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Deadly Modernity

The Environmental Crisis Behind Mongolia's Swift Development

March 10 and 11, 2016

**University of California, Berkeley
180 Doe Library**

Schedule of Events

Thursday, March 10

4:00 pm

Welcoming Remarks

Patricia Berger, UC Berkeley

Dorj Bayarkhu, Mongolian Consulate of San Francisco

Panel 1 - Mongolia's Environment: The Current Crisis and Historical Perspective

Chair: Patricia Berger, UC Berkeley

Oyungerel Tsedevdamba, Member of Parliament, Mongolia
“The Main Challenges to Land, Air and Water Caused by the Current Development of Mongolia”

Alicia Campi, The Jamestown Foundation
“Impacts of Mongolian Environment Issues on Domestic Politics, FDI, NEA”

Clyde Goulden, Drexel University
“Impacts of Climate Change to Mongolian Nomads”

Keynote Address

David Sneath, University of Cambridge

**“Mongolian Pastoralism and Sustainability:
Sociotechnical System Analysis and Rural
Reform”**

Friday

9:00 am

Panel 1 Continued - Mongolia's Environment: The Current Crisis and Historical Perspective

William Fitzhugh, Smithsonian Institution

“Archaeology, Heritage, and the Environment: Looking at the Present from the Bronze Age”

9:30 am

Panel 2 - Mining, Water, and the Steppes Under Stress

Part 1: Brian Baumann, UC Berkeley

Amy Hessel, West Virginia University

“Past, Current, and Future Drought in Mongolia”

Yuma Argo, Monterey County Health Department

(written with **Chuluunkhuyag Sangi**, Mongolian University of Science and Technology)

“Water Resources and Policy of Mongolia”

Sara Jackson, Metropolitan State University of Denver

“Will There Be Any Water Left to Pollute? Perceptions of Mining, Water Infrastructure, and Changing Visions of Land Use in Umnigovi Aimag”

Break

Part 2: Chair Franck Billé, Mongolia Initiative

Kirsten Dales, University of British Columbia

“Exploring the Political Ecology of Transboundary Resource Conflicts in Mongolia and Beyond”

Orhon Myadar, University of Arizona

“Digging Deeper: Beyond the Resource Nationalism Label”

Olaf Jensen, Rutgers University

“The River Wolf and the Blue Pearl: Conserving Mongolia's Aquatic Ecosystems in an Age of Global Change”

Discussion

12:30-2 pm

Lunch Break

2:00 pm

Panel 3 - Air Toxicity in Ulan Bator

Chair: Kirk Smith, UC Berkeley

Kirk Smith, UC Berkeley

“Air Pollution and Health: It Does Not Matter Where But It Does Matter Whom”

Purevdorj Baljinnyam Olkhanud, Mongolian National University of Medical Sciences

“Lead Exposure Among School Children in Ulan Bator”

Larry Dale, Lawrence Berkeley National Laboratory

“Quantifying Space Heating Stove Emissions Related to Different Use Patterns in Mongolia”

Break

Bolormaa Enkhbat, World Bank
“Mongolia’s Sustainable Development in a Global Context”

Oyungerel Tsedevdamba, Member of Parliament, Mongolia
“What Can and Should the Current Parliament and Government Do To Reduce Air Pollution”

Discussion

Break

4:30 pm

Panel 4 - Current and Future Action: Environmental Threats and the Roles of Government, NGOs, and Stakeholders

Chair: Alicia Campi, The James Town Foundation

Julian Dierkes, University of British Columbia
“Why is There No Environmental Movement in Mongolia?”

Roundtable:

Alicia Campi, The Jamestown Foundation

Oyungerel Tsedevdamba, Member of Parliament, Mongolia

Kirsten Dales, CIRDI, University of British Columbia

Bolormaa Enkhbat, World Bank

Sara Jackson, Metropolitan State University Denver

Orhon Myadar, University of Arizona

Kirk Smith, UC Berkeley

Discussion

Abstracts

Yuma Argo and Chuluunkhuyag Sangi

Water resources in Mongolia are decreasing due to climate change, unregulated use of water sources, and pollution. At the same time, demand for water resources is increasing as a result of population growth and economic expansion. In recent years, 569 lakes and three times as many rivers and creeks have disappeared. A few thousand engineered wells and waste water treatment plants have also disappeared. In rural areas, many people get sick. They know it is because of the drinking water; however, there are no laboratories to analyze water quality in these areas. Mongolia views this as a critical issue. Solving the stressed freshwater situation in Mongolia would require a coordinated approach of governmental institutions, donors, NGOs and key stakeholder. However, at present, there are no fully developed, integrated, institutional and legal infrastructures on Integrated River Basin Management (IRBM) issues in Mongolia. Thus, there is an urgent need to consider implementing the IRBM principles for sustainable water management.

Alicia Campi

Mongolian environmental issues impact and are impacted by the intersection of domestic politics and the proactive policies in the last twenty years of all Mongolian administrations, regardless of political party, to attract foreign direct investment (FDI), develop globalization development strategies and Northeast Asia regional integration plans, and respond to national security issues. This presentation will interweave the specific environmental problems and potential solutions into the wider context of Mongolia's growing role in Eurasia. It will

frankly address the role of western and Chinese investors and their ability to pressure Mongolian policymakers to develop mining policies and enforce environmental regulations, and review the positive and negative influences of foreign based or funded environmental NGOs on both Mongolian politicians and the local population.

Larry Dale

To reduce levels of outdoor air pollution, new energy-efficient solid fuel stoves have been offered for sale in the *ger* regions of Ulaanbaatar, the capital city of Mongolia. These energy-efficient stoves ideally use less fuel than the traditional stove and emit a tenth of the pollutant emissions. However, because the stoves were only broadly introduced in August 2011, limited documented information exists of actual household fuel and stove use behaviors or the impact of those behaviors on emissions. During the 2011-2012 heating season (October–March), we evaluated stove use behavior in a small subset of *ger* households with either a traditional or an energy-efficient stove. Relying on a combination of in-person interviews and stove use monitor (SUM) technology, we observe that stove use behavior can vary substantially between households and identify three main burn cycles related to the use of the energy-efficient stove, which may impact the degree to which particulate matter (PM) emissions can be mitigated. We analyze the temperature data recorded by the SUMs from a convenience sample of 13 *ger* households with small Turkish (Ulzi) stoves and 4 households with traditional Mongolian stoves. We show that SUMs can potentially play a key role in identifying the frequency of ignition and refueling events and thus the impact user behavior can have on stove emissions. Our analysis reveals that households using small-Turkish stoves in our cohort use their stoves on average 2.5 times per day during

the heating season (December 2011-February 2012). But, in a subset of these *ger* households, the small-Turkish stove use frequency can be as high as four stove use events per day, suggesting the occurrence of refueling events that may lead to increased PM emissions.

Kirsten Dales

In recent decades, Mongolia has experienced rapid economic growth with one of the world's fastest emerging mineral-based economies. With Mongolia moving away from socialism in 1990 and transitioning to a market economy, livestock privatization, coupled with extraordinary periods of extractive growth and the liberalization of trade policies, has resulted in degradation of land, water and forest resources. While mining offers the potential to support broad-based social and economic development, environmental degradation resulting from mineral extraction has become a highly politicized issue at local, national and regional scales. The synergistic impacts of mining and climate change on land degradation, desertification and water scarcity have disproportionately high impacts on vulnerable rural populations with implications for local livelihoods, national resource interests and regional geopolitics. While changes on the Mongolian landscape have been historically affected by the physical climate, land tenure policies and pastoral herding strategies, increased vulnerability to climate change and water scarcity have arisen as critical topics for Mongolia and neighboring countries. Overall, 210 rivers flow through Mongolia into Russia and China, and numerous agreements on transboundary waters since 1905. In general, drainage basins of trans-boundary rivers between Mongolia and the Russian Federation cover 31% of the Mongolia's territory, while China shares surface water bodies and ground water resources spanning 9 *aimags*. Drawing

linkages between neoliberal governance regimes, livelihood insecurity and political ecology of water, this paper probes transboundary water conflicts in the wake of Mongolia's rapid development with a specialized focus on the decentralization of water governance and politics of scale.

Julian Dierkes

Nature is of great symbolic, social, and economic importance to Mongolians. At the same time, nature is visibly threatened by climate change, dynamics of the livestock economy, and industrial as well as artisanal mining activities. Yet, no large-scale and generalized environmental movement has emerged from Mongolia's vibrant civil society. I examine Mongolia from the perspective of political opportunities and post-modern values to tentatively conclude that many social relations are either atomistic or organized vertically in Mongolia leading to a failure to coalesce around a broader environmental movement.

Bolormaa Enkhbat

The global community came together in 2015 to approve the Sustainable Development Goals (SDGs) and the Paris Agreement. We are now tasked with moving from announcements to implementation in achieving globally agreed goals of ending poverty by 2030 and holding the increase in global temperature to well below 2 °C. The ambitious goals of these two agendas have varying implications for countries at different stages of development. What does “sustainable development” mean for Mongolia and its future growth? What does it mean to strike a balance between economic development and environmental sustainability? Does one come at the expense of the other? Mongolian government policies (Green growth plan, INDC, Energy master plan, etc.) lay out a

vision for green development, in line with global trends. The challenge at hand is to materialize our plans into action. .

William Fitzhugh

Mongolia appears to many as a timeless landscape, unmodified by glacial epochs, agriculture, or--until recently--urbanism, agriculture, and industrialization. Nevertheless, great changes have in fact taken place during the past 10,000 years in its landscapes, cultures, and history. In this presentation we explore a few of these revolutionary changes, with particular attention to changes that occurred during the Bronze Age, ca. 3000 years ago, when deer stones and khirigsuur monuments appear and for the first time people began making a prominent mark on the land.

Clyde Goulden

Mongolians have several names for rains including *shivree borro*, and *zuser borro* for different types of light warm rains, and *aadar borro* for intense cold rains or thunderstorms. Interviews with nomadic herders near Lake Hövsgöl and in Hentii Aimag to understand their perceptions of the changing climate suggest that as the climate has warmed (more than 2° C since 1940), rains have changed from *shivree* or *zuser* rains lasting from one half to 2-3 days, to an increased frequency of *aadar* rains that last less than one hour. This suggests a transition from stratiform to convective rains. Herders claimed the *aadar* rains were very damaging to their pastures, their animals and their families while tending herds, and increases runoff and causes localized flooding.

Amy Hessler

Understanding connections between climate, ecosystems, and society during historical and modern climatic transitions requires annual resolution records with high fidelity climate signals. In semi-arid regions, high temperatures in coming decades are projected to increase the frequency, duration, and severity of droughts. Drought conditions in Mongolia's grasslands are directly tied to grassland productivity, the basis for its pastoralist economy. Between 1996-2011, Mongolia experienced an extended drought that coincided with rapidly changing political, social, and environmental conditions. Because Mongolia's climate is highly variable, it is difficult to place recent climatic extremes and associated social and ecological change in context without long records of climatic variability. Here we ask: 1) how extreme was the 21st century drought in the last two millennia? 2) what is the forecast for drought in the next 100 years? 3) what are the consequences of future drought for pastoralism? We present a 2061-year long tree-ring reconstruction of growing-season drought, derived from live and dead Siberian pine (*Pinus sibirica*) trees from two lava flows in central Mongolia. These trees are water-stressed and their radial growth is correlated with both soil water availability (scPDSI) and grassland productivity. To contextualize the severity of recent droughts, and to explore the range of future conditions, we perform long control runs of GFDL climate model. Our reconstructions, calibrated and validated on instrumental June-September scPDSI (1959-2011) account for >70% of the variability in regional scPDSI when >70% of the annual rainfall occurs. Our tree-ring data combined with existing reconstructions of temperature, meteorological data, and model results suggest that while the late 20th century pluvial was one of the wettest, the early 21st century drought was one of the most severe and hot droughts in

the last two millennia. Our results suggest that future moisture conditions are highly uncertain and could result in both extremely high productivity or continued high severity drought and low grassland productivity. These results support the need for both flexible policy and additional research on moisture delivery to Inner Asia.

Sara Jackson

Water is central to contestations over Mongolia's mining boom, particularly in South Gobi province where some of the country's largest mines are located including the Oyu Tolgoi copper-gold mine. While water resource rights and scarcity have been the focus of community complaints against Oyu Tolgoi, potential problems with water pollution have received much less attention. Company officials and consultants contend that advantages of mining in the Gobi include the use dry tailings ponds, which lower the risks of contaminated water leaching into the soil and burst dams. However, as more and more water resources are directed to mining operations, decreased water tables may lead to higher concentrations of salts and other minerals that harm human, livestock, and wildlife populations. In this presentation I argue that perceptions of shrinking water sources, diversions of water from nomadic herding to mining, and the biophysical properties of water in the region obscure potential long term water pollution threats. Through the redirection of water resources mining is transforming not only the local hydrogeology, but also hydro-social cycles in Mongolia's Gobi region that are intimately connected to both the quantity and quality of water resources. The research for this presentation draws on interviews, focus groups, and participant observation conducted in Mongolia between 2010 and 2015 as well as document collection and analysis.

Olaf Jensen

Cultural and religious values surrounding protection of water have long served to maintain Mongolia's lakes and rivers in near-pristine condition. However, new threats are increasing human impacts on Mongolia's fresh waters. Many of these new threats, including atmospheric deposition of pollution and climate change, originate far beyond Mongolia's borders. Others, such as overgrazing and overfishing, are driven in large part by global economic forces. Over the past twelve years, a team of Mongolian and American scientists – the Mongolian-American Aquatic Ecology Research Initiative – has been studying changes to the ecology of northern Mongolian lakes and rivers. Our findings reflect an ecosystem whose processes remain largely intact, but which is already showing signs of strain from multiple interacting stressors. Lake Hovsgol, Mongolia's largest freshwater lake and the 19th largest lake in the world by volume, is among the world's most pristine and unique lakes. Despite its remoteness, protected status, and low human population density, Lake Hovsgol is threatened by the synergistic pressures of climate change, water pollution, overfishing, and development. Analysis of local weather station data reveals a 1.8°C increase in air temperature over the last half century, a rate of warming more than three times the global average, which contributes to the drying of many previously reliable streams and the loss of fish spawning habitat. Surveys for pelagic microplastics and shoreline macroplastics indicate that Lake Hovsgol is more polluted than many more developed and densely populated watersheds. Interviews with herders and park rangers and shoreline surveys for derelict fishing gear suggest that gillnet fishing, though illegal, is increasing in intensity. Analyses of long-term monitoring data suggest that fish populations, including those of globally endangered species, are in decline. These issues are

likely to be exacerbated as access and tourism increase and Mongolia moves to develop its rivers for hydropower.

Orhon Myadar

Mongolia has recently drawn international attention for its rapidly growing economy and because the growth has been fueled by the burgeoning mining industry. Recently, however, amid growing tension between the government of Mongolia and multinational mining companies, a host of multinational institutions have warned that resource nationalism threatens to bust Mongolia's mining boom and turn back its growth.

In this paper on the politics of natural resources I will specifically focus on the formation in 2009 of the Oyu Tolgoi mining company as a joint venture between Rio Tinto (with at 66% share) and the Mongolian Government (with a 34% share) to mine one of the world's largest and highest-grade copper and gold deposits in the South Gobi desert of Mongolia. The OT agreement is vital in understanding the implications of resource nationalism. This mega 6.6 billion dollar mine is expected to contribute to as much as 30% of Mongolia's GDP when fully operational. Out of a sense among many Mongolians that a 66/34 split was unfair, the Government of Mongolia has attempted to revisit the agreement several times but has not been able to renegotiate the terms.

Despite numerous public protests against the OT deal, the government's efforts, and complaints made by the communities impacted by OT have been effectively silenced as resource nationalism and thereby threatening the future of Mongolia. The term "resource nationalism" is often used to generalize all efforts of developing countries to exert greater control over their natural resources, including capturing a greater share of the wealth generated by their extraction and limiting the role of foreign companies in shaping domestic environmental policy,

as dangerous attempts to foment xenophobic nationalism. This paper explores the positions of various stake-holders, including mining companies, national governments, advocacy groups and communities, whose interests intersect through the concept of resource nationalism, and the use of the term itself as an effective rhetorical device in defeating efforts to renegotiate the OT framework.

Purevdorj Baljinnyam Olkhanud

Despite dramatic declines of children's blood lead levels (BLLs) worldwide, significant exposure remains, particularly in developing countries due to their rapid environmental changes. Thus we aimed to determine blood lead levels of children living in Ulaanbaatar, Mongolia and to identify potential risk factors influencing their BLLs with a lifestyle and residential environment questionnaire. We selected four elementary schools based on their geographical location within Ulaanbaatar so that different regions of the city could be assessed. A total of 153 school children aged 6-8 years old were tested in February and March of 2014. For BLL measurement, capillary blood was tested using the LeadCare II, and the children's parents were requested to fill out a structured questionnaire to identify demographical, socio-economical, environmental and behavioral risk factors for lead exposure. The geometric mean BLL was 5.3 $\mu\text{g}/\text{dL}$ (95% CI: 4.9 – 5.7 $\mu\text{g}/\text{dL}$) and 54.5% of the children had BLLs $>5 \mu\text{g}/\text{dL}$ (the US CDC's current safety reference level). Factors that were significant ($p < 0.05$) predictors of BLL in a multiple linear regression model were sex, age, father's education level, and father's job type. The BLL from this study in 2014 shows a 60% decrease since a prior 2005 study, likely due to the ban on leaded gasoline in the country. However, academic performance was significantly influenced by BLL, indicating

that actions still need to be taken to reduce lead exposure in Ulaanbaatar.

Kirk Smith

Air pollution is the largest environmental health risk factor in the world, causing far more ill-health today than poor water and sanitation, chemicals, climate change, and all other quantified environmental risks combined. Quantified public air pollution impacts are conventionally divided into two main types: ambient or outdoor air pollution (AAP) and household air pollution (HAP) from use of solid fuels. Being the least densely populated country on Earth, most of Mongolia does not suffer large risks from air pollution, but in contrast, Ulaanbaatar has some of the worst pollution conditions in the world in winter. This is due both to typical ambient sources such as vehicles, power plants, and refuse burning as well as strong household sources, particularly heating with coal. Both types affect the air people breathe -- indoor sources affect the outside and vice versa -- and thus the standard distinction between types is less useful in this situation. Human exposure, which is the best predictor health risk, depends as much on where the people are as where the pollution is and control of health impacts therefore is best achieved by exposure management rather than a focus on pollution in particular places, such as the tops of buildings. I describe here a pioneering study initiated by the Ministry of Environment and conducted by a joint Mongolian and US team to explore the exposure implications of alternative future pollution control scenarios for the city taking into account baseline trends in population, economic growth, background health, housing patterns and so on. It relied on existing data, conducted additional measurements, and developed new models of exposure for the city. It shows that it is possible, if ambitious,

for the city to reduce the exposure of its population from the current unacceptably high levels to near internationally acceptable levels by the middle of next decade with consequent substantial reduction in health impacts.

David Sneath

In the post-collective period, Mongolia's livestock sector has proved vulnerable to climatic variability. Over the last two decades Mongolia has lost millions of livestock to harsh winters (*zud*). The scale of these losses, and the underlying problem of barely viable herding households, reflected the weakness of the atomized and demechanized pastoral sector that emerged from decollectivisation. I argue that we can learn from the successful pastoral systems of the past, both in the collective and the neo-feudal eras of Mongolian history. These large-scale pastoral operations can be understood as 'sociotechnical systems' that combined techniques and equipment with particular regimes of property and citizenship. Since models of climate change suggest increasing levels of climatic variability, we must consider what scale and type of institutions will be best able to support sustainable and productive pastoralism in the future.

Oyungerel Tsedevdamba

Opening Remarks: There are three primary threats to the environment caused by the current development of Mongolia. The first is the threat to the land: these include mining, overgrazing and conflict between industries. The second are threats to the air: pollution in Ulaanbaatar and other settled areas pose dangers to public health. Finally, third are threats to the water: ground water pollution and in particular a poor level of sanitation coupled with bad waste management.

Panel Presentation:

First of all, government should channel its limited resources to invest into the new technology that can bring new non-coal heating systems to average families in ger districts of Ulaanbaatar where the most poisonous air pollution is hurting people and children in the worst ways. There are many innovative solutions that the mongolian engineers worked on for many years, and at least a few of private companies have produced successful heating systems and brought them to market. Now they need to scaled up. Government should help them immediately. At the same time government should offer the start-ups on this area a protection from extortion, violence and racketeerings that are already coming from the coal-selling networks. Going away from coal in the ger district shall be organized in a peaceful way as this multi-billion tugrik business can threaten the helpless or sponsor the powerful.

Parliament can adopt laws to encourage clean heating.

Parliament has already put the 4-year target to eliminate the ger district smoke, and therefore, the parliament shall be consistent to its goal and shall delegate enough budget for the Cabinet and the City of Ulaanbaatar and other cities and towns so that they could delegate it to the non-coal heating systems.

Biographies

Yuma Argo, Monterey County Health Department

Yuma Argo is an environmental health specialist and interpreter/translator, with a background in HVAC engineering. She was formerly the project consultant for the Ministry of Environment and Green Development of Mongolia, as well as for the Environmental, Energy Project Impact Evaluation at Social Impact, Inc. Washington DC, and lecturer at Mongolia University of Science and Technology in Environmental Engineering Department. Argo received her Masters of Public Health in Environmental Health Science program at the University of California, Berkeley School of Public Health. Her specialties include environmental health specialist programs, indoor and outdoor air quality, and renewable energy.

Alicia Campi, The Jamestown Foundation

Dr. Alicia Campi has a Ph.D. in Mongolian Studies, was involved in the preliminary negotiations to establish bilateral relations with Mongolia, in the 1980s, and served as a diplomat in Ulaanbaatar. She owns the Mongolian consultancy company U.S.-Mongolia Advisory Group, and writes and speaks extensively on Mongolian issues. Additionally, Dr. Campi is currently teaching about Mongolia at three different academic institutions.

Larry Dale, Lawrence Berkeley National Laboratory

Larry Dale is an energy and water economist at Lawrence Berkeley National Laboratory. In the Energy Efficiency Standards Group, Larry Dale works on a variety of cross cutting economic studies to determine the cost effectiveness of energy efficiency standards. These include studies determining the price elasticity of demand for selected appliances, appropriate discount rates to use in benefit cost analysis, methods to estimate the regional employment impacts of efficiency standards, retrospective price analysis, and lifecycle cost methodology. Dr. Dale has also performed economic impact studies on a range of different environmental and resource threats, including climate change, air pollution, and resource scarcity. Some of his recent studies have been concerned with the impact of climate change on resource sectors in California, as well as research into the available methods to improve air quality in Ulaanbaatar. Dale has an M.S. in resource economics from the University of California, Davis, and a Ph.D. in resource economics from the University of Hawaii.

Kirsten Dales, University of British Columbia

Kirsten Dales is a Program Officer for the Canadian International Resources and Development Institute (CIRDI), and doctoral fellow with the University of British Columbia's Forest and Conservation Sciences department. Her research and practices focus broadly on human-environment interactions, with a special interest in natural resource governance and international development. Her research addresses issues related to trans-boundary resource conflicts and multilateral environmental agreements, which utilize theoretical and empirical intersections of political ecology and

complex systems science. In recent years, Kirsten has provided expert services to the United Nations Industrial Development Organization (UNIDO), UNESCO, Global Affairs Canada on the issue of artisanal and small-scale mining (ASM). Through an ongoing commitment to interdisciplinary scholarship and extended periods of fieldwork in North America, Nepal, Mongolia, Ethiopia, and West Africa, Ms. Dales has studied the impacts of artisanal mining on river-floodplain systems and has developed interventions to limit contaminant mobility through phytoremediation technologies and capacity development initiatives. Her current research explores how forest-mining conflicts from Artisanal and Small-scale Gold Mining (ASGM) influence the environmental rate and transport of heavy metal contaminants in trans-boundary river systems, including the Niger (West Africa), Selenge (Mongolia-Russia) and Puyango-Tumbes (Ecuador-Peru) international drainage basins.

Julian Dierkes, University of British Columbia

Julian Dierkes is an associate professor at the University of British Columbia's Institute of Asian Research where he also coordinates the Program on Inner Asia. Julian was trained as a sociologist and "Japan hand", but has expanded his attention to Mongolia, democratization, and mining policy for over a decade. He is the editor of "Change in Democratic Mongolia" (Brill, 2012). Together with several graduate students he maintains the Mongolia Focus blog. Most of his followers @jdierkes are Mongolian. Julian is a four-time election observer of Mongolian national elections, the project lead of the Canadian International Resources and Development Institute's (CIRDI) "IMAGinE Mongolia" project, and regularly consults on evaluating political risk in Mongolia.

Bolormaa Enkhbat, World Bank

Bolormaa Enkhbat works in the field of climate change at the World Bank (DC). Her research interests include the socio-economic impact of extractive industries in resource-rich countries. She conducted research on a case study of the Kayelekera uranium mine in Malawi, in particular looking at the impacts of the mine in local Karonga community and larger economic development implications of the Kayelekera mine. Bolormaa is also passionate about rural development and has worked in strengthening rural youth enterprise in Kenya. Bolormaa holds an MPA from Columbia University and a B.S. in Economics with a minor in Environmental Studies from the University of Oregon.

William Fitzhugh, Smithsonian Institution

William Fitzhugh is the Curator of Archaeology and Director of the Arctic Studies Center at the Smithsonian. He received his M.A. and Ph.D. from Harvard University, with undergraduate education at Dartmouth College. Fitzhugh's areas of specialization include circumpolar archaeology, northern cultures, and environments. He conducts fieldwork and research on circumpolar archaeology, northern cultures, and environments with special attention to human-environmental interactions; initiates and produces exhibitions and public programs; prepares scholarly and popular publications, websites, films, and other products; serves as advisor for graduate and PhD students and instructs undergraduates, interns, and volunteers in field and laboratory work. Dr. Fitzhugh has also been conducting archaeology in Mongolia since 2001 and is a visiting professor at Dartmouth College.

Clyde Goulden, Drexel University

Dr. Clyde Goulden is the Director of the Asian Center and Director of Institute for Mongolian Biodiversity and Ecological Studies (IMBES), Patrick Center, Academy of Natural Sciences of Drexel University. He has a doctoral degree in zoology from Indiana University, a master's and bachelor's degree in biology from Kansas State Teachers College, Emporia. Dr. Goulden is interested in the interaction between human activity and climate change impacts on ecosystems and nomadic pastoralism in Asia. He has carried on research in Mongolia since 1994 with funding from the National Science Foundation, USAID, and other private foundations. Dr. Goulden also was the International Consultant for a GEF and World Bank funded training program for young Mongolian scientists. He has received Mongolia's "Friendship Medal" and "Polar Star Award" presented by the President of Mongolia. He has made extensive contributions in books and articles. He was senior editor of "The Geology, Biodiversity and Ecology of Lake Hövsgöl (Mongolia)," published by Backhuys Publ., and has a paper in *Climatic Change*, currently in press, entitled, "Interviews with Mongolian Herders and High Resolution Precipitation Data Reveal an increase in Short Heavy Rains and Thunderstorm Activity in Semi-arid Mongolia". His most recent writings: "Herder Perceptions of Climate Change" and "The Consequences of Unpredictable Weather" have appeared, respectively, on *New York Times* June 30, 2011 and August 1, 2011.

Amy Hessler, West Virginia University

Amy Hessler (Ph.D. University of Arizona, M.S. University of Wyoming, B.S. & B.A. University of California), is a Professor in the Department of Geology and Geography, West Virginia University. Amy's research is focused on understanding the

connections between human institutions, climate change, and forest ecosystems over the last 2000 years. She uses tree rings and other proxies of past climate to understand how forests and people react to past and current changes in climate. Most of her work has focused on mountain forest systems of North America and Inner Asia. Her recent work on the climate and ecology of the 13th century Mongol Empire has garnered interest from the international press including: *The Economist*, *The New York Times*, *USA Today*, and the *LA Times* among many others.

Sara Jackson, Metropolitan State University of Denver

Sara Jackson is a lecturer at MSU Denver's Earth and Atmospheric Science department. She has a Ph.D. (2015) in Geography from York University. Her ongoing research interests include political and cultural geographies of resource extraction in Mongolia and environmental justice issues in Colorado. Some of her notable publications include "Dusty roads and disconnections: Perceptions of dust from unpaved mining roads in Mongolia's South Gobi province" published in *Geoforum*, and "Imagining the mineral nation: contested nation-building in Mongolia", published in *Nationalities Papers*.

Olaf Jensen, Rutgers University

Olaf Jensen is an Assistant Professor in the Department of Marine and Coastal Sciences at Rutgers University. His research group studies fisheries and aquatic ecosystems, including marine, estuarine, and freshwater environments with the ultimate goal of improving the scientific basis for sustainable management. Dr. Jensen's work relies on a combination of mathematical modeling, data synthesis and

field studies in locations ranging from the Louisiana salt marsh to coastal New Jersey and Mongolian lakes and rivers. Dr. Jensen created the Mongolian-American Aquatic Ecology Research Initiative to coordinate a diverse interdisciplinary group of scientists working on freshwater ecosystems in Mongolia. He received his Ph.D. from the University of Wisconsin Center for Limnology, followed by a David H. Smith Conservation Research Fellowship at the University of Washington.

Orhon Myadar, The University of Arizona

Orhon Myadar is an assistant professor at the School of Geography and Development in the College of Social and Behavioral Sciences at the University of Arizona. As a political geographer, she studies geographical implications of politics at various scales. Professor Myadar is especially interested in the questions of power, ideology, mobility and identity within the context of shifting political landscapes. She studies how borders of belonging or exclusion shift as political regimes change and how these fluid borders shape everyday struggles of underserved and marginalized individuals and communities. Within this conceptual framework, she studies expressions of national identity through symbolic landscapes, counter-narratives, and acts of resistance. Myadar's current research examines forced mobility in the context of political turmoil. She is particularly interested in the ways narratives are told by, for, and about persons who have been forced to move and how these narratives shape the production and dissemination of knowledge about these persons. Her current project aims to counter-narrate dominant discourses surrounding refugees through stories told by refugees themselves.

Purevdorj Baljinnyam Olkhanud, Mongolian National University of Medical Sciences

Dr. Purevdorj B. Olkhanud is a public health physician with an MD in Internal Medicine, PhD in Cancer Immunology, and MPH with a concentration in Environmental Health. He completed a Postdoctoral Fellowship and worked as a Research Fellow at the National Institutes of Health (NIH) in the USA. The main focus of his research at the NIH was control of cancer metastasis and regulatory immune cells to develop better vaccines for cancer and other chronic diseases. This stream of research work resulted in a number of publications in scientific peer-reviewed journals such as *Cancer Research*, *Vaccine*, *Blood*, including three that were selected as cover page. In addition, he holds three U.S. patents in immunology for a discovery of a new treatment strategy of cancer. In 2012, he established and headed the first Department of Environmental Health Sciences at the School of Public Health in Mongolia to meet the urgent needs of the country in environment and occupational health. His current research focuses on adverse health effects of environmental exposures including air pollution, secondhand tobacco smoke, and trace elements (e.g. lead, arsenic). In addition, he conducts research in support of progressive policies that assess environmental and health impact.

Kirk Smith, UC Berkeley

Dr. Smith is Professor of Global Environmental Health and is the founder and director of the campus-wide Masters Program in Global Health and Environment. Previously, he was the founder and head of the Energy Program of the East-West Center in Honolulu. He serves on a number of national and international scientific advisory committees including the Global Energy Assessment, National Research Council's

Board on Atmospheric Science and Climate, the Executive Committee for WHO Air Quality Guidelines, and the International Comparative Risk Assessment of the Global Burden of Disease Project. He participated, along with many other scientists, in the IPCC's 3rd and 4th assessments and shared the 2007 Nobel Peace Prize. He was also Convening Lead Author for Climate and Health for the 5th Assessment. He holds visiting professorships in India and China and bachelors, masters, and doctoral degrees from UC Berkeley and, in 1997, Smith was elected member in the US National Academy of Sciences, one of the highest honors awarded to US Scientists by their peers. In 2009, he received the Heinz Prize in Environment and in 2012 was awarded the Tyler Prize for Environmental Achievement. Professor Smith's research focuses on environmental and health issues in developing countries, particularly those related to health-damaging and climate-changing air pollution from household energy use, and includes field measurement and health-effects studies in India, China, Nepal, Mexico, Laos, Mongolia, and Guatemala as well as development and application of tools for international policy assessments. He recently led a binational team exploring alternative options for controlling air pollution exposures and associated health impacts in Ulaanbaatar.

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David Sneath, University of Cambridge

David Sneath is the Director of the Mongolia and Inner Asia Studies Unit, as well as a reader, at the University of Cambridge's Division of Social Anthropology. He is a Fellow of Corpus Christi College at Cambridge and is an MRes and Ph.D. Pre-Field Tutor for Division of Social Anthropology. Dr. Sneath's research interests include inner and central Asia, pastoralism, the environment, decollectivisation and post-

socialist social transformations, political culture and economic institutions in inner Asia, and the anthropology of development. His latest research explores two main themes, the representations of steppe societies in social and historical studies, and the political economy and ecology of Mongolia and the Inner Asia. He is also involved in a project titled 'Pathways to understanding the changing climate: time and place in cultural learning about the environment,' collaborating with educationalists and anthropologists working in a range of locations including Inner Asia and the UK to try and develop a new comparative approach to understanding perceptions of environmental change. Dr. Sneath has published countless notable publications, including his two sole-authored monographs, *The Headless State: Aristocratic Orders, Kinship Society, and Misrepresentations of Nomadic Inner Asia* (Columbia, 2007) and *Changing Inner Mongolia: Pastoral Mongolian Society and the Chinese State* (Oxford, 2000).

Oyungerel Tsedevdamba, Member of Parliament, Mongolia

Mrs. Oyungerel Tsedevdamba is a member of the State Great Hural of Mongolia. Previously, Oyungerel also served as the Minister of Culture for Sports and Tourism of Mongolia and the Advisor on Human Rights and Public Participation to the President of Mongolia. Currently, she is also the President of the Local Solutions Foundation in Ulaanbaatar. Oyungerel is a Yale World Fellow and received her master's degree in International Policy Studies from Stanford University. She is a successful author, having published notable works including *The Green Eyed Lama* (2008), *Introducing Mongolia* (2015) and *My Entreaty* (2012). Oyungerel is a public speaker and translator. She translated Hesperian foundation's book A

Community Guide to Environmental Health into Mongolian (2009). She has also been the recipient of several awards, such as The Order of the Red Banner for Meritorious Labour Service, awarded by the President of Mongolia in 2014 and Chevalier de L'ordre des Arts et des Letters by the Minister of Culture of Republic of France in 2015.

