Federal Performance Report (NR223A750025C013-PE-SA2-24)

(For viewing only)

1. Federal Agency and Organizational Element to Which Report is Submitted
USDA NRCS

2. Federal Grant or Other Identifying Number Assigned by Federal Agency
NR223A750025C013

3a. UEI Number
KABJZBBJ4B54

3b. EIN (Data is Masked)

4. Recipient Organization (Name and complete address including Zip code)

Name
REGENTS OF THE UNIVERSITY OF MINNES OTA

Number & Street	City	State	Zip
200 OAK STREET SE	MINNEAPOLIS	MN	55455-2070

5. Recipient Identifying Number or Account Number:
CON000000099099

6. Project/Grant Period (Month, Day, Year)

Start Date:
9/27/22

End Date:
9/30/25

7. Reporting Period (Month, Day, Year)

End Date:
9/27/24

8. Final Report?
No

9. Report Frequency:
Semi-Annual

10. Performance Narrative: (Attach performance narrative as instructed by the awarding Federal Agency on the Attachments tab)
Performance Narrative: Alaska Soil Data Bank Project

Reporting Period: March 28, 2024 - September 30, 2024

Key accomplishments include:

1. Data Acquisition and Integration:
- Completed digitization of over 800 geotechnical borehole logs with emphasis on Western Alaska land resource region (85 villages)
- Acquired Fort Wainwright Wetlands data containing soil descriptions from 2013-2019
- Integrated new Department of Energy project field data, including 30-35 new observations near Galbraith Lake with carbon stock and ice content data to 2-3 meters depth
- Successfully matched approximately 2,500 Forest Service records with NASIS database using spatial joining methods
- Analyzed NASIS snapshot showing significant improvement in data coverage (34,661 total records with unique pedon ID, 34,029 records with unique geometry)
- Completed comprehensive analysis of soil taxonomic classifications, including special attention to permafrost-affected soils and Gelisol classification

2. Technical Infrastructure Development:
- Established secure data storage infrastructure on Minnesota Supercomputing Institute platform
- Developed hierarchical metadata dictionary system for efficient data querying
- Created organization structure for AKSDB data model with project, study area, and site hierarchies
- Successfully implemented data transfer between GEMS platform and MSI computing resources
- Completed imagery covariates and made them available on Google Cloud Storage bucket
- Processed DEM derivatives and completed flow accumulation calculations using 10m resolution IFSAR DEM

3. Covariate Development:
- Generated comprehensive terrain derivatives including:
- Terrain Ruggedness Indices at 4, 16, and 32 pixel neighborhoods
- Topographic Position Index at multiple scales
- Wetness Indices including Saga Wetness Index and Stream Power Index
- Solar radiation calculations for solstices and monthly intervals
- Additional metrics including profile/plan curvature, positive/negative openness, vector ruggedness measure
- Implemented 50km x 50km tiling strategy for efficient data management
- Processed Sentinel-1 and Sentinel-2 composites covering 2019-2023 in 5 seasonal windows

4. Outreach and Knowledge Dissemination:
- Presented project updates at three major outlets:
- Jelinski et al. 2024. A metadata focused harmonization workflow to generate high quality datasets for digital soil mapping and modeling: the Alaska Soil Data Bank Project. Pedometrics 2024. Las Cruces, NM 05-09FEB2024
- Ainuddin et al. 2024. Predictive Mapping of Soil Classes and Properties Beyond Carbon for Alaska: The Alaska Soil Data Bank Project. AI Climate Conference. St. Paul, MN 04MAY2024
- Presentation to the Earth Science Information Partners (ESIP) Soil Informatics Cluster, leading to new connections with similar international projects
- Established collaboration with Woodwell Climate Institute's Permafrost Pathways project
- Initiated partnership with USDA-funded AI Climate Institute at University of Minnesota

5. Project Management:
- Secured no-cost extension through September 30, 2025
- Established new partnerships with computer science researchers for AI integration
- Created and maintained comprehensive documentation on GitHub
- Conducted regular monthly team meetings with detailed minutes and recordings

Comparison of Accomplishments with Milestones and Deliverables:

According to the original project proposal, the Alaska Soil Data Bank (AKSDB) project aimed to achieve three main deliverables:
1. The Alaska Soil Data Bank (AKSDB): A scalable harmonization approach using controlled vocabularies and field metadata.
2. A 30m Alaska state-wide digital soil class map (Soil order and suborder).
3. An innovative raster-based, delineated soil map by segmentation analysis for Katmai National Park and Preserve.

Based on the meeting minutes and project updates, significant progress has been made towards achieving these deliverables, although some milestones have been adjusted due to the project's extended timeline.

1. Deliverable 1: The Alaska Soil Data Bank (AKSDB)
- Milestone: Data acquisition, centralization, and ingestion (Year 1, Quarters 1-4, ongoing)
- Achievement: Significantly expanded database through integration of geotechnical logs, Forest Service records, and new field data
- Progress: Successfully developed and implemented metadata tagging system and harmonization workflow
- Milestone: Data quality enhancement and harmonization (Year 1, Quarters 3-4; Year 2, Quarters 1-2, ongoing)
- Achievement: Completed comprehensive analysis of NASIS data, including taxonomic classification review
- Progress: Developed systematic approach for handling permafrost depth and thaw depth documentation
- Milestone: Data export and interoperability (Year 2, Quarters 1-2, ongoing)
- Achievement: Established secure data storage infrastructure with capability for public access to outputs
- Progress: Successfully matched and integrated Forest Service records with NASIS database records

Deliverable 2: Statewide 30m Predictive Digital Soil Mapping Product
- Milestone: Covariate curation and script development (Year 1, Quarters 3-4, ongoing)
- Achievement: Completed imagery covariates and cloud-free seasonal composites
- Progress: Generated comprehensive suite of terrain derivatives at multiple scales
- Milestone: Predictive model runs (Year 1, Quarters 3-4, projected Year 3)
- Achievement: Identified pH as first test variable for workflow development
- Progress: Established framework for testing different resolutions (30m vs 60m) for final products

3. Digital Soil Mapping Product for Katmai National Park and Preserve:
- Milestone: Segmentation analysis (Year 2, Quarters 1-2, projected Year 3)
- Achievement: Completed covariate development necessary for analysis
- Progress: Prepared framework for implementation using developed terrain derivatives
- Milestone: Predictive model runs and segment classification (Year 2, Quarters 1-2, projected Year 3)
- Achievement: Established computing infrastructure for modeling
- Progress: Not yet implemented

The project continues to make substantial progress toward its deliverables, with significant achievements in data acquisition, technical infrastructure development, and covariate processing. The no-cost extension through September 2025 provides adequate time to complete remaining milestones while maintaining high data quality standards. The project has also expanded its impact through conference presentations and new collaborations, particularly in the areas of AI integration and permafrost research.

11. Other Attachments (Attach other documents as needed or as instructed by the awarding Federal Agency on the Attachments tab)

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12. Certification: I certify to the best of my knowledge and belief that this report is correct and complete for performance of activities for the purposes set forth in the Federal Award documents.

a. Typed or Printed Name and Title of Authorized Certifying Official

Nicolas Jelinski, Assistant Professor

b. Signature of Authorized Certifying Official
Nicolas Jelinski

c. Telephone (Area code, number and extension)
(612) 626-9936

d. Email Address
jeli0026@umn.edu

e. Date Report Submitted (Month, Day, Year)
11/13/24

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13. Agency Use Only:

Signature

Select a Certifying Official by typing their name into the appropriate field. As you type, a list of matching names will appear below the field (you may need to press the down arrow on your keyboard to display the list). Click the appropriate Certifying Official's name when it appears on the list of matches. Please note that the user must be registered in ezFedGrants. You can select yourself as the Certifying Official.

A Primary Certifying Official must be selected. The Secondary Certifying Official is optional. Notifications and work items will be sent to each Certifying Official selected here.

Primary Certifying Official

Nicolas Jelinski

Attachments

Title	Operator	Date/Time
Jelinski et a Pedometric Presentatic	Nicolas Jelinski	11/13/2024 1:59 PM
Ainuddin et al AI CLIMATE Poster	Nicolas Jelinski	11/13/2024 2:01 PM

Comments

Comment	Commented By	Date/Time
No items		