remote sensing for extent and duration of flooding is well established and has the additional advantage of visual inspection of results to engage a wide audience. Particularly for monitoring, we will seek index related approaches that give best results beginning with the Normalized Water Index (NDWI) (Gao, 1996) and then compare to the various subsequent modified indexes. Classification methods that in iteration can include additional community sourced information will be pursued following Sadiq et al.(2022). Using requested NASA High End Computing (HEC) resources, university based researchers will lead acquisition and processing of the datasets into formats that can be used in participatory analysis and mapping. Table 1 lists CSDA remote sensing data inputs to be used. A time series of at least 5-years will be used to identify patterns of flooding and then to relate them to extreme or other events and clear sky flooding.

Using requested NASA High End Computing (HEC) resources, University of Maryland (UMD) based researchers will lead acquisition and processing of the datasets into formats that can be used with high resolution field measurements. Table 1 lists CSDA remote sensing data inputs to be used. A time series of at least 5-years of cloud free images at community identified and informed moments of localized flooding will be used to identify temporal and spatial flooding patterns.

Table 1: Satellite data products employed in support of back-casting activities.

Source	Relevant spectral bands	Expected Distribution	Spatial	Temporal
Planet -- PlanetScope	**Primary for water detection:** Near infrared, red, far red, coastal blue **Secondary depending on CJ/EJ community requirement:** panchromatic, green	16-bit Geo Tiff	3 meter	1-day
Maxar – Worldview (1-4)	**Primary for water detection:** Near infrared1, Near infrared2, red, red edge, coastal blue **Secondary depending on CJ/EJ community**	11-bit	0.31m panchromatic 1.24m spectral	varies

Flood monitoring is more than creating a simple mask for standing water commonly used in landcover mapping. Researchers found that most indexes such as the Water Index (WI), Normalized Difference Water Index (NDWI), Red and Short Wave Infra-Red (RSWIR), and Green and Short Wave Infra-Red (GSWIR) over or underestimated flooded area (Memon et al., 2015). Turbulence and sediment in the water can lead to underestimation as can flooding in high vegetation or treed areas. Reflective surfaces may be misclassified as flooded areas leading to over estimation.

Mateo-Garcia et al. (2021) have successfully mapped flooding using a machine learning classifier with small sat data to overcome index based approaches. They used a large data set of over 100 human identified ground truth flood observations to train the flood segmentation algorithm. Thresholds are set on water indexes based on the machine learning (neural network) classifier.

ALFA-EJC proposes to follow on the work of these and other researchers in a two-step approach to **Supervised classification** of CSDA images. This approach to image processing is possible due to the in-depth engagement of EJ communities to create local flooding timelines and maps. This is a unique opportunity to train a classifier on such site specific first hand knowledge of small scale and localized flooding. ***Our methodology makes highly efficient use of resources by leveraging the engagement of EJ communities through the Communiversity model to carry out field work for collecting ground truth data for training and validation.***

Analysis Step 1: create a training data set developed with the EJ community members in the four study sites. This will require:

1. Identification of cloud free Maxar Worldview at times when flooding has occurred in the past. A major question remains: will be four sites will have a sufficient number of cloud free views. This may lead to reselection of study sites that have more clear views when flooding has occurred.
2. In study sites, EJ communities will delineate the boundaries of their community and this may be divided based on overlay of the census track boundaries
3. Flooded area detection segmentation for EJ communities with Worldview cloud free views will proceed with automated detection via index and followed by on screen digitization of plots as necessary
4. Beginning with a set of cloud free PlanetScope views, we will compare the different water indexes to see what works best in each site and across study sites
5. We will then calculate changes in PlanetScope NDWI (or alternative water index that performs better) for each identified localized flood hazard area. This will serve as training data.
6. This training data will be cross-validated between study sites
7. Assessment of training set type 1 and type 2 errors will inform next steps for improving training data precision and accuracy

Analysis Step 2: supervised classification of entire scenes covering surrounding CEJST census tracks will proceed based on the training data set**.** We propose to use supervised classification packages available in the open source software R. Our research team also has experience in custom coding in C and Python to handle any data management, data preparation or adjustments to classifier algorithms. We begin with tried and true Decision Tree classifiers following Friedl and Brodley (1997). PI Morrow co-authored a paper with Friedl in 1998 using a different modeling approach (see biosketches in section 4). Steps for supervised classification include:

- Select a set of training sites representative across image to be classified

- Extract pixels representing desired classes of flooding (eg recurrent flooding, clear sky flooding, standing water, …)
- Train classifier based on samples
- Classify the image
- Evaluate the classification. Possible sources of error may be introduced from numerous sources but special attention will be given to discrepancy between training and classified images due to angle viewing effects in PlanetScope data

This expanded classification will allow the research team to measure differences in frequency and area of localized flooding between EJ communities as well as between better severed and underserved census tracts identified by the CEJST tool. Measurement of these differences may inform assessment of distributional justice of localized flooding as well as some relationships to other indicators of root causes of potentially observed inequality.

Flood monitoring in project year 2 will be undertaken with community members based on the Communiversity model. It is likely that this will include flood journals, but the community will lead the discussion on how best to record flood events through at least 6-months of PY2 to test the ability to of the trained classifier to identify flooding that is most important from a community point of view.

2.4 Expected contributions to EJ Community localized flood knowledge from synoptic analysis of integrated ground truth and high resolution remotely sensed observations

Very localized flooding effecting parts of a community, a single street or a few homes has received little research attention. There are practical limitations such as difficulty in observing smaller areas with aerial imagery for recurrent or clear sky flooding. Flood maps based on digital elevation models may not capture recent changes in topography from local earth work or new grey infrastructure. Cumulative impacts of impervoious surfaces are complicated to estimate by simple models and may be underreported. Therefore, estimation of recurrent small scale flooding or increasingly reported clear sky flood of underserved communities requires alternative observational approaches such as those offered by CSDA assets..

The contributions of this research may progress basic questions about localized flooding. ALFA-EJC will:

- As a first contribution, have produced observation based estimates of the extent of recurrent, periodic and clear sky localized flooding.

- As a second contribution, have improved understanding of the prevalence of different types of flooding in EJ communities.

- As a third contribution, have explored the capability of different water indexes to identify different types of localized flooding.

- As a fourth contribution, have improved understanding of localized flooding in increasing or undergoing other types of change.

- As a fifth contribution, have assessed the ability to detect localized flooding in areas and times of the year that have high levels of cloud cover.

Although these contributions will be initially limited to the four study sites and the surrounding census tracks, there is potential for expansion into more regular localized flood monitoring of the most at risk CJ and EJ communities.

2.5 Open Source Software and Hardware

ALFA-EJC is committed to every aspect of Open Source Science and will only use open source software. The open source code/data for water indexes/flooding threshold tools will be available from our GitHub site. ALFA-EJC will also have dedicated repositories for all project outputs on a GitHub site and use the Zenodo folder 'Environmental Justice' for archiving and sharing research outputs. Modeling will primarily be conducted in R, Python and other open source languages will be used as necessary to manipulate data. All scripts will be posted. Jupyter notebooks will be piloted for CJ&EJ community engagement. Computing hardware requirements are minimized as most data processing will be conducted through requested NASA HEC resources. University Data Hub and available departmental IT support and equipment are sufficient for other modeling, scenario development and broadcast communication tasks. The DSCEJ's Bezos Earth Fund Data Center has sufficient resources to sustainably host research outputs and open source materials for the foreseeable future.

2.6 Resilience and robustness of ALFA-EJC in the face of uncertainty

Potential pitfalls for ALFA-EJC related to uncertainty and error are largely counterbalanced by a very experienced team of researchers. Furthermore, special capabilities related to long-term relationships with CJ&EJ networks and complementary on-going CJ&EJ evidence base data initiatives ensure project resilience. For example, if if one study site has too much cloud cover during flood events, the EJ networks will likely be able to find several alternative study sites along the Gulf Coast. The team has >100-years of combined data analysis and participatory experience with a diverse set of analytical tools to handle most challenges. Methods illustrate procedural expertise with tests to identify Type-1 and Type-2 errors in classification, deal with view angle issues, and ensure validity and accuracy of research products. Dr. Borak did his PhD on dealing with view angle issues and regularly works in areas that have cloud cover challenges.

Covid and potentially other health-related restrictions to engage face-to-face with community may limit some ground truth activities. The PI has recently led a major international organization to pivot a global capacity development program to online. Lessons from this experience include leveraging collaborative online tools for better

engagement, fully facilitating virtual sessions with dedicated technological backstopping, and adjusting the length/frequency/tempo of sessions to promote active interaction. Engaging coastal communities may require health safeguards and adjustment to virtual or 1-to-1 meetings rather than in-person group interviews.

Special capabilities DSCEJ and Tulane University are currently leading an adapted-for-NASA Communiversity activity with four EJ networks: the National Black Environmental Justice Network, the Historically Black College and University-Community Based Organization Gulf Coast Equity Consortium, the Deep South Center for Environmental Justice (DSCEJ) Community Advisory Board, and the Environmental Justice Forum. Their work mapping Southern Gulf Coast, primarily African American, underserved EJ communities and their priorities will facilitate mobilization of CJ&EJ community partner scientists for this project. The LA Board of Regents and NASA EPS-CoR have supported Tulane University to conduct convene Open Source Science and Environmental/Climate Justice networks, organizations, change makers, and CJ&EJ communities along the Gulf Coast for greater collaboration. The University has made generous availably of facilities and funds to support data driven initiatives including work on CJ&EJ including use of the excellent facilities and outstanding conference support of our Tulane Bywater Institute Coastal and River Center. Tulane University Presidential Initiatives on data literary and equity, inclusion and diversity have come together in a new Data Hub that will connect not only students but diverse stakeholders to open science approaches. DSCEJ will provide a sustainable home for building upon ALFA-EJC's results with its well-funded Besos Earth Fund Data Center initiative that will be the premiere CJ&EJ knowledge hub in the South if not the entire United States.

ALFA-EJC's robustness will be derived from investing the lion's share of the budget in creating an inclusive and diverse interdisciplinary team. Dedicated team members are budgeted to work in an essential roles 1)remote sensing/modeling data & 2)external facing CJ&EJ Communiveristy lead. Essential high level/higher cost interdisciplinary expertise is more modestly budgeted and focused on periods of greatest need to maintain a flexible, diverse, and robust technical backbone. Three SOs build upon one another with major outcome level deliverables completed each project year (PY). PY1/IDSO1 retrospective modeling informs the development of PY2/IDSO2 nowcast models and scenarios. Engagement with CJ&EJ community scientists with ground truth from the start of the project ensures a coherent logic to causal description of model of both retrospective and near real time flood mapping results. ALFA-EJC is built around an open science platform with open science output milestones to ensure alignment and coherence across project activities.

2.7 Management structure

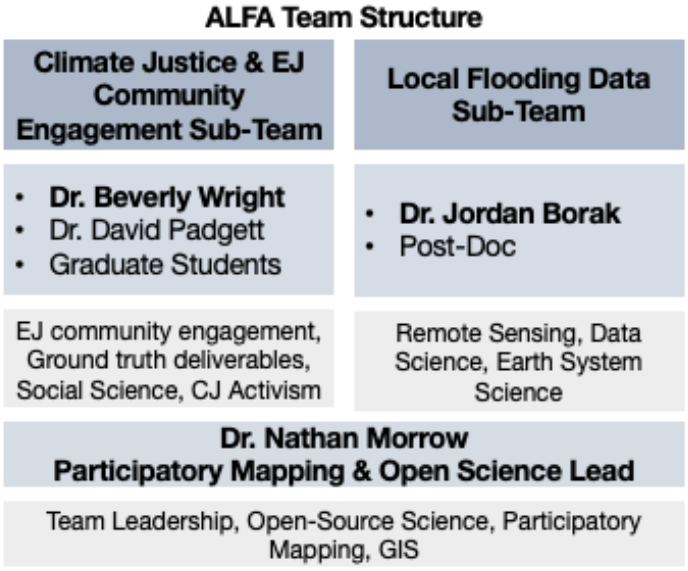

Figure 1: Sub-team Management Structure

The ALFA-EJC management structure aims to encourage collaboration enabled by technology (Ramachandran, Bugbee & Murphy, 2021) with clear shared objectives, empowered leadership of sub-teams, and easy exchange through advanced digital tools for inclusive communication. Implementing an interdisciplinary project requires active and engaged project leadership with regular team communication and directed reflection. ALFA-EJC brings together investigators that work at different time and spatial scales as well as with different disciplinary tools and methods. To balance interdisciplinary interaction with research efficiency, tasks and sub-tasks will be assigned to sub-teams led by a Co-Investigator with the PI participating in all of the teams' work planning and task result monitoring. Furthermore, the PI is responsible for promoting necessary cross-team interaction, monitoring dependencies, open science, and further interdisciplinary co-creation tasks and results. Quarterly virtual all team meetings, annual workplanning, and PI/Co-I business meeting focused on reporting project progress during the AGU meeting provide necessary collaborative discourse. Dependencies, emerging challenges, co-created cross-learning and solutions from virtual/face-2-face team interaction will be used to monitor workplan and share with NASA.

2.8 Outcomes and primary tasks of task identified personnel

ALFA-EJC outcomes will produce Open Science deliverables (see Tentative Schedule 2.4.1 below). These will include a more technical publication based on findings related to localized flooding in the study sites and another on the use of CSDA for engaged Open EJ research to be presented to scientific and applied audience at the AGU. Open science plan, assessment and mapping training materials, community research presentations, will be posted on a GitHub and other sites.

Dr. Nathan Morrow as PI is accountable for grant implementation, compliance, risk management and reporting, quality and timeliness of all deliverables, implementation of the DMP, responsive communication, and reporting to NASA and all stakeholders. Dr. Morrow will manage collaboration, GitHub sites. Dr. Morrow will take the technical lead on all spatial analysis and mapping sub-tasks. Accountable for all milestones, he ensures inclusive and equitable contributions to collaborative deliverables including publications, open science and reports in following Milestone Schedule.

Dr. Beverly Wright as Co-Investigator supported by a DSCEJ associate is accountable for the fidelity of the proposed activities and deliverables to the principles of Communiversity for engagement with CJ&EJ communities. As Director of DSCEJ, 'end-user', she will advise on planning and tasking with the goal of applying all ALFA-EJC deliverables to advance wellbeing outcomes for CJ&EJ communities. Dr. Wright/DSCEJ staff associate will lead sub-team tasks directly related to CJ&EJ community engagement. SO/PY-1, mobilizes community science partners in the Communiverity model, any necessary training, and grountruthing of classifier. SO/PY-2 co-creation and improvement of ALFA products through CJ&EJ community input and interactive validation of causal dynamics and interim results. DSCEJ will promote the utilization of results and deliverables for advancing justice outcomes, influencing decisions, developing capacity and ultimately advancing CJ&EJ in the 4 primary communities and wider Gulf Coast region. Finally, standing-up an open source science ALFA-EJC site hosted on the DSCEJ data center.

Dr. Jordan Borak's research responsibilities will focus on acquiring data and generating satellite-based (i.e., localized) maps and flood measurements. In addition to detailed documentation of all procedures and codes used and all datasets generated, overall summary of satellite data characteristics over the study area and a set of specific lessons learned will be posted following the DMP. Dr. Borak will also visit the study sites with the Senior Consultant who leads community engagement with in the Communiversity model. They will work together on integration of participatory approaches to mapping and analysis with the image processing approach.

Consultants: Dr. David Padgett is Senior Consultant to DSCEJ for 'ground truth' activity community engagement with in the Communiversity model. He will advise on participatory approaches to mapping CJ&EJ community/network causal pathways/priorities, co-lead up to 8 CJ&EJ community/network engagements/workshops, and advise on transfer of all materials that could be used as STEM related outputs to the Data Hub and the Data Center.

2.9 Tentative Schedule of Research and Deliverables

Project Year 1: Establish patterns of clear sky and precipitation event flooding at EJ study sites			
Q	**Milestone deliverable**	**Open science output**	**Reporting**
Q1	• Review of NASA and EJ community timeseries data sets on localized flooding • Literature review focus on measuring, modeling & forecasting localized flooding in EJ communities	• Open Access Annotated Bibliography for Localized Flooding and EJ Open Science • GitHub site	• Submit Work and Costing plan • Submit PY1 Q1 report
Q2	• CJ&EJ Community initial engagement • Selection and retrieval of flood area parameters from CSDA and *in situ* sources • Team meeting with Dr. Borak for joint work at field sites	• Register open science plan for reproducibility	• PY1 Q2 report with some discussion of data quality
Q3	• Run classification model for clear sky and precipitation localized flooding in study sites • CJ&EJ partner review of causal links for flooding	• Open science badges PI/CO-I	• PY1 Q3 Report w/initial classification overview
Q4	• First ground truth CJ&EJ engagement	• GitHub updated • Annual inclusion/DMP tasks	• Draft peer review manuscript • PY1 Annual Report
Project Year 2: Near real time analysis of flooding with CJ & EJ communities			
Q	**Milestone deliverable**	**Open science output**	**Reporting**
Q1	• Annual planning meeting with Dr. Borak for joint work at study sites • CJ/EJ community meeting on flooding monitoring	• CJ & EJ community Open Science badge contest	• Share PY2 workplan • Submit PY2 Q1 report
Q2	• Train cohort of CJ community scientists on Localized Flooding Analysis	• Community GitHub event • Posting of CJ/EJ • Engagement materials	• PY2 Q2 report w/ monitoring overview
Q3	• Produce Localized Flooding Analysis in each study site • CJ network causal elements of CJ scenarios	• Open Science for localized flooding presentation at AGU • GitHub update • All documents to Zenodo	• PY2 Q3 Report w/ discussion of open science engagement
Q4	• Finalize & broadcast general guide to Analysis of Localized Flooding	• GitHub updated • Annual inclusion/DMP tasks • Closing and reporting on all Inclusion and DMP Plan activities	• Final Tech/Financial Report • Draft peer review manuscript

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4.0 Data management plan

Accountability for full implementation of the Data Management Plan (DMP) and ensuring full compliance to NASA DMP requirements lies with the Dr. Nathan Morrow as PI. He has extensive experience managing geographic and remotely sensed data for research and decision making. He has published peer reviewed articles on data for decision making (Mock, Morrow & Papendeick, 2012) has written and taught about data responsibility (Morrow, 2022), and recently was awarded a grant for increasing the use of Open Source Science for Environmental Justice.

End User License Agreements for PlanetScope and Maxar Worldview describe how commercial data can be used by NASA researchers for Scientific Use research purposes as outlined in the research award agreement. Public Release or Commercial Use of the CSDA data is prohibited. Any raw imagery must be securely handled. Only derivative products with clearly defined research purposes are to be shared with the general public, used in publications or shared with our community based stakeholders.

Every effort will be made to limit the access to original or raw PlanetScope and Maxar Worldview data. Dr. Borak works in a secure NASA affiliated research center with a nasa.gov email. The raw data will almost exclusively be processed in the HEC computing environment by Dr. Borak following the strict security protocols of his center. On occasions when Dr. Morrow is required to use imagery, it will be processed in HEC environment or on a secured workstation. No raw data will be present on laptops during travel. Tulane's Export Control officer also will advise on our compliance with EULAs for commercial data when working with the public, stakeholders, and EJ communities.

ALFA-EJC is committed to Open Source Science and identified personnel will complete NASA TOPS core curriculum to earn a minimum of 5 open science badges.

The ALFA-EJC's team will pursue the development plan along the lines of the "Geosciences Paper of the Future" with the intention move towards improving the DMP "to make data, software, and methods openly accessible, citable, and well documented" (Gil et al., 2016) and the FAIR principles: Findable, Accessible, Interoperable, & Reusable (Wilkinson et al., 2016). As part of the advancement of CJ&EJ data for decision making methods and with the specific expertise in the ALFA-EJC science leadership in this research area, the team will leverage the DSCEJ Data Center and Tulane University's Data Hub along side GitHub, data.nasa.gov, and Zenodo to ensure data and information are shared in ways that maximize access, reuse and application to new problems, contexts, and research questions. Data will be made publically available with enough detail to allow for validation and metadata standards will conform to open science standards of the repository such as coding in XML.

All spatial derived and map products will have ISO 19115 compliant meta data.

The ALFA-EJC data management plan ensures public access to publications and digital datasets arising from NASA research. All ALFA-EJC data posting and archiving tasks will be **confirmed quarterly**. Open Science milestones are identified on the schedule and assigned responsibility to the postdoc and accountability to the PI. The preprints will be posted on Earth and Space Science Open Archive, associated with the American Geophysical Union, pre-print server https://www.essoar.org/. Open access articles will be available as soon at final revisions are accepted, but expected to be within one year from project closure.

Data sets, meta data and other materials developed to support the proposed research will be archived at data.nasa.gov, as appropriate, and Zenodo (https://zenodo.org/) site associated with European Organization for Nuclear Research (CERN) and expected to maintain the open archive as long as CERN exists. ALFA-EJC has created an Environmental Justice 'community' on Zenodo to encourage findability of the research and exchange with other EJ/CJ researchers.

All derived products and documents produced by ALFA-EJC encourage redistribution, reproduction and creation of derivatives with a Creative Commons Attribution 4.0 International license, and uploaded to Zenodo/DSCEJ Data Hub/Github including:

- 4 or more localized flooding maps made available in geotiff and pdf formats
- Scripts and source code for training classifier and classifying flooded areas from imagery including source code, guidance notes and results/validation
- Manuscripts and documentation of change and stress detection. These will be given a unique doi when uploaded and include source code, guidance notes and results/validation on GitHub site

Development of the project in year one will take place primarily on a dedicated GitHub site. During initial extraction of remote sensing measurements as discreet data sets will temporarily be stored in the NASA HEC environment. As derived products are finalized and model source code documented in a distributable version, these information assets will be open source licensed and uploaded to data.nasa.gov and Zenodo. Full documentation will be completed by project close out and will be transferred to the Tulane Data hub with links to the permanent archives.

The PI will maintain communication as necessary with the data repository and the NASA program manager to ensure that: DMP is updated as needed at time of award; appropriate attribution is included; data meet minimum quality standards; and data are appropriately evaluated for and secured to prevent disclosure of personally identifiable information and to protect proprietary interests, confidentiality, and intellectual property rights.

Section 5.0 Biographical Sketches

PI: Nathan Morrow

1. Professional Preparation

Boston University, Geography, Bachelor of Arts with Honors 1997
Boston University, Geography, Master of Arts 1998
University of Maryland, Geography, Doctor of Philosophy (M. Hansen advisor) 2021

2. Professional Experience and Positions

Current Sponsored Research:

- PI, Assessment of the Gulf Coast Environmental Justice Landscape for Equity (AGEJL-4-Equity), NASA-funded, 10/22-4/23
- PI, Open Science Outlook for Environmental Justice and Resilience of the Louisiana Gulf Coast (OSO-LoGiC), NASA-EPSCoR-funded, 5/22-4/23
- Co-PI, Sahel Collaboration & Communication, USAID-funded, 10/20-9/25

Appointments:

- Associate Research Professor, Tulane Public Health & Tropical Medicine, 2022-.
- Associate Research Professor, Tulane Law, 2014-2018, Adjunct 2007-2012
- Associate Clinical Professor, Tulane School of Social Work, 2012-2014
- Associate Clinical Professor, Tulane Public Health & Tropical Medicine, 2011-2014, Adjunct 2007-2022

3. Selected Bibliography

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. https://doi.org/10.3390/land11010123

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**

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

Muchoney, D., Borak, J., Chi, H., Friedl, M., Gopal, S., Hodges, J., **Morrow, N.**, & Strahler, A. (2000). Application of the MODIS global supervised classification model to vegetation and land cover mapping of Central America. *International Journal of Remote Sensing*, *21*(6–7), 1115–1138. https://doi.org/10.1080/014311600210100

Morrow, N., & Prince, S. (1999). Use of potential and actual primary production models to map drought and degradation in semi-arid Southern Africa. *EOS Transactions, 80*(46), F403.

Morrow, N., & Friedl, M. (1998). Modeling biophysical controls on land surface temperature and reflectance in grasslands. *Agricultural and Forest Meteorology*, *92*(3), 147–161. https://doi.org/10.1016/S0168-1923(98)00098-7

4. Research Experience: Scientific, Technical, Management

Dr. Morrow has acquired a wide range of skills and expertise with 25 years of experience not only as a professor but also leading implementation, developing capacity and ensuring research-based evidence for interdisciplinary/multi-sectoral food security, humanitarian response, and child wellbeing policy implementation projects. He has served as Chief of Party for a multi-organizational consortium for multi-country developmental relief and humanitarian aid response valued at over 400 million USD responding to an El Niño drought food security crisis in southern Africa -- a precursor to now ubiquitous resilience policy-focused programming. As co-chair of the Emergency and Disaster Evaluation thematic group at the American Evaluation Association, Dr. Morrow has promoted inclusive engagement and more rigorous measurement models in resilience research and intervention planning. The Global Environment Facility (GEF-7) replenishment strategy was informed, in part, by a geospatial analysis of environmental security led by Dr. Morrow.

Dr. Morrow is PI for two projects that intend to strengthen capacity for open source science to address challenges in CJ & EJ research in collaboration with Gulf Coast EJ community networks and organizations. Strategic assessment and strategy processes to strengthen evidence-based decision support have been a feature of Dr. Morrow's research and consulting with a variety of organizations including work on USAID's resilience measurement operational research in the Horn of Africa, needs assessment capacity for the United Nation's World Food Programme, and the global redesign of World Vision International's system for reporting to the International Board and other stakeholders on impact for improved child wellbeing. Dr. Morrow was invited to conduct the first-ever technical review of an SDG target indicator; 2.1.2 -- Prevalence of severe or moderate food insecurity. He recently completed a global capacity development effort for evidence based policy and policy implementation for the UN Food and Agriculture Organization for >50 countries.

Dr. Morrow continues to actively use remote sensing and geospatial analysis in his applied research following on early contributions to the MODIS, NPOESS, and Land-Use and Land-Cover Change science mission. These technologies featured in Developmental Evaluations of the World Food Program's mVAM program for improved needs assessment and hazard monitoring. They also feature in his teaching that includes problem sets related to assessing flood damage or humanitarian logistics planning.

Co-I: Institutional PI: Dr. Beverly Wright

1. Professional Preparation

Grambling State University, Sociology, Bachelor of Arts 1969
State University of New York at Buffalo, Sociology, Master of Arts 1971
State University of New York at Buffalo, Sociology, Doctor of Philosophy 1977

2. Professional Experience and Positions

Executive Director, Deep South Center for Environmental Justice, 2005-present
Professor of Sociology, Dillard University, 2005-2017,
Professor of Sociology, Xavier University of Louisiana, 1992-2005
Associate Professor, Wake Forest University, 1989-1993

3. Selected Bibliography

Wright, B.H., (2015) Environmental Injustice and the State of Black New Orle-ans," pp. 100 - 113 in McConduit-Diggs, Erika, State of Black New Orleans: 10 Years Post-Katrina. New Orleans: The Urban League of Greater New Or-leans.

Wright, B.H.,, and Nance, E., (2012). "Toward Equity: Prioritizing Vulnerable Communities in Climate Change," Duke Forum for Law and Social Change, 4 (1), 1-21.

Wright, B.H., (2011). "Race, Place, and the Environment in the Aftermath of Katrina," Anthropology of Work Review, American Anthropological Associa-tion, 32 (1), 4-8.

Bullard, Robert D. & **Wright**, **B.H.,** "Disastrous Response to Natural and Man-Made Disasters: An Environmental Justice Analysis Twenty-Five Years after Warren County," UCLA Journal of Law and Environmental Policy 26: 2008.

Wright, B.H., (1998). "Endangered Communities: The Struggle for Environmental Justice in Louisiana's Chemical Corridor," Journal of Public Management and Social Policy, 4(2), 181-191.

Wright, B.H., Bullard, R.D., & Johnson, G.S., (1997). "Confronting Environmental Injustice," [Special Issue]. Journal of Race, Gender, and Class, 5, 65-79.

Bullard, R. D. & **Wright, B.H**., (1993). "Environmental Justice for All: Community Perspectives on Health and Research Needs," Toxicology and Industrial Health, 9(5), 821-841.

Wright, B.H., & Bullard, R.D., (1990). "Hazards in the Workplace and Black Health: A Review," Journal of Sociology, 4(1), 45-74.

4. Research Experience: Scientific, Technical, Management

In 1992, Dr. Wright founded the Deep South Center for Environmental Justice at Xavier University in New Orleans (later moved to Dillard University in 2005) modeled on Communiversity Model approach. As the founding director of the first university based environmental justice organizations, Dr. Wright has been at the forefront of the movement to empower and build resiliency in low-income and people of color who are threatened by natural and manmade disaster, hazards, and emergencies. Dr. Wright worked collaboratively with some of the nation's leading environmental justice and health equity scholars on communities disproportionately impacted by industrial pollution, environmental hazards, and natural and manmade disasters in the Louisiana Chemical Corridor, also known as "Cancer Alley." Dr. Wright have served as PI or coinvestigator on dozens of research projects that address emergency management, response, and resiliency of workers and residents impacted by nearby or "fence line" refineries and petrochemical plants, Superfund sites, hurricanes, floods, and industrial accidents and spills – managing grants of over 23,000,000 USD. DSCEJ addresses environmental and health inequities along the Mississippi River Chemical Corridor and is a community/university partnership providing education, training, and job placement. Since Hurricane Katrina, much of her work at the Center has focused on research, policy and community outreach as well as assistance and education of displaced African-American residents of New Orleans. After EPA identified more than 200 sites around the city with elevated lead and arsenic levels, I forged a unique partnership with the U.S. Steelworkers to launch "A Safe Way Back Home Project," a proactive pilot neighborhood cleanup project. Using our NIEHS-funded Minority Worker Training Program model, the neighborhood-centered pilot cleanup project trained more than 60 small businesses and contractors in hazardous waste removal, mold remediation and health and safety methods, and trained hundreds of volunteers from around the country to assist community residents in the cleanup and return safely to their devastated New Orleans homes and neighborhoods. Over these last thirty years working in the field of environmental justice, health disparities and community sustainability. Her research experience has shown that federal, state and local policies can have a long lasting and sometimes devastating impact on communities. Dr. Wright recognizes the importance of educating communities on the science related to issues of health and that engaging them with policymakers empowers communities to advocate on their own behalf to push government to make policy changes that better protect the public health. Dr. Wright is currently a member of the White House Environmental Justice Advisory Council (WHEJAC) and she serves on the Justice 40 committee.

Co-I: Institutional PI: Dr. Jordan Borak

1. Professional Preparation

Graduate Certificate, Data Science: University of Maryland, College Park, 2019.
Ph.D. in Geography: Boston University, 2000.
Master of Arts in Geography: Boston University, 1996.
Bachelor of Science in Geography (Math minor): University of Illinois, Urbana-Champaign, 1992.

2. Professional Experience and Positions

Current Sponsored Research:

- PI, Enhanced Roughness Length Estimates from ICESat-2 Vegetation Products
- Co-I,National Climate Assessment Land Data Assimilation System
- Co-I, Shallow Water Bathymetry Products and Analysis for Near-shore

Appointments:

- Associate Research Scientist, Earth System Science Interdisciplinary Center, University of Maryland and Hydrological Sciences Laboratory, NASA/Goddard Space Flight Center (June 2011 – present).
- Senior Support Scientist, Science Systems and Applications, Inc., then Wyle Information Systems, LLC, and Hydrological Sciences Branch, NASA/GSFC (July 2002 – June 2011).
- Support Scientist, Science Systems and Applications, Inc., MODIS Land Data Operational Product Evaluation Facility, NASA/GSFC (November 2000 – June 2002).
- Research Associate, Department of Geography and Laboratory for Global Remote Sensing Studies, University of Maryland (July 1999 – November 2000).
- Research Fellow, Department of Geography and Center for Remote Sensing, Boston University (September 1993 – June 1999).

3. Selected Bibliography

Borak, J.S., M.F. Jasinski, and N. Tangdamrongsub, 2021: Fusing ICESat-2 and MODIS Vegetation Data Products to Enhance Momentum Aerodynamic Roughness Fields with Spatially-Explicit Scaling for Improved Land Surface Modeling [Poster presentation G15B-0350]. AGU 2021 Fall Meeting, 13-17 Dec.

Tangdamrongsub, N., C. Hwang, **J.S. Borak**, S. Prabnakorn, and J. Han, 2021: Optimizing GRACE/GRACE-FO data and *a priori* hydrological knowledge for improved global Terrestrial Water Storage component estimates. *J. Hydrol.*, **598**, 126463.

Borak, J.S., M.F. Jasinski, and N. Tangdamrongsub, 2020: Enhanced vegetation aerodynamic roughness for momentum with ICESat-2 data products: early results [Poster presentation H194-0005]. AGU 2020 Fall Meeting, 1-17 Dec.

Jasinski, M.F., **J.S. Borak**, S.V. Kumar, D.M. Mocko, C.D. Peters-Lidard, M. Rodell, H. Rui, H.K. Beaudoing, B.E. Vollmer, K.R. Aresenault, B. Li, J.D. Bolten, and N. Tangdamrongsub, 2019: NCA-LDAS: Overview and Analysis of Hydrologic Trends for the National Climate Assessment. *J. Hydrometeorol.*, **20**, 1595-1617.

Kumar, S.V., M. Jasinski, D. Mocko, M. Rodell, **J. Borak**, B. Li, H. Kato Beaudoing, and C. D. Peters-Lidard, 2019a: NCA-LDAS land analysis: Development and performance of a multisensor, multivariate land data assimilation system for the National Climate Assessment. *J. Hydrometeorol.*, **20**, 1571-1593.

Kumar, S.V., D.M. Mocko, S. Wang, C.D. Peters-Lidard, and **J. Borak**, 2019b: Assimilation of remotely sensed Leaf Area Index into the Noah-MP land surface model: Impacts on water and carbon fluxes and states over the Continental U.S. *J. Hydrometeorol.*, **20**, 1359-1377.

de Gonçalves, L.G.G., **J.S. Borak**, M.H. Costa, S.R. … 2013: Overview of the Large-Scale Biosphere-Atmosphere Experiment in Amazonia Data Model Intercomparison Project (LBA-DMIP). *Agr.Forest Meteorol.,***182-183**,111-127.

Borak, J.S., and M.F. Jasinski, 2009: Effective interpolation of incomplete satellite-derived leaf-area index time series for the continental United States. *Agr. Forest Meteorol.,* **149**, 320-332.

Borak, J.S., M.F. Jasinski, and R.D. Crago, 2005: Time series vegetation aerodynamic roughness fields estimated from MODIS observations. *Agr. Forest Meteorol.,* **135**, 252-268.

4. Research Experience: Scientific, Technical, Management

Dr. Borak's research interests include Earth science data processing and analysis: particular focus on long-term time series data at regional and continental scales; inter-annual and seasonal variability of vegetation and water cycle components; land-cover characterization from satellite observations; quality assessment of remotely sensed data. He has 25+ years experience with C programming and shell scripting in Unix-type environments; 4+ years with Python and Java. He also is an expert in machine learning software: scikit-learn and Keras; statistics and visualization packages: R, Tableau, and SAS.

Senior Consultant: David Padgett

1. Professional Preparation

Western Kentucky University, Geography/Geology, Bachelor of Science 1987
University of Florida, Geography/Environmental Engineering, Master of Science 1992
University of Florida, Geography/Geology, Doctor of Philosophy 2001

2. Professional Experience and Positions (Appointments)

Associate Professor of Geography, Tennessee State University, 2005-present
Visiting Assistant Professor, Vanderbilt University 2012-2013,
Assistant Professor of Geography, Tennessee State University 1999-2005
Visiting Assistant Professor of Environmental Studies, Oberlin College 1996-1999

3. Selected Bibliography

Padgett, D.A., Solis, P., Adams, J.K., Duram, L.A., Hume, S., Kuslikis, A., Lawson, V., Miyares, I.M., and Ramirez, A. "Diverse Experiences in Diversity at the Geography Department Scale," The Professional Geographer online edition, January (2013).

Padgett, D.A., Marsh, E., Harper, J., and Robinson, C. "Green Careers Curriculum Manual: Improving Access to Green Careers through Environmental Science and Engineering at Historically Black Colleges and Universities," U.S. Environmental Protection Agency (EPA 904-B-12-001), January (2012).

"Teaching Race, Class, and Cultural Issues in Earth Science to Enhance Multicultural Education Initiatives," Journal of Geoscience Education, vol. 49, no. 4, (2001), pp. 364-369.

4. Research Experience: Scientific, Technical, Management

Dr. David Padgett is a geoscientist by training with more than 30-years of experiences of in community engaged action research. He has worked in academia and as a consultant on projects including Community Air Quality Sensor Training and Community Air Quality Mapping, Community Asset Mapping, and WeGlobal Research Project on African Americans Living Abroad. Through his research and experience he has the appropriate expertise to co-develop participatory mapping tools. He has also mentored generations of graduate students at Tennessee State University throughout their academic journey. Given his expertise and skillset he is a highly-valued member of the team for ensuring quality deliverables from this project.

Section 6.0: Current and Pending Support

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.	
Investigator: Dr. Nathan	Other agencies (including NASA) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending

Project/Proposal Title**:** Assessment of the Gulf Coast Environmental Justice Landscape for Equity (AGEJL-4-Equity)

Source of Support: NASA A.49 Earth Science Applications: Equity and
Total Award Period Covered: 10/22-06/23

Person-Months Per Year Committed to the Project: 2.0

Support: ☒ Current ☐ Pending

Project/Proposal Title: Open Science Outlook for Environmental Justice and
Role: PI

Source of Support: NASA EPSCoR Louisianna BoR RID Project
Total Award Period Covered: 3/22-05/23

Person-Months Per Year Committed to the Project: 2.0

Support: ☐ Current ☒ Pending

Project/Proposal Title: High-resolution Extreme Event and Localized Temperature

Role: PI

Source of Support: NASA A.28 Interdisciplinary Science
Total Award Period Covered: FY24-FY26

Person-Months Per Year Committed to the Project: 5.4

Support: ☐ Current ☒ Pending

Project/Proposal Title: EJ Core GC; Engaging diverse researchers and EJ
Role: PI

Source of Support: NASA Science Mission Directorate –F.14- Transform to Open
Total Award Period Covered: 07/23-06/25

Person-Months Per Year Committed to the Project: 3.6

Support: ☐ Current ☒ Pending

Project/Proposal Title: Analysis of Locally Flooded Areas with Environmental Justice
Role: PI

Source of Support: NASA Science Mission Directorate –A.44- COMMERCIAL
Total Award Period Covered: 09/23-08/25

Person-Months Per Year Committed to the Project: 1.8

Support: ☐ Current ☒ Pending

Project/Proposal Title: Application of Commercial Smallsat Data to Enhance Flood Resilience
Role: Co-PI

Source of Support: NASA Science Mission Directorate –A.44- COMMERCIAL
Total Award Period Covered: 09/23-08/25

Person-Months Per Year Committed to the Project: 1.8

Current and Pending Support

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Dr. Jordan S. Borak	Other agencies (including NASA) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending
Project/Proposal Title: Enhanced Roughness Length Estimates from ICESat-2 Vegetation Products
Role: PI
Source of Support: NASA Cryospheric Program/Studies with ICESat-2
Total Award Period Covered: 05/20-04/23
Person-Months Per Year Committed to the Project: 3.0

Support: ☒ Current ☐ Pending
Project/Proposal Title: National Climate Assessment Land Data Assimilation System, NCA-LDAS
Role: Co-I
Source of Support: NASA National Climate Assessment Program
Total Award Period Covered: FY16-FY23
Person-Months Per Year Committed to the Project: 3.6

Support: ☒ Current ☐ Pending
Project/Proposal Title: Shallow Water Bathymetry Products and Analysis for Near-Shore Coastal and Inland Waters
Role: Co-I
Source of Support: NASA The Science of Terra, Aqua, and Suomi-NPP
Total Award Period Covered:
Person-Months Per Year Committed to the Project:3.0

Support: ☒ Current ☐ Pending
Project/Proposal Title: Remote Sensing of Vegetation in Puerto Rico for NIST's Hurricane Maria Infrastructure Project
Role: PREP Research Associate
Source of Support: NIST Community Resilience Program
Total Award Period Covered: 07/22-06/23
Person-Months Per Year Committed to the Project: 3.0

Support: ☐ Current ☒ Pending
Project/Proposal Title: Improving Our Understanding of Gulf Coast Wetland Dynamics with Spaceborne Lidar
Role: Co-I
Source of Support: NASA Cryospheric Program/Studies with ICESat-2
Total Award Period Covered: 05/23-04/26
Person-Months Per Year Committed to the Project: 3.0

Support: ☐ Current ☒ Pending
Project/Proposal Title: Spatio-Temporal Connections of Integrated Energy, Water and Biogeochemical Processes Across Alaska's Land and Ocean Ecosystems
Role: Co-I
Source of Support: NASA Interdisciplinary Research in Earth Science
Total Award Period Covered: 6/23-05/26
Person-Months Per Year Committed to the Project: 1.2

Support: ☐ Current ☒ Pending Project/Proposal Title: High-resolution Extreme Event and Localized Temperature for Health Forecasting in Under-served Lowlands of the Gulf Coast (HEELTHFUL-GC) Source of Support: NASA Interdisciplinary Research in Earth Science Total Award Period Covered: 07/23-06/26 Person-Months Per Year Committed to the Project: 3.6/2.4/1.8
Support: ☐ Current ☒ Pending Project/Proposal Title: Ancient Climate Change Resilient but Understudied Enset agrifood system Diversity Mapping for Food Security and Sustainability (ACCRUED-MFSS) Role: Co-I Source of Support: NASA Commercial Smallsat Data Scientific Analysis Total Award Period Covered: 09/23-08/25 Person-Months Per Year Committed to the Project: 3.6
Support: ☐ Current ☒ Pending Project/Proposal Title: Application of Commercial Smallsat Data to Enhance Flood Resilience in Support of Under-served Communities in Puerto Rico Role: PI Source of Support: NASA Commercial Smallsat Data Scientific Analysis Total Award Period Covered: 10/23-09/25 Person-Months Per Year Committed to the Project: 2.4

Section 7.0: Statements of Commitment and Letters of Support

DEEPSOUTH CENTER FOR ENVIRONMENTAL JUSTICE

9801 Lake Forest, Blvd
New Orleans, LA 70127
(504) 272-0956
www.dscej.org

March 21, 2023

Dr. Nathan Morrow
Tulane University School of Public Health and Tropical Medicine
1440 Canal St, Suite 2200
New Orleans, Louisiana, 70112

Dear Dr. Morrow,

It is with pleasure that I provide this letter of support for your proposal entitled "Analysis of Locally Flooded Areas with Environmental Justice Communities (**ALFA-EJC**)." Funding opportunity A.44 COMMERCIAL SMALLSAT DATA SCIENTIFIC ANALYSIS -- NNH22ZDA001N-CSDSA)." As the executive director of the Deep South Center for Environmental Justice, I have experience engaging communities on issues related to environmental justice and policy. After review of your proposal, I believe this is an opportune time to leverage NASA open Earth science to address the adverse impacts of climate change on vulnerable communities.

Specifically, because of the vast array of environmental health inequities that are affecting the gulf coast. The mission of the Deep South Center for Environmental Justice is to improve the lives of children and families harmed by pollution and vulnerable to climate change in the Gulf Coast Region through research, education, community, and student engagement for policy change. I firmly believe that this landscape analysis will be a starting point to jumpstart the use and integration of community engaged methodologies and environmental health data to improve the quality of life of our constituents.

I acknowledge that I am identified by name as Collaborator to the investigation, entitled "Analysis of Locally Flooded Areas with Environmental Justice Communities (**ALFA-EJC**)," that is submitted by Dr. Nathan Morrow to the NASA funding announcement**,** NNH22ZDA001N-IDS Interdisciplinary Research in Earth Science**,** and that I intend to carry out all responsibilities identified for me in this proposal. I understand that the extent and justification of my participation, as stated in this proposal, will be considered during peer review in determining in part the merits of this proposal. I have read the entire proposal, including the management plan and budget, and I agree that the proposal correctly describes my commitment to the proposed investigation." To conduct work for this investigation, my participating organization is the Deep South Center for Environmental Justice.

I am thrilled at the prospect of this work and am happy to endorse and give this my full support. If there is any additional information you need from me, please do not hesitate to ask and I'd be happy to assist as best as I can.

Sincerely,

Beverly Wright

Beverly Wright, Ph.D.
Executive Director

UNIVERSITY OF
MARYLAND
EARTH SYSTEM SCIENCE INTERDISCIPLINARY CENTER
Office of the Director

5825 University Research Court, Suite 4001
M Square Building
University of Maryland
College Park, Maryland 20740
TEL (301) 405-0050 FAX (301) 405-8468

Letter of commitment

Date: March 14, 2023

To: Dr. Nathan Morrow, Tulane University
From: University of Maryland, ESSIC
Subject: Statement of Commitment from Department

Dear Dr. Morrow

I acknowledge that Dr. Jordan Borak is identified by name as a Collaborator to the research proposal entitled: "Analysis of Locally Flooded Areas with Environmental Justice Communities (ALFA-EJC)" that is submitted by Tulane University to NASA in response to the NASA Roses Commercial Smallsat Data Scientific Analysis NNH22ZDA001N-CSDSA. Dr. Borak intends to carry out all responsibilities identified by Tulane University in this proposal.

Sincerely,

Ellen D. Williams

Dr. Ellen Williams,
Director, Earth System Science Interdisciplinary Center (ESSIC)

TENNESSEE STATE UNIVERSITY
College of Liberal Arts
3500 John A. Merritt Blvd.
Nashville, Tennessee 37209-1561
Department of History, Political Science, Geography & Africana Studies
(615) 963-5497 (FAX)
(615) 963-5471

March 23, 2023

Dr. Nathan Morrow
Tulane University School of Public Health and Tropical Medicine
1440 Canal St, Suite 2200
New Orleans, Louisiana, 70112

Dear Dr. Morrow,

I am writing this letter in support for your project entitled "Analysis of Locally Flooded Areas with Environmental Justice Communities (ALFA-EJC)." Funding opportunity A.44 COMMERCIAL SMALLSAT DATA SCIENTIFIC ANALYSIS -- NNH22ZDA001N-CSDSA)."

For at least the past five years, I have provided technical assistance through the Deep South Center for Environmental Justice (DSCEJ) for environmental justice and community-based organization (CBO) stakeholders on issues related to your project, including:

- Stakeholder training in geoscience and cartography in support of strategies to mitigate the negative impacts of landfills upon the hydrologic ecosystems in the Wedgewood Community in Pensacola, Florida.
- Community-based participatory asset mapping and hydrological data analysis in support of community legal actions versus a proposed inland port facility that threatens the quality of life in the historic Turkey Creek community in Gulfport, Mississippi.
- Geographic information systems (GIS) training in support of a community-based flood mitigation program in New Orleans' Lower Ninth Ward.
- Leading community-based organizations in the DSCEJ "Gulf Waters Justice Training Institute" (GWJTI), a six-week series of workshops designed to enhance tropical storm and flooding preparedness and mitigation

I acknowledge that I am identified by name as Consultant to the investigation, entitled "Analysis of Locally Flooded Areas with Environmental Justice Communities (ALFA-EJC)," that is submitted by Dr. Nathan Morrow to the NASA funding announcement, NNH22ZDA001N-IDS Interdisciplinary Research in Earth Science, and that I intend to carry out all responsibilities identified for me in this proposal.

I accept the daily consulting fee of 550 USD for 23.6 days of work for a total fee of 13,000 USD.

I understand that the extent and justification of my participation, as stated in this proposal, will be considered during peer review in determining in part the merits of this proposal.

I have read the entire proposal, including the management plan and budget, and I agree that the proposal correctly describes my commitment to the proposed investigation."

If you need any further information from me, please contact me at dpadgett@tnstate.edu or 615.258.3657

Cordially,

David Padgett

David A. Padgett

Section 8.0: Budget

Section 8a. Budget Narrative:

Senior Personnel
Dr. Nathan Morrow as PI will provide 0.15 FTE. He is accountable for grant implementation, compliance, risk management and reporting, quality and timeliness of all deliverables, implementation of the DMP, responsive communication, and reporting to NASA and all stakeholders. Dr. Morrow will manage collaboration, GitHub sites. Dr. Morrow will take the technical lead on all spatial analysis and mapping sub-tasks. Accountable for all milestones, he ensures inclusive and equitable contributions to collaborative deliverables including publications, open science and reports in following Milestone Schedule. The base salaries applied to this budget reflect the actual salaries and include a 3% anticipated increase per year.

Fringe Benefits
Tulane's fringe rates include health insurance, FICA, unemployment, workers' compensation, retirement, terminal leave payout and employee assistance. Amounts for the sponsor's contribution to employee fringe benefits are calculated using Tulane's U.S. Department of Health and Human Services (DHHS) approved Fringe Benefit Rates effective August 30, 2022. The approved rates are as follows: XX% for Faculty and XX% for students.

Consultant: Dr. Padgett is a professor at Tennessee State University and established NASA investigator will be hired as a consultant to provide expert participatory and dynamic facilitation of community engagement. The consultant rate was determined by the field competition, past consulting fee history on a similar NASA funded grant and an average rate was derived. The total cost for consultancy is provided in the NSPIRES cover page and does not include any other costs than Dr. Padgett's time. $XX in year 1 and $XX in year 2.

Travel
Site visits in project Year 1 to four sites allow Dr. Morrow to work with the communities Establish patterns of clear sky and precipitation event flooding at EJ study sites. Site visits in the second project year will allow Dr. Morrow to support the annual planning meetings and community meetings on flooding monitoring. Total: $8,000.

Total Direct Costs
Direct costs are $XX in Year 1, and $XX in Y2. Total direct costs: $XX.

Subawards

Deep South Center for Environmental Justice:

> Deep South Center for Environmental Justice was selected as a Subcontract candidate due to the expert work in integrating participatory methods in environmental justice work and expertise of developing EJ Community capacity to engage with Earth and social science. They were also selected for their reputation for agile high quality community collaboration. DSCEJ will facilitate direct support for community partners and community organizations that from their extensive CJ&EJ networks across the region. DSCEJ will dedicate experienced personnel to the project's Communiversity-modeled activities. Dr. Beverly Wright, CO-I and Institutional PI supported by DSCEJ staff, is accountable for

the fidelity of the proposed activities and deliverables to the principles of Communiversity and will contribute directly to engagement with communities. Dr. Wright will be co-lead author of all peer-reviewed manuscripts and other major communications.

The sub-award will be spent on engagement of community partners to engage their communities: $28,000 in year 1 and $28,000 in year 2.

$0 will be spent from sub-contract on open access publishing fees.

Indirect Costs. Deep South Center for Environmental Justice had an indirect rate of XX%. $XX in year 1, $XX in year 2.

Total Subaward: $XX.

University Of Maryland:

Personnel salaries and benefits are requested for the UMD personnel who will be performing this research as described in the proposal narrative. The Senior/Key Personnel are as follows: Dr. Jordan Borak, Associate Research Scientist (FTE of .20 person-months per year).The base salaries applied to this budget reflect the actual salaries set forth by our institution and include a 3% anticipated escalation per year.

Fringe benefits include health insurance, FICA, unemployment, workers' compensation, retirement, terminal leave payout and employee assistance. Amounts for the sponsor's contribution to employee fringe benefits are calculated using UMD's U.S. Department of Health and Human Services (DHHS) approved Fringe Benefit Rates effective July 1, 2022. The approved rates are as follows: X% for Faculty, XX% for Staff, XX% for Graduate Assistant and XX% for Contractual Faculty/Staff, hourly students, and most Faculty/Staff additional pays. Tuition Remission is a UMD fringe benefit but is not included in the fringe calculation and is budgeted separately as applicable. Additional information about fringe benefits can be found at: https://ora.umd.edu/resources/benefits-stipends. The Fringe Benefit Rate Agreement can be found at: https://ora.umd.edu/resources/fa. Fringe rates may be renegotiated and adjusted in future years.

Travel funds are requested in the amount of $5,000 ($2,500 per year) for the PI to attend one Annual Team Meeting, in each year of this project for the purpose of collaborating with colleagues and co-creation of research findings. Dr. Borak will also participate in joint field work with communities in study sites. The standard travel cost estimates below are based on the average expenses reported by department faculty for similar activities in previous fiscal year. All travel costs are budgeted in accordance with UMD, state, and federal policies and are estimated based on historical averages, UMD per diem rates (domestic travel, only) and current gsa.gov rates. Please note that this travel is contingent upon COVID-19 regulations imposed at the state and federal level.

Yr 1: Team Meeting and Joint Field Work, New Orleans & Gulf Coast, LA: $2,500
Yr 2: Team Meeting and Joint Field Work, New Orleans & Gulf Coast, LA: $2,500

Indirect Costs
The University of Maryland's established indirect cost rate for research conducted off-campus is 27.5% of Modified Total Direct Costs (MTDC). The MTDC base excludes

tuition remission, equipment over $5,000, rental costs of off-campus facilities, and the portion of individual subcontracts over $25,000. This rate has been approved by the cognizant government agency, Department of Health, and Human Services. This rate was approved on June 23, 2022 and is effective until amended. Any questions should be referred to the Office of Research Administration (301) 405-6269 or oraa@umd.edu.

Total Subaward: $XX

Indirect Costs

The Negotiated Indirect Cost Rate Agreement for Tulane University is XX%. Indirect costs are $XX in Y1, and $XX in Y2. Total indirect costs: $XX.

Total Direct and Indirect Costs

The total budget for 2 years is $XX.

Section 8b. Budget details

*As per ROSES guidance, all cost for people including salary, benefits, overhead or totals have been removed.

Tulane		**Year 1**	**Year 2**	**Total**
	Personnel			
	Faculty - Morrow - .15 LOE	X	X	X
	Graduate Students	X	X	X
	Fringe Benefits			
	Faculty (XX%)	X	X	X
	Students (XX%)	X	X	X
	Subtotal Personnel	X	X	X
	Consultants (Dr. Padgett)	X	X	X
	Travel - 4 sites 1/yr			
	Ground transport	1,600.00	1,600.00	3,200.00
	Hotel	1,600.00	1,600.00	3,200.00
	Meals & incidentals	800.00	800.00	1,600.00
Total Direct Costs - Tulane		X	X	X
F&A (indirect) Tulane (XX%)		X	X	X
Subawards				
DSCEJ				
	Community partner engagement			
	Open access publication costs	-	-	-
	Total Direct	28,000.00	28,000.00	56,000.00
	F&A (Indirect) DSCEJ XX%	X	X	X
	Subtotal	X	X	X
	F&A (Indirect) Tulane XX% (<=25k)	X	X	X
	Subaward Total	X	X	X
UMD				
	Personnel			
	Faculty - Borak (.2 yr1, .15 yr 2)	X	X	X
	Fringe Benefits (XX%)	X	X	X
	Subtotal Personnel	X	X	X
	Travel - Annual Meeting (N.O.)			
	Airfare	500.00	500.00	1,000.00
	Hotel	1,000.00	1,000.00	2,000.00
	Ground and meals	1,000.00	1,000.00	2,000.00
	Total Direct	X	X	X
	F&A (Indirect) UMD XX%	X	X	X
	Subtotal	X	X	X
	F&A (Indirect) Tulane XX% (<=25k)	X	X	X
	Subaward Total	X	X	X
	Total Direct	X	X	X
	Total Indirect	X	X	X
Total Project Cost		X	X	X

Section 9. Table of Work Effort

Work Effort

Name	Role	Commitment (months per year)								
		Year 1			***Year 2***			***Sum***		
		This Project		*Other Funded Projects*	*This Project*		*Other Funded Projects*	*This Project*		*Other Funded Projects*
		NASA Support	*Total*		*NASA Support*	*Total*		*NASA Support*	*Total*	
Nathan Morrow	PI	1.8	1.8	0	1.8	1.8	0	3.6	3.6	0
Jordan Borak	Co-I	2.4	2.4	3.0	1.8	1.8	3.0	7.2	7.2	0
Sum of work effort:		**4.2**	**4.2**	**3.0**	**3.6**	**3.6**	**3.0**	**7.8**	**7.8**	**6.0**
Comments: Dr. Beverly Wright is the director of the Deep South Center for Environmental Justice and she supports the project in that capacity rather than direct costs that will be dedicated to specific project engagement activities.										

Section 10. Facilities and Equipment:

Tulane will provide facilities for workshops and meetings at no direct cost to the project. Facilities include the state-of-the-art research, education and outreach amenities of the River and Coastal Center offered by the ByWater Institute at Tulane. The TRCC opened in 2016 and features laboratories, offices, and a public meeting space with views of the Mississippi River. The building is managed by the ByWater Institute, but scholars can use the meeting space for programming relevant to the TRCC mission. The Tulane River and Coastal Center is available for exhibitions, classes, demonstrations, shows, receptions, meetings, and/or conferences that relate to the mission of the ByWater Institute. The Forum is 1400 square feet with flexible seating and views of the Mississippi River. The Selley Foundation Room is 200 square feet with fixed conference seating and views of the river