FREDERICK S. PARDEE CENTER FOR INTERNATIONAL FUTURES

JOSEF KORBEL SCHOOL OF INTERNATIONAL STUDIES | UNIVERSITY OF DENVER

"What IFs # 1," acrylic on canvas, 20" x 20" Lisa Lane Filholm, 2018

The Art of Forecasting: 40 Years of IFs

ANNUAL REVIEW
2017-2018

FREDERICK S. PARDEE CENTER FOR INTERNATIONAL FUTURES
JOSEF KORBEL SCHOOL OF INTERNATIONAL STUDIES
UNIVERSITY of DENVER
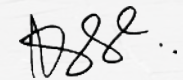
LETTER FROM THE DIRECTOR

Dear Friends,

This past year I have spent time reflecting on the 40 years of work invested in developing International Futures (IFs). Barry B. Hughes—founder of IFs and the Pardee Center—spent the first half of this period working collaboratively with other academics but largely alone. Over time Barry built a small team starting in the late 1990s. (Read more about the history and development of IFs on page 4 of this review.)

We are now in a new period of IFs research characterized by processes of institutional development. We have grown in our capacity to ingest data and collaboratively develop code, with research teams operating in Africa, the Americas, Asia, and Europe. With institution building comes the formalization of procedures, including those that we've recently developed for hiring, grant writing and reporting, and budget planning. The underlying code of IFs is also transitioning from an unsupported development language (Visual Basic 6) to a widely accessible language (Visual Basic .NET). This move will facilitate the development of the tool by other academics and researchers.

Building an institution requires people who invest in our values. We are thankful to have sustaining funding from Mr. Fred Pardee, support from the University of Denver, and a talented group of faculty, staff, and students dedicated to learning and exploring the future of global development. This fall we are extending our scientific research expertise by hiring Professor and Director of Research Brian O'Neill to the Korbel faculty and the Pardee Center. Brian brings a wealth of experience in the integrated assessment modeling field, has published widely, and has developed the iPETS model framework at the National Center for Atmospheric Research. He has also played a leading role in the development of the Shared Socio-Economic Pathways scenarios, an important framework for integrating research across organizations like ours.

Over the next 40 years my goal is to create a globally exceptional research center that formalizes the pursuit of knowledge through the development of integrated, open, and free software platforms to help people better understand our present and future world. You are invited to join us!

With hope,

Jonathan D. Moyer, PhD

40 YEARS OF INTERNATIONAL FUTURES

Reflections by Barry B. Hughes, PhD, Senior Scientist and Mentor
John Evans Professor, University of Denver

It is nearly half a century since the emergence of the first computer models for thinking about possible long-term global futures and for considering how we might, at least in some small way, make the future better. I have had the great privilege of studying and developing such models over that entire period. My work began in 1972 at Case Western Reserve University in association with Mihajlo Mesarovic and the World Integrated Model (WIM) and the second report on global futures to the Club of Rome. In 1977, I began to create a new world model called International Futures (IFs). My primary goal was to create an educational tool for university students, but secondarily to help professional policy analysts think about the future, even while recognizing the risk of overselling the policy analysis capability of models. The acronym "IFs" intentionally conveys the reality that any story or scenario from a model is essentially a complex if-then statement. From the beginning, the model with 10 global regions was freely available for anyone to use, but in the early days the need to use FORTRAN language on punched cards for early mainframe computers discouraged all but the very intrepid.

Karl Deutsch at Harvard recognized the power of the world modeling effort and organized a scientific initiative at the Wissenschaftszentrum Berlin (now known as the WZB Berlin Social Science Center) to develop a global model under the direction of Stuart Bremer. The GLOBUS project ran through the 1980s, with GLOBUS moving to a supercomputer via a remote terminal with a blinking cursor interface. Coincident with my move to the University of Denver, I became a commuting member of that development team.

I also continued to develop IFs, strengthening its educational credentials and becoming more confident in its ability to contribute to analysis of important long-term policy issues. In the mid-1980s I created a simplified version for use on an Apple III—still the blinking cursor. In 1991, Visual BASIC began to support the development of a menu interface and use of third-party objects for graphics, maps, and statistics.

In 1997, the European Commission invited me to a meeting of teams organizing a project on the rise and impact of the so-called New Economy driven by information and communications technology. The project supported Mohammod Irfan and José Solórzano in joining me, and they are legacy members of the IFs team. Coincident with the ending of that project in 2000, the U.S. National Intelligence Council requested that IFs contribute to one of the Global Trends studies that it prepared every four years for new and returning presidential administrations. That led to such contributions in three successive reports, and it supported the creation of a web-based version of IFs to supplement that on desktops and laptops, greatly enhancing its availability globally.

Also in the early 2000s, an invitation to the headquarters of RAND in Santa Monica introduced IFs to Frederick Pardee, who subsequently funded the Frederick S. Pardee Center for International Futures at the University of Denver's Josef Korbel School of International Studies. The Pardee Center is now the home of the IFs system, and Fred's support and strong interest in improving the human condition undergirded the writing of five volumes in a series called *Patterns of Potential Human Progress*. Work for that series greatly extended IFs, adding new models on education, health, governance, and infrastructure, as well as enhancing others, including the economic model's ability to represent levels of poverty. In that same period, Dale Rothman invited IFs participation in support of the outlooks chapter of the fourth Global Environment Outlook of the United Nations Environment Programme.

A new stream of global modeling had emerged under the umbrella label of integrated assessment models (IAMs). Partially rooted in the energy price shocks to the global economy in the 1970s, it quickly directed special attention to climate change and became closely associated with efforts of the Intergovernmental Panel on Climate Change to understand and limit such change. The IAM community had established a consortium of modeling projects in 2007, and Dale Rothman helped the Pardee Center become a member.

IFs has considerably more focus than other IAMs on issues of human development, such as poverty and hunger reduction, advance of education, and improvement of health. That, and coverage of 186 countries and subunits, positions it well for a new era that is emerging via the enunciation of the Sustainable Development Goals and the related global effort, supported by models, to improve the human condition in a world that is environmentally sustainable.

As this historical survey suggests, IFs and I owe debts to far more people than I can possibly acknowledge and thank, among them Mihajlo Mesarovic, Tom Shook, Harold Guetzkow, Stuart Bremer, Karl Deutsch, Richard Chadwick, Evan Hillebrand, Dale Rothman, Jackie Cilliers, and our continuing benefactor, Fred Pardee. Institutionally, the University of Denver and the Korbel School have been wonderful professional homes for IFs and for me. Janet Dickson, my wife and professional colleague, has contributed in uncountable ways, including close collaboration on the PPHP volume series and my forthcoming book on IFs in the context of other global model projects.

Jonathan D. Moyer, Director of the Pardee Center since 2015, works ardently to make IFs a living tool for anyone wishing to add to its development and use. I am proud of Jonathan and the Pardee Center team (now too many to name) and their commitment to the IFs system, working to improve the human condition. And who knows – perhaps in the future, under Jonathan's direction, IFs will become a cloud-based voice-driven plug-and-play modular system that automatically updates data and reformulates its key functions and algorithms!

RESEARCH PROJECT HIGHLIGHTS

Diplometrics

The Diplometrics Project is an ongoing effort by many of our student research staff, managed by Whitney Doran, seeking to better understand and measure the international system, integrating three key efforts: data gathering; tool building; and analysis. The project focuses on dyadic state interactions that measure the depth and breadth of political, diplomatic, economic, security, and cultural ties between countries. During the 2017-18 academic year, our team explored new research questions related to diplomatic capacity, cultural affinity, state-sponsored media, and power projection. We also significantly expanded our ability to forecast bilateral trade, migration, arms trade, and foreign direct investment.

Institute for Security Studies

Through the ISS, we have recently become more involved with Project ENACT: Enhancing Africa's capacity to respond to transnational organised crime, a project funded by the European Union. This work aims to mitigate the impact of transnational organised crime in Africa on development, governance, security and the rule of law. The project consortium is made up of 11 partners from six countries. Director Jonathan D. Moyer and others are using IFs to help build a comprehensive knowledge base and boost the skills and capacity of key African stakeholders to better respond to transnational crime threats.

We also collaborated with the ISS on the policy brief *Shaping the future: Strategies for sustainable development in Kenya* and an accompanying background research report on possible development scenarios in Kenya over the next 20 years. The reports use IFs to explore potential progress towards the achievement of selected Sustainable Development Goals (SDGs) and key targets as set out in Kenya's national development plan.

Minerva Initiative

This US Department of Defense grant analyzes previous attempts to predict the onset of state failure, evaluates the drivers of state fragility qualitatively and quantitatively, builds tools and data associated with the drivers of domestic conflict (including 50 qualitative case studies about conflict onset and near onset), and uses IFs to forecast the probability of failure across multiple dimensions. This grant also covers the building of the Major Episodes of Contention database and supports ongoing development of the DataGator tool. Staff and faculty on this project include our researcher Drew Bowlsby and Korbel professors Erica Chenoweth, Cullen Hendrix, Oliver Kaplan, and Timothy Sisk.

United Nations Development Programme

In consultation with the United Nations Development Programme's Country and Regional Offices, we produced two country analysis reports this year. *Sustainable Development Goals: Moldova 2030* and *Sustainable Development Goals: Brazil 2030* use IFs to examine development trends, scenarios of possible interventions, and potential long-term outcomes towards achieving the SDGs. Launched in 2015, the SDGs are a series of 17 global goals to reduce poverty, protect the environment, and ensure prosperity for all to 2030. The research aims to help steer collective efforts toward achievement of the SDGs in Moldova and Brazil. Continuing this partnership into next year, we have plans to produce similar analyses of Mexico and Egypt for the UNDP.

United Nations Environmental Programme

Our Research System Developer Steve Hedden has spent the year serving as a coordinating lead author for the "Outlooks" section of the UN Environmental Programme's (UNEP) sixth *Global Environmental Outlook* report (GEO-6). The publication, also supported by Director Jonathan D. Moyer and Senior Scientist Barry B. Hughes, is scheduled for release at the end of 2018. The goal of GEO-6 is to understand the current state and trends of the environment, and to try to inform the international community on policies to meet environmental objectives. In pursuit of this goal, GEO-6 is compiling its sixth edition of the GEO global assessment.

USAID-Latin America and the Caribbean Office of Regional Sustainable Development (LAC/RSD)

Our research efforts expanded to include partnerships with USAID's Latin America and Caribbean Bureau's Office of Regional Sustainable Development (LAC/RSD), USAID missions to Honduras and Guatemala, and Mathematica Policy Research, to understand and explore trends in education systems, societal violence, labor market dynamics, and migration in Central America and the Caribbean. Throughout the year, staff and researchers met with colleagues from USAID, local implementing partners and members of the development community, as well as government officials in Honduras and Guatemala.

Western Cape Provincial Government

This year marks our seventh year of collaborative research with the Western Cape Provincial Government of South Africa, applying IFs on a provincial scale in the region. Pardee Center researchers, including Alanna Markle, who relocated to Cape Town this year, have collected subnational data and performed strategic analysis across many policy issues. This year of the project has seen research on the future of provincial-level migration in the province and its impact on service delivery, as well as an analysis of the co-occurence of undernutrition and over-nourishment in the Western Cape.

The Pardee Center team at IFs training in Kampala, Uganda.

RESEARCH PROJECT HIGHLIGHTS

USAID-Uganda

For several years, our researchers have worked with USAID-Uganda and the Learning Contract to forecast development trends and opportunities for the future of Uganda. We began with a 2015 report which helped policymakers consider aid allocation across development priorities and directly influenced the Uganda Country Development Cooperation Strategy, a five-year plan required from each USAID mission to inform budgeting, planning, and resource allocation.

We expanded our analysis of trends in Uganda's development with a 2016 report for USAID-Uganda and QED, using IFs to evaluate the current development context in Uganda to better understand the sequencing of policy priorities as well as identify leverage points to more rapidly improve human and social development.

The Pardee Center has significantly extended its collaboration with USAID and the Learning Contract in the last year. In the summer of 2017, two Pardee Center student employees served as interns with the project in Kampala, gathering subnational data and demonstrating the use of IFs to project partners.

In November 2017, we co-published *Estimating District GDP in Uganda* in partnership with USAID. This research uses satellite data to estimate the size of Uganda's 116 district economies, which can be used to explore how resources may be distributed throughout Uganda. The research was featured on the front page of Uganda's *Daily Monitor* in January, 2018, demonstrating the applied nature of our research, as well as its relevance to Ugandan development practitioners. In February 2018, three members of the Pardee Center team (David K. Bohl, Jonathan D. Moyer, and Mickey Rafa) led an IFs workshop in Kampala on quantitative analysis and long-term strategic planning for various organizations working in government, civil society, and academia. While in Kampala, Moyer and Rafa presented *Estimating District GDP in Uganda* at UNICEF's Speaker Series.

Pardee research in Uganda continued in the spring of 2018. The Pardee team authored *Using Nighttime Lights for Poverty Analysis in Uganda* as a new method for exploring subnational poverty estimates in Uganda. Mickey Rafa shared this nightlights research with the Colorado-Wyoming Chapter of the American Statistical Association at their Spring Meeting, while Professor Paul Sutton presented the nightlights research at the American Association of Geographers' Annual Meeting in New Orleans. Finally, the Pardee Center published policy briefs that explored primary education in Southwest Uganda and subnational migration estimates in Uganda.

We look forward to continued partnerships with USAID and its partners in Uganda to prioritize and meet development goals.

OUR YEAR BY THE NUMBERS

147 DAYS OF STAFF TRAVEL TO PARTNERS, CLIENTS & CONFERENCES

14 SPONSORED PROJECTS WITH **9** CLIENTS & PARTNERS

$1.7 MILLION IN SPONSORED RESEARCH

100 STUDENTS EMPLOYED AS RESEARCH PROJECT AIDES

~7,400,000 DATA POINTS COLLECTED

14 REPORTS & POLICY BRIEFS PUBLISHED

~1,300 DATA SERIES PULLED, VETTED & CONSOLIDATED

5 MODEL VALIDATION EXERCISES PERFORMED FOR NEW MODELS ADDED TO IFs

8 STUDENTS ON THE DATA TEAM

6 GRADUATE STUDENT INTERNSHIPS WITH PARDEE CENTER PARTNERS

THE DIPLOMETRICS PROJECT BY THE NUMBERS

19,230 UNIQUE OBSERVATIONS ACROSS 17 CATEGORIES OF MILITARY HARDWARE & 171 COUNTRIES	**408** UNIQUE OBSERVATIONS ADDED TO IGO DATASET	**45,570** UNIQUE OBSERVATIONS ADDED TO WORLD LANGUAGE DATASET
590 UNIQUE OBSERVATIONS ADDED TO MULTILATERAL TREATIES DATASET	**53,338** UNIQUE OBSERVATIONS ADDED TO DIPLOMATIC SERVICES DATASET	**3,042** UNIQUE OBSERVATIONS ADDED TO IGO DATASET
414,528 DIPLOMATS COUNTED FOR DIPLOMATIC SERVICES DATASET	**282** DIPLOMATIC LISTS CODED FOR DIPLOMATIC SERVICES DATASET	**45,000+** DISTINCT HEADS OF GOVERNMENT STATE VISITS CODED AND CLEANED

In 2018, second-year MA student and Hughes-Dickson scholar Ellie Bremer served a summer internship with the United Nations Development Programme (UNDP). She provided research support for the Strategic Policy Unit, a group within the UNDP's Bureau for Policy and Programme Support helping country missions better plan to achieve the Sustainable Development Goals. Her work included data collection and quantitative analysis, as well as support for policy papers, reports, and speeches for the UNDP and its contribution to global policy debates and key developmental processes. Recent graduate Brendan Mapes completed this internship in the summer of 2017.

Data Den: Feeding the Beast

Maintaining a modeling platform as ambitious as IFs requires us to constantly update more than 4,200 historical series in the database, while working relentlessly to enhance and improve the model. This year we established the "Data Den," a collaborative workspace for identifying, consolidating, vetting, and learning about data, in addition to learning more about the IFs tool itself. Building on the foundation set by Professor Barry B. Hughes and Dr. Mohammod T. Irfan, and with Research Associate Kanishka Narayan at the helm (working closely with Research Systems Developer Steve Hedden), the data team has pulled over 1,300 individual series over the past 12 months. Not only does this work ensure that the model and our projections are operating with the most recent data available, it also means that every packaged version of the model has a complete, current, and vetted database.

Pardee Methods Lunch Workshops Serve the Korbel School Community

The Pardee Center organized a series of free, introductory workshops for the Korbel School community this year, designed to introduce students, staff, and faculty to software tools frequently used in social science research. Presented by members of our quantitative research staff and affiliated faculty, each two-hour session offered an overview and introduction to a tool, as well as tips for use and application.

September-November 2017
David K. Bohl leads remote IFs Training Workshop in five sessions.
United Nations Development Programme, Brazilian Institute of Applied Economic Research, Economic and Social Development Council of the Presidency of Brazil
Josef Korbel School of International Studies, University of Denver
Denver, CO

October 2017
Jonathan D. Moyer presents on Power and Influence.
AMG National Trust Bank Executive Session
Greenwood Village, CO

October 2017
Steve Hedden and Jonathan D. Moyer participate in the Global Environmental Outlook (GEO-6) 2nd authors' meeting.
United Nations Environment Programme
Guangzhou, China

November 2017
Jonathan D. Moyer joins launch of new USAID-Central America project.
USAID LAC/RSD Education Team, Mathematica Policy Research Headquarters
Washington, DC

December 2017
David K. Bohl joins panel on "Benefits and Risks of Future Forecasting Methodologies."
US Army Futures Forum: Structuring Our Futures Thinking
Atlantic Council and the US Army Future Studies Group
Washington, DC

December 2017
Jonathan D. Moyer joins inaugural meeting of ENACT Technical Reference Group.
Institute for Security Studies and INTERPOL, in affiliation with the Global Initiative against Transnational Organised Crime
Geneva, Switzerland

February 2018
Director Alexis Goosdeel and Scientific Director Paul Griffiths of the European Monitoring Center for Drugs and Drug Addiction (EMCDDA) visit the Pardee Center on a learning expedition.
Josef Korbel School of International Studies, University of Denver
Denver, CO

January 2018
Barry B. Hughes serves as a lead presenter, "Advancing the 2030 Agenda: Interlinkages and Common Themes at the HLPF 2018."
Expert Meeting for United Nations Division for Sustainable Development, Department of Economic and Social Affairs.
New York, NY

PRESENTATIONS, MEETINGS, CONFERENCES, AND VISITS

September 2017
Pardee researchers present "How to Use IFs to Think about the SDGs, Economic Vulnerability, and Artificial Intelligence" to delegates from the Biennial of the Americas Festival: David K. Bohl, Jonathan D. Moyer, Meredith Moon, Andrew Scott.
Josef Korbel School of International Studies, University of Denver
Denver, CO

June 2017
Pardee Center and ISS launch report on growth and development in Mozambique: Jonathan D. Moyer, David K. Bohl, Alex Porter.
Irish Aid
Maputo, Mozambique

November 2017
Alanna Markle presents on migration to the Western Cape Government.
Department of the Premier Executive Committee Meeting
Cape Town, South Africa

November 2017
Pardee Center research affiliates join ENACT Research Programme: Zachary Donnenfeld, Alex Porter, Lily Welborn.
European Union Pan-African Programme
Nairobi, Kenya

October 2017
Drew Bowlsby joins panel discussion, "Projecting armed conflict and unrest under climate change scenarios."
Impacts World 2017 Conference
Potsdam, Germany

December 2017
Jonathan D. Moyer presents "The Use of Data in Long-term Planning: The International Futures Integrated Assessment Platform."
Geneva Center for Security Policy for the Executive Office of the Secretary-General of the United Nations
New York, NY

November 2017
USAID science fellow Ernest "Dick" Greene visits Pardee Center for IFs training.
Josef Korbel School of International Studies, University of Denver
Denver, CO

January 2018
Mickey Rafa teaches hands-on IFs session to Data Analysis for Development graduate course with Professor Aaron Schneider.
Josef Korbel School of International Studies, University of Denver
Denver, CO

January 2018
Barry B. Hughes records informational video with Dr. James Griesemer, Director of DU's Strategic Issues Program.
The Engaging Ideas Series, University of Denver
Denver, CO

March 2018
Jonathan D. Moyer attends
States of Fragility workshop.
Organization for Economic
Co-operation and Development
(OECD)
Washington, DC

May 2018
Jonathan D. Moyer meets with
ENACT Index Technical Reference
Group.
Institute for Security Studies in
affiliation with the Global
Initiative against Transnational
Organised Crime
Dar es Salaam, Tanzania

April 2018
Pardee Center team visits USAID for project
planning meetings: Jonathan D. Moyer,
Alex Porter, Andrew Scott, José Solórzano.
USAID-Latin America and the Caribbean
Office of Regional Sustainable
Development
**Guatemala City, Guatemala and Teguci-
galpa, Honduras**

February 2018
Jonathan D. Moyer and Mickey
Rafa present "Estimating District
GDP in Uganda."
UNICEF Speaker Series
Kampala, Uganda

February 2018
Mickey Rafa and Jonathan D.
Moyer present "Estimating
District GDP in Uganda."
UNICEF Speaker Series
Kampala, Uganda

May 2018
Jonathan D. Moyer presents
ongoing analysis in education, labor,
violence, and migration in Central
America.
USAID-Latin America and Caribbean
Regional Offices
Washington, DC

May 2018
Steve Hedden participates
in the Global Environmental
Outlook (GEO-6) 4th authors'
meeting.
United Nations Environment
Programme
The Hague, Netherlands

February 2018
Pardee Center team conducts
IFs training: Jonathan D. Moyer,
David Bohl, Mickey Rafa.
USAID-Uganda and the
Learning Contract
Kampala, Uganda

March 2018
Jonathan D. Moyer participated
in States of Fragility workshop.
Organization for Economic
Co-operation and
Development (OECD)
Washington, DC

May 2018
Andrew Scott speaks on
"Framing the Future."
DaVinci Institute Speaker Series
Westminster, CO

PRESENTATIONS, MEETINGS, CONFERENCES, AND VISITS

February 2018
Steve Hedden and Jonathan
D. Moyer participate in the
Global Environmental Outlook
(GEO-6) 3rd authors' meeting.
United Nations Environment
Programme
Singapore

March 2018
Steve Hedden and Alex
Porter speak on IFs and
integrated forecasting.
Development Dialogues
Series, Posner Center
Global Classroom
Denver, CO

April 2018
Mickey Rafa presents
"Using Nighttime Lights
for Poverty Analysis in
Uganda."
Colorado-Wyoming
Chapter of the American
Statistical Association
Spring Meeting
Boulder, Colorado

April 2018
Alanna Markle presents
FuturesCape Policy Brief on the
Double Burden of Malnutrition.
Western Cape Provincial
Government, Department of the
Premier
Cape Town, South Africa

June 2018
Andrew Scott and Whitney
Doran present on the Diplometrics
Project to International Futures
undergraduate course with
Professor Keith Gehring.
Josef Korbel School of International
Studies, University of Denver
Denver, CO

February 2018
Alanna Markle attends Global
Compact on Migration
Information Session.
Statistics South Africa
Pretoria, South Africa

April 2018
Professor Paul Sutton presents research in
collaboration with Pardee Center on "Using
Nighttime Imagery to Estimate Gross Domestic
Product at Sub-National Levels in Africa."
American Association of Geographers'
Annual Meeting
New Orleans, LA

April 2018
Jonathan D. Moyer presents on
co-authored piece with Oliver Kaplan
"Human Trafficking, War, and Social
Disruption and Change."
International Studies Association
2018 Annual Convention
San Francisco, CA

June 2018
Pardee Center co-sponsors 38th
International Symposium on
Forecasting; David K. Bohl serves
on panel "Global Forecasting: The
International Futures Model."
Boulder, CO

PUBLICATIONS 2017-2018

Reports

Power and influence in a globalized world
by Jonathan D. Moyer, Tim Sweijs, Mathew J. Burrows, and Hugo Van Manen.
Frederick S. Pardee Center for International Futures, the Atlantic Council, and the Hague Center for Strategic Studies.
February 2018
An introduction to the Formal Bilateral Influence Capacity (FBIC) Index, a new way to measure the formal economic, political, and security influence capacity of states worldwide from 1963 to 2016. The authors find that global influence is concentrated in the hands of the few but the trend is changing; a growing number of states wields greater amounts of influence over greater distances.

Sustainable Development Goals report: Brazil 2030
by Andrew C. Scott, David K. Bohl, Steve Hedden, Jonathan D. Moyer, and Barry B. Hughes.
United Nations Development Programme (Bureau for Policy Programme Support).
December 2017
An examination of development trends and scenarios, to explore potential futures in Brazil for achieving the SDGs by 2030.

Sustainable Development Goals report: Moldova 2030
by Andrew C. Scott, David K. Bohl, Steve Hedden, Jonathan D. Moyer, and Barry B. Hughes.
United Nations Development Programme (Bureau for Policy Programme Support).
October 2017
An examination of development trends and scenarios, to explore potential futures in Moldova for achieving the SDGs by 2030.

Prospects and challenges: Mozambique's growth and human development outlook to 2040
by Alex Porter, David K. Bohl, Stellah Kwasi, Zachary Donnenfeld and Jakkie Cilliers. Irish Aid and the Institute for Security Studies.
June 2017
An assessment of key trends and alternative scenarios related to Mozambique's development, with a particular focus on how the country can better leverage the gains from its energy industry to foster inclusive growth and reduce poverty.

Estimating and forecasting district-level migration patterns in Uganda
by David K. Bohl and Mickey Rafa.
USAID and Frederick S. Pardee Center for International Futures.
April 2018
A study of the drivers of internal migration and available subnational demographic data, to derive an estimate of district-level migration flows in Uganda.

The future of primary education survival in southwest Uganda
by Mickey Rafa and Ellie Bremer.
USAID and Frederick S. Pardee Center for International Futures.
April 2018
Analysis of the historical patterns in survival rates, the potential causes of high rates of attrition from the primary system, and the impact that improvements in education funding could have in Southwest Uganda.

Conference Papers

Structure learning from time series with false discovery control
by Bernat Guillen Pegueroles, Bhanukiran Vinzamuri, Karthikeyyan Shanmugam, Steve Hedden, Jonathan D. Moyer and Kush R. Varshey.
Frederick S. Pardee Center for International Futures, IBM Research.
May 2018
The result of an ongoing collaboration between the Pardee Center and IBM's Science For Social Good Initiative, this paper proposes a new structure learning algorithm to test for causality between variables in the IFs model. Submitted to the Neural Information Processing Systems (NIPS) Conference, Montreal, Canada.

Introducing the Human Trafficking Index dataset
by Oliver Kaplan, Jonathan D. Moyer, and Mickey Rafa.
University of Denver.
April 2018
A new panel dataset of categorical indicators on the presence of human trafficking—a largely hidden phenomenon that occurs in diverse forms--and policy responses to trafficking, including description of construction and potential uses of the data, as well as an agenda for future research. Presented at the International Studies Association 2018 Annual Convention, San Francisco, CA.

Projecting armed conflict and unrest under climate change scenarios
by Elisabeth Gilmore Clark, Håvard Hegre, Kristina Petrova, Jonathan D. Moyer and Drew Bowlsby.
The Minerva Initiative, the European Research Council, and the MISTRA Geopolitics Programme.
October 2017
Consideration of two issues: 1. How to think systematically about the existing evidence on the associations of climate change and conflict; and 2. How to develop credible projections of the implications for the future burdens of armed conflict. Presented at Impacts World 2017, Potsdam, Germany.

Newspapers/Blog Posts

Why Trump's tariffs could weaken US influence in the world
by Jonathan D. Moyer and David K. Bohl.
The Washington Post's Monkey Cage.
March 2018
An examination of geopolitical risks associated with trade conflict, as well as the effect of trade on global influence of a country.

Richest, poorest districts
by Stephen Kafeero
Uganda Daily Monitor.
January 2018
Pardee Center research featured on the front page of *Uganda's Daily Monitor* on Sunday, January 21, highlighting our report for the USAID/Uganda Monitoring, Learning, and Evaluation Contract: *Estimating District GDP in Uganda*.

Building capacity to think about the future
by Jonathan D. Moyer, Alex Porter, and Christopher Rice.
The Mad Scientist Laboratory, a U.S. Army Training and Doctrine Command (TRADOC) initiative.
December 2017
A look at how the IFs model can help analysts and decision-makers understand current trajectories of development and make integrated, informed choices for a more optimal future.

PUBLICATIONS 2017-2018

Policy Briefs

Double burden of malnutrition
by Alanna Markle and Dale van der Lingen.
FuturesCape Policy Brief, Western Cape Provincial Government.
March 2018
Weighing the economic costs of the high co-occurrence of over-consumption and undernutrition in the Western Cape to 2040; findings are being used to advance food security initiatives spearheaded by the Chief Directorate of Policy and Strategy.

A delicate balance: Water scarcity in South Africa
by Zarchary Donnenfeld, Courtney Crookes and Steve Hedden.
African Futures Project Paper, Institute for Security Studies.
March 2018
A national-level forecast of water supply and withdrawals until 2035; the third in our series of reports studying the water crisis in South Africa.

Building the future: Infrastructure in Nigeria until 2040
by Alex Porter & Julia Schunemann.
Frederick S. Pardee Center for International Futures and Institute for Security Studies.
December 2017
An exploration of some ambitious but realistic interventions to improve economic growth and development in Nigeria, where basic physical infrastructure deficit severely undermines the country's prospects for economic growth and development.

Finding a foothold: Assessing forecastability in transnational organised crime
by Alex Porter, David K. Bohl, Jonathan D. Moyer and Lily Welborn.
Enhancing Africa's Response to Transnational Organised Crime (ENACT).
December 2017
A conceptual background for understanding and quantifying the future in broad terms and in the context of transnational organized crime (TOC), including an assessment of 'forecastability' in five TOC categories.

Estimating district GDP in Uganda
by Mickey Rafa, Jonathan D. Moyer, Mickey Rafa, Xuantong Wang and Paul Sutton.
USAID and Frederick S. Pardee Center for International Futures.
November 2017
Pardee Center researchers use nighttime lights imagery and data measuring crop production and prices to estimate the size of Uganda's 116 district economies, providing the foundation for exploring poverty and income distribution at a finer spatial resolution than currently provided by surveys in Uganda.

Migration trends in the Western Cape
by Alanna Markle and Dale van der Lingen.
FuturesCape Policy Brief, Western Cape Provincial Government.
November 2017
A review of migration trends in the Western Cape, highlighting the significant and growing influence of migration on demographic change in the province since 2001.

Leading Cape 2040: By the numbers
by Alanna Markle.
Western Cape Government, Department of the Premier's Chief Directorate: Policy and Strategy.
October 2017
The main findings from Leading Cape 2040 and the final in a series of six policy papers produced by The Pardee Center in partnership with the Western Cape Government Department of the Premier, looking at key challenges the province will face to 2040.

Using nighttime lights for poverty analysis in Uganda
by Mickey Rafa, Jonathan D. Moyer, Xuantong Wang and Paul Sutton.
USAID and Frederick S. Pardee Center for International Futures.
April 2018
Support for the premise that nightlights data can be a frequent, low-cost, high-resolution alternative to traditional measurements of poverty, and an exploration of the relationships between poverty, living conditions, and nighttime lights data for the districts of Uganda.

ISS TODAY ARTICLES BY PARDEE AFFILIATES: INSTITUTE FOR SECURITY STUDIES

Gender parity is key for better education outcomes
by Zachary Donnenfeld.
June 2018

Africa needs a revolution in education
by Jakkie Cilliers and Stellah Kwasi.
April 2018

Central Africa's Gathering Storm
by Fonet Akum and Zachary Donnenfeld.
March 2018

Food security under threat in Kenya
by Lily Welborn.
March 2018

South Africa can balance its water system, but the clock is ticking
by Zachary Donnenfeld.
March 2018

South Africa's water crisis is bigger than the Cape
by Zachary Donnenfeld.
February 2018

Why African health policy needs gender mainstreaming
by Zachary Donnenfeld and Anne-Marie Hildson.
January 2018

Natural gas won't solve Mozambique's development challenges
by Zachary Donnenfeld and Alex Porter.
December 2017

How Namibia can realize its vast development potential
by Zachary Donnenfeld.
October 2017

Africa's future: Seven key trends
by Julia Bello-Schünemann and Zachary Donnenfeld.
October 2017

Downstream costs of the Grand Ethiopian Renaissance Dam
by Zachary Donnenfeld.
July 2017

Mr. Pardee Lends Support to New Learning Center in Johannesburg Featuring IFs

On May 28, an International Futures installation opened at the African Leadership Academy in Johannesburg, a secondary school that prepares an elite cadre of students from across Africa for careers of leadership and service. Along with the Frederick S. Pardee Library for the Future of Africa on campus, the school now offers interactive, hands-on training in the IFs model, which helps young scholars learn to think about the future in data-driven, integrated ways. This work was inspired and funded by our founding supporter; Mr. Pardee is an economist, businessman, and philanthropist who has been a sustaining supporter of IFs and our center since 2007.

Collaboration and Connections on Campus

Our report with USAID, *Estimating District GDP in Uganda,* represents an exciting collaboration between the Korbel School of International Studies and the University of Denver's Geography Department; the research team includes Mickey Rafa and Jonathan D. Moyer from the Pardee Center, Professor Paul Sutton of DU's Geography Department, and geography student Tony Wang (PhD expected 2020). Pardee Center research-project aide Stellah Kwasi (MA International Development, 2018) and Tony Wang spent the summer of 2017 in Kamplala with USAID-Uganda, using IFs to inform program design, management, and assessments on a subnational level. We have also expanded our research/project aide staff to include Master's and PhD students from the Ritchie School of Engineering and Computer Science, Morgridge College of Education, and Daniels College of Business.

Mickey Rafa, Assistant Director of Research Operations

Mickey Rafa, a DU alumnus (MA International Studies, 2013; MS Business Analytics, 2017) and member of the IFs team since 2011, has transitioned to his new position as Assistant Director of Research Operations. Mickey has served most recently as our Financial and Program Officer, initiating and managing a steady stream of contracts, grants, and communication with clients. His care and concern for our resources, along with his vision of our potential, have shaped our progress and set us up for longevity. Mickey has led research activities in collaboration with DU's geography department on developing subnational GDP estimates in Uganda using satellite imagery. He has also been instrumental in data creation, exploratory data analysis, and development trends analysis and forecasting. Mickey's primary research focus is on the subnational projects of the Pardee Center in South Africa (with the Western Cape Government) and Uganda (with USAID/The Learning Contract). We trust Mickey will, in his new position, continue to shape the future of our institution. We are happy, as ever, to have such a valuable member of our team.

Brian O'Neill, Incoming Director of Research

Starting in the Fall of 2018, Brian O'Neill joins the faculty of the Josef Korbel School of International Studies as professor and the Pardee Center's new Director of Research. We look forward to welcoming him to campus! Brian holds a PhD in Earth Systems Science and an MS in Applied Science, both from New York University. His research interests are in human-environment interactions, in particular the relationship between future societal development, greenhouse gas emissions, and climate change impacts. He has led research groups on Integrated Assessment Modeling and on Climate and Human Systems at the US National Center for Atmospheric Research (NCAR), and on Population and Climate Change at the International Institute for Applied Systems Analysis (IIASA). Brian is a Convening Lead Author for the Intergovernmental Panel on Climate Change's ongoing Sixth Assessment Report. He is also the lead author of *Population and Climate Change*, published by Cambridge University Press.

Andrew Scott, Outgoing Ping Pong Phenom

It was a year of cultural diplomacy and athletic dedication by many of our students and staff. Korbel School supporter Dr. Paul Docktor donated a ping pong table to the building, which was housed in a room off our Research Annex. Team Pardee took advantage of this proximity, spending lunch hours devoted to gaining a competitive edge at the 2018 all-school bracketed tournament, hosted by the Center for Middle East Studies. Our Research Associate Andrew Scott, the odds-on favorite, made a strong showing but came up short in the championship round to Wuxiang Zhou, a visiting scholar representing the Center for China-US Cooperation. Although we will miss him, Andrew will have plenty of opportunity to better his game when he moves to Beijing for a new research position this fall.

Alex Porter, Whitney Doran, and Steve Hedden,
Bryce Canyon Half Marathon, 2018

Staff members attempt the s-curve dance, celebrating 40 years of IFs

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Annual Review design by Camryn Dreyer

OUR LOGO: THE ART OF FORECASTING

The shape of our logo is an abstraction of an s-curve, an important mathematical function for the study of technology.
The upward direction of the logo represents our generally optimistic view of human development potential.
The brushstroke in the middle represents the fact that forecasting is an art.
The original crimson and gold hues represent our home at the University of Denver.
The three main strokes shape the letters "IFs," the main resource developed by the Pardee Center.

"What IFs # 2," acrylic on canvas, 20" x 20" Lisa Lane Filholm, 2018

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The challenges facing global policymakers are rarely isolated to single issue areas. Nor do they respect time, geographic boundaries, or budgetary cycles. Given this reality, the way we think about policy choices should be as integrated and long-term as the very real-world challenges we aim to address. At the Frederick S. Pardee Center for International Futures, we believe that with the right data and methods, we can—and for the sake of each person affected by these policy decisions, we should—look past immediate politics or silos to better understand how actions we take today might play out in the future. With our center's integrated assessment platform, International Futures (IFs), we have a one-of-a-kind, dynamic tool that helps us bring more structure, data and academic rigor into the integrated forecasting process.