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SUSTAINABILITY SCIENCE, ECOLOGY

Surviving Siberia

The Yamal region in western Siberia, Russia, has long been thought of as a bellwether of Arctic tundra ecosystems experiencing the effects of climate change. In addition to warming, the region is also subject to other disruptions, such as industrial development, pollution, and socio-economic upheaval. Bruce Forbes et al. report that, despite the fragmentation and transformation of a large proportion of the Yamal environment, the native Nenet people have proven largely resistant to the changes around them for the past 1,000 years. The authors found that the Nenets' social–ecological system has adapted to the effects of recent land use and environmental changes, allowing them to avoid or exploit a range of natural and anthropogenic habitats. Analyzing ≈30 years of natural and social science data on the nomadic, pastoral herders, the authors suggest that the Nenets and their large reindeer herds may be more resilient to rapid ecological changes than previously thought. The authors caution, however, that continued expansion of infrastructure like oil and gas fields under development in the area, combined with terrestrial and freshwater ecosystem degradation, climate change, and an influx of workers, could present a threat to the Nenets in the future. — J.L.

Nomadic caravans crossing under a pipeline.

"High resilience in the Yamal-Nenets social–ecological system, West Siberian Arctic, Russia" by Bruce C. Forbes, Florian Stammler, Timo Kumpula, Nina Meschtyb, Anu Pajunen, and Elina Kaarlejärvi (see pages 22041–22048)

ENGINEERING

Three-dimensional cellular migration

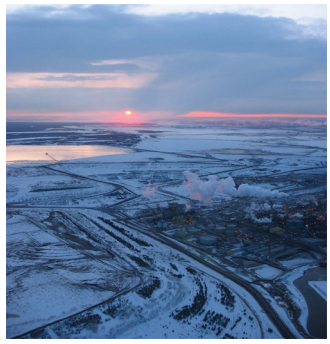
Although coordinated cell movement in mammals is important for tissue formation, wound healing, and immune responses, researchers have not been able to model realistic, three-dimensional cellular migration. An improved understanding of the mechanical interactions between cells and their surroundings could help researchers explore the consequences of errors in normal cell movement, such as tumors. Stacey Maskarinec et al. report a method that combines laser scanning confocal microscopy and a digital volume correlation algorithm that may allow researchers to track and measure cell-mediated deformation in three dimensions. The authors demonstrated the technique in vitro using fibroblasts on polyacrylamide gels of various depths and thicknesses, on which time-lapse confocal imaging showed the movement and displacement of the cells in the x-, y-, and z planes. Their findings were similar to earlier two-dimensional analyses, and the authors suggest that the outcome can provide additional information about how cells explore vertical movement. Although the study did not simulate a particular type of cell, the results could be used to explore the properties of biomaterials for cells used, for example, in regenerative medicine, according to the authors. — J.L.

"Quantifying cellular traction forces in three dimensions" by Stacey A. Maskarinec, Christian Franck, David A. Tirrell, and Guruswami Ravichandran (see pages 22108–22113)

ENVIRONMENTAL SCIENCES

Unexpected pollution from Alberta's oil sands

In Canada, the northern Alberta oil sands projects are part of a booming industry in which bitumen is extracted from sand and upgraded into crude oil. Erin Kelly et al. have found that the projects are releasing greater amounts of polycyclic aromatic compounds (PACs) into the Athabasca River and its tributaries than previously reported. The authors measured PAC concentrations in the Athabasca, its tributaries, and snow and report that snow was contaminated with PAC within 50 km of oil sands projects, with highest levels found near the projects. In water, PAC concentrations were sufficient to cause



Oil sands development on west bank of Athabasca River.

toxicity to fish, including higher rates of mortality and deformities, lower growth rates, and sex hormone deficiencies. According to the authors, the Regional Aquatics Monitoring Program should be redesigned, release its full results and data to the public, and have better scientific and technical oversight to monitor pollution and runoff, which is expected to increase in the next decade. — P.D.

"Oil sands development contributes polycyclic aromatic compounds to the Athabasca River and its tributaries" by Erin N. Kelly, Jeffrey W. Short, David W. Schindler, Peter V. Hodson, Mingsheng Ma, Alvin K. Kwan, and Barbra L. Fortin (see pages 22346–22351)

NEUROSCIENCE, PSYCHOLOGICAL AND COGNITIVE SCIENCES

Reward circuitry underpowered in depression

Losing pleasure or interest in previously rewarding stimuli, such as favorite foods or hobbies, is a hallmark of major depressive disorder. Depression not only reduces a person's capacity to feel pleasure, but, according to imaging studies, also reduces their ability to sustain positive responses and complete the brain's reward circuit. Previous work suggested that the loss of pleasure may be due to a decreased capacity to feel the emotion, but Aaron Heller et al. looked instead to deficits in reward-processing and emotion-regulation networks. The authors investigated the neural underpinnings of this symptom by using fMRI to compare activation patterns in the brains of depressed and control subjects. Measuring the ability of subjects to enhance their positive emotion, the authors found that depressed subjects were unable to sustain activation in the brain region known as nucleus accumbens, which is involved in building positive responses and reward. Knowing that the capacity for pleasure exists but that the circuitry to sustain positive responses in the brain's reward system is misfiring may help researchers devise drug therapies or behavioral modifications to strengthen positive connections in the nucleus accumbens, according to the authors. — T.H.D.

"Reduced capacity to sustain positive emotion in major depression reflects diminished maintenance of fronto-striatal brain activation" by Aaron S. Heller, Tom Johnstone, Alexander J. Shackman, Sharee N. Light, Michael J. Peterson, Gregory G. Kolden, Ned H. Kalin, and Richard J. Davidson (see pages 22445–22450)