

## **Earth Lab Post-Doctoral Research and Teaching Scholars at the University of Colorado-Boulder**

The Earth Lab initiative, part of the University of Colorado Boulder's "Grand Challenge: Our Space, Our Future," seeks post-doctoral researchers to join a dynamic team pushing the frontiers of coupled earth and social system science (<http://www.colorado.edu/grandchallenges/>). Earth Lab's mission is to harness the wave of Earth observations from aerospace platforms and other sources to better understand the pace and pattern of environmental change.

Earth Lab will:

- **Capitalize on the Data Deluge from Space** to accelerate science;
- **Reduce Environmental Risk and Surprise** by using this wealth of data to understand and predict both slow and abrupt Earth System change to help society manage and adapt;
- **Train a New Generation of Data Scientists in Earth Analytics.**

Earth Lab's developing Analytics Hub will be a state-of-the-art computing facility that leverages existing cyberinfrastructure investments at the University of Colorado-Boulder and houses scientific support staff and specialists who assist researchers and students with all data management, analysis and visualization needs.

Earth Lab seeks 8 Post-Doctoral Research and Teaching Scholars in the areas described below: Fire, Forest Health, Decision and Risk Analysis, Erosion, Permafrost in a Warming Climate, Data Harmonization, Extremes and Threshold Behaviors in Coupled Natural and Social Systems and the Earth Analytics Education Initiative. Candidates are responsible for carrying out Earth Lab's research and teaching program. Successful candidates must have content knowledge and data analytics skills relevant to each theme, as well as eagerness to bridge among the themes, and interact with specialists in data analytics, visualization, and informatics in a High Performance Computing environment. Interest in mentoring undergraduate and graduate students is a plus, as Earth Lab is committed to advancing education and developing the Earth Systems data analytics workforce. Interest in interacting with the private sector, especially companies providing environmental sensing data and analysis, from space, aerial, and *in situ* platforms, is also desirable. Please note, Earth Lab is also hiring an Earth Data Analytics Specialist, see here for more details on this position:

[http://www.colorado.edu/geography/jkbalch/jkbprofile/Earth\\_Lab\\_Jobs%21.html](http://www.colorado.edu/geography/jkbalch/jkbprofile/Earth_Lab_Jobs%21.html)

### **Overall Qualifications:**

- Doctoral degree in natural or social sciences related to the Earth Lab mission themes as described below.
- Strong quantitative background.
- Experience in, or willingness to learn, appropriate programming and data analytic tools. Ideally the candidates will have experience programming in languages such as R, Python, and Linux and using geospatial analysis software such as QGIS or ArcGIS.

- Experience integrating and analyzing large, and/or heterogeneous datasets, including Earth observations from remote-sensing platforms.
- Experience working with a High Performance Computing environment is a plus.
- Demonstrated publication and grant-writing skills.

A post-doc is sought for each of **Earth Lab's initial Science Projects (7) and Education Initiative (1)**:

**1) Fire:** This project will explore how we can better understand changing fire regimes across the U.S. using satellite observations, government records, and field data on climate, fuels, ignitions, and fire behavior over the past several decades. The goal of this project is to develop better models of fire likelihood and risk based on a suite of climate and anthropogenic variables. This work is part of a larger effort to: i) assess fire dynamics across the U.S. in relation to preceding climate conditions and proximity to anthropogenic ignition sources; and ii) model mid-century fire risk in ecosystems and developed areas across the U.S under future climate change and land use scenarios.

Specific Qualifications: Completed Ph.D. in ecology, biogeography, ecosystems science, or related field with a specific focus on modeling the drivers of disturbance processes. Previous analytics experience creatively using and integrating recent satellite data on fire, e.g., MODIS burned area or active fire products, Landsat-based MTBS data, or others is desired.

Contact for this theme: Jennifer Balch, Department of Geography, [jennifer.balch@colorado.edu](mailto:jennifer.balch@colorado.edu)

**2) Forest Health:** This project will explore the factors driving Colorado's forest dieback. Integration of datasets on canopy structure and loss (e.g., LiDAR data), drought (e.g., soil moisture from integrated meteorological sources), beetle kill (e.g., from aerial detection surveys), fire dynamics (e.g., from satellite-derived burned area), and field-based surveys of forest structure (e.g., from the Niwot Ridge LTER) will be explored to identify convergence and divergence of disturbance events, cross-scale interactions, and consequent ecosystem response. In addition, these data sources will be used to guide targeted observations of forest properties detected from a suite of sensors on unmanned aerial systems (UAS or drones).

Specific Qualifications: Ph.D. in ecology, ecosystem science or related field with emphasis on forested ecosystems; experience in remote sensing, GIS, and forest landscape modeling is desired.

Contact for this theme: Carol Wessman, Ecology & Evolutionary Biology, Environmental Studies Program, and the Cooperative Institute for Research in Environmental Sciences, [carol.wessman@colorado.edu](mailto:carol.wessman@colorado.edu)

**3) Decision and Risk Analysis:** This project will integrate decision and risk analysis with data from multiple Earth system sensors to improve risk management and decision-making, and to

evaluate the value of data and information in land use, hazards mitigation, ecosystems management and related areas. Earth Lab's visualization and simulation studio will enable environmental researchers and managers to apply risk and decision analysis to geo-data to design early warning and response strategies and to test alternative management interventions. An initial focus on drought will integrate data from satellite, met stations, drones, and other platforms with the decision structures in agriculture and water resources to address key questions related to natural resources adaptation, including analytics that help land and water managers make better decisions in the face of drought.

Specific Qualifications: Expertise in quantitative decision and risk analysis, training in behavioral economics or related social science fields, and demonstrated ability to bring quantitative analysis to bear on environmental decisions.

Contact for this theme: William R. Travis, Department of Geography and Institute of Behavioral Science: [william.travis@colorado.edu](mailto:william.travis@colorado.edu)

**4) Erosion:** Project Erosion employs Earth System sensors, geospatial data, analytics, and models to improve our understanding of landscape characteristics and change on short time scales relevant to human interactions, assessment of natural hazards, and prediction of evolving natural systems. Project Erosion's first effort will focus on ability to detect change of features on the Earth's surface where speeds are large, such as landslides, gullies, and fluvial corridors, thus allowing detection of changes on short timelines (the observational record of high resolution sensors on spacecraft). The second effort will build capacity for quantifying and modeling geomorphic change, using geospatial data as a basis for developing and testing numerical models to: quantify landscape form and dynamics; efficiently adapt/develop numerical models that represent the best present understanding of the processes involved; identify and extract appropriate inputs using the database; and calibrate and test the model through iterative model-data comparison and parameter optimization. Interaction with other Earth Lab research themes, such as Project Forest or Project Permafrost, is encouraged.

Specific Qualifications: Ph.D. in relevant field; experience using spatial datasets and modeling geomorphic systems. Strong communication skills required.

Contacts for this theme: Greg Tucker, Department of Geological Sciences and Cooperative Institute for Research in Environmental Sciences (CIRES): [gtucker@colorado.edu](mailto:gtucker@colorado.edu)  
Bob Anderson, Department of Geological Sciences and Institute of Arctic and Alpine Research (INSTAAR) [robert.s.anderson@colorado.edu](mailto:robert.s.anderson@colorado.edu)  
Suzanne Anderson, Department of Geography and Institute of Arctic and Alpine Research (INSTAAR) [suzanne.anderson@colorado.edu](mailto:suzanne.anderson@colorado.edu)

**5) Permafrost in a Warming Climate:** Project Permafrost will integrate Earth observations from satellites, field studies and eventually UAS and piloted aircraft to improve how we measure the pace and pattern of permafrost degradation caused by a rapidly warming Arctic. Software algorithms and visualization tools will be built to produce permafrost index and change maps

based on a multi-scale analysis of seasonal variation in and linkages among snow cover, surface temperature, soil moisture, permafrost, and vegetation productivity identifying areas most vulnerable to climate change. A set of visualization and analysis tools will be developed in the Analytics Hub that access satellite data and integrate these with other types of in-situ and environmental data sets to study the relationships between climate drivers and environmental responses. The ultimate goal is to work toward development of a predictive capability in collaboration with NSIDC (the National Snow and Ice Data Center), USGS (the U.S. Geological Survey), and other external research scientists and Federal agencies using Maximum Entropy modeling or similar techniques to identify regions of future vulnerability.

Specific Qualifications: Completed Ph.D. in atmospheric science, biogeochemistry, ecology, or related field with experience working with satellite remote sensing data, large, complex datasets and associated data analysis techniques. It is desirable that the candidate has knowledge of permafrost or land surface modeling and skills in R, Matlab or Python programming languages.

Contact for this theme: Brian R. Johnson, National Snow and Ice Data Center, Cooperative Institute for Environmental Sciences: [brian.johnson@nsidc.org](mailto:brian.johnson@nsidc.org)

**6) Data Harmonization:** This theme examines satellite, drone, and field-based data collected at varying resolutions to determine how Earth science phenomena are represented at different space and time scales. Working with other Earth Lab projects, the successful candidate will develop tools and techniques for harmonizing (merging) vector and raster data distributed by federal, state and local agencies, including terrain data (DEMs), census data (ACS, PUMS), parcel data, meteorological data, hydrography (NHD), vegetative indices (NDVI), and novel forms of spatio-temporal data such as social media streams and real-time sensor data. Furthermore, the successful candidate will be expected to disseminate research findings and share ‘best-practices’ with Earth Lab team members, and the wider research community.

Specific Qualifications: Expertise in data analysis, statistics (especially geo-spatial), visualization, and high performance computing. Strong programming skills in a language such as Python, R, C/C++, Java, and/or Javascript are a must.

Contact for this theme: Barbara Battenfield, Department of Geography, [babs@colorado.edu](mailto:babs@colorado.edu)

**7) Extremes and Threshold Behaviors in Coupled Natural and Social Systems:** This project seeks to build on the suite of Earth Lab efforts, plus research findings in coupled human and environment systems, to pursue knowledge frontiers in dynamic and emergent system behaviors (e.g., understanding of extremes, threshold behaviors, and abrupt changes). We are seeking to better understand how fundamental processes may help explain extremes and abrupt behavior across systems, including wildfire dynamics, drought likelihood and consequences, forest transitions to alternate states, permafrost melting, erosional processes, and the human systems that are vulnerable to changes in these phenomena.

Specific Qualifications: Demonstrated interest and the skills necessary in exploratory approaches to system dynamics, extreme events, tipping points, and emergent behaviors, across a wide range of systems from natural to social.

Contact for this theme: Jennifer Balch, Department of Geography,  
[jennifer.balch@colorado.edu](mailto:jennifer.balch@colorado.edu)

**8) Earth Analytics Education Initiative:** Earth Lab will develop a suite of educational and training modules in Earth Analytics, including short training courses, an undergraduate and graduate certificate, and a professional master's degree. Earth Lab will provide a rich environment for student and professional development through innovative, interdisciplinary course and curriculum design. Earth Lab's goal is to help train the next generation of Earth scientists to become leaders in data analytics. This Scholar will take a leadership role in developing this new education initiative.

Specific Qualifications Include: Ph.D. in education or related field with demonstrated focus on STEM education, especially Earth science education, analytical approaches, bringing big data to classrooms, and an interest in developing education programs for traditional and non-traditional students, including practicing professionals.

Contact for this theme: Professor James Curry, Department of Applied Mathematics,  
[curry@colorado.edu](mailto:curry@colorado.edu)

The 8 positions will be filled as Research Associates at the University of Colorado-Boulder, with salary appropriate to qualifications and experience, and with eligible employee benefits. Initial appointment will be for one year with high likelihood of renewal for an additional year.

To Apply:

The job applicant website ([www.cu.edu/careers](http://www.cu.edu/careers)) will be open on December 6, 2015; all applications that are received by **January 8, 2016** will be given full consideration, but the positions will remain open until filled. Applicants should provide:

- 1) personal information prompted by the job website,
- 2) a 1-2 page cover letter explaining relevant research background and interest in a specific Earth Lab theme or themes (Doc 1),
- 3) complete C.V. (Doc 2),
- 4) a document listing the names and contact information for two references, who then will be prompted to separately upload their reference letters which are also due by January 8, 2016 (Doc 3),
- 5) proof of Ph.D. degree, or formal letter from your institution stating that all requirements for the Ph.D. degree have been completed (Doc 4),
- 6) and a separate document that specifies which Earth Lab theme or themes that you would like to apply for (i.e., please indicate 1-Fire, 2-Forest Health, 3-Decision and Risk Analysis, 4-Erosion, 5-Permafrost, 6-Data Harmonization; 7-Extremes, and/or 8-Education Initiative) (Doc 5).

**A Job Posting Number through the Department of Geography will be available on December 6, 2015 with the University of Colorado's launch of the new career website ([www.cu.edu/careers](http://www.cu.edu/careers)). Please check the Earth Lab hiring website for updates on how to apply for this position:  
[http://www.colorado.edu/geography/jkbalch/jkbprofile/Earth\\_Lab\\_Jobs%21.html](http://www.colorado.edu/geography/jkbalch/jkbprofile/Earth_Lab_Jobs%21.html)  
For general information on applying, please contact Chelsea Nagy ([Rachel.Nagy@Colorado.EDU](mailto:Rachel.Nagy@Colorado.EDU)).**

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