

SUSAN M. NATALI

Woodwell Climate Research Center
149 Woods Hole Road, Falmouth, MA 02540
508-440-1560, snatali@woodwellclimate.org

EDUCATION

B.S. Biology, Villanova University, 1991
Ph.D. Ecology and Evolution, Stony Brook University, 2008

PROFESSIONAL APPOINTMENTS

Arctic Program Director, Woodwell Climate Research Center, 2019-present
Associate Scientist, Woodwell Climate Research Center, 2015-present
Assistant Scientist, Woodwell Climate Research Center, 2012-2105
National Science Foundation (NSF) Polar Postdoctoral Fellow, 2010-2012
Postdoctoral Associate, University of Florida, 2008-2010

PROFESSIONAL INTERESTS AND EXPERTISE

- ◆ Ecological controls over cycling of carbon, nutrients, and contaminants
- ◆ Effects of permafrost thaw on Arctic biosphere-atmosphere exchange of greenhouse gasses
- ◆ Impacts of Arctic wildfire on vegetation, ground thaw, and carbon and nutrient cycling
- ◆ Ecological drivers of permafrost vulnerability and resilience to climate change
- ◆ Diversity, inclusivity, and equity in STEM
- ◆ Science-policy communications

PUBLICATIONS

Bengtsson F, Rydin H, Baltzer JL, Bragazza L, Bu ZJ, Caporn SJM, Dorrepaal E, Flatberg KI, Galanina O, Gałka M, Ganeva A, Goia I, Goncharova N, Hájek M, Haraguchi A, Harris LI, Humphreys E, Jiroušek M, Kajukalo K, Karofeld E, Koronatova NG, Kosykh NP, Laine AM, Lamentowicz M, Lapshina E, Limpens J, Linkosalmi M, Ma J, Mauritz M, Mitchell EAD, Munir TM, **Natali SM**, Natcheva R, Payne RJ, Philippov DA, Rice SK, Robinson S, Robroek BJM, Rochefort L, Singer D, Stenøien HK, Tuittila ES, Vellak K, Waddington JM, Granath G (2020) Environmental drivers of Sphagnum growth in peatlands across the Holarctic region. *Journal of Ecology*, 00: 1– 15, doi: 10.1111/1365-2745.13499

Bronen R, Pollock D, Overbeck J, Stevens D, **Natali SM**, Maio C (2020) Usteq: integrating indigenous knowledge and social and physical sciences to coproduce knowledge and support community-based adaptation, *Polar Geography*, 43:2-3, 188-205, doi: 10.1080/1088937X.2019.1679271

Dabrowski JS, Charette, M.A., Mann, P.J. Ludwig SM, **Natali SM**, Hokmes RM, Schade JD, Powell M, Henderson PB (2020) Using radon to quantify groundwater discharge and methane fluxes to a shallow, tundra lake on the Yukon-Kuskokwim Delta, Alaska. *Biogeochemistry*, 148, 69–89, doi:10.1007/s10533-020-00647-w

Estop-Aragonés C, Olefeldt D, Abbott BW, Chanton JP, Czimczik CI, Dean JF, Egan JE, Gandois L, Garnett MH, Hartley IP, Hoyt A, Lupascu M, **Natali SM**, O'Donnell JA, Raymond PA,

- Tanentzap AJ, Tank SE, Schuur EAG, Turetsky M, Walter Anthony K (2020) Assessing the potential for mobilization of old soil carbon after permafrost thaw: A synthesis of 14C measurements from the northern permafrost region. *Global Biogeochemical Cycles*, 34, e2020GB006672, doi: 10.1029/2020GB006672
- Frost GV, Loehman R, Saperstein LB, Macander MJ, Nelson PR, Paradis DP, **Natali SM** (2020) Multi-decadal patterns of vegetation succession after tundra fire on the Yukon-Kuskokwim Delta, Alaska *Environ. Res. Lett.*, 15: 025003
- Rodenhizer H, Ledman J, Mauritz M, **Natali SM**, Pegoraro E, Plaza, C, et al. (2020). Carbon thaw rate doubles when accounting for subsidence in a permafrost warming experiment. *Journal of Geophysical Research: Biogeosciences*, 125, e2019JG005528, doi: 10.1029/2019JG005528
- Duffy PB, Field CB, Diffenbaugh NS, Doney SC, Dutton Z, Goodman S, Heinzerling L, Hsiang S, Lobell DB, Mickley LJ, Myers S, **Natali SM**, Parmesan C, Tierney S, Williams AP (2019) Strengthened scientific support for the Endangerment Finding for atmospheric greenhouse gases. *Science*. 363 (6427), doi: 10.1126/science.aat5982
- Kropp, H, Loranty, MM, **Natali, SM**, et al. (2019) Tree density influences ecohydrological drivers of plant–water relations in a larch boreal forest Siberia. *Ecohydrology*, e2132, doi:10.1002/eco.2132
- Kwon MJ, **Natali SM**, Hicks Pries CE, Schuur EAG, Steinhof A, Crummer G, Zimov N, Zimov S, Heimann M, Kolle O, Göckede M (2019) Drainage enhances modern soil carbon contribution but reduces old soil carbon contribution to ecosystem respiration in tundra ecosystems. *Glob Change Biol*. 25: 1315– 1325, doi: 10.1111/gcb.14578
- Mauritz M, Celis G, Ebert C, Hutchings J, Ledman J, **Natali SM** et al. (2019) Using stable carbon isotopes of seasonal ecosystem respiration to determine permafrost carbon loss *Journal of Geophysical Research: Biogeosciences* 124 (1), 46-60
- Michaelides RJ, Schaefer K, Zebker HA, Parsekian A, Liu L, Chen J, **Natali SM**, Ludwig L, Schaefer S (2019) Inference of the impact of wildfire on permafrost and active layer thickness in a discontinuous permafrost region using the remotely sensed active layer thickness (ReSALT), *Environmental Research Letters*, 14, 035007
- Natali SM**, Watts JD, Rogers BM *et al.* (2019) Large loss of CO₂ in winter observed across the northern permafrost region. *Nature Climate Change*, 9, 852–857, doi:10.1038/s41558-019-0592-8
- Plaza C, Pegoraro E, Bracho R, Celis G, Crummer KG, Hutchings JA, Pries CEH, Mauritz M, **Natali SM**, Salmon VG, Schädel C, Webb EE and Schuur EAG (2019) Direct observation of permafrost degradation and rapid soil carbon loss in tundra *Nature Geoscience*, doi:10.1038/s41561-019-0387-6
- Sae-Lim J, Russell JM, Vachula RS, Holmes RM, Mann PJ, Schade JD, **Natali SM** (2019). Temperature-controlled tundra fire severity and frequency during the last millennium in the Yukon-Kuskokwim Delta, Alaska. *The Holocene*, 29(7), doi: 10.1177/0959683619838036
- van Gestel N, **Natali SM**, Andriuzzi W, Chapin FS, Ludwig S, Moore JC, Pressler Y, Salmon V, Schuur EAG, Simpson R, Wall DH (2019) Long-term warming research in high-latitude ecosystems: Responses from polar ecosystems and implications for future climate, In: *Ecosystem Consequences of Soil Warming*, Ed: Jacqueline E. Mohan, Elsevier, <https://doi.org/10.1016/B978-0-12-813493-1.00016-8>

- Alexander HD, **Natali SM**, Loranty M, Mack MC, Ludwig S, Davydov S, Zimov N (2018) Impacts of increased soil burn severity on larch forest regeneration on permafrost soils of far northeastern Siberia. *Forest Ecology and Management* 417: 144-153
- Finlayson M, Davies GT, Moomaw W, Chmura GL, **Natali SM**, Perry JE, Roulet N, Sutton-Grier AE (2018) The Second Warning to Humanity – Providing a Context for Wetland Management and Policy. *Wetlands*. doi:10.1007/s13157-018-1064-z
- Granath, G, Rydin H, Baltzer JL, Bengtsson F, Boncek N, Bragazza L, Bu ZJ, Caporn SJM, Dorrepaal E, Galanina O, Gałka M, Ganeva A, Gillikin DP, Goia I, Goncharova N, Hájek M, Haraguchi A, Harris, LI, Humphreys E, Jiroušek M, Kajukalo K, Karofeld E, Koronatova NG, Kosykh NP, Lamentowicz M, Lapshina E, Limpens J, Linkosalmi M, Ma JZ, Mauritz M, Munir TM, **Natali SM**, Natcheva R, Noskova M, Payne RJ, Pilkington K, Robinson S, Robroek, BJM, Rochefort L, Singer D, Stenøien HK, Tuittila ES, Vellak K, Verheyden A, Waddington J.M, Rice SK (2108) Environmental and taxonomic controls of carbon and oxygen stable isotope composition in Sphagnum across broad climatic and geographic ranges, *Biogeosciences*, 15, 5189-5202, <https://doi.org/10.5194/bg-15-5189-2018>
- Liang J, Ma S, Lu X, Mauritz M, **Natali SM**, Pegoraro EF, Penton CR, Plaza C, Salmon VG, Celis G, Cole JR, Konstantinidis KT, Tiedje JM, Zhou J, Schuur EAG, Luo Y (2018) Biotic responses buffer warming-induced soil organic carbon loss in Arctic tundra. *Global Change Biology*. doi:10.1111/gcb.14325
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- Ludwig SM, Alexander HD, Kielland K, Mann PJ, **Natali SM**, Ruess RW (2018) Fire severity effects on soil carbon and nutrients and microbial processes in a Siberian larch forest *Global Change Biology*, doi: 10.1111/gcb.14455
- Moomaw WR, Chmura GL, Davies GT, Finlayson CM, Middleton BA, **Natali SM**, Perry JE, Roulet N, Sutton-Grier AE (2018) Wetlands In a Changing Climate: Science, Policy and Management. *Wetlands*, <https://doi.org/10.1007/s13157-018-1023-8>
- Prevey J, Rixen C, Røger N, Høye T, Bjorkman A, Myers-Smith I, Elmendorf S, Ashton I, Cannone N, Chisholm C, Clark K, Cooper E, Elberling B, Fosaa AM, Henry G, Hollister R, Jónsdóttir IS, Klanderud K, Kopp C, Lévesque E, Mauritz M, Molau U, **Natali SM**, Oberbauer S, Panchen Z, Post E, Rumpf S, Schmidt N, Schuur E, Semenchuk P, Smith J, Suding K, Totland Ø, Troxler T, Venn S, Wahren H, Welker J, and Wipf S (2018) Warming shortens flowering seasons of tundra plant communities. *Nature Ecology & Evolution*.
- Schädel C, Koven CD, Lawrence DM, Celis G, Garnello AJ, Hutchings J, Mauritz M, **Natali SM**, Pegoraro E, Rodenhizer H (2018) Divergent patterns of experimental and model-derived permafrost ecosystem carbon dynamics in response to Arctic warming. *Environ. Res. Lett.*, 13 105002

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- Kropp H, Loranty M, Alexander M, Berner L, **Natali SM**, Spawn S (2017) Environmental constraints on transpiration and stomatal conductance in a Siberian Arctic boreal forest. *JGR Biogeosciences*, doi: 10.1002/2016JG003709
- Mauritz M, Bracho R, Celis G, Hutchings J, **Natali SM**, Pegoraro E, Salmon V, Schaedel C, Webb E, Schuur EAG (2017) Non-linear CO₂ flux response to seven years of experimentally induced permafrost thaw. *Global Change Biology*, doi: 10.1111/gcb.13661
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- Webb EE, Heard, K, **Natali SM**, Bunn AG, Alexander HD, Berner LT, Kholodov A, Loranty MM, Schade JD, Spektor V, Zimov N (2017) Variability in above and belowground carbon stocks in a Siberian Larch Watershed. *Biogeosciences*, <https://doi.org/10.5194/bg-2017-88>
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- Webb EE, Schuur EAG, **Natali SM**, Oken K, Bracho R, Krapek J, Risk D, Nickerson N (2016) Increased wintertime CO₂ loss as a result of sustained tundra warming. *JGR Biogeosciences*. 121(2) doi: 10.1002/2014JG002795
- Xue K, Yuan M, Shi Z, Qin Y, Deng Y, Cheng L, Wu L, He Z, Van Nostrand J, Bracho R, **Natali SM**, Schuur EAG, Luo C, Konstantinidis K, Wang Q, Cole J, Tiedje J, Luo Y, Zhou J (2016) Tundra soil carbon is vulnerable to rapid microbial decomposition under climate warming. *Nature Climate Change*, 6(6) doi: 10.1038/nclimate2940
- Deane-Coe KK, Mauritz M, Celis G, Salmon V, Crummer KG, **Natali SM**, Schuur EAG (2015) Experimental warming alters productivity and isotopic signature of tundra mosses. *Ecosystems*, 18(6):1070-1082, doi: 10.1007/s10021-015-9884-7
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- Hicks Pries CE, Schuur EAG, **Natali SM**, Crummer KG (2015) Old soil carbon losses increase with ecosystem respiration in experimentally thawed tundra. *Nature Climate Change*. 6(2) DOI: 10.1038/NCLIMATE2830
- Hicks Pries C, van Logtestijn R, Cornelissen J, **Natali SM**, Schuur EAG, Aerts R, Dorrepaal E (2015) Decadal warming causes a consistent and persistent shift from heterotrophic to autotrophic respiration in contrasting permafrost ecosystems. *Global Change Biology*, 12(12), doi: 10.1111/gcb.13032
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- Loranty MM, **Natali SM**, Berner LT, Goetz SJ, Holmes RM, Zimov NS, Zimov SA (2014) Siberian tundra ecosystem vegetation and carbon stocks four decades after wildfire. *JGR Biogeosciences*, 119: 2144–2154
- Natali SM**, Schuur EAG, Webb E, Hicks Pries CE, Crummer, CG (2014) Permafrost degradation stimulates carbon loss from experimentally warmed tundra. *Ecology*, 95:602–608, doi: <http://dx.doi.org/10.1890/13-0602.1>
- Hicks Pries CE, Schuur EAG, Vogel JG, **Natali SM** (2013) Moisture drives surface decomposition in thawing tundra. *JGR Biogeosciences*, 118:1-11, doi:10.1002/jgrg.20089
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- Natali SM**, Schuur EAG, Rubin RL (2012) Increased plant productivity in Alaskan tundra as a result of experimental warming of soil and permafrost. *Journal of Ecology*, 100: 488-498, doi:10.1111/j.1365-2745.2011.01925.x
- Trucco C, Schuur EAG, **Natali SM**, Bracho R, Belshe F, Vogel J (2012) Seven-year trends of CO₂ exchange in a tundra ecosystem affected by permafrost thaw. *Journal of Geophysical Research, Biogeosciences*, 117: G02031, doi:10.1029/2011JG001907
- Natali SM**, Mack MC (2011) News&Views: Fungal feedbacks to climate change. *Nature Climate Change*, 1: 192-193
- Natali SM**, Schuur EAG, Trucco C, Pries CEH, Crummer KG, Baron Lopez AF (2011) Effects of experimental warming of air, soil and permafrost on carbon balance in Alaskan tundra. *Global Change Biology*, 17: 1394-1407
- Duval BD, Dijkstra P, **Natali SM**, Magonigal JP, Ketterer ME, Drake BG, Lerdau MT, Gordon G, Anbar AD, Hungate BA (2011) Plant-soil distribution of potentially toxic elements in response to elevated CO₂. *Environmental Science and Technology*, 45:2570-2574
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- Natali SM**, Sañudo-Wilhelmy SA, Lerdau MT (2009) Plant and soil mediation of elevated CO₂ impacts on trace metals. *Ecosystems*, 12: 715-727
- Natali SM**, Sañudo-Wilhelmy SA, Lerdau MT (2009) Effects of elevated carbon dioxide and nitrogen fertilization on nitrate assimilation in forest trees. *Plant and Soil*, 314: 197-210

Natali SM, Sañudo-Wilhelmy SA, Norby R, Zhang H, Finzi A, Lerdau MT (2008) Increased mercury in forest soils under elevated carbon dioxide. *Oecologia*, 158: 343-354

Mackie J, **Natali SM**, Levinton JS, Sañudo-Wilhelmy SA (2007) Declining metal levels at Foundry Cove, NY (Hudson River, NY): Response to localized dredging of contaminated sediments. *Environmental Pollution*, 149: 141-148

Fang W, Taub DR, Fox GA, Landis RM, **Natali SM**, Gurevitch J (2006) Sources of variation in growth, form and survival in dwarf and normal-stature pitch pines (*Pinus rigida*, Pinaceae), in long-term transplant experiments. *American Journal of Botany*, 93: 1125-1133

CONTRIBUTED PAPERS AND DATASETS

Lead or co-lead on >175 presentations at international science meetings

Lead or contributing author on >40 openly available datasets archived at the Environmental Data Initiative, <https://environmentaldatainitiative.org/>

Lead or contributing author on >35 openly available datasets archived at the Arctic Data Center, <https://arcticdata.io/>

Lead or contributing author on 4 openly available datasets archived ORNL DAAC, <https://daac.ornl.gov/>

COMMUNICATION TO POLICY MAKERS (SELECT)

UNFCCC Climate Change Conference (COP25), co-led Permafrost Day in the Cryosphere Pavilion, December 2019, Madrid

Capitol Hill Briefing organized by Reps. Tonko and Castor, presented overview of Arctic carbon emissions (Natali et al. 2019)

Arctic Circle Assembly, Plenary Session Panelist, Reykjavik, Iceland, October 2016

UNFCCC Climate Change Conference (COP21), ICCI/WHRC Sponsored Side Event, *Thresholds and Closing Windows: Risks of Irreversible Cryosphere Climate Change*, Invited Speaker, 2015 Paris

Contributor to International Cryosphere Climate Initiative (ICCI) report, *Thresholds and Closing Windows: Risks of Irreversible Cryosphere Climate Change*, December 2015

Arctic Circle Assembly, Invited Speaker and Panelist, Reykjavik, Iceland, October 2015

UNFCCC Bonn Climate Change Conference, SB42, ICCI Sponsored Side Event, *Cryosphere as a Lens for Paris: Science-based Urgency and Ambition*, Invited Speaker, June 2015

Capitol Hill and State Dept. meetings, Washington DC. Met with staff from 6 Congressional offices and the House Science Committee, and Senior Arctic officials from the State Department for briefings on relevance of permafrost thaw for global climate, June 2015

MEDIA, OUTREACH, AND EDUCATION (SELECT)

Program Director for [the Polaris Project](#), an undergraduate Arctic research program.

Panelist for a virtual event for [Climate Week 2020: Arctic Permafrost Thaw: Science & Policy](#).

Interviewed by [Living on Earth](#) about the extreme climate events that occurred in the Arctic in the summer of 2020.

Featured in [National Geographic article](#) on Siberian methane craters (2020).

Contributed to a multiple-award winning book, [The Big Thaw](#) (2019), about permafrost thaw and featuring stories of Polaris Project participants.

Worked with a film-maker on an award-winning documentary, [Permafrost Now](#), (2018) that featured participants of the Polaris Project.

Worked with [The N.Y. Times](#) on a permafrost thaw article (2017).

Featured in news segment about permafrost thaw on [CBS This Morning](#), Oct 2017.

Interviewed for [Washington Post article](#) about permafrost emissions in the context of the Paris agreement, Dec 2015.

Press Event at Bonn Climate Conference, media coverage included: Agence France-Presse, which was picked up by >300 media outlets, June 2015.

PROFESSIONAL SERVICE & LEADERSHIP

Permafrost Carbon Network, (Working Group Lead/Member since 2012; Steering Committee since 2019)

NASA Arctic Boreal Vulnerability Experiment, Carbon Dynamics Working Group Lead (2016-2018) and Science Team Member (2016-2020)

International Arctic Systems for Observing the Atmosphere (IASOA), Atmosphere-Surface Exchanges Steering Committee (2016-2017)

American Geophysical Union (AGU) Biogeosciences Section, Outstanding Student Presentation Award Coordinator (2013-2018)

Associate Editor for Biogeosciences Special Issue, Changing Permafrost in the Arctic and its Global Effects in the 21st Century

Guest Editor for Environmental Research Letters, Resiliency and Vulnerability of Arctic and Boreal Ecosystems to Environmental Change: Advances and Outcomes of ABoVE (2017-2020)

PolarTREC Scientist (2011-2013, 2017); several ongoing collaborations with K-12 teachers

Reviewer for ~5-7 manuscripts/year; ~1-3 ad-hoc proposals/year; ~1 panel/year

GRANTS

Building an International Network of Ground Observations for the Arctic Carbon Monitoring and Prediction System, Woodwell Fund for Climate Solutions, 2020-2022, \$98K (lead PI)

Arctic Carbon Monitoring and Prediction System, Gordon & Betty Moore Foundation, 2019-2023, \$2,400K (Lead PI)

The Polaris Project: Catalyzing change in the Arctic research community, NSF IUSE, 2019-2022, \$1,421K (lead PI)

Developing a mechanistic understanding of decomposition of organic matter in frozen soil, NSF DEB, 2019-2021, \$171K (lead PI)

Accounting for permafrost carbon feedbacks in global climate policy: Estimates for gradual thaw, abrupt thaw, and wildfire, One Earth, 2019-2021, \$75K (Lead PI)

Mapping Methane Craters in the Arctic, Heising Simons Foundation, 2019-2021, \$148K (Lead PI)

Integrating science and Indigenous knowledge to support threatened Arctic communities, Woodwell Fund for Climate Solutions, 2019-2021, \$134K (Lead PI)

Establishing an Arctic Climate Change and Carbon Observatory, Woodwell Fund for Climate Solutions, \$180K, 2018-2020 (Lead PI)

Towards a northern pyrogenic carbon budget, Woodwell Fund for Climate Solutions, 2019-2020, \$49K, (J. Sanderman, Lead PI)

Understanding the causes and implications of enhanced seasonal CO₂ exchange in boreal and arctic ecosystems, NASA ABoVE, 2017-2020, \$1,379K (B. Rogers, Lead PI)

Polaris Project: Catalyzing demographic change in the Arctic research community through an immersive and sustained undergraduate research experience, NSF DUE, 2016-2019, \$1,448K (R. Holmes, Lead PI)

Winter respiration in the Arctic: Constraining current and future estimates of CO₂ emissions during the non-growing season, NASA ABoVE, 2015-2019, \$886K (Lead PI)

Mapping Hotspots for Methane Craters in the Siberian Arctic, NASA Novel Research, 2018-2019, \$42K (Lead PI)

Vegetation and ecosystem impacts on permafrost vulnerability, NSF Office of Polar Programs, 2015-2018, \$560K to Woodwell (\$1,270K total, Lead PI)

Fire regime influences on carbon dynamics of Siberian boreal forests. NSF Office of Polar Programs, 2013-2018, \$370K to Woodwell (\$800K total, H. Alexander, Lead PI)

The impact of fire on active layer thickness, NASA Rapid, 2016-2017, \$20K (K. Schaefer, Lead PI)

The carbon balance of Arctic River Deltas: Tundra fire as an agent of system change, NSF Rapid, 2015-2016, \$220K

Russian Visiting Scholars Program, Trust for Mutual Understanding, 2014-2016, \$12K

Developing a pan-arctic ecosystem respiration model, MBL-UChicago Collaboration Award, 2014-2015, \$25K, (E. Rastetter, Lead PI)

Effects of warming and drying on ecosystem carbon balance in Alaskan tundra. NSF Office of Polar Programs, 2012-2015, \$600K (Lead PI)

Vegetation permafrost dynamics in the context of changing climate. National Geographic Society, 2012-2014, \$21K (Lead PI)

FELLOWSHIPS & AWARDS

NSF, Polar Programs Postdoctoral Research Fellowship, 2010-2012

U.S. Permafrost Association, AGU Travel Grant, 2011

NSF, Graduate Research Fellowship, 2004-2008

NSF, Doctoral Dissertation Improvement Grant, 2007-2008

U.S. Department of Energy, Global Change Education Program Graduate Fellowship, 2006-2007

Association for Women in Science, Ruth Satter Predoctoral Award, 2006