Jennifer D. Watts

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Research Appointments

08/2019 – present	Assistant Scientist	Woodwell Climate Research Center, Falmouth, MA
09/2017 – 08/2019	Post-doctoral Fellow	Woodwell Climate Research Center, Falmouth, MA
01/2017 – 08/2017	Post-doctoral Fellow	University of Montana, Missoula, MT
06/2010 – 12/2016	Research Assistant	University of Montana, Missoula, MT
06/2009 – 05/2010	Research Assistant	Montana State University, Bozeman, MT
07/2008 – 05/2009	Research Assistant	United States Geological Survey, Bozeman, MT
06/2006 – 06/2008	Research Assistant	Montana State University, Bozeman, MT

Academic Courtesy Appointments

2017 – present Affiliate Assistant Professor of Remote Sensing, Department of Land Resources & Environmental Sciences, Montana State University, Bozeman, MT

Education

2017	Ph.D. Systems Ecology	University of Montana
2008	M.S. Land Rehabilitation	Montana State University
2006	B.S. Geospatial Analysis	Montana State University

Peer-Reviewed Publications

Mentored students indicated by*

Manuscripts Submitted & In Prep

1. ***J.D. Watts***, M. Farina*, J.S. Kimball, D. Zona, E. Euskirchen, M. Helbig, O. Sonnentag, J. Du, J. Kochendorfer, F.-J. Parmentier, D. Nadeau, C. Miller, et al. Multiyear CO_2 and CH_4 budgets for the Arctic-boreal region show strong contrasts in landscape carbon sink and source activity. *Global Change Biology*. **in prep**
2. ***J.D. Watts***, S. Natali, C. Minions*, et al. A new chamber observation network in Alaska reveals consistent CO_2 loss from soils during winter. *Nature Communications*. **in prep**
3. ***J.D. Watts***, S. Natali, B. Rogers, S. Goetz, et al. Baseline emissions of winter and growing season CO_2 emissions from permafrost affected soils in Alaska and western Canada. *Environmental Research Letters*. **in prep**
4. L. Schiferl, K. Arndt, S. Biraud, E.S. Euskirchen, J. M. Henderson, E. Larson, K. McKain, J. M. Munger, C. Sweeney, ***J.D. Watts***, Y. Yi, D. Zona, R. Commane. Uncertaintiy in the Alaskan North Slope net regional CO2 flux is driven by variable tundra ecosystem behavior and distribution. *Environmental Research Letters*. **in prep**
5. D. Zona, P. Lafleur, K. Hufkens, B. Giolli, G. Burba, J. Goodrich, A. Liljedahl, E. Euskirchen, ***J.D. Watts***, et al. Pan-arctic soil moisture limitation to peak season tundra carbon sequestration. *Nature Communications*. **In review**

6. E. Euskirchen, L. Bruhwiler, R. Commane, F.-J. Parmentier, C. Schadel, T. Schuur, ***J.W. Watts***. Chapter 5: Arctic Ecosystems. In Book: Balancing Regional Greenhouse Gas Budgets. **in review**

First Authored and Selected Publications

7. Y. Yi, J.S. Kimball, ***J.D. Watts***, S.M. Natali, D. Zona, J. Liu, M. Ueyama, et al. Investigating the sensitivity of soil respiration to recent snow cover changes in Alaska using a satellite-based permafrost soil carbon model. *Biogeosciences Discussions*, 1-38.
8. S. Natali & ***J.D. Watts***; B. Rogers, S. Potter, S.M. Ludwig*, A.-K. Selbmann, P. Sullivan, B.W. Abbott, K.A. Arndt, L. Birch, M.P. Bjorkman, A. Bloom, G. Celis, T.R. Christensen, C.T. Christiansen, R. Commane, E.J. Cooper, P. Crill, C. Czimcik, S. Davydov, J. Du, J.E. Egan, B. Elberling, et al. Large loss of CO_2 in winter observed across the northern permafrost region. *Nature Climate Change*, 9, 852-857, **2019**
9. Z. Liu, J.S. Kimball, N. Parazoo, A.P. Ballantyne, W. Wang, N. Madani, C.G. Pan, ***J.D. Watts***, R.H. Reichle, O. Sonnentag, P. Marsh, M. Hurkuck, M. Helbig, W.L. Quinton, D. Zona, et al. Increased high-latitude photosynthetic carbon gain during an anomalously warm spring offset by respiration carbon loss during winter in high latitudes. *Global Change Biology*, https://doi.org/10.1111/gcb.14863, **2019**
10. B.N. Duncan, L.E. Ott, J.B. Abshire, L. Brucker, M.L. Carroll, J. Carton, J.C. Comiso, E.P. Dinnat, B.C. Forbes, A. Gonsamo, W.W. Gregg, D.K. Hall, I. Ialongo, R. Jandt, R.A. Kahn, A. Karpechko, S.R. Kawa, S. Kato, T. Kumpula, E. Kyrola, T. V. Loboda, K.C. McDonald, P.M. Montesano, R. Nassar, C.S.R. Neigh, Claire L. Parkinson, B. Poulter, J. Pulliainen, K. Rautainen, B.M. Rogers, C.S. Rousseaux, A.J. Soja, N. Steiner, J. Tamminen. P.C. Taylor, M.A. Tzortziu, H. Virta, J.S. Wang, ***J.D. Watts***, D.M. Winker, D.L. Wu. Space-based observations for understanding changes in the Arctic-Boreal Zone. *Reviews of Geophysics*, https://doi.org/10.1029/2019rg000652, **2019**
11. J. Du, ***J.D. Watts***, L. Jiang, H. Lu, X. Cheng, C. Duguay, M. Farina*, Y. Qiu, Y. Kim, J.S. Kimball, P. Tarolli. Remote sensing of environmental changes in cold regions: methods, achievements and challenges. *Remote Sensing*, 11, 1952, **2019**
12. J. Du, J.S. Kimball, I. Velicogna, M. Zhao, L.A. Jones, ***J.D. Watts***, Y. Kim. Multicomponent satellite assessment of drought severity in the contiguous United States from 2002 to 2017 using AMSR-E and AMSR2. *Water Resources Research*, https://doi.org/0.1002/wrcr.v9999.9999, **2019**
13. J. Du, J.S. Kimball, J. Galantowicz, S.-B. Kim, S.K. Chan, R.R. Reichle, L.A. Jones, ***J.D. Watts***. Assessing global surface water inundation dynamics using combined satellite information from SMAP, AMSR2 and Landsat. *Remote Sensing of Environment*, 213, 1-17, **2018**
14. J. Du, J.S. Kimball, L.A. Jones, Y. Kim, J. Glassy, ***J.D. Watts***. A global satellite environmental data record derived from AMSR-E and AMSR2 microwave earth observations. *Earth System Science Data*, 9, 791, **2017**
15. A. Hursh*, A. Ballantyne, L. Cooper, M. Maneta, ***J.D. Watts***. The sensitivity of soil respiration to soil temperature, moisture and carbon supply at the global scale. *Global Change Biology*, 23, 2090-2109, **2017**
16. D. Zona, B. Gioli, R. Commane, J. Lindaas, S.C. Wofsy, C.E. Miller, S.J. Dinardo, S. Dengel, C. Sweeney, A. Karion, R.Y.-W. Chang, J.M. Henderson, P.C. Murphy, J.P. Goodrich, V. Moreaux, A. Liljedahl, ***J.D. Watts***, J.S. Kimball, D.A. Lipson, W. Oechel. Cold season emissions dominate the Arctic tundra methane budget. *Proc. Nat. Acad. Sci.*, 113, 40-

45, **2016**

17. S.J. Davidson, M.J. Santos, V.L. Sloan, ***J.D. Watts***, G.K. Phoenix, W.C. Oechel, D. Zona. Remote sensing of arctic tundra vegetation communities along a latitudinal gradient in North Alaska, USA. *Remote Sensing*, 8, 1-14, **2016**
18. J. Du, J.S. Kimball, L.A. Jones, ***J.D. Watts***. Implementation of satellite based fractional water cover indices in the pan-Arctic region using AMSR-E and MODIS. *Remote Sensing of Environment*, 184, 469-481, **2016**
19. ***J.D. Watts***, J.S. Kimball, A. Bartsch, K.C. McDonald. Surface water inundation in the boreal-Arctic: impacts on regional methane emissions. *Environmental Research Letters*, 9, 1-13, **2014**
20. ***J.D. Watts***, J.S. Kimball, F-J.W. Parmentier, T. Sachs, J. Rinne, D. Zona, W. Oechel, T. Tagesson, M. Jackowicz-Korczyński, A. Aurela, et al. A satellite data driven biophysical modeling approach for estimating northern peatland and tundra CO_2 and CH_4 fluxes. *Biogeosciences*, 11, 1961-1980, **2014**
21. ***J.D. Watts***, J.S. Kimball, L.A. Jones, R. Schroeder, K.C. McDonald. Satellite microwave remote sensing of contrasting surface water inundation changes within the Arctic-Boreal region. *Remote Sensing of Environment*, 127, 223-236, **2012**
22. ***J.D. Watts***, R.L. Lawrence, P. Miller, C. Montange. An analysis of cropland carbon sequestration estimates for North Central Montana. Climatic Change, 108, 301-331, **2011**
23. ***J.D. Watts***, S. Powell, R.L. Lawrence, T. Hilker. Improved classification of conservation tillage adoption using high temporal and synthetic satellite imagery. *Remote Sensing of Environment*, 115, 66-75, **2011**
24. ***J.D. Watts***, R.L. Lawrence, P. Miller, C. Montagne. Monitoring of cropland practices for carbon sequestration purposes in north central Montana by Landsat remote sensing. *Remote Sensing of Environment*, 113, 1843-1852, **2009**

Other Publications

25. S.M. Miller, M.A. Taylor, ***J.D. Watts***. Understanding high-latitude methane in a warming climate. *Earth & Space Science News*, https://doi.org/10.1029/2018EO091947 , **2018**
26. ***J.D. Watts***, et al. Integrating remote sensing and field measurements to identify environmental nonstationarity on interior Alaska DoD training lands. *Report to DoD SERDP*, RC18-L2-1486, 166 pp., **2019**

Published Measurement Datasets

- ***Watts, J.D.***, S. Natali, S. Potter, B.M. Rogers. **2019**. Gridded Winter Soil CO_2 Flux Estimates for pan-Arctic and Boreal Regions, 2003-2100. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1683
- Natali, S., ***J.D. Watts***, S. Potter, B.M. Rogers, S. Ludwig, A. Selbmann, et al. **2019**. Synthesis of Winter In Situ Soil CO_2 Flux in pan-Arctic and Boreal Regions, 1989-2017. ORNL DAAC, Oak Ridge, Tennessee, USA. Https://doi.org/10.3334/ORNLDAAC/1692
- Natali, S., S. Ludwig, C. Minions, ***J.D. Watts***. **2018**. ABoVE: Thaw Depth at Selected Unburned and Burned Sites Across Alaska, 2016-2017. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1579
- Minions, C., S. Natali, S. Ludwig, ***J.D. Watts***. **2018**. ABoVE: Year-round Soil CO_2 Efflux in Alaskan Ecosystems. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1620

- Du, J., J.S. Kimball, ***J.D. Watts***. **2016**. ABoVE: Fractional Open Water Cover for Pan-Arctic and ABoVE-Domain Regions, 2002-2015. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1362

PI/CO-I for Environmental Monitoring Stations

1. Soil temperature and moisture monitoring grids, Atqasuk and Ivotuk Alaska: In partnership with NASA ABoVE, the University of Montana, and San Diego State University.
2. Soil Respiration Stations, Alaska: vegetation phenology cameras, temperature and soil moisture sensors, CO_2 chambers. NASA ABoVE and Woods Hole Research Center.

Student Advising

Developed research projects for and supervised the work of undergraduate and graduate students.

Posters and Presentations at conference or symposium, and articles by student (*)

Undergraduate Supervision

2017 Stephen Shirley, Geography Department, University of Montana, MT

12/2017 S. Shirley*, ***J.D. Watts***, J.S. Kimball, Z. Zhang, B. Poulter, A.E. Klene. Regional comparison of tundra carbon budget response over the Alaska North Slope to varying environmental conditions. AGU Fall Meeting, December 2019, New Orleans, LA.

09/2017 S. Shirley*, ***J.D. Watts***. Tracking changing soil temperature, moisture and carbon in the Arctic. *https://earthobservatory.nasa.gov/blogs/fromthefield/category/above/*

09/2017 S. Shirley*, ***J.D. Watts***. Regional carbon budget assessment for Alaska. Montana IoE Undergraduate Summer Research Project

Graduate Supervision and Advising

2017– 2018 Brianna Rick, Geography Department, University of Montana, MT

05/2018 M.S. Thesis for B. Rick, *Greening of the Arctic: Plot-scale analysis of interactions between climate, vegetation, and permafrost at Toolik Lake, Alaska (1995-2017)*

2018– present Mary Farina, Land Resources & Env. Sci., Montana State University, MT

09/2019 M. Farina*, ***J.D. Watts***, S. Powell, R. Commane, M. Powell, L. Schiferl, C. Elder, N. Barnes, H. Webb, et al. Understanding drivers of spatial variability in Alaska's wetland methane budget. NASA Terrestrial Ecology Meeting, September 2019, College Park, MD

12/2019 M. Farina*, ***J.D. Watts***, S.L. Powell, S. Natali, R. Commane, M. Powell, L. Schiferl, N. Jacobs, C.E. Miller, et al. Assessment of spatiotemporal variability in Arctic-boreal carbon flux budgets. AGU Fall Meeting, December 2019, San Francisco, CA

Recent Selected Oral Presentations

12/2019 "Soil CO_2 flux in the permafrost zone: new insight from a year-round chamber network in Alaska and Canada", AGU Fall Meeting, San Francisco, CA

03/2019 "Detecting and modeling CH_4 emissions from boreal wetlands", Yale Investments Office Wetlands Meeting, New Haven, CT, *Invited*

12/2018 "The problem with wetlands and methane: challenges in understanding regional biophysical drivers and spatial distributions of emissions", AGU Fall Meeting, Washington

DC, *Invited*

04/2018 "The disparate north: using remote sensing and ground observations to characterize northern carbon flux", NASA JPL, Pasadena, CA, *Invited*

03/2018 "Challenges in scaling soil carbon flux", NCEAS, Santa Barbara, CA, *Invited*

12/2017 "Detecting recent changes in the Arctic-Boreal Carbon Sink", AGU Fall Meeting, New Orleans, MS

11/2017 "Microwave mapping of wetland properties", Global Carbon Project Wetland Meeting, Stanford in Washington, Washington DC, *Invited*

10/2017 "Opportunities and challenges for citizen science in Alaska", Woods Hole Research Center, Falmouth, MA, *Invited*

03/2017 "Carbon sink or source? Northern wetland response to climate warming", LRES Seminar Series, MSU, MT, *Invited*

03/2017 "Understanding scaling of wetland methane emissions", International Workshop to Reconcile Methane Budgets, Seattle, WA, *Invited*

11/2016 " Quantifying the pan-Arctic methane budget: a multi-scale approach", Woods Hole Research Center, MA, *Invited*

06/2016 "Monitoring a decade of change in pan-Arctic CO_2 and CH_4 exchange through integrated satellite remote sensing", International Conference on Permafrost, Potsdam, DE, *Invited*

11/2015 "Integrating tower eddy covariance, satellite remote sensing and ecosystem modeling to identify changes in hydrology and carbon fluxes across the Alaskan Arctic", Arctic Observing Open Science Meeting, Seattle, WA, *Invited*

12/2014 "Satellite microwave detection of boreal-Arctic wetland inundation changes and their impact on regional methane emission estimates", AGU Fall Meeting, San Francisco, CA, *Invited*

06/2014 "Using satellite remote sensing to monitor changing CO_2 and CH_4 emission constraints in Boreal-Arctic wetland regions", International Association of Landscape Ecology Meeting. Anchorage, AK, *Invited*

Recent Selected Poster Presentations

12/2019 M. Farina, ***J.D. Watts***, S.L. Powell, S. Natali, R. Commane, M. Powell, L. Schiferl, N. Jacobs, C.E. Miller, et al. "Assessment of spatiotemporal variability in Arctic-boreal carbon flux budgets". AGU Fall Meeting, San Francisco, CA

12/2019 L.D. Schiferl, M. Powell, S. Biraud, E.S. Euskirchen, M. Farina, J. Henderson, E. Larson, J.W. Munger, C. Sweeney, ***J.D. Watts***, D. Zona, R. Commane. "Insights into changing regional-scale carbon dioxide and methane fluxes from arctic tundra ecosystems". AGU Fall Meeting, San Francisco, CA

12/2019 N. Jacobs, W.R. Simpson, F. Hase, T. Blumenstock, Q. Tu, M.K. Dubey, H.A. Parker, ***J.D. Watts***, M. Farina, S. Heerah. "Regional CH_4 column gradients over Tanana Flats wetlands in interior Alaska". AGU Fall Meeting, San Francisco, CA

12/2019 L. Birch, C.R. Schwalm, G. Keppel-Aleks, D.L. Lombardozzi, S. Natali, X. Lin, ***J.D. Watts***, B.M. Rogers. "Improving simulation of carbon cycle fluxes in Arctic-boreal vegetation in the Community Land Model". AGU Fall Meeting, San Francisco, CA

12/2019 ***J.D. Watts***, S. Potter, J.S. Kimball, T. Douglas, B.M. Rogers, et al. "Integrating remote

sensing and field measurements to identify environmental nonstationarity on Interior Alaska DoD Training Lands." DoD SERDP-ESTCP Symposium, Washington DC

10/2019 J. Luo, M. Ueyama, M. Okamura, ***J.D. Watts***, H. Iwata, E. Euskirchen, M. Goeckede, O. Sonnentag, et al. "Estimating northern ecosystem methane flux based on a satellite data driven model, TCF." AsiaFlux2019, Takayama, Japan

09/2019 M. Farina, ***J.D. Watts***, S. Powell, R. Commane, M. Powell, L. Schiferl, C. Elder, N. Barnes, H. Webb, et al. Understanding drivers of spatial variability in Alaska's wetland methane budget. NASA Terrestrial Ecology Meeting, College Park, MD

05/2019 ***J.D. Watts***, et al. "Quantifying cold season CO_2 emissions in Alaska and Northwest Canada". NASA ABoVE Science Team Meeting, La Jolla, CA

12/2018 ***J.D. Watts***, et al. "Quantifying cold season CO_2 emissions in Alaska and Northwest Canada". AGU Fall Meeting, Washington, DC

01/2018 ***J.D. Watts***, et al. "Mapping cold season soil CO_2 emissions in the Arctic-boreal region". NASA ABoVE Team Meeting, Seattle, WA

12/2016 ***J.D. Watts***, et al. **"** Monitoring regional changes in Alaskan boreal-Arctic carbon flux and underlying biophysical processes using in situ observations, models and satellite remote sensing". AGU Fall Meeting, San Francisco, CA

06/2016 ***J.D. Watts***, et al. **"**Monitoring dynamic changes in pan-Arctic land surface water coverage". International Conference on Permafrost, Potsdam, Germany

04/2015 **J.D. Watts**, et al. **"**Monitoring surface water changes across North American Arctic-boreal regions and impacts on ecosystem carbon fluxes". NASA Carbon Cycle & Ecosystems Joint Science Workshop, Hyattsville, MD

Teaching

Spring 2020 – Guest Lecturer. GPHY 426/429, Remote Sensing, Montana State University. Class Lead, William Kleindl; Lab Instructor, Mary Farina

Student Teaching

2008 – LRES 525, Applied Remote Sensing, Montana State University
2007 – LRES 426, Remote Sensing, Montana State University
2006 – LRES 454, Landscape Pedology (incl. lab), Montana State University

Invited Lecturer

2019 – Climate Change & Environment, Pringry School, New Jersey

2013 – Geography 487, Remote Sensing/Raster Analysis, University of Montana

Professional Activities and Service

Workshop/Meeting Organizing Committees (Recent):

2019-2021: NASA ABoVE Science Team Meeting Organizing Committee

2019: NASA ABoVE Data and Model Synthesis Group Co-chair

2019: Permafrost Carbon Network Organizing Committee

2017-2019: NASA ABoVE Hydrology & Permafrost Group Co-chair

2018: NASA ABoVE/Goddard/JPL Carbon Group Workshop Organizing Chair

2016: International Conference on Permafrost, Co-convener

Science Team and Professional Membership

NASA ABoVE Science Teams (Carbon; Permafrost & Hydrology; Citizen Science), American Geophysical Union (AGU), Association of Polar Early Career Scientists (APECS), US Permafrost Association (USPA), Permafrost Carbon Network (PCN), Arctic Research Consortium of the United States (ARCUS), Interagency Arctic Research Policy Committee

Guest Editor *Environmental Research Letters; Remote Sensing*

Journal Reviewer

Science; *Global Change Biology*; *Remote Sensing of Environment*; *Remote Sensing*; *Biogeosciences*; *Wetlands Ecology & Management*; *Environmental Research Letters*

Proposal and Panel Reviewer

USDA Small Business Innovation Research Program;
NASA Experimental Program to Stimulate Competitive Research (EPSCoR); NASA Earth and Space Science Fellowship (now FINESST); NASA Terrestrial Ecology; NSF Polar Programs

Science Outreach

2020: T-MOSAIC Remote Sensing Action Group,
https://www.t-mosaic.com/remote.html
2018: PolarTREC Project Lead,
https://www.polartrec.com/expeditions/winter-respiration-in-the-arctic
2016-2018: The Arctic in the Classroom Project Lead,
https://www.arcus.org/tac/projects/landscape-change

Professional Training & Workshops

2019 – Training and Retaining Leaders in STEM – Geospatial Sciences (TRELIS) training and fellowship program for early career faculty. Washington, DC
2018 – Training for effective leadership, employee development and conflict management. Woods Hole Research Center, Falmouth, MA
2016 – Alaska Science Communication Workshop (NSF sponsored). Sitka Sound Science Center, Sitka, AK
2016 – ARCUS (Arctic Research Consortium of the United States) Make an Impact: The Arctic in the Classroom Workshop. Fairbanks, AK
2015 – FluxCourse Training Program. Niwot Ridge LTER, CO
2015 – Arctic Permafrost Training Program. North Central Siberia, RU
2014 – Greenhouse Gas Data Workshop. Observatoire de Haute-Provence, France. Hosted by the International Carbon Observing Program (ICOS) and the US National Ecological Observatory Network (NEON)
2014 – Summer Field Campaign, North Slope, Alaska. CO_2 and CH_4 carbon flux measurements at NASA SMAP partner Cal./Val. and Amerflux tower eddy covariance sites

2013 – Circumpolar Active Layer Monitoring (CALM) Network, AK
2012 – NASA SMAP-VEX12 Field Campaign, Winnipeg, CN
2012 – LI-COR Eddy Covariance Training Workshop. Berkeley, CA
2011 – Arctic Climate System Modeling Summer Program. International Arctic Research Center (IARC), Fairbanks, AK

Computing Programs & Languages

Python, ESRI ArcGIS, IDL, ENVI, R, C, eCognition, Google Earth Engine

Awards, Post-Graduate

International Arctic Science Committee (IASC) $1,500 (2018)

Awards, Graduate

NASA Earth and Space Science Fellowship (NESSF) $90,000 (2013-2016)
Title: *Potential Contrasts in CO_2 and CH_4 Flux Response under Changing Climate Conditions: Satellite Driven Analysis of the Net Ecosystem Carbon Budget for Arctic and Boreal Regions*.
Award ID: 14-EARTH14R-25.
United States Permafrost Association Travel Grant $2,000 (2016)
ARCUS Travel Grant (Make An Impact Workshop) $1,300 (2016)
NASA Montana EPSCoR Visiting Speaker/Scientist $500 (2016)
NASA Montana EPSCoR Research Travel Grant $500 (2016)
International P.E.O. Scholar Award $15,000 (2015)
AmeriFlux Training Award $2,500 (2015)
NASA Montana EPSCoR Research Travel Grant $900 (2015)
University of Montana Office of Sponsored Programs Travel Grant $150 (2012)

Awards, Undergraduate

Montana Access Grant (2005-2006): $2,000
Montana Baker Grant (2005-2006): $900
Montana State University Scholars Program Research Grant (2003-2004): $3,000
Montana State University Scholars Program Travel Grant (2004): $1,000
Bryson L. James Student Competition Research Award (2004): $300