

Cover

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Project Title: Cumulative Effects of Arctic Oil Development - planning and designing for sustainability

PD/PI Name: Donald A Walker, Principal Investigator
Gary P Kofinas, Co-Principal Investigator
Yuri L Shur, Co-Principal Investigator

Recipient Organization: University of Alaska Fairbanks Campus

Project/Grant Period: 09/15/2013 - 08/31/2019

Reporting Period: 09/01/2017 - 08/31/2018

Submitting Official (if other than PD\PI): Donald A Walker
Principal Investigator

Submission Date: 07/19/2018

Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions) Donald A Walker

Accomplishments

* What are the major goals of the project?

Cumulative Effects of Arctic Oil Development -- Planning and Designing for Sustainability

Goals of the Project:

Developing arctic oil & gas resources requires extensive networks of roads, pipelines and other forms of infrastructure. The cumulative environmental and social effects of expanding developments are difficult to assess — especially in the face of rapid climate change and unpredictable politics, oil markets, and social and economic changes. Previous analyses of the cumulative effects (CE) of oil and gas development in northern Alaska have recommended comprehensive adaptive planning approaches to 1) minimize the spread of infrastructure across land that is used by indigenous people for subsistence, and 2) reduce the indirect effects of infrastructure that result in the thawing of ice-rich permafrost. A sustainable approach to CE requires collaboration between indigenous people, industry, and scientists from a broad spectrum of disciplines to address these infrastructure-related concerns. This project does that with detailed ground studies, local community input, industry involvement and an international perspective. A project has three major components:

1) Case study of the cumulative effects of industrial infrastructure at Prudhoe Bay, Alaska. This component focuses on infrastructure-related effects associated with gravel mines, roads and other areas of gravel placement. The study includes ground-based studies, an examination of infrastructure and landscape change at multiple scales, and a human dimension component that includes evaluation of adaptive management planning for infrastructure in northern Alaska and CE studies associated with the Iñupiat village of Nuiqsut. The study is developing a process-based understanding of infrastructure-related permafrost/ landform/ vegetation succession in terrain undergoing thermokarst formation (the development of highly eroded landforms that result from the thawing of ice-rich permafrost). The study will help to answer the questions “What will these areas look like in 50-100 years?” and “Can adaptive management methods address the complex issues related to placement, usage and decommissioning of infrastructure in Northern Alaska?”

2) Arctic Infrastructure Action Group: Rapid Arctic Transitions due to Infrastructure and Climate (RATIC). The goal of RATIC is to bring cumulative-effects-of-infrastructure issues to greater prominence within the international Arctic research community and encourage research on the joint effects of climate change and expanding infrastructure in the Arctic. The initiative was developed during the Climate Change 2014 Conference in Ottawa and the Third International Conference on Arctic Research Planning (ICARP III) in Yohama, Japan. RATIC consists of permafrost scientists, ecologists, hydrologists,

engineers, social scientists and educators seeking to develop adaptive management strategies that address the unique issues related to networks of infrastructure in arctic permafrost environments.

3) Education/outreach component. A new field course is training students in arctic system science and introducing them to the issues of industrial development and adaptive management approaches. The 21-day course includes a 16-day expedition along the Elliott and Dalton highways in Alaska. The course includes a visit to Minto, an Athabascan village on the Tolovana River; Wiseman, an old mining community along the Dalton Highway; and the Prudhoe Bay Oilfield, where they learn firsthand about the issues with oilfield infrastructure, its impacts and the oil industry's ecological monitoring and vegetation rehabilitation practices.

*** What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?**

Major Activities:

1. Publication or in review of 27 papers and conference abstracts. See products.
2. Kanevskiy and Shur: Publication of synthesis paper regarding thermokarst degradation and stabilization.
3. Kanevskiy and Shur: Participation and presentation of paper at the 5th European Conference on Permafrost, 23 Jun -Jul1, Chamonix, France.
4. Kofinas serving as Lead Author of IPCC Report "Oceans and Cryosphere – Polar Regions" (Chapter 3). GK is responsible for section on Human Responses to climate change. First order draft of chapter was released for expert public review (2500 comments received) and the second order draft is not in preparation. The final report will be released 2019.
5. G. Kofinas Organized and facilitated workshop with community (tribal, village corporation, and city) leaders of Nuiqsut to discuss research findings and get input. As part of the meeting cumulative effects were discussed as related to implications to local communities situated adjacent to an expanding oil field.
6. Gary Kofinas Guest editor of Special Issue of *Frontiers in Ecology and the Environment*.
7. Gary Kofinas and students conducted ~30 interviews with industry and agency staff on adaptive management of cumulative effects completed. T Curry, PhD student, left our research project and a new student, Barbara Johnson, is now joining and will complete the interviews in Sept. After that we will complete the coding and prepare a manuscript based on our findings.
8. AGC18-01 Data Report: SNOW, THAW, TEMPERATURE, AND PERMAFROST BOREHOLE DATA FROM THE COLLEEN & AIRPORT SITES, PRUDHOE BAY, AND PHOTOS OF QUINTILLION FIBER OPTIC CABLE IMPACTS, NORTH SLOPE, ALASKA (see attached report)
9. Walker et al.: submission of synthetic article regarding cumulative effects of infrastructure and climate change at Prudhoe Bay: Walker, D. A., Shur, Y., Kanevskiy, M., Reynolds, M., Kofinas, G., Romanovsky, V., et al. (2018). Cumulative effects of oilfield infrastructure and climate change in the Prudhoe Bay Oilfield, Alaska, illustrate the need for an international strategy to address rapid arctic transitions due to infrastructure and climate. *Frontiers in Ecology and the Environment*. (see attached)
10. Walker et al.: Contributions and co-authors of two chapter the AMAP Snow, Water, Ice and Permafrost 2017 Update.
11. Walker and Reynolds: Participation and 2 presentations at the 48th Annual Arctic Workshop, Boulder Colorado, 4-6 April 2018.
12. Walker, Breen, Kanevskiy, Shur: Summer field course: Arctic Alaska Vegetation: Field Excursion to the Brooks Range & Beyond, 14-30 June 2018 (see below under Training and Professional Development)

Specific Objectives:

During 2017–18 our specific objectives were:

- Followup on the RATIC workshop at 2017 Arctic Science Summit Week in Prague
- Write a section regarding human responses to climate change for the IPCC Report "Oceans and Cryosphere (Chapter 3)

- Contribute to the 2017 SWIPA Report with chapters describing the 2015 flood at Prudhoe Bay, the linkages between hydrology and vegetation in the Arctic.
- Finish analysis of the data from 383 iButton data loggers that were installed along 4 ArcSEES transects at Prudhoe Bay
- Complete a data report from the 2016 winter field season.
- Write a synthesis paper regarding the cumulative effects of infrastructure and climate in the Prudhoe Bay oilfield
- Plan for other synthesis activities of the project.

Significant Results: We completed all the above goals, which are described under "Major Activities"

Key outcomes or Other achievements:

*** What opportunities for training and professional development has the project provided?**

1. Three new graduate students received partial support from this grant.

Shawnee Gowan: logistic support for work at her research site on the Grizzly Glacier.

Rose Vining: logistic support to help with ArcSEES data sets at Prudhoe Bay.

Barbara Johnson: new graduate student working with Gary Kofinas on human dimensions of the project.

2. Summer course, "Arctic Alaska Vegetation, Field Excursion to the Brooks Range and Beyond" 14-30 June 2018. See attached syllabus.

*** How have the results been disseminated to communities of interest? If so, please provide details.**

Nothing to report.

*** What do you plan to do during the next reporting period to accomplish the goals?**

1. Completion of papers for the Special Issue of *Frontiers in Ecology and the Environment*.

2. Write a synthesis paper regarding the "cumulative effects to vegetation of oilfield development and climate change" to be submitted to *Applied Vegetation Science*.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
Cover only.pdf	Summer field course syllabus	Donald Walker	07/19/2018
2018_SummerFieldCourse_BIOL495-695_Syllabus_FINAL.pdf	Syllabus for summer course	Donald Walker	07/19/2018
AGC 18-01 Data Report DRAFT 20180718.pdf	Data Report AGC18-01	Donald Walker	07/19/2018
Cumulative effects of infrastructure and a warming Arctic to permafrost and ecosystems20180819(96dpi)sw.pdf	Walker et al. 2018 submitted. Cumulative effects of infrastructure and a warming climate to permafrost and arctic ecosystems	Donald Walker	07/19/2018

Products

Books

Book Chapters

Berman, M., Kofinas, G., and BurnSilver, S. (2017). Measuring Community Adaptive and Transformative Capacity in the Arctic Context. *Northern Sustainability, Understanding and Addressing Change in the Circumpolar World* Gail Fondahl and Gary Wilson. Springer. Heidelberg. 59. Status = PUBLISHED; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes

BurnSilver, S.B., R. Boone, G. Kofinas, and T. Brinkman (2018). Tradeoffs in the mixed economies of village Alaska: Hunting, working and sharing in the context of change. *The Give and Take of Sustainability: Archaeological and Anthropological Perspectives* New Direct. M. Hegemony. Cambridge University Press. Cambridge. 52. Status = PUBLISHED; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes

Mård, J., Box, J. E., Brown, R., Mack, M., Mernild, S. H., Walker, D., & Walsh, J. (2017). Cross-cutting scientific issues. *Snow, Water, Ice and Permafrost in the Arctic (SWIPA) 2017* AMAP. Arctic Monitoring and Assessment Programme. Oslo. 231. Status = PUBLISHED; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes ; OTHER: <https://www.amap.no/documents/doc/Snow-Water-Ice-and-Permafrost-in-the-Arctic-SWIPA-2017/1610>.

Padilla, E and G Kofinas (2018). Letting the Leaders Pass: Barriers to Using Traditional Ecological Knowledge in Co-management as the Basis of Formal Hunting Regulations. *When the Caribou Do Not Come: Indigenous Knowledge and Adaptive Management in the Western Arctic* Brenda L Parlee and Ken Caine. UBC Press. Vancouver. 190. Status = PUBLISHED; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes

Romanovsky, V., Isaksen, K., Drozdov, D., Anisimov, O., Instanes, A., Leibman, M., McGuire, A. D., Shiklomanov, N., Smith, S., Walker, D. (2017). Changing permafrost and its impacts. *Snow, Water, Ice and Permafrost in the Arctic SWIPA 2017* AMAP. Arctic Monitoring and Assessment Programme. Oslo. 66. Status = PUBLISHED; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes ; OTHER: <https://www.amap.no/documents/doc/Snow-Water-Ice-and-Permafrost-in-the-Arctic-SWIPA-2017/1610>.

Inventions

Journals or Juried Conference Papers

Bjella, K., Kanevskiy, M., and Hinkel, K. (2017). The Use of Electrical Resistivity Methods for Ground Ice Characterization for Engineering. *Congress on Technical Advancement Cold Regions Engineering*. 2017 59. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Blair, B and G Kofinas (2018). A comparison of risk perceptions between levels of government in Arctic Alaska underscores the importance of scale in problem definition for adaptation decisions. *Frontiers in Ecology and the Environment – Frontiers in Ecology and the Environment – Special Issue “Social-Ecological Dynamics at the Extreme: Arctic Alaska”*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Brinkman, T, Kofinas, G. et al. (2018). Community research fatigue: A search for solutions. *Frontiers in Ecology and the Environment – Special Issue “Social-Ecological Dynamics at the Extreme: Arctic Alaska”*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Coulombe, S., Fortier, D., Lacelle, D., Kanevskiy, M., and Shur, Y. (2018). Origin, burial and preservation of late Pleistocene-age glacier ice in Arctic permafrost (Bylot Island, NU, Canada). *The Cryosphere*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Fortier, D., Strauss, J., Slioger, M., Calmels, F., Froese, D., and Shur, Y. (2018). Late Pleistocene yedoma in south-western Yukon (Canada): a remnant of Eastern Beringia?. *5th European Conference On Permafrost – Book of Abstracts, 23 June - 1 July 2018, Chamonix, France*. 637. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Frost, G. V., Christopherson, T., Jorgenson, M. T., Liljedahl, A. K., Macander, M. J., Walker, D. A., & Wells, A. F. (2018). Regional patterns and asynchronous onset of ice-wedge degradation since the mid-20th century in arctic Alaska.. *Remote Sensing*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Kanevskiy M., Shur, Y., and Jorgenson, T. (2018). Ice-wedge thermokarst: Past, present, and future.. *5th European Conference On Permafrost – Book of Abstracts, 23 June - 1 July 2018, Chamonix, France*. 647. Status = PUBLISHED;

Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Kanevskiy, M., Shur, Y., Jorgenson, T., Brown, D. R. N., Moskalenko, N. G., Brown, J., et al. (2017). Degradation and stabilization of ice wedges: Implications for assessing risk of thermokarst in northern Alaska. *Geomorphology*. 297 20. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: doi: 10.1016/j.geomorph.2017.09.001

Koch, J.C., Jorgenson, M.T., Wickland, K.P., Kanevskiy, M., and Striegl, R. (2018). Ice wedge degradation and stabilization impacts water budgets and nutrient cycling in arctic trough ponds. *Journal of Geophysical Research –Biogeosciences*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Kofinas, G and J. Schmidt (2018). The Art and Science of Assessing Resilience of Arctic Alaska. *Frontiers in Ecology and the Environment – Special Issue “Social-Ecological Dynamics at the Extreme: Arctic Alaska”*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Schmidt, J and G Kofinas (). Local knowledge and western science in a rapidly changing socio-ecological system. *Frontiers in Ecology and the Environment – Special Issue “Social-Ecological Dynamics at the Extreme: Arctic Alaska”*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Schmidt, J, G Kofinas, N. O’Neal, T. Brinkman (). Local Knowledge and Science: Observations of Landscape Change in the Nuiqsut Homelands. *Special Report published by the University of Alaska Fairbanks – A report of the Alaska EPSCoR Project*. 1-24. Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = No

Stephani, E., Kanevskiy, M., Darrow, M., Croft, P., Drage, J., and Wuttig, F. (2018). Early self-stabilization conditions of a retrogressive thaw slump, North Slope, Alaska. *5th European Conference On Permafrost – Book of Abstracts*. 207. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Walker, D. A. (2018). Hierarchical arctic vegetation mapping, classification, and transects: A framework for examining arctic terrestrial change. *48th International Arctic Workshop*. Abstract ID 15. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; OTHER: from http://instaar.colorado.edu/meetings/AW2018/abstract_details.php?abstract_id=15

Walker, D. A., Daniëls, F. J. A., Matveyeva, N. V., Šibík, J., Walker, M. D., Breen, A. L., et al. (2018). Circumpolar Arctic Vegetation Classification. *Phytocoenologia*, 48 181. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: <http://doi.org/10.1127/phyto/2017/0192>

Walker, D. A., Shur, Y., Kanevskiy, M., Reynolds, M., Kofinas, G., Romanovsky, V., et al. (2018). Cumulative effects of oilfield infrastructure and climate change in the Prudhoe Bay Oilfield, Alaska, illustrate the need for an international strategy to address rapid arctic transitions due to infrastructure and climate. *Frontiers in Ecology and the Environment*. . Status = SUBMITTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Yu, Q., Epstein, H., Engstrom, R., & Walker, D. (2017). Circumpolar arctic tundra biomass and productivity dynamics in response to projected climate change and herbivory. *Global Change Biology*. 94 713. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: <http://doi.org/10.1111/gcb.13632>

Zhang, X., Bianchi, T. S., Cui, X., Rosenheim, B. E., Ping, C.-L., Hanna, A. J. M., Kanevskiy, M., Schreiner, K.M., Allison, M. A. (2017). Permafrost organic carbon mobilization from the watershed to the Colville River delta: Evidence from 14C ramped pyrolysis and lignin biomarkers. *Geophysical Research Letters*. 44 11491. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: doi: 10.1002/2017GL075543.

Zhou, Jiake, Laura Prugh, Ken D. Tape, Gary Kofinas, and Knut Kielland (2017). The role of vegetation structure in controlling distributions of vertebrate herbivores in Arctic Alaska. *Arctic, Antarctic, and Alpine Research*. 49 (2), 291. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Zhou, Jiake, Laura Prugh, Ken D. Tape, Gary Kofinas, and Knut Kielland (2017). The role of vegetation structure in controlling distributions of vertebrate herbivores in Arctic Alaska. *Arctic, Antarctic, and Alpine Research*. 49 (2), 291. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Licenses

Other Conference Presentations / Papers

Raynolds, M. K., Walker, D. A. (2018). *A raster-based circumpolar arctic vegetation map*. 48th Annual International Arctic Workshop, Boulder, CO, 4-8 April 2018. Boulder, CO. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Other Products

Data Report.

Walker, D. A., Kanevskiy, M., Raynolds, M. K., & Peirce, J. L. (Eds.). (2018). *2016 ArcSEES data report: Snow, thaw, temperature and permafrost borehole data from the Colleen & Airport sites, Prudhoe Bay, Alaska, and Quintillion fiber optic cable impacts, North Slope, Alaska* (No. AGC18-01. (p. 67). Fairbanks, In house data report, published on line at https://www.geobotany.uaf.edu/library/pubs/WalkerDA2018_agc18-01_datarpt.pdf

This is third and final data report of the ArcSEES project,

“Cumulative Effects of Arctic Oil Development—

Planning and Designing for Sustainability.” It includes

data collected during five field trips in 2014–2016 from

five research transects established at the Lake Colleen

Site A and Airport study sites in the vicinity of Deadorse,

Prudhoe Bay, Alaska.

This report focuses on methods, data and results in

the following areas:

- Summer thaw and water depths at the Colleen

Site A and Airport study sites during field trips in

August 2014, 2015, and 2016.

Snow depths and snow-pit descriptions collected

during 27–30 March 2016.

- Thermokarst boreholes: 28 boreholes at the

Airport study site in August 2015, and 3 boreholes

in thermokarst pits on Transect 1 (Colleen

Site A) and Trasect 5 (Airport site) from 27–30

March 2016.

- Air, snow, and soil temperature data recorded

with iButton® temperature loggers placed along

transects and at permanent vegetation plots in

2014–2016.

- Quintillion fiber-optic cable

Other Publications

Gerlach, Craig, Philip A. Loring, Gary Kofinas, and Henry Penn (2017). *Resilience to Rapid Chang in Bering, Beaufort, and Chukchi Sea communities*. Chapter 6 of Adaptation Actions for a Changing Arctic (AACA) Bering/Chukchi/Beaufort Region Report.. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Patent Applications**Technologies or Techniques****Thesis/Dissertations****Websites or Other Internet Sites****Participants/Organizations****What individuals have worked on the project?**

Name	Most Senior Project Role	Nearest Person Month Worked
Walker, Donald	PD/PI	4
Kofinas, Gary	Co PD/PI	1
Shur, Yuri	Co PD/PI	1
Buchhorn, Marcel	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Raynolds, Martha	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Matyshak, George	Other Professional	2
Peirce, Jana	Other Professional	2
Wirth, Lisa	Other Professional	1
Curry, Tracie	Graduate Student (research assistant)	1

Full details of individuals who have worked on the project:**Donald A Walker****Email:** dawalker@alaska.edu**Most Senior Project Role:** PD/PI**Nearest Person Month Worked:** 4**Contribution to the Project:** Project PI, Vegetation analysis, data report editor, publication of paper to FEE**Funding Support:** NASA grant NNX14AD90G**International Collaboration:** Yes, Russian Federation**International Travel:** No**Gary P Kofinas****Email:** gary.kofinas@alaska.edu**Most Senior Project Role:** Co PD/PI**Nearest Person Month Worked:** 1**Contribution to the Project:** Co-PI

Funding Support: This grant

International Collaboration: Yes, Russian Federation

International Travel: No

Yuri L Shur

Email: yshur@alaska.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 1

Contribution to the Project: co-PI

Funding Support: This project

International Collaboration: No

International Travel: No

Marcel Buchhorn

Email: mbuchhorn@alaska.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 0

Contribution to the Project: Post-doc, field work, GIS/remote sensing lab manager, building new facility

Funding Support: This project plus NASA LCLUC Grant, and PreABoVE

International Collaboration: Yes, Germany

International Travel: No

Martha K Raynolds

Email: mkraynolds@alaska.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 1

Contribution to the Project: Field research, mapping, writing publications

Funding Support: This project

International Collaboration: No

International Travel: No

George Matyshak

Email: matyshak@gmail.com

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 2

Contribution to the Project: Soils descriptions and analysis at field sites

Funding Support: travel support from this grant

International Collaboration: Yes, Russian Federation

International Travel: No

Jana L. Peirce

Email: jlpeirce@alaska.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 2

Contribution to the Project: Writing and editing reports, field work, data analysis

Funding Support: this grant

International Collaboration: No

International Travel: No

Lisa Wirth

Email: lisa@gina.alaska.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: Mapping, GIS, web site, field work

Funding Support: This project, NASA PreABoVE project

International Collaboration: No

International Travel: No

Tracie Curry

Email: tncurry3@alaska.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Ph.D. thesis

Funding Support: This project

International Collaboration: No

International Travel: No

What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
Earth Cryosphere Institute	Other Organizations (foreign or domestic)	Tyumen, Russia
University of Eastern Finland	Academic Institution	Finland

Full details of organizations that have been involved as partners:

Earth Cryosphere Institute

Organization Type: Other Organizations (foreign or domestic)

Organization Location: Tyumen, Russia

Partner's Contribution to the Project:

Financial support

In-Kind Support

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution: Helping with RATIC workshop and Russian case study

University of Eastern Finland

Organization Type: Academic Institution

Organization Location: Finland

Partner's Contribution to the Project:

Financial support

Collaborative Research
Personnel Exchanges

More Detail on Partner and Contribution: Helping with the RATIC workshop and Russian case study

What other collaborators or contacts have been involved?

Nothing to report

Impacts

What is the impact on the development of the principal discipline(s) of the project?

1. Contributing a fundamental understanding of long-term effects of roads and climate change to permafrost and ecosystems.
2. Long-term vegetation change near roads.
3. Deep understanding of climate-related and infrastructure-related thermokarst.
4. Consequences of roads to snow regimes and dust regimes, effects on species diversity, and vegetation structure.

What is the impact on other disciplines?

The research has relevance to a wide variety of scientific, engineering, and education disciplines. The research is providing a better understanding of the complex processes and impacts involved with construction of infrastructure in the Arctic, and how these impacts are interacting with climate change. It will contribute to a better understanding of permafrost-hydrological interactions, the impacts of road dust, altered snow regimes, and flooding associated infrastructure. It should help with better engineering of roads. The human dimensions aspects are focusing on how to adaptively manage the impacts of development and climate change, how various stakeholder groups view and address the issue of cumulative impacts. The education component is addressing the need to better educate students and other stakeholders on the arctic systems, development in the Arctic, and impact of both climate change and

What is the impact on the development of human resources?

We conducted a 17-day summer field course (BIOL 495/695, Arctic Alaska Vegetation) along the Dalton Highway to provide students with deep understanding of tundra vegetation, permafrost, wildlife, disturbances, climate change, and ecosystem processes.

Three graduate students received partial support from this grant.

1. Tracie Curry was the third year of her Ph.D. and moved to another to another project.
2. Rose Vining was developing a master's thesis project at Prudhoe Bay with some minor support from this project and decided to take a leave of absence.
3. Shawnee Gowan is working on master's thesis regarding vegetation succession following glaciation. She received with some minor project support from this grant, but is primarily being supported through teaching assistants and small grants.

What is the impact on physical resources that form infrastructure?

Nothing to report.

What is the impact on institutional resources that form infrastructure?

Nothing to report.

What is the impact on information resources that form infrastructure?

Nothing to report.

What is the impact on technology transfer?

Nothing to report.

What is the impact on society beyond science and technology?

See above "what is the impact on human resources"

Changes/Problems**Changes in approach and reason for change**

Nothing to report.

Actual or Anticipated problems or delays and actions or plans to resolve them

We will apply for a no-cost extension in August to finish several publications and to present results and organize/participate in a Rapid Arctic Transitions due to Infrastructure and Climate Workshop at Arctic Science Summit Week 2019.

Changes that have a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use or care of biohazards

Nothing to report.

Special Requirements**Responses to any special reporting requirements specified in the award terms and conditions, as well as any award specific reporting requirements.**

Nothing to report.