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**The PAN tropical investigation of bioGeochemistry and Ecological Adaptation (PANGEA): Scoping a NASA-Sponsored Field Campaign**

**Draft Report - September 2024**

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**Foreword & Request for Comment**

NASA’s Research Opportunities in Space and Earth Sciences released in 2022 called for proposals to conduct scoping studies to identify the scientific questions and develop the initial study design and implementation concept for a new NASA Terrestrial Ecology field campaign. In the spring of 2023, NASA selected two projects for funding, including a project entitled: “*A Scoping Study for the NASA Tropical Terrestrial Ecology Campaign”* (NASA Grant 80NSSC23K1019 to the University of California, Los Angeles). This report contains the recommendations from this scoping study, which presents the **PAN tropical investigation of bioGeochemistry and Ecological Adaptation (PANGEA).** NASA outlined ten expectations to be identified for each scoping study:

1. The science questions and issues.
2. The current state-of-the-science.
3. The potential for a major, significant scientific advancement.
4. The central, critical role of NASA remote sensing.
5. The essential scientific components of the study and why coordinated teamwork is required in their implementation.
6. An overall study design identifying the required observational (e.g., spaceborne, airborne, and/or supporting in situ observations) and analytical (e.g., models, data, and information system) infrastructure.
7. The feasibility of the proposed project, both technical and logistical.
8. The engagement of the broader research community to seek feedback on the ideas, to assess interest, and to foster diversity and inclusion.
9. The disciplinary skills needed to conduct the study and engage potential partners in their planning activities.
10. Potential use of results for applications and decision support.

It is expected that this white paper provide:

1. The scientific rationale;
2. An initial study design concept for a new field campaign or related team project;
3. A thorough presentation of science questions, goals, and objectives;
4. The underlying rationale in terms of state-of-the-art, relevance, and expected advances;
5. Implementation concepts; and
6. Other information to enable NASA to fully evaluate the project.

In this white paper, we outline the PANGEA campaign concept, including the PANGEA Science Themes (*Section 2*), Science Questions (*Section 3*), the scientific and technical advancement arising from PANGEA (*Section 4*), the critical role of NASA remote sensing (*Section 5*), PANGEA’s research strategy and study design (*Section 6*), technical and logistical feasibility (*Section 7*), ability to enable Earth Action (*Section 8*), and PANGEA’s capacity building and training priorities (*Section 9*). The final white paper will be submitted to NASA Headquarters on December 6, 2024.

The PANGEA scoping leadership team and working group leads are very interested in public comment on the campaign proposed in this draft white paper. We would especially like to draw attention to the PANGEA Science Questions in *Section 3*. We developed a modular campaign strategy that would allow for the campaign to be conducted at different funding levels (see *Section 6.2.1* for more information). For the final white paper, we will identify a set of core science questions that will be required in the lowest budget option (referred to as the Threshold Investigation). The pairing down of these core questions is ongoing and we welcome feedback.

As part of this modular approach, PANGEA prioritizes ground and airborne measurements in a Core Domain that emphasizes the African tropics owing to major data and knowledge gaps in the region, and the tropical Americas for important comparisons. A PANGEA extended domain encompasses pan-tropical forests for satellite remote sensing and modeling analyses (see *Section 1.5* for more information). Candidate landscapes within the Core Domain are included in *Section 6.3*. We welcome input on additional candidate landscapes based on criteria described in *Section 6.2.4* Field Observations and Studies.

During the scoping process, the PANGEA team has engaged with a broad community of potential partners to ensure that, if PANGEA is selected, the campaign can effectively align and coordinate with ongoing and forthcoming activities. We welcome feedback on PANGEA’s strategy for engagement, with respect to science activities, applications, and training priorities.

The PANGEA Leadership Team and Working Groups will work to address comments and incorporate feedback into the final version of this white paper, submitted in December.

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