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

**Draft Report - September 2024**

**Lead Authors:**

**\* Denotes coordinating authors**

Elsa M. Ordway\* (University of California, Los Angeles), Michael Keller\* (USFS, JPL), Ane Alencar (IPAM), Adia Bey (NASA Goddard Space Flight Center, UMD), Renato K. Braghiere (Caltech/JPL), Anabelle Cardoso (University of Buffalo & University of Cape Town), Dana Chadwick (JPL), Jose Dolores (Penn State), Regina Eckert (JPL), Temilola Fatoyinbo (GSFC), Yanlei Feng (MIT), António Ferraz (JPL), Liane Guild (NASA Ames), Matthew Johnson (NASA Ames), Esi Kane (University of Energy and Natural Resources, Sunyani-Ghana), Lydie-Stella Koutika (CRDPI), Yue Li (UCLA), Junjie Liu (JPL), Marcos Longo (Lawrence Berkeley National Lab, LBNL), Ian Mccubbin (JPL), Félicien Meunier (Ghent University), Charles Miller (Jet Propulsion Laboratory, California Institute of Technology), Helene C. Muller-Landau (Smithsonian), Robinson Negrón-Juarez (LBNL), Teodyl Nkuintchua (World Resources Institute),Matheus Nunes (UMD), Le Bienfaiteur Sagang Takougoum (UCLA), Maria J. Santos (University of Zurich), Fabian D. Schneider (Aarhus University), Marc Simard (JPL), Bonaventure Sonké (Univ. of Yaounde I), Hannah Stouter (UCLA), César Terrer (MIT), Marius von Essen (UCLA), Michelle Y. Wong (Yale), Sarah Worden (JPL), Xiangming Xiao (OU), Virginia Zaunbrecher (UCLA)

**Contributing Authors:**

Isaac N. Aguilar Rivera (Caltech), Jennifer Bowen (Stanford), Iniquilipi Chiari (Global Alliance of Territorial Communities, GATC), Ovidiu Csillik (Wake Forest), Gloria Diez (GATC), Marcelo Doroso (GATC), Deborah Delgado Pugley (PUCP), Alejandra Echeverri Ochoa (University of Califonia-Berkeley), Evan Gora (Cary Institute), Alison Hoyt (Stanford), Juan Carlos Jintiach (GATC), Victor Maqque (University of Oklahoma, OU), Clarice Perryman (Stanford), Zoe Pierrat (JPL), Leila Saraiva (GATC), Debjani Singh (ORNL)

**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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**Members of the Biogeochemical Cycles and Carbon Dynamics Working Group:** Abhishek Chatterjee (JPL), Alfred Ngomanda (CENAREST), Alysson Bery (Congo Basin Institute), Anne Ola (INRS), Ashley Ballantyne (University of Montana), Asmadi Saad (Jambi University), Bassil El Masri (Murray State University), Beisit Luz Puma Vilca (Sylvera), Ben Taylor (Harvard), Bila-Isia Inogwabini (WWF), Carla Restrepo (University of Puerto Rico), Chima Iheaturu (University of Bern), Corneille Ewango (Okapi Faunal Reserve), Danielle Potocek (Spark Climate Solutions), David Lagomasino (East Carolina University), DHEERESH KUMAR, Doug Morton (NASA Goddard), Ekene Rangel, Elhadi Adam (University of the Witwatersrand), Eric Cosio (Pontifical Catholic University of Peru), Farrel Boucka (AGEOS), Fernanda Santos (ORNL), Fiona Soper (McGill), Flavia Durgante (Karlsruhe Institute of Technology), Francis Manfoumbi (AGEOS), Gerbrand Koren (Utrecht University), Gillian Galford (University of Vermont), Gislain MOFACK II (FAO), Gretchen Keppel-Aleks (University of Michigan), Hankui Zhang (SDSU), Hans Verbeeck (Ghent University), Jim Dalling (UIUC), Jingfeng Xiao (UNH), Joe Mohan (UCI), Josh Fisher (Chapman University), Kate Nelson (McGill University), Krista Anderson-Teixeira (Smithsonian), Laura Duncanson (University of Maryland), Luis Fernandez NGOULA (University of Yaounde), Marcia Macedo (WHRC), Marijn Bauters (Ghent University), Moses Cho (University of Pretoria), Na Chen (MIT), Nate McDowell (PNNL), Patrick Namulisa (Columbia), Nick Parazoo (JPL), NIMPA NGUEMO Christiane Guillaine (University of Bamenda), Nohemi Huanca-Nunez (Yale), Norma Salinas (Pontifical Catholic University of Peru), Pascal Boeckx (Ghent University), Paul Arellano (NAU), Paulo Brando (Yale), Petya Campbell (University of Maryland Baltimore County), Robinson Negron-Juarez (LBNL), Rogelio Corona (UNAM), Rolf Obame (USTM), Ruofei Jia (MIT), Sarah Batterman (Cary Institute of Ecosystem Studies), Sparkle Malone (Yale), Steve Kwatcho Kengdo (UC Berkeley), Tana Wood (USDA Forest Service), Timothy Filley (University of Oklahoma), Tomasso Jucker (University of Bristol), Trevor Cambron (MIT), Vincent Medjibe (USDA Forest Service), Wu Sun (Carnegie Science), Yann Nouvellon (CIRAD), Yoseline Angel (NASA Goddard), Zeli Tan (PNNL)

**Members of the Structure, Function and Diversity Working Group:** Jesus Aguirre-Gutierrez, Loren Albert, Luciana Alves, Junior Amboko, Nicolas Barbier, Stephanie Bohlman, Jeanine Cavender-Bares, Caroline Chaves Arantes, Moses Cho, Rogelio O. Corona-Núñez, Claudia Coronel Enríquez, KC Cushman, Stuart Davies, Laura Duncanson, Alvaro Duque, Sandra M Duran, Bassil El Masri, Josh Fisher, Evan Fricke, Evan Hockridge, Miroslav Honzak, Tommaso Jucker, Matthias Kunz, Moses Libalah, David Luther, Tim Mayer, Paul Moorcroft, Doug Morton, Luis Fernandez Ngoula, Christopher Nytch, Jack Orebaugh, Dina Rasquinha, Nicholas Russo, Norma Salinas, Arturo Sánchez-Azofeifa, Wu Sun, Jennifer J Swenson, Nathan Swenson, Simon Tamungang, Jill Thompson, Marcelle Thompson, German Vargas G., Rodrigo Vargas G., Jiaming Wen, Michael Wimberly, Lin Xiong, Xi Yang

**Members of the Climate Feedbacks & Interactions Working Group:** Nate McDowell, Chi Chen, Manuel Lerdau, Rogelio O. Corona-Núñez, Josh Fisher, Daniela Francis Cusack, Eric Davidson, Luiz A. T. Machado, Maricar Aguilos, Sam Rabin, Rob Spencer, zhuonan wang, Isela Jasso, William F. Laurance, Leila Constanza Hernandez Rodriguez, Susan Laurance, Jingfeng Wang, Gabrielle De Lannoy, Gerbrand Koren, Jie Hsu, Tomas Ferreira Domingues, Carl Norlen, Jiafu Mao, Mingjie Shi, Yanlei Feng, Jonathan Wang, Amy Zanne, Emmanuel Barde Elisha, Evan Gora, Xiangzhong Luo, Marie Brigitte Makuate , Landing Mané, Denis Jean Sonwa, Louis Defo, L. Ruby Leung, Yoshiaki Hata, Cynthia Wright, Eric Bastos Gorgens, Manh-Hung Le, Debora Regina Roberti, Kevin Njabo, Victor Aimé Kemeuze, John Adams Katikomo, Nyong Princely Awazi, Andrea, Martin Arthur Meka Zibi II, Peke Koukou Léon c'est la vie, Donald-l'or Nyame Mbia, Nkemnkeng Francoline Jong, Vanessa Mavila, Olivier Bosela, Akwayopanga Denis, Bakeleki Bohin Jean Marie, Carmen Loncthi Fobasso, Apene Derek Aziwoh , Cyrille Bienvenu Bediang, Susanna B Hecht, Jancy Kelly Boungou Matoumouna, Jonathan Tahiri Heri, Bertrant James Taya Saah, Nzanzu Mulimirwa Philémon, Regis Koumba Mouissou, Amour Macelvi Matoumouene Goma, Paul Martial Tene Tayo, Nanda Silatsa Serge, Alain Okito, Stella Songwe Tikeng, Ncangu Bahindwa Benjamin , Sandjo Phallin Romeal , Timothy Bonebrake, James Okwiri, Matthieu Aksanti Cizungu, Theirry Michel Tene, Igor Akendengué Aken, Clovis Nzuta Kengne, Essama Essama Mathurin, Dolorès Mache, Emmanuel Kohbe Wanso, Vadel Eneckdem Tsopgni, Usongo Patience Abaufei , Djorwe Enock, Ravinder Sehgal, Donato Ndong Ndong Nzang, Nguimalet Cyriaque Rufin, Hubert Yamvu, Foupouapegnigni Moihamette, Amadou Bossiomo Mfela, Hugues Irenge Nganiza, Zacharie Mounkene Bounyahre, Junior Baudoin Wouokoue Taffo, Djosebe Azaria, Fritz Betchem, Alysson Bery, Robert Vancelas Obiang Zogo, Daniel Brice Knko Nkontcheu, Eric Fokam, Marcel Caritá Vaz, Armand Okende, Greg Jongsma, Joost van Haren, Rui Cheng, Peter Ssimbwa

**Members of the MDS Working Group:** Shivani Agarwal (Columbia University), Rachel Albrecht (University of São Paulo, USP), Luciana Alves (UCLA), Andrés Baresch (University of Maryland), Ana Bastos (Leipzig University), Carly Batist (Raiforest Connection), Anthony Bloom (JPL), Damien Bonal (INRAE, Université de Lorraine, AgroParisTech, UMR Silva), Santiago Botia (Max Planck Institute for Biogeochemistry), Na Chen (MIT), Bradley Christoffersen (The University of Texas Rio Grande Valley), Michael Coe (Woodwell Climate Research Center, WCRC), Matteo Detto (Princeton University), Hannes De Deurwaeder (Princeton University), Michael Dietze (Boston University), Francina Dominguez (University of Illinois Urbana-Champaign, UIUC), Chris Doughty (Northern Arizona University), Kim Ely (LBNL), Jianing Fang (Columbia University), Rosie Fisher (Centre for International Climate and Environmental Research Oslo, CICERO), Saulo Freitas (National Institute for Space Research, INPE), Pierre Gentine (Columbia University), Viola Heinrich (Helmholtz Centre Potsdam), Marina Hirota (Federal University of Santa Catarina), Forrest Hoffman (Oak Ridge National Laboratory, ORNL), Jennifer Holm (LBNL), Ruofei Jia (MIT), Trevor Keenan (University of California, Berkeley), Nancy Kiang (NASA GISS), Charles Koven (LBNL), Jennifer Kowalczyk (LBNL), Jeremy Lichstein (University of Florida), Yanlan Liu (Ohio State University), Nima Madani (JPL), Landing Mané (Central Africa Forest Satellite Observatory), Isabelle Maréchaux (INRAE, AMAP), Bassil El Masri (Murray State University), Guilherme Gerhardt Mazzochini (Federal University of Rio de Janeiro, UFRJ), David Medvigy (University of Notre Dame), Leila Mirzagholi (MIT), Gislain II Mofack (University of Yaoundé I), Paul Moorcroft (Harvard University), Neil-Yohan Musadji (Masuku University of Science and Technology), Jessica Needham (LBNL), Christiane Guillaine Nimpa Nguemo (University of Bamenda), Rogelio Omar Corona Núñez (National Autonomous University of Mexico, UNAM), Rolf Mabicka Obame (Masuku University of Science and Technology), Grace Jopaul Loubota Panzou (Denis Sassou Nguesso University), Gilberto Pastorello (LBNL), Mateus Dantas de Paula (Senckenberg – Leibniz Institution for Biodiversity and Earth System Research), Arthur Prudêncio de Araujo Pereira (Federal University of Ceará), Thomas Pugh (Lund University), Celso von Randow (National Institute for Space Research, INPE), Natalia Restrepo-Coupe (University of Arizona, Cupoazu LLC), Evandro Marcos Saidel Ribeiro (USP), Bianca Fazio Rius (University of Campinas, Center for Research on Biodiversity and Environment), Leila Hernandez Rodriguez (LBNL), Iris Roitman (University of Brasília), Sergio Rojas (Humboldt Institute), Thais Rosan (University of Exeter), Lina María Sánchez-Clavijo (Humboldt Institute), André Santos (LBNL), Rosa Maria Nascimento dos Santos (Amazonas State University; in memoriam), Shawn Serbin (NASA/GSFC), Alexander Shenkin (Northern Arizona University), Alexey Shiklomanov (NASA/GSFC), Jacquelyn Shuman (NASA Ames Research Center), Anna Spiers (LBNL), Ying Sun (Cornell University), Abigail Swann (University of Washington), Anna Trugman (University of California, Santa Barbara), María Uriarte (Columbia University), María del Rosario Uribe-Diosa (Climate Focus), Rodrigo Vargas (University of Delaware), Hans Verbeeck (Ghent University), Marco Visser (Leiden University), Weile Wang (NASA Ames Research Center), Rachel Ward (University of California, Berkeley), Mathew Williams (University of Edinburgh), Chonggang Xu (Los Alamos National Laboratory, LANL), Xiangtao Xu (Cornell University), Julia Yang (University of California, Berkeley), Jevan Yu (MIT), Maurício Rumenos Guidetti Zagatto (USP), Wenli Zhao (Columbia University)

**Members of the Community Engagement and Research Applications Working Group:** Yoseline Angel, Shivani Argawal, Kemin Austin, Carly Batist, Ruksan Bose, Glen Bush, Rogelio O. Corona-Núñez,, Fanny Djomkam,, Marius Ekué, Matt Hansen, Simon Hoyte, Nohemi Huanca, Chima Iheaturu, Yovita Ivanova, Gerbrand Koren, Matthias Kunz, Patrick Meyfroidt, Catherine Nakalembe, Tatiana Nana, Christiane Nimpa, Kevin Njabo, Carl Norlen, Florence Palla, Catherine Potvin, Danielle Rappaport, Nick Russo, Denis Sonwa, Hannah Stouter, Iroro Tanshi, Luicie Temgoua, Stella Songwe Tikeng, Beisit Luz Puma Vilca