Geospatial Sciences Center of Excellence
South Dakota State University

Triennial Report 2012 - 2014

WECOTA HALL

SDSU

USGS
science for a changing world

Editorial Staff

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David P. Roy

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Purpose

This report introduces the Center and summarizes the last 3 years of activity. The intent of this report is to advertise our achievements to the wider academic community, attract new students and postdoctoral researchers, and to provide a baseline to measure our future progress.

South Dakota is named after the Lakota and Dakota Sioux American Indian tribes. The state was admitted to the Union in 1889, and today has a population of about 853,000. South Dakota is a beautiful rural state with a continental climate and four distinct seasons, ranging from very cold winters to hot summers, with an average of 230 sunny days per year. In 2013 the CNBC ranked South Dakota as the state with the 7th highest quality of life based on several factors, including local attractions, the crime rate, health care, as well as air and water quality. It was ranked by the CNBC as the top state for business in 2013. South Dakotans have the nation's 2nd shortest commute-to-work time (U.S. Census Bureau's 2010 American Community Survey) and the 3rd lowest unemployment rate (Department of Labor December 2011 assessment).

Several people helped me to put this report together but special thanks go to Eric Salas.

David P. Roy
Triennial Report Editor
Professor, SDSU

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Geospatial Sciences Center of Excellence

The **Geospatial Sciences Center of Excellence (GSCE)** was inaugurated as a formal collaboration between South Dakota State University and the United States Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center in September 2005. The GSCE mission is to apply geographic information science capabilities, especially remote sensing, to advance the scientific understanding of the Earth System and, in particular, the characteristics and consequences of a changing global landscape.

Through the GSCE, the interdisciplinary SDSU-EROS research team applies remote sensing, geographic information systems, geospatial analysis, digital mapping, and modeling to document and understand the changing earth. From the perspective of the USGS EROS, the GSCE provides a unique and powerful opportunity to advance USGS EROS efforts to provide operational observation and monitoring that supports USGS science goals related to climate change, ecosystem dynamics, human health and the environment, natural hazards, and water needs.

Over the past three years, GSCE faculty research has led to the identification of transformative products and access systems. In the coming three years, these transformations will become reality, making USGS EROS and the GSCE the central hub for global land change monitoring, assessment, and projection.

The idea and vision for the GSCE was formed and implemented by scientific and administrative leaders at SDSU, EROS, and the South Dakota State Board of Regents. As this report shows, we have made significant progress in achieving our founders' original vision.

The GSCE truly represents a unique partnership that strengthens both SDSU and EROS. Since inception in September 2005, the senior scientists from SDSU and EROS have worked together to make the GSCE a recognized global center for geographic information science research.

Tom Loveland
Research Physical Scientist, USGS EROS Center
Adjunct Professor, SDSU

Senior Scientists & Professors

Twelve senior scientists constitute the GSCE faculty and are drawn from academia and the United States Geological Survey Earth Resources Observation and Science (EROS) Center staff. By serving the international, national and South Dakota communities through teaching, graduate supervision and research investigations, the faculty have established the GSCE as an internationally recognized center for research in geospatial sciences.

Prof. Mark A. Cochrane

Ph.D. Ecology
Biology Department, Pennsylvania State University, USA, 1998

S.B. Environmental Engineering Science
Massachusetts Institute of Technology, USA, 1993

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Faculty SDSU

Professional Positions

Mark relocated to South Dakota State University in 2005 where he is currently a senior scientist and professor in the Geospatial Sciences Center of Excellence and the Natural Resource Management Department. He has also been an associate researcher with the non-governmental organization (NGO) Instituto do Homem e Meio Ambiente na Amazônia (IMAZON) since 1995. Prior to working at SDSU, he was a senior research scientist with the Center for Global Change and Earth Observations (CGCEO) and an adjunct professor with the Geography Department at Michigan State University. From 1998-1999, he lived in Brazil and was a postdoctoral scientist with the Woods Hole Research Center and an associate researcher with the NGO Instituto de Pesquisa Ambiental da Amazônia (IPAM).

Research Interests

Dr. Cochrane's research focuses on understanding spatial patterns, interactions and synergisms between multiple physical and biological factors that affect ecosystems. Recent work has emphasized climate change impacts, human dimensions of land-cover change, and the potential for sustainable development. Ongoing research projects aim to understand how climate and disturbance regime changes interact, assessing biodiversity impacts resulting from various forms of forest management and degradation, including fire, fuels treatments, forest fragmentation and logging. Current work is establishing Monitoring, Reporting, and Validation (MRV) methods to quantify and track carbon emissions related to fire emissions from peatswamp forests in Indonesia. Dr. Cochrane's interdisciplinary work combines ecology, climate science, remote sensing and other fields of study to provide a landscape perspective of dynamic processes involved in land-cover change. He has published more than 70 peer reviewed scientific journal papers, 16 book chapters, and edited or authored 3 books. His most recent book, *Tropical Fire Ecology: Climate Change, Land Use and Ecosystem Dynamics* (Springer-Praxis) provides detailed information on the fire situation for roughly half of the planet's fire-affected surface (2009).

Teaching

Fire and Ecosystems (GSE/GEOG/WL/BIOL-767), Mark Cochrane, Graduate level course offered as part of the Geospatial Science and Engineering (GSE) Ph.D. program, Spring 2013.

Introduction to Global Climate Change (GSE/BIOL 792 & GEOG 790), Mark Cochrane, Graduate level course offered as part of the GSE Ph.D. program, Spring 2012, 2014.

Prof. Niall P. Hanan

Ph.D. Biology
Biology Department, Queen Mary College, London University
UK, 1990

B.Sc. Hons
Liverpool Polytechnic, Liverpool, UK, 1985

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Faculty SDSU

Professional Positions

Niall is senior scientist in the Geospatial Sciences Center of Excellence and professor of Natural Resource Management (NRM) at South Dakota State University. Niall held postdoctoral appointments at the University of Maryland (1991-1995), Wageningen University Research, The Netherlands (1995-1997), UC-Santa Barbara and Carnegie Institution of Washington, Stanford (1998). He then joined the Natural Resource Ecology Laboratory (NREL) at Colorado State University where he spent 12 years as an assistant, associate and senior research scientist. Niall moved to SDSU in January 2011.

Research Interests

Niall's research focuses on the ecology and ecosystem dynamics of semi-arid grasslands, savannas and grazing systems in Africa and globally. His ongoing research projects are strongly interdisciplinary, including theoretical, empirical and model-based studies of the ecology of savannas and other semi-arid vegetation systems, the role of human management of grazing, fire and other disturbances in ecosystem dynamics, the use of micrometeorological techniques to study vegetation-atmosphere exchanges of carbon and water, and the use of remote sensing and geospatial datasets to measure and model ecosystem dynamics at landscape, regional and continental scales. Niall has published more than 50 peer reviewed scientific papers and has recent funding from NSF, NASA, USAID, and other agencies.

Teaching

Advanced Methods in Geospatial Modeling: Global Ecology and Modeling (GSE/GEOG-760), Niall Hanan, Graduate level course offered as part of the Geospatial Science and Engineering (GSE) Ph.D. program, Spring 2012, Spring 2013.

Geospatial Science and Engineering Seminar (GSE-790), Niall Hanan, Graduate level course required as part of the Geospatial Science and Engineering Ph.D. program, Fall 2013, Spring 2014, Fall 2014.

Special Topics (GSE-792), Niall Hanan, Graduate level reading and discussion course on current progress in global ecology, global change and sustainability offered as part of the GSE Ph.D. program, Fall 2013.

Prof. Geoffrey M. Henebry

Ph.D. in Environmental Sciences
The University of Texas at Dallas, USA, 1989

M.Sc. in Environmental Sciences
The University of Texas at Dallas, USA, 1986

B.A. in Liberal Arts
St. John's College, Santa Fe, USA, 1982

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Faculty SDSU

Professional Positions

Geoff was a postdoctoral fellow and then research assistant professor with the Konza Prairie Long Term Ecological Research (LTER) Project at Kansas State University, 1989-1996. During a Fulbright senior research fellowship from 9/1993 to 3/1994, he worked at INPE (the Brazilian National Institute for Space Research) on characterizing flooding dynamics in the Pantanal Matogrossense using Synthetic Aperture Radar. Geoff joined the Department of Biological Sciences at Rutgers-Newark in 1996 as an assistant professor. However, the Great Plains beckoned and Geoff and his family moved to the University of Nebraska-Lincoln in 1999. He worked in the Center of Advanced Land Management Information Technologies as an associate geoscientist in the Conservation and Survey Division and then as a research associate professor in the School of Natural Resource Sciences until moving north to South Dakota State University in 2005. In addition to being a senior scientist in the GSCE, Geoff is a tenured full professor in the Department of Natural Resource Management. He served as the Coordinator of the Ph.D. program in Geospatial Science and Engineering from 2006-2011. Since September 2012, Geoff has served as the Co-Director of the GSCE.

Research Interests

Land surface phenology: the spatio-temporal dynamics of the vegetated land surface as observed by remote sensors. The biogeophysical consequences of land use land cover change (LCLUC), particularly land-atmosphere interactions. Effects of climatic variability and change on land surface dynamics. Landscape ecology of grasslands, croplands, and disturbances. Since 2013 Geoff has served as the Chair of the Advisory Committee of the USA National Phenology Network (http://usanpn.org). He currently serves on the editorial boards of BioScience, Landscape Ecology, and the International Journal of Biometeorology. He has contributed to more than 100 scientific papers and reports, 14 book chapters, and co-edited a book. Geoff's research is currently funded by NASA, NIH, and NSF. He is active in the American Geophysical Union (AGU) and the US Chapter of the International Association for Landscape Ecology (US-IALE). Since 2001 Geoff has been a Certified Senior Ecologist by the Ecological Society of America.

Teaching

Introduction to Geospatial Science and Engineering (GSE-740), Geoffrey Henebry, Graduate level course required as part of the Geospatial Science and Engineering Ph.D. program, Fall 2012, Fall 2014.

Geospatial Science and Engineering Seminar (GSE-790), Geoffrey Henebry, Graduate level course required as part of the Geospatial Science and Engineering Ph.D. program, Spring 2012, Fall 2012, Spring 2013.

Prof. David P. Roy

Ph.D. Remote Sensing
Geography Department, University of Cambridge, UK, 1994

M.Sc. Remote Sensing and Image Processing Technology
Meteorology Department, University of Edinburgh, UK, 1988

B.Sc. Geophysics
Environmental Sciences Department, University of Lancaster, UK, 1987

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Faculty SDSU

Professional Positions

David was a postdoctoral research fellow with the National Environment Research Council for Thematic Information Systems, University of Reading, U.K. (1993 to 1994) and with the Space Applications Institute of the Joint Research Center of the European Commission, Ispra, Italy (1994 to 1996). In 1996 he moved to the U.S. to take a position as an assistant and then as an associate research scientist in the Department of Geography, University of Maryland, and to lead the Moderate Resolution Imaging Spectroradiometer (MODIS) Land Data Operational Product Evaluation group at NASA's Goddard Space Flight Center. David relocated to South Dakota State University in 2005 where he is currently a senior scientist and professor in the GSCE and the Geography Department.

Research Interests

David's research focuses on the development of remote sensing and advanced computing methods to integrate/fuse satellite sensor data and to map and characterize terrestrial change, Petabyte volume satellite data processing and visualization, and the causes and consequences of land cover and land use change.

He is co-chair of the USGS NASA Landsat Science team, a member of the NASA MODIS land science team, the NASA Land-Cover/Land-Use Change Science Team, the NASA Suomi National Polar-orbiting Partnership (NPP) land science team, and the GOFC-GOLD Fire Implementation team. He is chair of the US Land Processes (LP) Distributed Active Archive Center (DAAC) User Working Group (UWG) and a member of the NASA Earth Exchange (NEX) UWG. He is a recipient of three NASA group achievement awards recognizing his contributions to the NASA MODIS Terra and Aqua missions. David has published more than 80 peer reviewed scientific journal papers and more than 10 book chapters. He has led research grants that total more than $12 million as principal investigator and more than $11 million as a co-investigator.

Teaching

Quantitative Remote Sensing for Terrestrial Monitoring (GSE/GEOG-741-S01), David Roy, Graduate level course offered as part of the Geospatial Science and Engineering Ph.D. program, Spring 2013, Spring 2015.

Remote Sensing (GEOG-484), David Roy (laboratories assisted by Sanath Kumar and Emma White), Undergraduate level course offered as part of the SDSU Geography degree and masters program, Fall 2012, Fall 2013, Fall 2014.

Prof. Michael C. Wimberly

Ph.D. Ecology
College of Forestry, Oregon State University, USA, 1999

M.Sc. Quantitative Resource Management
College of Forest Resources, University of Washington, USA, 1995

B.A. Environmental Science
Department of Environmental Sciences, University of Virginia, USA, 1990

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Faculty SDSU

Professional Positions
Mike was a postdoctoral research scientist with USDA Forest Service Pacific Northwest Research Station from 1999 through 2001 and an assistant professor of Forest Landscape Ecology in the Warnell School of Forest Resources at the University of Georgia from 2001 through 2005. He joined the newly-created Geospatial Sciences Center of Excellence (GSCE) at South Dakota State University as an associate professor in 2005 and was promoted to full professor in 2011. He currently holds the positions of Senior Research Scientist in the GSCE and professor in the Department of Natural Resource Management.

Research Interests
Mike conducts interdisciplinary research that combines ecological concepts with satellite remote sensing, geographic information science, and spatial statistics to study species distributions, natural disturbances, landscape change, and human health. His current work includes the Epidemic Prognosis Incorporating Disease and Environmental Monitoring for Integrated Assessment (EPIDEMIA) project, which is focused on identifying environmental risk factors and developing predictive models for outbreaks of vector-borne and zoonotic diseases. Results are being applied to forecast and map outbreaks of human West Nile virus disease in the United States and epidemic malaria in the highlands of East Africa. He is also leading the Coupled Human and Natural Geospatial Environments (CHANGE) project, which combines spatial analysis of landscape change using remotely sensed data with the development of a land change simulation model that integrates human land use with natural disturbances and vegetation dynamics. Specific areas of land change research include interactions between human population expansion and fire regimes in the western United States, the effects of land use change, logging, and fire on tropical forest degradation and loss in West Africa, and the ecological impacts of agricultural intensification and extensification in the Great Plains of the United States.

Teaching
Geospatial Analysis (GSE/GEOG-743), Michael Wimberly, Graduate level course offered as part of the Geospatial Science and Engineering Ph.D. program, Spring 2012, Fall 2013.

Landscape Ecology (NRM 706/706L), Michael Wimberly, Graduate level course offered by the Department of Natural Resource Management, Fall 2014.

Prof. Xiaoyang Zhang

Ph.D. Geography
King's College London, University of London, London,
United Kingdom, 1999

M.Sc. Geography
Nanjing Institute of Geography and Limnology, Chinese Academy of
Sciences, Nanjing, China, 1991

B.Sc. Geography
Department of Geography, Peking University, Beijing,
China, 1984

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Faculty SDSU

Professional Positions

Dr. Xiaoyang Zhang is a senior scientist at the Geospatial Sciences Center of Excellence and an associate professor at the Department of Geography, South Dakota State University (SDSU). Before joining SDSU in 2013 he was a research assistant at the Institute of Hydrobiology, Chinese Academy of Sciences (CAS) (1984-1988), a research assistant and then associate professor at the Institute of Geodesy and Geophysics, CAS (1988-1995); a research associate at the Department of Geography, Boston University (1999-2005); and a senior research scientist working at the NOAA *Center for Satellite Applications and Research* through the Earth Resources Technology company (2005-2012) and the Earth System Science Interdisciplinary Center, University of Maryland (2012-2013), Maryland.

Research Interests

Dr. Zhang's research is focused on the investigation of land surface dynamics and climate impacts using remotely sensed data at regional to global scale. His research aims at the development of a long-term continuous data record of global land surface phenology from AVHRR, MODIS, and VIIRS satellite data, and the establishment of operational systems for near-real time monitoring of land surface phenology and biomass burning emissions in using polar orbiting and geostationary satellite data streams. In addition his research includes the examination of climate impacts on land surface dynamics using the products he has developed.

He is a member of the NASA Suomi-NPP Land Science Team. He has published more than 45 peer reviewed scientific journal papers, 24 book chapters, and recently edited a 332 page book *Phenology and Climate Change* (InTech, 2012).

Teaching

Advanced Methods in Geospatial Modeling: Computation for Remote Sensing Analysis and Product Generation (GSE 792–S01), Xiaoyang Zhang, Graduate level course offered as part of the Geospatial Science and Engineering Ph.D. program, Fall 2014.

Prof. Alisa L. Gallant

Ph.D. Remote Sensing and GIS program
Colorado State University, USA, 1997

M.Sc. Biological Science
Oregon State University, USA, 1985

B.A. Biology
Sonoma State University, USA, 1979

B.A. Art
Sonoma State University, USA, 1979

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Faculty EROS

Professional Positions

Alisa has woven training in ecology and physical science towards conducting integrated landscape research since the early 1980s. She was a regional ecosystems geographer at the U.S. Environmental Protection Agency Research Laboratory in Corvallis, Oregon, from 1983-1990. After returning to school for a doctorate, she took a postdoctoral position from 1996 to 1998 as the remote sensing and geospatial analysis specialist for the Landscape Biodiversity Lab at Montana State University in Bozeman, Montana. In 1998 she accepted a position as a research physical scientist at the U.S. Geological Survey, Earth Resources Observation and Science (EROS) Center in Sioux Falls, South Dakota, where she continues to work. In 2011 she joined the Geospatial Sciences Center of Excellence and the Geography Department at SDSU as an adjunct faculty member.

Research Interests

Integrated, interdisciplinary, multiscale studies that incorporate remote sensing, GIS/geospatial modeling, landscape/land-change characterization, and ecoregional analyses for biodiversity applications. Alisa is the remote sensing and geospatial analysis lead for the Terrestrial Wetland Global Change Research Network (TWGCRN), an international network formed to study climate change interacting with other stressors in interconnected wetland-upland landscapes. She particularly is interested in opportunities offered by the TWGCRN to link patterns of acoustic energy and other in-situ information with spatiotemporal patterns of energy measured remotely in the optical, infrared, and microwave portions of the spectrum. Alisa also collaborates on research integrating remote and in-situ environmental data to study relations of land-use dynamics to honey bee declines and conservation programs.

Prof. Kevin P. Gallo

Ph.D. Agricultural Meteorology/Remote Sensing
College of Agriculture, Purdue University, USA, 1984

M.Sc. Agricultural Climatology
College of Agriculture, Purdue University, USA, 1981

B.Sc. Geography (Meteorology)
Geography Department, Northern Illinois University, USA, 1978

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Faculty EROS

Professional Positions
Kevin has been a physical scientist with the Center for Satellite Applications and Research (STAR), National Environmental Satellite, Data, and Information Service (NESDIS) of the National Oceanic and Atmospheric Administration (NOAA) since 1985. Prior to joining NOAA, Kevin was a postdoctoral research associate with the Laboratory for Applications of Remote Sensing, Purdue University (1984) and an assistant professor of Agricultural Meteorology, Cornell University (1984-1985). Kevin has been a visiting scientist at the USGS/EROS (1986-1991 and 1999-present) and NOAA's National Climatic Data Center (1991-1998).

Research Interests
Kevin's current research activities include:

* The use of high-resolution satellite data and in situ data to validate NOAA operational satellite data and products;

* Satellite-based analysis and assessment of the urban heat island effect (warmer air temperatures associated with urban compared to rural environments) on trends in temperature observed at climate stations; and

* Analysis and assessment of land surface properties (e.g., land surface temperature and vegetation indices) at in situ climate stations to provide recommendations on use of the stations for validation of future satellite-derived products

Prof. Shuguang Liu

Ph.D. Forest Ecology and Hydrology
University of Florida, USA, 1996

M.Sc. Forest Ecology
Beijing Forestry University, China, 1987

B.Sc. Forest Science
Central-South Forestry University, China, 1984

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Faculty EROS

Professional Positions

Leo was a research scientist at the State Planning Commission, Beijing, China and the Chinese Academy of Sciences, Beijing, China prior to gaining his Ph.D. in 1996. He then moved to the USGS Earth Resources Observation and Science (EROS) Center as a government contractor. Since 2003 he has been an honorable professor at the Chinese Academy of Sciences, China and an advisor to the US National Research Council. In 2008 he became a federal employee of the USGS Earth Resources Observation and Science (EROS) Center.

Research Interests

Leo is leading an interdisciplinary team to develop advanced data assimilation systems to improve the monitoring and forecast of land surfaces conditions including carbon sources and sinks, hydrological cycle, and ecosystem goods and services. He leads a USGS/NASA effort to develop innovative up-scaling approaches to quantifying the spatial and temporal dynamic changes of contemporary carbon stocks and fluxes in the US, and quantify the economic and environmental consequences of biofuel production in the Northern Great Plains. He has played key roles in several interdisciplinary studies on estimation of carbon sequestration supply and prediction of ecological sustainability under various physical, socioeconomic, and environmental conditions at the regional scale in Central and North America, Asia, and Africa.

Leo's work has been funded by various agencies including NASA, NSF, DoD, USAID, USDA, and USGS. He has published more than 50 peer reviewed scientific journal papers. He currently serves on the editorial boards of The Open Forest Science Journal and Tropical and Subtropical Botany.

Prof. Thomas R. Loveland

Ph.D. Department of Geography
University of California, Santa Barbara, USA, 1998

M.Sc. Department of Geography
South Dakota State University, USA, 1976

B.Sc. Department of Geography
South Dakota State University, USA, 1974

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Faculty EROS

Professional Positions

Tom has held a number of geographic remote sensing positions dealing with land use and land cover issues. He started his career as a Land Use Analyst for the South Dakota State Planning Bureau in 1977. He also served as the Director of the Arizona State Land Department's Resource Analysis Division in Phoenix, AZ. Most of Tom's career has been spent at the USGS Earth Resources Observation and Science Center (EROS) where he has been engaged in many large area land cover characterization studies spanning local to global scales. Tom is currently leading Landsat science activities for the USGS and he provides science input to all USGS remote sensing activities. Tom has been co-director of the Geospatial Sciences Center of Excellence since 2004.

Research Interests

Tom's interests revolve around understanding the geography of land change. Using remote sensing, he has investigated the characteristics of land use and land cover, the geographic variability in landscape dynamics, and the consequences of change on environmental systems. He has been involved in mapping land cover characteristics throughout the United States and globally. Tom was instrumental in reestablishing a national land cover mapping program in the USGS, and he was among the first to create continental and global-scale land cover data sets derived from remotely sensed imagery. His recent research has focused on documenting the rates, cause, and consequences of contemporary US land cover change. Tom chairs the USGS-NASA Landsat Science Team and was a member of the NASA National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project science team. He is a member of the editorial board for the Journal of Land Use Sciences and has served in leadership roles in a number of national and international science organizations including the American Society of Photogrammetry and Remote Sensing, Climate Change Science Program, and the Global Observation of Forest Cover/Global Observation of Lands Dynamics. Tom has published over one hundred journal articles, book chapters, and other professional papers. He serves on numerous national and international science advisory panels dealing with remote sensing, and has received career achievement awards from the Department of the Interior, U.S. Geological Survey, American Society of Photogrammetry and Remote Sensing, and the Association of American Geographers.

Prof. Gabriel B. Senay

Licensed Professional Engineer (P.E.) in Civil Engineering
Water Resources, 2002

Ph.D. Department of Agricultural Engineering
The Ohio State University, USA, 1996

M.Sc. Catchment Hydrology
Wageningen University, The Netherlands, 1991

B.Sc. Agricultural Engineering
Alemaya University, Ethiopia, 1986

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Faculty EROS

Professional Positions

Gabriel joined the U.S. Geological Survey (USGS) Earth Resources Observation Science (EROS) Center as a research physical scientist in 2008. Before that, he worked as a senior and principal scientist under different contractors (Raytheon, SAIC and ARTS) to USGS/EROS since 2000. Since 2005 his USGS/EROS appointment has been shared with the Geospatial Sciences Center of Excellence at SDSU where he works as an adjunct professor in the Department of Agricultural and Biosystems Engineering and the Geographic Information Science Center of Excellence. He worked for 2 years (1998-2000) as a contactor to US Environmental Agency (EPA) in Cincinnati, Ohio. He moved to the United States in 1992 to pursue his Ph.D. work at the Ohio State University and undertook postdoctoral research at Oklahoma State University, Stillwater, Oklahoma (1996-1998).

Research Interests

Gabriel's research focus is on the integration of satellite-derived data with Agro-hydrologic modeling for water resources and agricultural production assessment and monitoring. His research focuses on developing simplified algorithms for operational early warning applications to monitor droughts and potential food security risks in the developing world. He seeks to maximize the societal benefit of earth observation systems through better resource assessment and planning that have been made possible due to improved access to remotely sensed data.

His research work is funded through grants obtained from various organizations such as NASA, USGS, USDA, NIH and NSF.

Prof. James E. Vogelmann

Ph.D. Plant Biology
Indiana University, USA, 1983

B.A. Botany
University of Vermont, USA, 1978

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Faculty EROS

Professional Positions

Jim was a National Research Council postdoctoral researcher and staff member at the Jet Propulsion Laboratory, California from 1984-1987. He then became a research assistant professor at the Complex Systems Research Center, which is part of the Institute for the Study of Earth, Oceans and Space at the University of New Hampshire from 1987-1994. From 1994 to 2008, Jim was a principal scientist for various corporate contracts at the USGS EROS Center. Jim joined the USGS EROS Center as a Research Ecologist in 2008. He has been affiliated with the Geospatial Sciences Center of Excellence at South Dakota State University since 2005.

Research Interests

Jim's current research interests include characterizing the Earth's natural resources, conditions, and changes, using remotely-sensed data. His current research efforts include conducting large area monitoring investigations, vegetation classification and land cover research, analysis of multi-temporal remotely-sensed data sets for characterizing multiple landscape properties and changes, vegetation characterization for fire hazard evaluation, and developing operational methodologies for employing remote sensing for assessing changing trends in vegetation condition related to climate patterns and other factors. Jim is a member of the current Landsat Science Team (2012 to present), and was a member of the previous two Landsat Science Teams (1996-2001 and 2006-2011).

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Research Professors

The GSCE faculty are complemented by research faculty hired at assistant, associate and full research professor equivalents. Research professors pursue externally funded research and increase GSCE opportunities for collaborative research and student and postdoctoral education.

Dr. Valeriy Kovalskyy

Ph.D. Geospatial Science & Engineering
South Dakota State University, 2011

M.Sc. Environmental Sciences
Ohio University, USA, 2004

B.A. Geography
Lviv National University, Ukraine, 2001

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Asst. Research Professor

Professional Positions

Dr. Kovalskyy completed his Ph.D. in August 2011 under the supervision of Dr. Geoffrey Henebry. He is currently employed as a postdoctoral researcher on the NASA Web Enabled Landsat Data (WELD) project at the GSCE. He continues to work on the use of remote sensing and advanced computing methods and is focusing on the expansion of the WELD satellite data processing to global scale, working with the Landsat and Landsat Data Continuity Science Teams and with NASA AMES supercomputer researchers. Currently, he is an assistant research professor funded by the NASA Web Enabled Landsat Data (WELD) and the USGS Landsat 8 WELD projects for which he undertakes research to develop, optimize, and assess the production of derived remote sensing science products.

Research Interests

Dr. Kovalskyy's interest in phenology and remote sensing comes from his Ph.D. thesis topic: "Development and validation of the Event Driven Phenology Model." For the thesis he developed and validated a new approach to phenology modeling that can: a) interact with ongoing meteorological conditions, b) work in both prognostic and diagnostic modes, c) track uncertainties via error propagation; and d) use remotely sensed data (NDVI) to adjust outcomes via data assimilation. Development of the new interactive phenology model required solid scientific as well as technical preparation that came from his education and more than 3 years of industrial programming experience. He developed his research and technical skills while obtaining his Master of Environmental Science degree from Ohio University and my Bachelor's degree in geography from Ivan Franko National University in Lviv Ukraine, where he worked on the use of emerging computer technologies for optimization of zoning in nature protection areas.

Dr. Izaya Numata

Ph.D. Geography
University of California Santa Barbara, 2006

M.Sc. Remote Sensing
National Institute for Space Research, (INPE – Brazil),
1999

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Asst. Research Professor

Professional Positions
After his Ph.D., Izaya worked as an assistant specialist at the University of California Santa Barbara (2006-2007). Then he moved to SDSU GSCE in 2007 to start his postdoc with forest degradation in the Amazon (2007-2013). Since 2013, he works as an assistant research professor at the GSCE.

Research Interests
Izaya's research interests are in monitoring, characterizing and evaluating land-use and land-cover (LULC) dynamics and human-environmental interactions that cause LULC change. His research approach includes intensive use of remote sensing for biophysical and chemical characterization of land surfaces (land covers and land uses) and spatiotemporal analyses. He has studied biophysical and chemical dynamics of degraded pastures as well as forest fragmentation and associated biomass collapse and carbon emissions in Amazonia. His current research project funded by NASA assesses vulnerabilities and responses of fragmented forests to drought in the Amazon by combing field inventories, remote sensing and land surface models.

Dr. Lara Prihodko

Ph.D. Ecology
Colorado State University at Fort Collins, USA, 2004

M.A. Geography
University of Maryland at College Park, USA, 1992

B.A. Archaeology
Boston University, Boston, USA, 1990

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Asst. Research Professor

Professional Positions

After completing her masters, Lara worked for Hughes STX providing scientific support in the Biospheric Sciences branch at NASA Goddard Space flight center (1992-1995). From there, she moved overseas to the Netherlands, where she worked as a research assistant at the Winand Staring Center in Wageningen (1995-1997). She then returned to school to complete her Ph.D. in Ecology at Colorado State University (CSU) where she was also a postdoctoral fellow in the Department of Atmospheric Science (2004-2006). Before her move to South Dakota State University in summer 2011, she was a research scientist at the Natural Resource Ecology Laboratory at CSU (2006-2011). Lara is currently an assistant research professor in the Geospatial Sciences Center of Excellence.

Research Interests

Lara specializes in modeling biosphere-atmosphere interactions with particular emphasis on regional to continental scale carbon dynamics, biogeochemistry and land surface characterization. Past research has included characterizing the sensitivity and uncertainty of land surface models due to their parameterization with data assimilation techniques and model parameterization of drought tolerance in the seasonally dry Amazõnian rainforest to improve coupled carbon-climate simulations. Most recently her work has focused on coupled human and natural systems in continental Africa. Current projects include the development of a model of vegetation, disturbance (fire and herbivory) and carbon cycle dynamics for continental Africa to assess the role of Africa in the global carbon cycle, measuring and modeling the dispersion and deposition of nitrogen and phosphorous released during savanna fires in Africa and the role it may play in regional biogeochemistry and fertility and understanding the sustainability and resilience of coupled human-ecological-hydrological systems in semi-arid West Africa in the face of global change. Her work is currently supported by NSF, NASA and USAID.

Dr. Christopher Wright

Ph.D. Ecology
Montana State University, USA, 2004

M.Sc. Agronomy
Montana State University, USA, 1993

B.A. Biology
Williams College, USA, 1990

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Christopher.Wright@sdstate.edu

Asst. Research Professor

Professional Positions

After completing his Ph.D., Chris was a National Research Council Postdoctoral Associate at USGS EROS (2004-2007), followed by a year working as an independent contractor to USGS. He joined GSCE as a Postdoctoral Fellow in 2008, and was promoted to Assistant Research Professor in 2013.

Research Interests

Chris is a quantitative ecologist with interests in network approaches to biological organization ranging from food webs to habitat networks. In the geospatial science realm his areas of expertise include wetland and grassland remote sensing, geoinformatics, and analysis of agricultural land use change. His current research is focused on climate change and land use change as drivers of habitat fragmentation in the Great Plains and is funded by the National Science Foundation.

Postdoctoral Fellows

The GSCE is a "Research Center of Excellence" and postdoctoral fellows play a vital role in the research conducted at the center. Postdoctoral fellows work in collaboration with GSCE faculty and are encouraged to seek their own research funding to grow the research portfolio of the Center and to develop their careers. Successful postdoctoral researchers are encouraged to advance to assistant research professor positions at the GSCE.

Dr. Christopher Barber

*GSCE Advisor **Dr. Mark Cochrane***

Academic Qualifications

Ph.D. Geospatial Science and Engineering, South Dakota State University, USA, 2012

B.Sc. Environmental Studies, Richard Stockton College of New Jersey, USA, 1997

Contact
+1 605-688-4787
christopher.barber@sdstate.edu

Current Research Interests

Tropical forest dynamics, climate change, enviromental conservation.

Representative Papers

Barber, C.P., Cochrane, M.A., Souza, Jr C., Veríssimo, A. 2012.Dynamic performance assessment of protected areas, *Biological Conservation*, 149, 6-14.

Cochrane, M.A. and Barber, C.P. 2009. Climate change, human land use and future fires in the Amazon, *Global Change Biology*, 15(3), 601-612.

Postdoctoral Fellow

Academic Qualifications

Ph.D. Geography
King's College London
UK, 2013

M.Sc. Forestry
University of Montana
USA, 2004

B.Sc. Mechanical Engineering
Case Western Reserve
University
USA, 1999

Contact

+1 605-688-4787
patrick.freeborn@sdstate.edu

Dr. Patrick Freeborn
GSCE Advisor **Dr. Mark Cochrane**

Representative Papers

Freeborn, P.H., Wooster, M.J., Roy, D.P., and Cochrane M.A. 2014. Quantification of MODIS fire radiative power (FRP) measurement uncertainty for use in satellite-based active fire characterization and biomass burning estimation, *Geophysical Research Letters*, 41, 1988–1994.

Freeborn, P.H., Wooster, M.J., Roberts, G.J., and Xu, W. 2014. Evaluating the SEVIRI fire thermal anomaly detection algorithm across the Central African Republic using the MODIS active fire product, *Remote Sensing*, 6(3), 1890-1917.

Freeborn, P.H., Cochrane, M.A., and Wooster, M.J. 2014. A Decade Long, Multi-Scale Map Comparison of Fire Regime Parameters Derived from Three Publicly Available Satellite-Based Fire Products: A Case Study in the Central African Republic, *Remote Sensing*, 6(5), 4061-4089.

Current Research Interests

Characterizing the impact of satellite viewing geometry and observation frequency on measurements of fire radiative power (FRP) and energy (FRE); Comparing, contrasting, and assimilating multiple satellite-based active fire and burned area products; Interpreting global associations between fire danger and fire activity.

Postdoctoral Fellow

Dr. Armel Kaptue

*GSCE Advisor **Dr. Niall Hanan***

Academic Qualifications

Ph.D. Remote Sensing and Physics of biosphere, Paul Sabatier University of Toulouse, France, 2010

M.Sc. Applied Computer Science and Geomatics, International Institute for Water and Environmental Engineering of Ouagadougou, Burkina Faso, 2007

Secondary and High School Teacher's Diploma, Mathematics, Higher Teacher Training College of Yaounde, Cameroon, 2005

M.Sc. Mathematics option Numerical Analysis, University of Yaounde I, Cameroon, 2005

B.Sc. Mathematics option Applied Mathematics, University of Dschang, Cameroon, 2002

Contact

+1 605-688-6255
armel.kaptue@sdstate.edu

Current Research Interests

Modeling of coupled natural humans systems; Quantitative estimation of land surface variables and modelling of land cover and land use change; Study of land atmosphere interaction processes; Mitigation, adaptation and vulnerability of terrestrial ecosystems.

Representative Papers

Kaptué, A., S. M. De Jong, J.-L Roujean, C. Favier and C. Mering. 2011. Ecosystems mapping at the African continent scale using a hybrid clustering approach based on 1 km resolution multiannual data from SPOT/VEGETATION, *Remote Sensing of Environment*, 115, 452-464.

Kaptué, A., J.-L Roujean and S. M. De Jong. 2011. Comparison and relative quality assessment of the GLC2000, GLOBCOVER, MODIS and ECOCLIMAP land cover data sets at the African continental scale, *International Journal of Applied Earth Observation and Geoinformation*, 13, 207-219.

Kaptué, A., J.-L Roujean, A.Bégué, S. O. Los, A. A. Boone, J.-F. Mahfouf, D. Carrer and D. Badiane. 2011. A new characterization of the land surface heterogeneity for use in land surface models, *Journal of Hydrometeorology*, 12, 1321-1336.

Postdoctoral Fellow

Academic Qualifications

Ph.D. Cartography and Geographic Information Systems
Institute of Remote sensing and Digital Earth
Chinese Academy of Sciences, Beijing, China, 2014

B.Sc. Surveying and Mapping Engineering
Henan Polytechnic University, Henan, China, 2009

Contact

+1 605-688-4921
lingling.liu@sdstate.edu

Dr. Lingling Liu

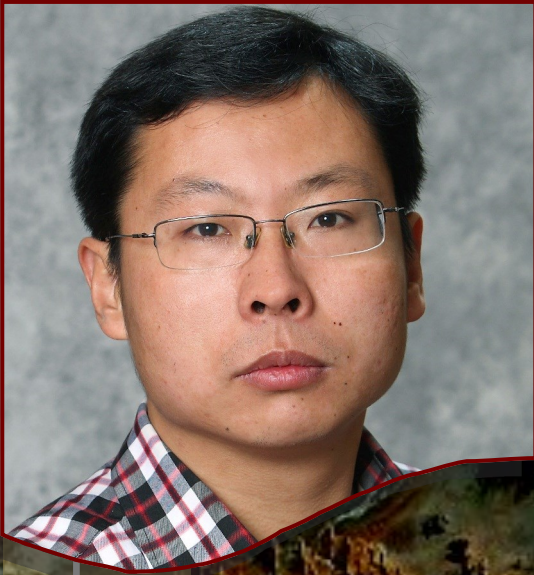*GSCE Advisor* **Dr. Xiaoyang Zhang**

Representative Papers

Lingling, L.,Liangyun, L., Liang, L., Alison, D., Isaac, P., Mark,D.S.2014. Effects of elevation on spring phenological sensitivity to temperature in Tibetan Plateau grasslands. *Chinese Science Bulletin*, 59(34): 4856-4863.

Lingling L.,Liangyun L.,Yong,H. 2012. Response of spring phenology to climate change across Tibetan Plateau. In: *Remote Sensing, Environment and Transportation Engineering* (RSETE), 2012 2nd International Conference on, IEEE, 1-4.

Lingling L.,Liangyun L.,Yong,H. 2012. Assessment and inter-comparison of satellite-derived Start-of-Season (SOS) measures in Eurasia for 1982-2006. *Progress in Geography*, 31(11): 1433-1442. (in Chinese)

Current Research Interests

Real-time monitoring and short-term forecasting land surface vegetation phenology from VIIRS

Postdoctoral Fellow

Academic Qualifications

Ph.D. Ecology
Institute of Applied Ecology
Chinese Academy of Sciences
China, 2010

B.Sc. Environmental Science
Northeast Normal University
China, 2005

Contact

+1 605-688-4773
zhihua.liu@sdstate.edu

Dr. Zhihua Liu
*GSCE Advisor **Dr. Michael Wimberly***

Current Research Interests

Climate change and fire regimes;
land use and land cover change;
application of remote sensing

Representative Papers

Liu, Z., Wimberly, M.C., Lamsal, A., Sohl, T.L., and Hawbaker, T.J. 2014. Coupled simulation of human-driven and natural land cover change in the Front Range Corridor, CO, conference proceeding for 7th International Congress on Environmental Modelling and Software, June 15-19, 2014, San Diego, California, USA

Liu, Z., Yang, J., Chang, Y., Weisberg, P.J., He, H.S. 2012. Spatial patterns of fire occurrence and its future trend under global warming in a boreal forest of Northeast China, *Global Change Biology*, 18, 2041–2056. doi: 10.1111/j.1365-2486.2012.02649.x

Liu, Z., He, H.S., Yang, J. 2012. Emulating natural fire effects using forest harvesting in a boreal forest landscape of Northeast China, *Journal of Vegetation Science*, 23, 782-795. doi: 10.1111/j.1654-1103.2012.01397.x.
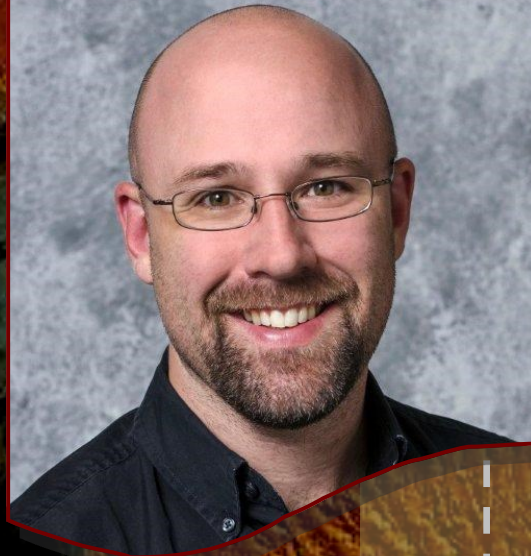
Postdoctoral Fellow

Academic Qualifications

Ph.D. Biology, University of
Missouri, Columbia, MO,
USA, 2010

M.Sc. Wildlife & Fisheries
Sciences, Texas A&M
University, College Station, TX,
2002.

Contact

+1 605-688-4779
chris.merkord@sdstate.edu

Dr. Chris Merkord
GSCE Advisor **Dr. Michael Wimberly**

Representative Papers

Dixon, M. D., C. J. Boever, V. L. Danzeisen, <u>C. L. Merkord</u>, E. C. Munes, M. L. Scott, W. C. Johnson and T. C. Cowman. 2015. Effects of a "natural" flood event on the riparian ecosystem of a regulated large-river system: the 2011 flood on the Missouri River, USA. *Ecohydrology* 8(5): 812-824.

Jankowski, J. E., <u>C. L. Merkord</u>, W. Farfan Rios, K. García Cabrera, N. Salinas Revilla and M. R. Silman. 2013. The relationship of tropical bird communities to tree species composition and vegetation structure along an Andean elevational gradient. *Journal of Biogeography* 40 (5): 950-962.

<u>Merkord, C. L.</u>, T. Mark, D. Susanibar, A. Johnson and C. C. Witt. 2009. Avifaunal survey of the Río Chipaota valley in the Cordillera Azul region, San Martín, Peru. *Ornitologia Neotropical* 20 (4): 535-552.

Current Research Interests

Dr. Merkord's research addresses the interactions between climate, land use, ecosystem function, and human health. His current research involves the development of early warning systems for outbreaks of vector-borne and zoonotic diseases using predictive models based on environmental remote sensing data along with vector and disease surveillance data. He is currently studying the influences of climatic variability on malaria outbreaks in Ethiopia, and the influences of climate and land use on the mosquito vectors and avian hosts of West Nile virus in the United States.

Postdoctoral Fellow

Academic Qualifications

Ph.D. Remote Sensing, Institute of Remote Sensing Applications (IRSA), Chinese Academy of Science (CAS), 2010.

B.Sc. GIS and Remote Sensing, Shenyang Jianzhu University, 2004

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+1 605-688-4225
yuchu.qin@sdstate.edu

Dr. Yuchu Qin
*GSCE Advisor **Dr. David Roy***

Current Research Interests

Dr. Qin's research is on LiDAR data processing, image processing and remote sensing applications, with a particular emphasis on data fusion of active and passive sensor images for estimating vegetation parameters, integrating GIS and remote sensing for environment applications, and research in support of the NASA WELD project.

Representative Papers

Roy, D.P., Qin, Y., Kovalskyy, V. , Vermote, E.F., Ju, J., Egorov, A., Hansen, M.C., Kommareddy, I., Yan, L. 2014, Conterminous United States demonstration and characterization of MODIS-based Landsat ETM+ atmospheric correction, *Remote Sensing of Environment*, 140, 433-449.

Qin, Y., Niu, Z., Lin, W., Rui, X., Wang, C. 2006, Study on Digital Urban Planning Model, *Journal of Chongqing Jianzhu University,* 28(4):138-141.

Qin, Y.,Wu, Y.,Niu, Z.,Zhan, Y., Xiong Z. 2008. Reconstruction of Sparse Forest Canopy Height Using Small Footprint LIDAR Data, *Journal of Natural Resources*, Vol. 23 (3): 507-507

Postdoctoral Fellow

Academic Qualifications

Ph.D. Geospatial and
Environmental Analysis
Virginia Polytechnic Institute
and State University
USA, 2012

M.A. Geography
University of Arizona
USA, 2000

B.A. Mathematics
Williams College
USA, 1991

Contact

+1 605-688-6591
jessica.walker@sdstate.edu

Dr. Jessica Walker
GSCE Advisor **Dr. Geoffrey Henebry**

Representative Papers

Walker, J.J., de Beurs, K.M., and Henebry, G.M. Phenology patterns across urban to rural gradients in the U.S. Great Plains. *Remote Sensing of Environment, In Press.*

Walker, J.J., de Beurs, K.M., and Wynne, R.H. 2014. Dryland vegetation phenology across an elevation gradient in Arizona, USA, investigated using data fusion products, *Remote Sensing of Environment*, 144, 85-97.

Walker, J.J., de Beurs, K.M., Wynne, R.H., and Gao, F. 2012. Evaluation of Landsat and MODIS data fusion products for analysis of dryland forest phenology, *Remote Sensing of Environment*, 117, 381-393.

Current Research Interests

Dr. Walker uses high-temporal and high-spatial resolution remote sensing datasets to characterize vegetation phenology patterns at landscape to regional scale. Her research has involved a MODIS-based investigation of the spatial and temporal extent to which urbanized areas across the Midwestern U.S. affect the greenness trends of surrounding ecosystems.

Postdoctoral Fellow

Academic Qualifications

Ph.D. Geography, University of Oklahoma, Norman, Oklahoma USA, 2014

M.Sc. Geography, Institute of Mountain Hazards and Environment, Chinese Academy of Sciences, China, 2009

B.Sc. Geographic Information Systems, Sichuan Normal University, China, 2006

Contact

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dong.yan@sdstate.edu

Dr. Dong Yan
GSCE Advisor **Dr. Xiaoyang Zhang**

Current Research Interests

Dr. Yan uses observations from geostationary satellites to investigate the responses of land surface phenology to rainfall changes in the Sahara Desert. He is also comparing retrievals of land surface phenology from geostationary and polar-orbiting satellites to investigate the impacts of drought on land surface phenology in Congolese rainforests.

Representative Papers

Yan, D., de Beurs, K.M., and Fan, J. 2013. The Impacts of Weather and Conservation Programs on Vegetation Dynamics in China's Loess Plateau, *Land*, 2(4), 573-594.

Yan, D., J.R. Fan and G.Q. Ou. (2008). Estimation of Crop Evapotranspiration in Dadu River Watershed using MODIS LAI. *Resources and Environment in the Yangtze Basin*, 18(10), 976-984

Yan, D., J.R. Fan, F.F. Guo, X. Guo, and K.F. Gong. 2010. Spatiotemporal Distribution of Precipitation Erosivity in Tibet Autonomous Region. *Bulletin of soil and water conservation*, 30(4), 17-21. [In Chinese].

Postdoctoral Fellow
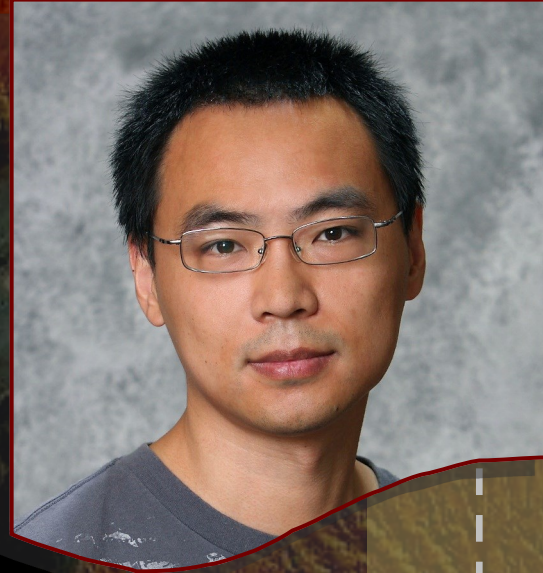
Academic Qualifications

Ph.D. Geodetic Science, The Ohio State University, Ohio, USA, 2011

M.Sc. Photogrammetry and Remote Sensing, Tongji University, China, 2005

B.Sc. Surveying Engineering, Tongji University, China, 2002

Contact

+1 605-688-4225
lin.yan@sdstate.edu

Dr. Lin Yan
*GSCE Advisor **Dr. David Roy***

Representative Papers

Yan, L. and Niu, X. Spectral-angle-based Laplacian Eigenmaps for Nonlinear Dimensionality Reduction of Hyperspectral Imagery, *Photogrammetric Engineering & Remote Sensing, In Press.*

Yan, L. and Roy, D.P. 2014. Automated crop field extraction from multi-temporal Web Enabled Landsat Data, *Remote Sensing of Environment*, 144, 42-64.

Li, R., Yan, L., Di, K., and Wu, B. 2008. A New Ground-based Stereo Panoramic Scanning System, the XXIth ISPRS Congress, Beijing, China, July 3-11, 2008, 6 p.

Current Research Interests

Automated crop field extraction in conterminous US; nonlinear dimensionality reduction (manifold learning) of multispectral multi-temporal remote sensing imagery; land surface phenology fitting using nonlinear harmonic models. All works are based on the Landsat WELD (*https://landsat.usgs.gov/WELD.php*)

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Postdoctoral Fellow

Academic Qualifications

Ph.D. Geography and
Resource Management,
Chinese University of Hong
Kong, Hong Kong, 2013

M.Sc. Remote Sensing,
Zhejiang University,
Hangzhou, China, 2010

B.Sc. Geographic Information
Systems,
Zhejiang University,
Hangzhou, China, 2007

Contact

+1 605-688-4225
hankui.zhang@sdstate.edu

Dr. Hankui Zhang
GSCE Advisor **Dr. David Roy**

Current Research Interests

Landsat data preprocessing,
BRDF correction, and multi-
resolution satellite image fusion.
All works are based on the
Landsat WELD (https://
landsat.usgs.gov/WELD.php)
data.

Representative Papers

Zhang, H.K., Chen, J.M., Huang, B., Song, H.H., and
Li, Y.R. 2014. Reconstructing seasonal variation of
Landsat vegetation index related to leaf area index
by fusing with MODIS data, *IEEE Transaction of
Selected Topics in Applied Earth Observations and
Remote Sensing*, 7(3), 950 - 960.

Zhang, H.K., and Huang, B. 2014. Intermodality
models in pan-sharpening: analysis based on remote
sensing physics, International *Journal of Remote
Sensing*, 35(2), 515-531.

Zhang, H.K., and Huang, B. 2013. Support vector
regression-based downscaling for intercalibration of
multiresolution satellite images, *IEEE Transaction
on Geoscience and Remote Sensing*, 51(3), 1114-1123

Postdoctoral Fellow

Geospatial Science and Engineering (GSE) Ph.D. Program

The Geospatial Science and Engineering (GSE) Ph.D. is an interdisciplinary program that combines advanced course-work with cutting-edge research to advance the field of geospatial sciences. The focus is on transforming geospatial data into relevant information through acquisition, processing, characterization, analysis, and modeling in order to understand geographic patterns, processes, and relationships at scales ranging from landscapes to the globe. GSCE senior scientists from both SDSU and EROS serve as the core faculty, and other participating departments include Agricultural and Biosystems Engineering, Civil and Environmental Engineering, Electrical Engineering and Computer Science, Geography, and Natural Resource Management. GSE students may declare one of two specializations: (1) Remote Sensing Geography, and (2) Remote Sensing Engineering, or they may elect to pursue a degree in interdisciplinary geospatial science without a specialization.

The GSE program is coodinated by the GSCE, with Dr. Mike Wimberly serving as the graduate program coordinator. GSCE faculty members are responsible for teaching GSE courses, including Introduction to GSE (GSE 740), GSE Seminar (GSE 790), Quantitative Remote Sensing for Terrestrial Monitoring (GSE 741), Geospatial Analysis (GSE 743), and Fire and Ecosystems (GSE 767). Two umbrella courses—Advanced Methods in Geospatial Modeling (GSE 760) and Advanced Remote Sensing Applications (GSE 766)—cover specific topics in depth, including water resources, conservation applications, quantitative methods, and ecological modeling. Special topics courses (GSE 792) have been offered in several subjects, including global climate change and GIS applications in ecology.

The first students were accepted in 2005 and there are currently 20 students enrolled in the GSE program, including full-time students support by GSCE research activities and part-time students associated with USGS EROS. To date, 15 students have successfully completed their dissertations and have been awarded Ph.D. degrees. These graduates have gone on to pursue careers teaching geospatial sciences at the university level or conducting research in university and government laboratories.

New students are continually recruited into the program. We seek highly motivated applicants with strong backgrounds in the geospatial sciences or a closely-related field. Current faculty research interests range broadly, and include quantitative remote sensing, sensor design and calibration, land cover and land use change, geography, hydrology, landscape ecology, climate change, and fire science as well as applications of geospatial technologies in natural resource management, public health, agriculture, and other fields. Prospective students are encouraged to contact faculty members in their area of specialization to inquire about admission and funding opportunities. The Graduate Studies section of the GSCE webpage is available at http://globalmonitoring.sdstate.edu and has additional information for prospective applicants.

NASA Ph.D. Fellowship Awardees

The following seven students were awarded prestigious NASA Earth and Space Science Ph.D. Fellowship grants. The purpose of the NASA fellowship is to ensure continued training of interdisciplinary scientists to support the study of the Earth as a system. The student applications were evaluated through a two-step process: first through mail review, and then by a panel composed of members of academic institutions and research organizations as well as program managers at NASA Headquarters. NASA selects nationally only approximately 55 students each year for these highly competitive fellowships.

Chris Barnes

(advisor Dr. David Roy) was awarded a NASA Earth and Space Science Ph.D. Fellowship from 2006 to 2009 for his proposal titled, "*United States Land Cover Land Use Change, Albedo and Radiative Forcing: Past and Potential Climate Implications*".

Amadou Dieye

(advisor Dr. David Roy) was awarded a NASA Earth and Space Science Ph.D. Fellowship from 2007 to 2010 for his proposal titled, "*Land Cover Land Use Change and Soil Organic Carbon Under Climate Variability in Semi-Arid to Sub-Humid West African Sahel (1975-2050)*".

Erik Lindquist

(advisor Dr. Matt Hansen) was awarded a NASA Earth and Space Science Ph.D. Fellowship grant from 2007 to 2010 for his proposal titled, "*Using MODIS and Landsat data to advance regional, high-spatial resolution change monitoring for the humid tropical forests of the Congo Basin*".

Chris Barber

(advisor Dr. Mark Cochrane) was awarded a NASA Earth and Space Science Ph.D. Fellowship from 2008 to 2011 for his proposal titled, "*Applied Remote Sensing for Conservation Monitoring*".

Yoland Munzimi

(advisor Dr. Matt Hansen) was awarded a NASA Earth Science Systems Fellowship grant 2010 to 2013 for her proposal titled, "*Satellite-derived Rainfall Estimates (TRMM products) used for Hydrological Predictions of the Congo River flow*".

Sanath Kumar

(advisor Dr. David Roy) was awarded a NASA Earth Science Systems Fellowship from 2010 to 2013 for his proposal titled, "*Fire Type Classification in the Brazilian Legal Amazon*".

Alemayehu Midekisa

(advisor Dr. Mike Wimberly) was awarded a NASA Earth and Space Science Fellowship from 2011 to 2014 for his proposal titled, "*Integrating Multi-Sensor Satellite Data for Malaria Early Warning in the Amhara Region of Ethiopia*".

Woubet Gashaw Alemu

(advisor Dr. Geoffrey Henebry) was awarded a NASA Earth and Space Science Ph.D. Fellowship from 2013 to 2016 for his proposal titled, "*Modeling land surface phenologies and seasonalities using earthlight: a comparison between tropical and temperate croplands, and application to assessment of agricultural productivity*".

Francis Dwomoh

(advisor Dr. Mike Wimberly) was awarded a NASA Earth and Space Science Ph.D. Fellowship from 2014 to 2017 for his proposal titled, "*Vulnerability of protected areas to human encroachment, climate change and fire in the fragmented tropical forests of West Africa.*"

Ph.D. Students

Ph.D. students are integral to the GSCE and the majority of students are taking a Ph.D. in Geospatial Science and Engineering under the supervision of GSCE faculty. Student dissertation topics reflect a range of research interests and geographies and the GSCE multi-disciplinary research environment. Outstanding Ph.D. students are encouraged to advance to postdoctoral positions at the GSCE.

Henok Alemu

GSCE Advisor **Dr. Gabriel Senay**
Started Spring 2007
henok.alemu@sdstate.edu

Ph.D. Dissertation Title
Contemporary Changes and Drivers of Evapotranspiration in the Nile Basin

Academic Qualifications

M.Sc. Photogrammetry & Geoinformatics, Stuttgart University of Applied Sciences, Germany, 2006

Professional Masters, GIS, ITC, Netherlands, 2004

B.Sc. Applied Geology, Mekelle University, Ethiopia, 2001

Representative Paper

Alemu, H., Senay, G.B., Kaptue, A.T., Kovalskyy, V. 2014. Evapotranspiration variability and its association with vegetation dynamics in the Nile Basin, 2002–2011, *Remote Sensing*, 6, 5885-5908.

Current Research Interests

Geospatial science applications in hydrology and ecohydrology

Ph.D. Students

Woubet G. Alemu

GSCE Advisor **Dr. Geoffrey Henebry**
Started Fall 2011
woubet.alemu@sdstate.edu

Ph.D. Dissertation Title
Modeling land surface phenologies and seasonalities using Cool Earthlight: A comparison between tropical and temperate croplands, and its application for agricultural crop productivity assessment

Academic Qualifications

M.Sc. Land Resources Management, Bahir Dar University, Ethiopia, 2011

M.Sc. Remote Sensing & GIS, Addis Ababa University, Ethiopia, 2007

B.A. Geog. & Environmental Study, Addis Ababa University, Ethiopia, 2004

Representative Paper

Alemu, W. and Henebry, G.M. 2013. Land surface phenologies and seasonalities using cool earthlight in mid-latitude croplands, *Environmental Research Letters*, 8, 045002 (10pp), *doi:10.1088/1748-9326/8/4/045002*

Current Research Interests

Land surface phenology and seasonality, Cropland dynamics and crop productivity, Synergistic use of microwave and optical remote sensing in temperate and tropical croplands

Christoffer Axelsson

*GSCE Advisor **Dr. Niall Hanan***
Started Spring 2013
christoffer.axelsson@sdstate.edu

Ph.D. Dissertation Title
From process to pattern: Self-Organization in Vegetation Communities across Environmental Gradients in sub-Saharan Africa

Academic Qualifications

M.Sc. in Geo-information Science and Earth Observation for Environmental Modelling and Management (GEM), UK, Sweden, Poland, Netherlands, 2011

M.Sc. in Surveying, Faculty of Engineering, Lund University, Sweden, 2001

Representative Paper

Axelsson, C., Skidmore, A. K., Schlerf, M., Fauzi, A., Verhoef, W. 2013. Hyperspectral analysis of mangrove foliar chemistry using PLSR and support vector regression, *International Journal of Remote Sensing*, 34, 1724-1743.

Current Research Interests

Ecological modeling with special focus on savanna and dryland systems; remote sensing of vegetation; analyzing the drivers of ecosystem change.

Ph.D. Students

Esther Mosase

*GSCE Advisor **Dr. Niall Hanan***
Started Fall 2014

Ph.D. Dissertation Title
TBD

Academic Qualifications

M.Sc. Agricultural Engineering, Botswana College of Agriculture, Gaborone, Botswana, 2012

B.Sc. Environmental Science, University of Botswana, Gaborone, Botswana, 2002

Current Research Interests

Remote Sensing Hydrology, Water Resource Management, Hydrological modeling

Amadou M. Dieye

*GSCE Advisor **Dr. David Roy***
Started Fall 2005
amadou.dieye@sdstate.edu

Ph.D. Dissertation Title
Land cover land use change and soil organic carbon under climate variability in Sahelian West Africa (1975-2055)

Academic Qualifications

M.A. Geographic Information Systems & International Development, Clark University, USA, 1998

B.Sc. Survey and Engineering, Ecole Nationale Superieure de Geologie, France, 1988

Representative Paper

Dieye, A. M., Roy, D.P., Hanan, N.P., Liu, S., Toure, A. 2012. Sensitivity analysis of the GEMS soil organic carbon model to land cover land use classification uncertainties under different climate scenarios in Senegal, *Biogeoscience, Special Issue: Earth observation for land-atmosphere interaction science*, 9, 631-648.

Current Research Interests

The use of remote sensing and Geographic Information Systems techniques for natural resources monitoring, mapping land use and land cover change, and the relationship between climate change and land cover land use in semi-arid to sub-humid West Africa.

Ph.D. Students

Francis Dwomoh

*GSCE Advisor **Dr. Michael Wimberly***
Started Spring 2012
francis.dwomoh@sdstate.edu

Ph.D. Dissertation Title
Vulnerability of protected areas to human encroachment, climate change and fire in the fragmented tropical forests of West Africa

Academic Qualifications

M.Sc. Geo-information Science and Earth Observation for Natural Resource Management, International Institute for Geo-information Science and Earth (ITC), Enschede, The Netherlands & Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana, 2009

B.Sc. Natural Resources Management, Kwame Nkrumah University of Science & Technology, Ghana, 2002

Representative Paper

Appiah, M., Blay, D., Damnyag, L., Dwomoh, F. K., Pappinen, A., and Luukkanen, O. 2009. Dependence on forest resources and tropical deforestation in Ghana, *Environment, Development and Sustainability*, 11(3), 471-487. Springer Netherlands. DOI: http://dx.doi.org/10.1007/s10668-007-9125-0

Current Research Interests

Exploring historical satellite imagery to understand the interactions between climate, human land use, forest fires, and their effect on the stability of protected areas in the West African tropical forest region.

Njoki Kahiu

*GSCE Advisor **Dr. Niall Hanan***
Started Spring 2013
milkah.kahiu@sdstate.edu

Ph.D. Dissertation Title
TBD

Academic Qualifications

M.Sc. Geo-information Science and Earth Observation for Natural Resource Management, ITC, Netherlands, 2009

B.Sc. Environmental Science, Kenyatta University, Kenya, 2003

Representative Paper

<u>Kahiu, M.N</u> and Hanan, N.P 2014: Beyond "Big-Leaf" Leaf Area Index: Partitioning MODIS Leaf Area Index into Tree & Grass Components for Biophysical, Ecological and Grazing Systems Applications in Sub-Saharan Africa, Poster at Frontiers in Earth Observation for Land System Science, Berlin, Germany, 17-18 March, 2014

Current Research Interests

Remote sensing of African grazing resources, focusing on monitoring forage quantity and quality at continental and regional scales.

Ph.D. Students
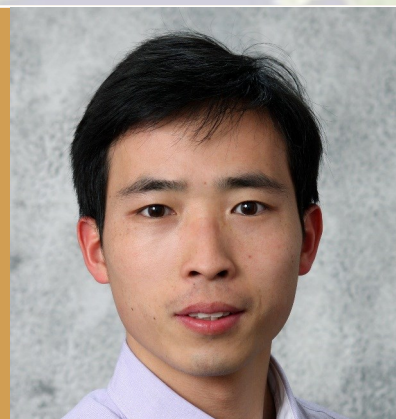
Fangjun Li

*GSCE Advisor **Dr. Xiaoyang Zhang***
Started Spring 2014
fangjun.li@sdstate.edu

Ph.D. Dissertation Title
TBD

Academic Qualifications

M.Sc. Geographic Information Science and Cartography, Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences, China, 2010

B.E. Geomatics, Central South University, Changsha, China, 2007

Representative Paper

Chen, F., Li, X., <u>Li, F.</u>, Liu, J., and Yang, J. 2010. Enhancing remote sensing images by adjusting histogram globally and locally, in Multispectral, Hyperspectral, and Ultraspectral Remote Sensing Technology, Techniques, and Applications III, Allen M. Larar; Hyo-Sang Chung; Makoto Suzuki, Editors, Proceedings of SPIE Vol. 7857 (SPIE, Bellingham, WA 2010), 78570T.

Current Research Interests

Biomass burning emissions, Multi-source data fusion
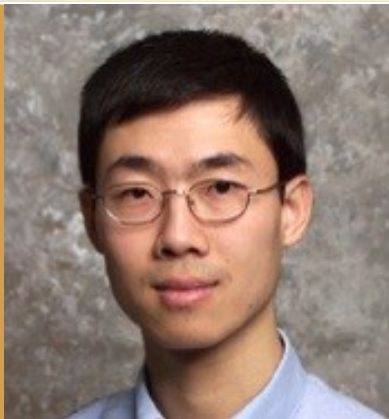
Zhengpeng Li

GSCE Advisor **Dr. Shuguang (Leo) Liu**
Started Fall 2006
zli@usgs.gov

Ph.D. Dissertation Title
TBD

Academic Qualifications

M.Sc. Computer Science, South Dakota School of Mines & Technology, USA, 2004

M.Sc. Environmental Science, Peking University, China, 2000

B.Sc. Inorganic Chemistry, Peking University, China, 1997

Representative Paper

Tan, Z., Liu, S., Li, Z., and Loveland, T.R. 2007. Simulated responses of soil organic carbon stock to tillage management scenarios in the Northwest Great Plains, *Carbon Balance and Management*, 2, 7, doi:10.1186/1750-0680-2-7.

Current Research Interests

Using remotely sensed products in regional carbon cycling modeling, data assimilation and decision support systems, primarily applying the General Ensemble Biogeochemical Modeling System (GEMS) in ecosystems including forest, grassland and agricultural lands.

Ph.D. Students

Erik Lindquist

GSCE Advisor **Dr. Matthew Hansen**
Started Fall 2005
erik.lindquist@sdstate.edu

Ph.D. Dissertation Title
TBD

Academic Qualifications

B.A. in Botany, Miami University, Ohio, USA, 1994

Representative Paper

Lindquist, E., Hansen, H., Roy, D.P., and Justice, C.O. 2008. The suitability of decadal image data sets for mapping tropical forest cover change in the Democratic Republic of Congo: implications for the mid-decadal global land survey, *International Journal of Remote Sensing*, 29, 7269–7275.

Current Research Interests

Quantifying and monitoring tropical forest cover change using high spatial resolution satellite imagery in Central Africa.

Alemayehu Midekisa

*GSCE Advisor **Dr. Michael Wimberly***
Started Fall 2009
alemayehu.midekisa@sdstate.edu

Ph.D. Dissertation Title
Integrating multi-sensor satellite data for malaria early warning in the Amhara region of Ethiopia

Academic Qualifications

M.Sc. GIS & Remote Sensing, Addis Ababa University, Ethiopia, 2006

B.Ed. Education, Minor Geography, Alemaya University, Ethiopia, 2003

Representative Paper

Midekisa A., Senay G.B., Henebry G.M., Semuniguse P. & Wimberly M.C. 2012. Remote sensing-based time series models for malaria early warning in the highlands of Ethiopia, *Malaria Journal*, 11, 165.

Current Research Interests

Quantifying the spatial and temporal associations of malaria transmission in relation to climatic and land cover factors using multi-sensor remote sensing data in the Ethiopian highlands

Ph.D. Students

Bhaskar Ramachandran

*GSCE Advisor **Dr. Geoffrey Henebry***
Started Fall 2009
bhaskar@usgs.gov

Ph.D. Dissertation Title
TBD

Academic Qualifications

M.Sc. GIS, University of Edinburgh, UK, 1992

M.Phil. Geography, University of Delhi, India, 1986

M.A. Geography, University of Delhi, India, 1982

B.A. Geography, University of Delhi, India, 1980

Representative Paper

Ramachandran, B., Justice, C., and Abrams, M., (Editors) Land Remote Sensing and Global Environmental Change: NASA's Earth Observing System and the Science of ASTER and MODIS. Springer, 2011.

Current Research Interests

Exploring the Semantic Web paradigm towards building an ontology-based semantically-enabled geographical information science knowledge representation, discovery, and interoperability capabilities.

Jason Stoker

GSCE Advisor **Dr. David Roy**
Started Fall 2005
jstoker@usgs.gov

Ph.D. Dissertation Title
Evaluating Landsat and spatial aggregation of high-resolution LiDAR for Improved national-scale vegetative classifications

Academic Qualifications

M.Sc. Geomatics, Colorado State University, USA, 2002

B.Sc. Natural Resource Management, Colorado State University, USA, 1997

Representative Paper

Stoker, J., Harding, D., and Parrish, J. 2008. The Need for a National Lidar Dataset, *Photogrammetric Engineering and Remote Sensing*, 74, 1066-1068.

Current Research Interests

Active Lidar remote sensing; fusion of Lidar data with passive optical data and 3-D information representation for ecological applications.

Ph.D. Students

Emma Victoria White

GSCE Advisor **Dr. David Roy**
Started Fall 2010
emma.white@sdstate.edu

Ph.D. Dissertation Title
Changing field sizes of the conterminous United States, a decennial Landsat assessment

Academic Qualifications

M.Sc. Remote Sensing and Image Processing, University of Edinburgh, UK, 2008

B.Sc. Geographic Information Science, University of Newcastle, UK, 2006

Representative Paper

White, E.V. and Roy, D.P. 2011. A contemporary decennial global sample of changing agricultural field sizes, B11E-05. Agricultural Mapping, Monitoring, and Data Visualization for a Changing Global Environment I, Oral Presentation at Fall Meeting, AGU, San Francisco, Calif., 5-9 Dec. 2011.

Current Research Interests

Agricultural change and land cover mapping using Landsat series remotely sensed data, with particular interest in field size distributions.

Recent Ph.D. Graduates

In the last three years, the GSCE has produced nine Ph.D. graduates —
eight finished with a Ph.D. degree in Geospatial Science and Engineering,
and one finished with a Ph.D. in Biology.

Dr. Rafael Barreto de Andrade

Ph.D. Biology

Graduated *2012*
Advisor *Dr. Mark Cochrane*

Ph.D. Dissertation Title

Tropical Forest Fires and Biodiversity: Dung Beetles as Indicators of Animal and Plant Community Changes in the Brazilian Amazon

Dr. Rafael Andrade graduated with a Ph.D. in Biology on July 2012 under the supervision of Dr. Mark Cochrane and Dr. Jos Barlow (Lancaster University). He is currently a post-doctoral associate at the Universidade Estadual de Campinas, Brazil and University of Colorado, Boulder. His current research focuses on investigating the effects of recurring fires on communities of butterflies and other insects in a transitional Cerrado-Amazon forest.

Representative Papers

Andrade, R.B. de, Barlow, J., Louzada, J., Mestre, L., Silveira, J., Vaz-de-Mello, F.Z., Cochrane, M.A. 2014. Biotic congruence in humid tropical forests: A multi-taxa examination of spatial distribution and responses to forest disturbance, *Ecological Indicators*, 36, 572–581.

Andrade, R.B. de, Barlow, J., Louzada, J., Vaz-de-Mello, F.Z., Souza, M., Silveira, J.M., Cochrane, M.A. 2011. Quantifying responses of dung beetles to fire disturbance in tropical forests: The importance of trapping method and seasonality, *PLoS ONE*, 6, e26208.

Andrade, R.B., Lucci Freitas, A.V. 2005. Population biology of two species of Heliconius (Nymphalidae: Heliconiinae) in a semi-deciduous forest in southeastern Brazil, *Journal of the Lepidopterists' Society*, 59, 223–228.
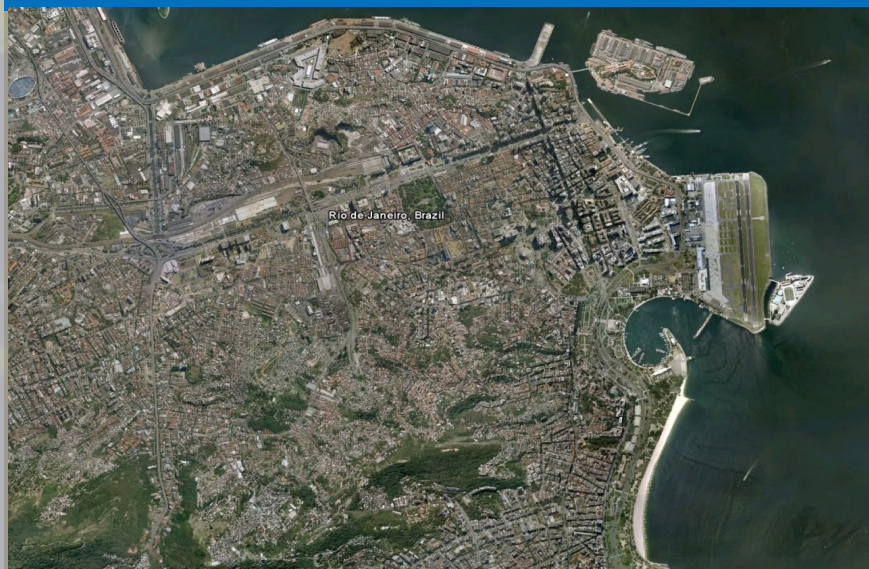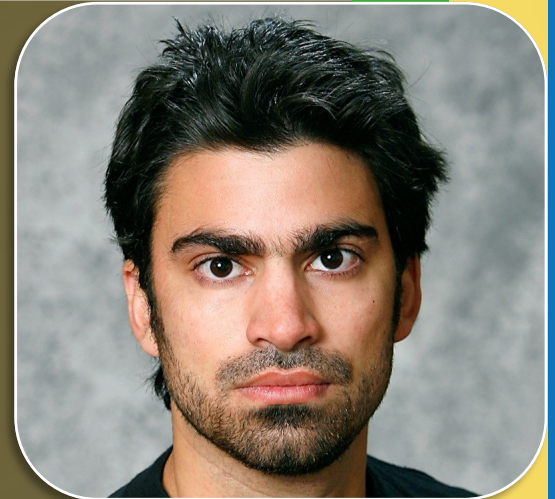
Rio de Janeiro, Brazil (June 2009)

Dr. Christopher Barber

Ph.D. Geospatial Science & Engineering

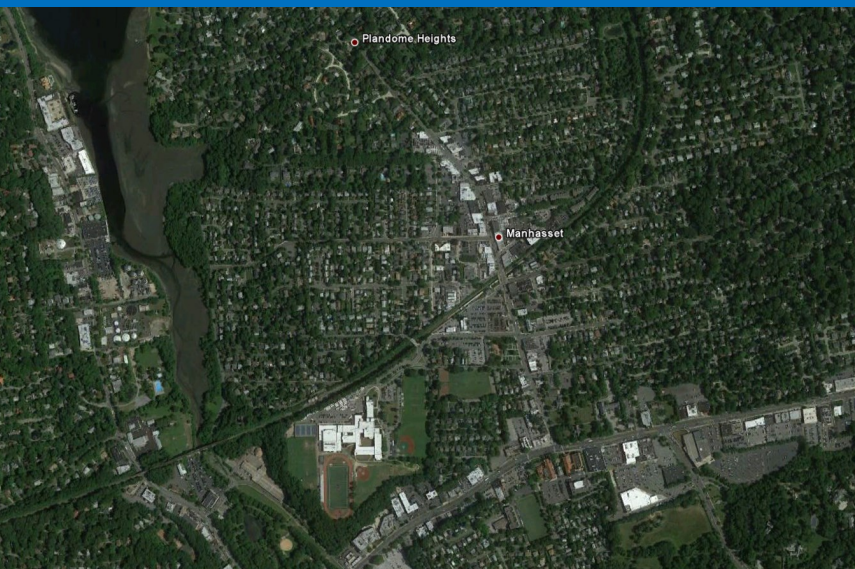*Manhasset, New York, USA (June 2010)*

Ph.D. Dissertation Title

Assessing the effectiveness of conservation and protected areas in the Brazilian Amazon

Dr. Barber graduated with his Ph.D. in July 2012 under the supervision of Dr. Mark Cochrane. He is currently employed as a Postdoctoral Fellow at SDSU/GSCE in Dr. Cochrane's lab group. He continues to work on land cover, forest dynamics, and conservation efforts in the Brazilian Amazon as well as investigating local effects of global climate change.

Representative Papers

Barber, C.P., Cochrane, M.A., Souza, Jr C., Veríssimo, A. 2012.Dynamic performance assessment of protected areas, *Biological Conservation*, 149, 6-14.

Cochrane, M.A. and Barber, C.P. 2009. Climate change, human land use and future fires in the Amazon, *Global Change Biology*, 15(3), 601-612.

Recent Ph.D. Graduates

Dr. Jean-Robert Bwangoy-Bankanza

Ph.D. Geospatial Science & Engineering

Graduated *2013*
**Advisor** *Dr. Matthew Hansen*

Ph.D. Dissertation Title

Mapping the flooded forest of the Congo Basin using multisource and multi-resolution data.

Dr. Bwangoy-Bankanzag graduated with his Ph.D. in May 2013 under the supervision of Dr. Matthew Hansen. He returned to the Democratic Republic of Congo (DRC) where he is a full professor at the University of Kinshasa, Department of Agronomy, and continues undertaking both applied and fundamental forest remote sensing and GIS research. He was a member of the recent DRC delegation to the United Nations Climate Convention, New York, September 2014. He is also DRC country director for Wildlife Works, a U.S. based company, that focuses on forest conservation and REDD+ carbon trading programs.

Representative Papers

Bwangoy, J.R B., Hansen, M.C., Roy, D.P., De Grandi, G., Justice, C.O., 2010, Wetlands mapping in the Congo Basin using optical and radar remotely sensed data and derived topographical indices, *Remote Sensing of Environment*, 114, 73 -86.

Margono, B. A., Bwangoy, J-R. B., Potapov, P. V. & Hansen, M. C. Mapping wetlands in Indonesia using Landsat data sets and derived topographical indices. *Geo-spatial Inform. Sci.* 17, 60–71 (2014).
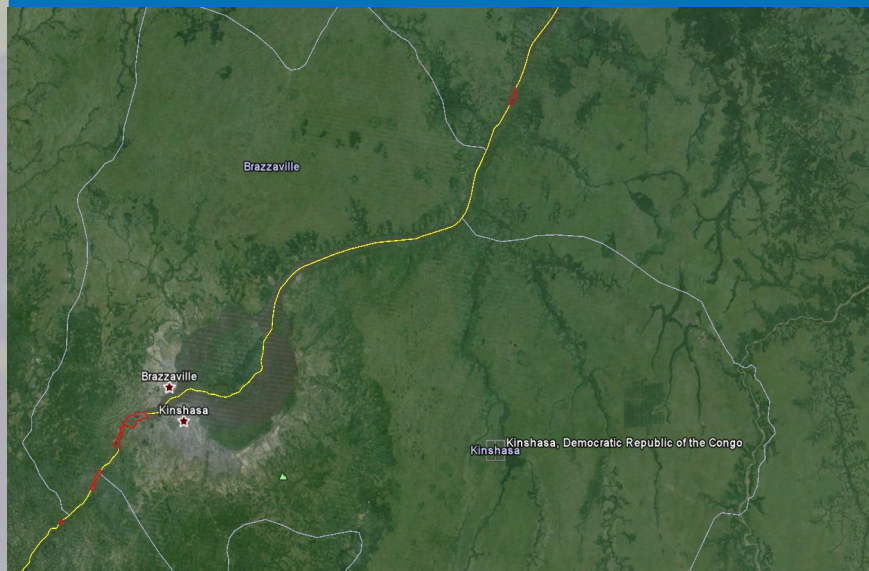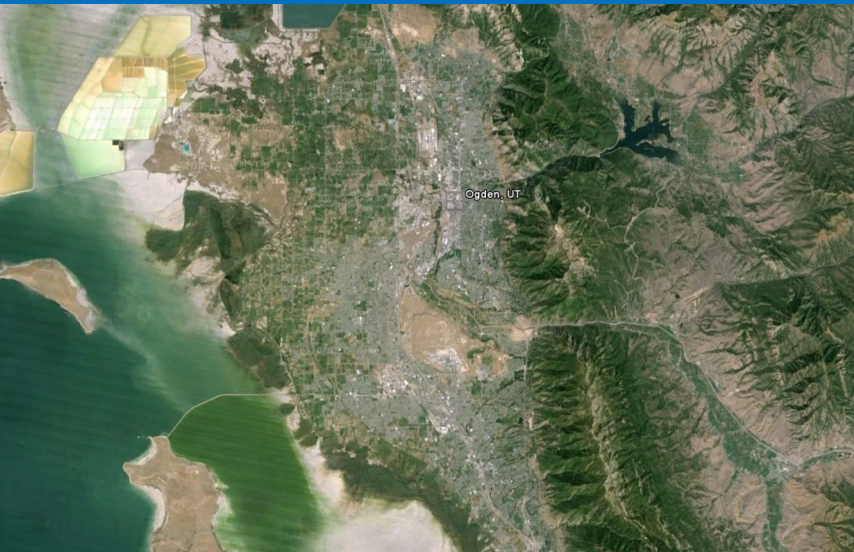

Kinshasa, Congo (April 2013)

Recent Ph.D. Graduates

Dr. Collin G. Homer

Ph.D. Geospatial Science & Engineering

Graduated *2013*
Advisor *Dr. Thomas Loveland*

Ogden, Utah, USA (June 2013)

Ph.D. Dissertation Title

Sagebrush ecosystem characterization, monitoring, and forecasting with remote sensing; quantifying future climate and wildlife habitat change.

Dr. Homer graduated with his Ph.D. in November 2013 under the supervision of Dr. Thomas Loveland. He is currently employed by the U.S. Geological Survey as Land Characterization Project Chief at the USGS Earth Resources Observation and Science (EROS) Center in Sioux Falls, SD. He continues to work on the use of remote sensing for land cover change monitoring and quantifying current and future impacts of land cover change at both continental and regional scales.

Representative Papers

Homer, C.G., Aldridge, C.A., Meyer, D.K. and Schell S. 2012. Multi-Scale Remote Sensing Sagebrush Characterization with Regression Trees over Wyoming, USA; Laying a Foundation for Monitoring, *International Journal of Applied Earth Observation and Geoinformation*, 14, 233-244.

Homer, C.G., Meyer, D.K., Aldridge, C.A., and S. Schell. 2013. Detecting Annual and Seasonal Changes in a Sagebrush Ecosystem with Remote Sensing Derived Continuous Fields, *Journal of Applied Remote Sensing*, 7 (1), No. 073508.

Homer, C.G., Xian, G., Aldridge, C.L., Meyer, D.K., Loveland, T.L. and M. O'Donnell. 2014. Forecasting Sagebrush Ecosystem Components and Greater Sage Grouse Habitat for 2050, Capitalizing on 28 years of Landsat Satellite Imagery and Climate Data, *Ecological Indicators*, *In Press*.

Dr. Alemayehu A. Midekisa

Ph.D. Geospatial Science & Engineering

Graduated *2014*
Advisor *Dr. Michael Wimberly*

Ph.D. Dissertation Title

Integrating Multi-Sensor Satellite Data for Malaria Early Warning in the Amhara Region of Ethiopia.

Dr. Midekisa graduated with his Ph.D. in November 2014 under the supervision of Dr. Mike Wimberly. Currently, he is a postdoctoral researcher with the Global Health Group at the University California, San Francisco. His work involves the application of satellite remote sensing for malaria risk mapping and forecasting in support of malaria elimination efforts in Swaziland, Thailand, and other locations around the word.

Representative Papers

Midekisa, A., Senay, G.B., Henebry, G.H., Semuniguse, P., and Wimberly, M.C. 2012. Remote sensing-based time series models for malaria early warning in the highlands of Ethiopia. *Malaria Journal*, 11, 165.

Wimberly, M.C., Midekisa, A., Semuniguse, P., Teka, H., Henebry, G.M., Chuang, T., and Senay, G.B. 2012. Spatial synchrony of malaria outbreaks in a highland region of Ethiopia. *Tropical Medicine & International Health*, 17, 1192-1201.

Midekisa, A., Senay, G.B, and Wimberly, M.C. 2014. Multi-sensor Earth Observations to Characterize Wetlands and Malaria Epidemiology in Ethiopia. *Water Resources Research*, 50, 8791-8806.

Lake Tana, Ethiopia (Sept, 2013)

Recent Ph.D. Graduates

Dr. Shahriar Pervez

Ph.D. Geospatial Science & Engineering

Khulna, Bangladesh (April 2013)

Ph.D. Dissertation Title

Assessing the impacts of climate and land use and land cover change on freshwater availability: Application in the Ganges and the Brahmaputra river basins.

Dr. Pervez graduated with his Ph.D. in August 2014 under the supervision of Dr. Geoffrey Henebry. Currently, he is a senior scientist with ASRC Federal InuTeq working at U.S. Geological Survey Earth Resources Observation and Science center. His work involves science research developing models, methods and geospatial information for remote monitoring and early warning of famine, food insecurity, and environmental hazards, and assessment of observed and projected climate change impacts on regional scale hydrological cycle components.

Representative Papers

Pervez, M.S. and Henebry, G.M. 2014. Spatial and seasonal responses of precipitation in the Ganges and Brahmaputra river basins to ENSO and Indian Ocean dipole modes: implications for flooding and drought, *Nat. Hazards Earth Syst. Sci. Discuss.*, 2, 1671-1692, doi:10.5194/nhessd-2-1671-2014, 2014.

Pervez, M.S. and Henebry, G.M. 2014. Projections of the Ganges-Brahmaputra precipitation—downscaled from GCM predictors, *Journal of Hydrology*, 517, 120-134.

Pervez, M.S., Budde, M., and Rowland, J. 2014. Mapping irrigated areas in Afghanistan over the past decade using MODIS NDVI, *Remote Sensing of Environment*, 149, 155-165.

Dr. Eric Ariel L. Salas

Ph.D. Geospatial Science & Engineering

Graduated *2014*
Advisor *Dr. Geoffrey Henebry*

Ph.D. Dissertation Title

Evaluation and application of a new shape-sensitive metric useful for characterizing both spectral curves and LiDAR waveforms.

Dr. Eric Ariel Salas completed his Ph.D. in March 2014 under the supervision of Prof. Geoffrey Henebry. He is currently employed as a Postdoctoral Research Scientist with the Department of Fish, Wildlife and Conservation Ecology at New Mexico State University. His responsibilities include using machine-learning methods to create a land cover/land use map for the Pamir Mountains in Tajikistan as well as species distribution modelling and application of remote sensing for biodiversity estimate.

Representative Papers

Salas, E.A.L. and Henebry, G.M. 2013. A New Approach for the Analysis of Hyperspectral Data: Theory and Sensitivity Analysis of the Moment Distance Method, *Remote Sensing*, 6 (1), 20-41.

Salas, E.A.L. and Henebry, G.M. 2012. Separability of maize and soybean in the spectral regions of chlorophyll and carotenoids using the Moment Distance Index, *Israel Journal of Plant Sciences*, 60 (1-2), 65-76.

Salas, E.A.L. and Henebry, G.M. 2009. Area between peaks feature in the derivative reflectance curve as a sensitive indicator of change in chlorophyll concentration, *GIScience and Remote Sensing*, 46(3), 315-328.
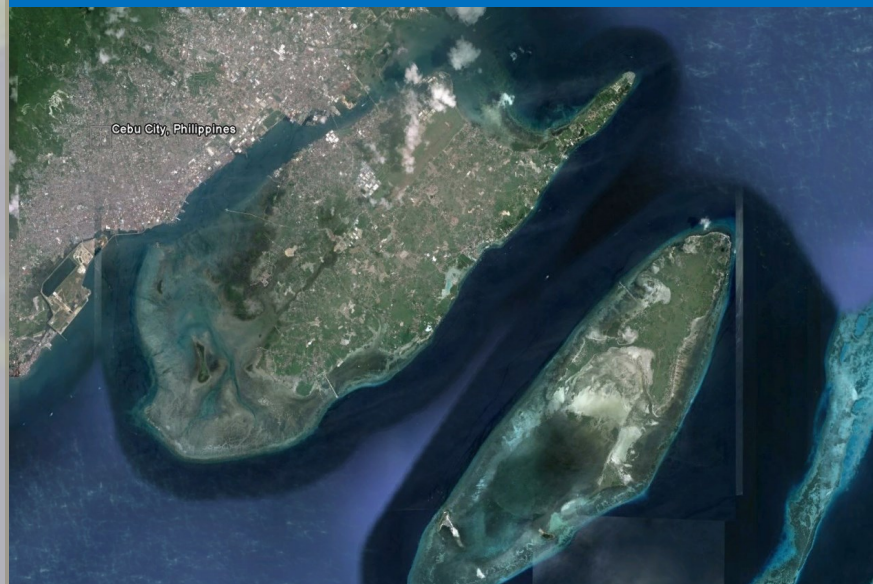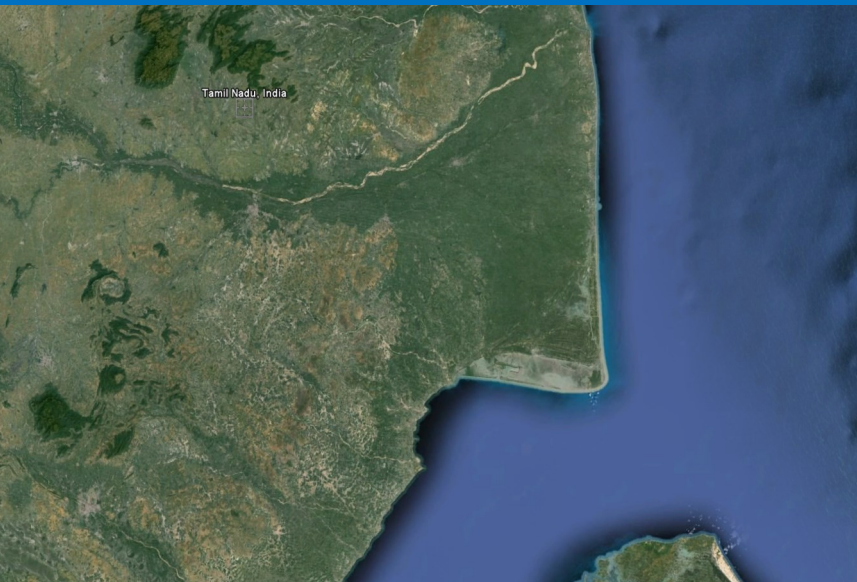

Cebu, Philippines (July 2013)

Dr. Sanath Kumar Sathyachandran

Ph.D. Geospatial Science & Engineering

Graduated *2014*
Advisor *Dr. David Roy*

Tamil Nadu, India (April 2013)

Ph.D. Dissertation Title

Fire Type Classification in the Brazilian Tropical Moist Forest Biome

Dr. Sanath Kumar graduated with his Ph.D. in May 2014 under the supervision of Prof. David P. Roy. He is currently employed as a Postdoctoral Fellow in the Geospatial Sciences Center of Excellence. He continues to work with Dr. Roy on advancing remote sensing methods for improved characterization of active fires.

Representative Papers

Kumar, S.S., Roy, D.P., Cochrane, M.A., Souza JR, C.M., Barber, C., Boschetti, L. 2014. A quantitative study of the proximity of satellite detected active fires to roads and rivers in the Brazilian tropical moist forest biome, *International Journal of Wildland Fire*, 23, 532-543. doi:/10.1071/WF13106.

Smith, A.M.S., Tinkham, W.T., Roy, D.P., Boschetti, L., Kremens, R.L., Kumar, S.S., Sparks, A., Falkowski, M.J. 2013. Quantification of fuel moisture effects on biomass consumed derived from fire radiative energy retrievals, *Geophysical Research Letters*, 40, 6298-6302, doi:10.1002/2013GL058232.

Kumar, S.S., Roy, D.P., Boschetti, L., Kremens, R. 2011. Exploiting the power law distribution properties of satellite fire radiative power retrievals - a method to estimate fire radiative energy and biomass burned from sparse satellite observations, *Journal of Geophysical Research*, 116, D19303, doi:10.1029/2011JD015676.

Recent Ph.D. Graduates

Dr. Naga Manohar Velpuri

Ph.D. Geospatial Science & Engineering

Graduated *2012*
Advisor *Dr. Gabriel Senay*

Ph.D. Dissertation Title

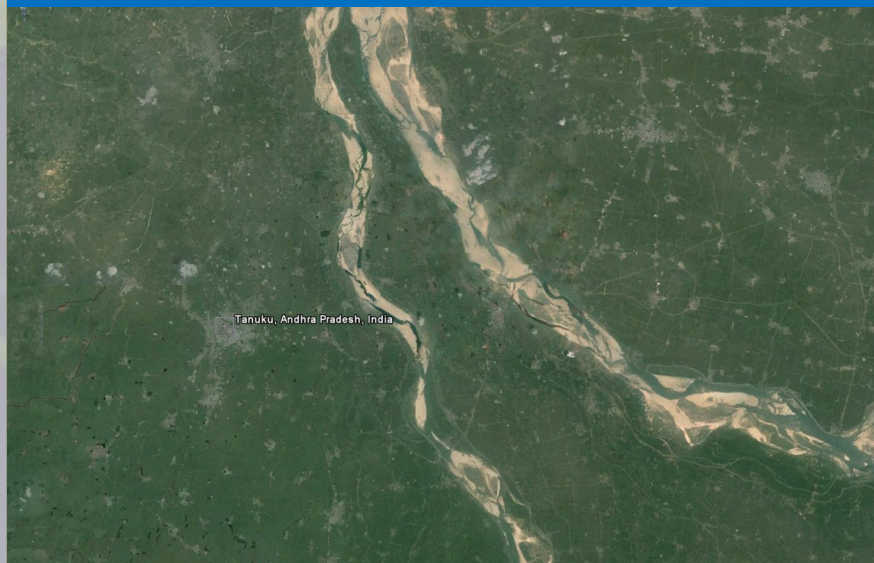*Satellite Driven Hydrologic Modeling of Ungauged Lakes and Reservoirs: Applications in East Africa*

Dr. Velpuri graduated with his Ph.D. in May 2012 under the supervision of Dr. Gabriel Senay. He is currently employed as a Research Scientist at the USGS Earth Resources Observation and Science (EROS) Center in Sioux Falls, SD. His research includes multi-spatial and multi-temporal analysis of hydrologic and climate data and development of innovative approaches and models relevant to agriculture and water resources applications.

Representative Papers

Velpuri, N.M., and Senay, G. B. 2012. Assessing the potential hydrological impact of the Gibe III Dam on Lake Turkana water level using multi-source satellite data, *Hydrology and Earth System Sciences*, 16, 3561–3578.

Velpuri, N.M., Senay, G. B., and Asante K.O. 2012. A multi-source satellite data approach for modelling Lake Turkana water level: calibration and validation using satellite altimetry data, *Hydrology and Earth System Sciences*, 16, 1-18.

Velpuri, N.M., Senay, G. B., Alemu, H., Rowland, J., and Verdin, J.P. 2014. Africa Wide Monitoring of Small Surface Water bodies Using Multi-Source Satellite Data: Monitoring System for FEWS NET, Nile River basin: Ecohydrological Degradation, Climate Change and Hydropolitics, Eds. Melesse, A.M., Abtew, W., & Setegn, S.G., Elsevier publications.

Tanuku, India (May 2013)

Current Masters Students

Marcelline Ndekelu

M.S. in Geography, expected 2015
"Remote sensing a human census of Kinshasa, Democratic Republic of the Congo"
Advised by Dr. David Roy
Funded through Fulbright Foreign Student Program

Mandira Sigdel-Phuyal

M.S. in Geography, expected 2014
"Understanding the Biogeography of Trees in the Woodland-Prairie Eco-tone Region of North America: A Case Study of the Sheyenne National Grassland, ND "
Advised by Dr. Niall Hanan
Funded through some support from Hanan IDC

Sefa Adekpui

M.S. in Geography, expected 2015
MSc Title TBD
Advised by Dr. David Roy
Funded through GSCE Graduate Research Assistantship

Ashley Swartos

M.S. in Geography, expected 2014
"Mapping oil palm expansion in the Brazilian Amazon"
Advised by Dr. Mark A. Cochrane
Funded through NASA research project NNX11AB89G

Cole Krehbiel

M.S. in Geography, expected 2015
"Monitoring urbanization-related land cover change on the U.S. Great Plains and impacts on remotely sensed vegetation dynamics"
Advised by Dr. Geoffrey Henebry
Funded through NASA research project NNX12AM89G

Brianna Lind

M.S. in Biology, expected 2015
"Termite diversity in southern Africa: a multi-scale test of biodiversity theory"
Advised by Dr. Niall Hanan
Funded through NSF Division of Environmental Biology Program DEB: 1139096

Note: The GSCE does not have a separate Masters Program, these Masters students are included because they are advised by GSCE faculty.

Previous Masters Students

Sarah Arnold
M.S. in Geography, graduated 2009
"Changing Fire Return Intervals in Southern California"
Advised by Dr. Mark Cochrane
Funded through Joint Fire Sciences Program Research Grant 06-3-3-11

Stephen Boyte
M.S. in Geography, graduated 2009
"Wildfire regimes and landscape dynamics in the Black Hills, USA"
Advised by Dr. Mike Wimberly
Funded through USDA Forest Service Cooperative Agreement PNW 06-JV-11261976-270

Aaron Friesz
M.S. in Geography, graduated 2012
"Effects of bird community structure on West Nile Virus incidence in the Northern Great Plains"
Advised by Dr. Michael C. Wimberly
Funded through NIH research project R01AI079411

Namita Giree
M.S. in Geography, graduated 2012
"A Sample-based Forest Monitoring Strategy using Landsat, AVHRR and MODIS data to Estimate Gross Forest Cover Loss in Malaysia between 1990 and 2005 "
Advised by Dr. Matthew Hansen
Funded through advisor's indirect funds

Benjamin Helder
M.S. in Geography, graduated 2012
"Characterizing maize and soy senescence by divergence of multiple spectral indices"
Advised by Dr. Geoffrey Henebry
Funded through NASA research project NNX07AT61A and advisor's indirect funds

Aashis Lamsal
M.S. in Geography, graduated 2011
"Evaluating geospatial visualization methods for West Nile Virus risk mapping"
Advised by Dr. Michael C. Wimberly
Funded through NIH Grant R01AI079411

Confiance Mfuka
M.S. in Geography, graduated 2013
"Characterizing spectral signatures for forest cover and loss using field data: A case-study of Kimvula Territory in Congo (DRC)"
Advised by Dr. Matthew Hansen
Funded through USAID CARPE

Christopher Moran
M.S. in Biology, graduated 2011
"Mountain Pine Beetles, Mitigation Treatments, and Fire Behavior in Ponderosa Pine of the Black Hills, SD"
Advised by Dr. Mark Cochrane
Funded through Joint Fire Sciences Program Research Grant 06-3-3-11

Previous Ph.D. Students

Dr. Christopher Barnes
Graduated 2010
Ph.D. Geospatial Science & Engineering
Advised by Dr. David Roy

"United States Land Cover Land Use Change, Albedo and Radiative Forcing: Past and Potential Climate Implications"

Dr. Mark Broich
Graduated 2010
Ph.D. Geospatial Science & Engineering
Advised by Dr. Matthew Hansen

"Advancing the Quantification of Humid Tropical Forest Cover Loss with Multi-Resolution Optical Remote Sensing Data: Sampling and Wall-to-Wall Mapping"

Dr. Narayanaraj Ganapathy
Graduated 2011
Ph.D. Geospatial Science & Engineering
Advised by Dr. Mike Wimberly

"Influences of forest roads on the spatial pattern of modern wildfire regimes in the East Cascades of Washington State"

Dr. Valeriy Kovalskyy
Graduated 2011
Ph.D. Geospatial Science & Engineering
Advised by Dr. Geoffrey Henebry

"An Event Driven Phenology Model: Development and Validation"

Dr. Luiz Mestre
Graduated 2011
Ph.D. Biological Sciences
Advised by Dr. Mark Cochrane

"Effects of wildfires on Amazonian bird communities"

Center Scholars Program

GSCE Center Scholars Program is a research experience for undergraduate (REU) program designed to enable SDSU students to gain hands-on experience with real research problems and to help qualify them for a career in geographic information science or associated geospatial sciences. GSCE faculty mentor these motivated undergraduates to develop the spatial, analytical and critical thinking skills necessary for effective investigation of geospatial questions.

Entry to the Program is competitive. Selection occurs during the spring semester and is restricted to juniors and sophomores. Each Scholar is paired with a Senior Scientist to work on a specific research project of mutual interest. During the academic year, the research pace is slower—no more than 10 hours per week—but during the summer the Scholar can work up to 40 hours per week. By the end of the following spring semester, the Scholar is required to present the research at one scientific conference, which may be regional, national, or international in scope.

The Program was initiated in 2006 and eleven Center Scholars had graduated through the system by the end of 2011. During the current triennial period (2012-2014), four more Center Scholars were mentored in research and presented their work at scientific conferences. Cole Krehbiel and Josh Bucher each worked with Dr. Geoff Henebry during 2012-2013.

Josh Bucher presented his research entitled Delineating open water extent in the Prairie Pothole region and Rainwater Basin using rule-based segmentation of Landsat data at the annual meeting of the Association of American Geographers in Los Angeles, CA in April 2013. Josh graduated in May 2013 with a major in Geography.

Cole Krehbiel presented his research entitled Exploring MODIS band 23 for urban remote sensing: Seasonal and view angle effects at the Joint Urban Remote Sensing Event (JURSE 2013) in São Paulo, Brazil, in April 2013 and again at the American Geophysical Union Fall Meeting in December 2013 with a poster entitled Exploring the mid-infrared region for urban remote sensing: seasonal and view angle effects. Cole also published this work, with co-authors Drs. Kovalskyy and Henebry in the international journal Remote Sensing Letters. The article can be freely accessed here: http://dx.doi.org/10.1080/2150704X.2013.853891. Cole graduated in December 2013 with honors and a triple major in Geography, Geographic Information Science, and Spanish.

Loretta Bartosh worked with Dr. Mark Cochrane during 2014 and presented her research entitled Climate change on the Coteau des Prairies in relation to agricultural production at the 46th South Dakota State University Geography Convention in March 2015, where it was awarded first place among student posters. Loretta graduated in May 2015 with a major in Agricultural Education and minors in Horticulture and Geography.

September Gering worked with Dr. Mike Wimberly during 2014 and presented her research entitled Malaria eradication in the United States and why it matters at the 46th South Dakota State University Geography Convention in March 2015. September graduated in May 2015 with a major in History and minors in Geography and Spanish.

Research Staff

Research associates and geospatial analysts provide key research, technical, and computational support to externally funded GSCE research projects.
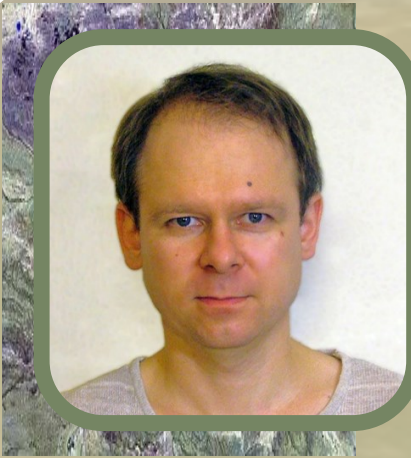
Alexey Egorov

Started May 2009
alexey.egorov@sdstate.edu

Academic Qualifications
M.Sc. Biology, Yaroslavl State University, Russia, 1995

Current Research Interests
Alexey is working on a NASA-funded research project entitled "Web-enabled Landsat data (WELD) — a consistent seamless near real time MODIS-Landsat data fusion for the terrestrial user community" with Dr. David Roy and Dr. Matthew Hansen. His duties include developing methods for mass-processing Landsat, Ikonos and QuickBird images for land cover and change characterizations.

Representative Paper
Hansen, M.C., Egorov, A., Roy, D.P., Potapov, P., Ju, J., Turubanova, S., Kommareddy, I., Loveland, T. 2011. Land cover monitoring of the conterminous United States with Landsat: First results from the Web-Enabled Landsat Data (WELD) project, *Remote Sensing Letters*, 2, 4, 279-288.

Indrani Kommareddy

Started August 2009
indrani.kommareddy@sdstate.edu

Academic Qualifications
M.Sc. Information Systems, Dakota State University, USA, 2008

B.E. Computer Science and Engineering, Jawaharlal Nehru Technological University, India, 2006

Current Research Interests
Indrani Kommareddy is a computer programmer and systems analyst responsible for putting together a satellite production and distribution system in support of NASA funded Web-enabled Landsat data (WELD) project. The WELD project web distribution system (http://weld.cr.usgs.gov/) currently has more than 500 users from 20 countries.

Representative Paper
Kommareddy, I., Roy, D.P., and Ju , J. Web-enabled Landsat data (WELD) Project a NASA Making Earth System data records for Use in Research Environments (MEASURES) funded project, Quick Overview of WELD Project & WELD Product Distribution Metrics, *9th NASA Earth Science Data System Working Group (ESDSWG)*, New Orleans, October 20-22, 2010.

Aashis Lamsal

Started September 2011
aashis.lamsal@sdstate.edu

Academic Qualifications
M.Sc. Geography, South Dakota State University, USA, 2011

B.E. Computer Engineering, Tribhuvan University, Nepal, 2006

Current Research Interests
Aashis has provided geospatial data management and analysis support for Dr. Michael Wimberly on multiple projects funded by NIH, NASA, and DOE. Most recently, he has served as the lead programmer and analyst for a land change simulation modeling projects support through a cooperative agreement with USGS EROS. Aashis' main responsibility on this project has been the development of the Coupled Human and Natural Geospatial Environments (CHANGE) model, which integrates human driven land cover and land use change with natural vegetation succession and disturbance.

Representative Paper
Lamsal, A., Wimberly, M.C., Liu, Z., and Sohl, T.L. 2014. A simulation model of human-natural interactions in dynamic landscapes. Proceedings of the 2014 International Congress on Environmental Modelling and Software, San Diego, CA, June 15-19.

Administrative & Information Technology Staff

Administrative and information technology staff ensure the smooth running of the GSCE and support all faculty, staff, and student activities.

Administrative Staff

Rachael Auch

Computer Support Specialist
rachael.auch@sdstate.edu
605-688-6850

While studying at SDSU, Rachael worked as a student technician for nearly 3 years, and after graduating worked in an IT/office management role for a local corporation for another 3 years before joining GSCE as the department's computer support specialist.

Vicki Bierschbach

Senior Secretary
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605-688-6591

Vicki received her Bachelor's Degree in Business Administration with emphasis in accounting from Northern State University in Aberdeen, SD. She has worked in public and private accounting in different industries, most recently, the research field.

Julie Westberg

Senior Accountant
julie.westberg@sdstate.edu
605-688-6139

Julie has a Bachelor's Degree in Consumer Affairs (Financial Management) from South Dakota State University and is currently pursuing a Master's Degree from State in Adult Development.

Information Technology Staff

Dr. Anil Kommareddy
Computer and Information Research Scientist
Anil.Kommareddy@sdstate.edu
605-688-5792

The GSCE computing resources are architected, built and administered by Anil Kommareddy. Anil has a B.E. degree in Electrical and Electronics Engineering from the University of Madras in India. He has expertise in the design, build and maintenance of high performance computing clusters and software stacks. His coding accomplishments include development of machine-learning code including Classification and Regression Tree algorithms customized to classify large satellite datasets and development of codes to process satellite images using different image processing libraries.

Anil's hardware and software design architectures have provided the GSCE with cost effective solutions and the proven capability to expand the GSCE computing systems. When he joined the GSCE in 2005 there was 1 server with 12TB of RAID storage, 6 Workstations, and 27 desktops. Today, the GSCE has 27 servers with 795TB of RAID storage with a high speed 4Gbps and 8Gbps SAN network, 106 Workstations and 30 Laptops spanning multiple computer operating systems — Redhat Enterprise Linux, Mac OS, Windows Server 2008R2, Windows 7, and Windows XP. This astounding growth is due to faculty research grant activity, but it is fundamentally reliant on Anil's ability to develop reliable computing solutions at low cost and to maintain a stable GSCE computing environment.

GSCE Computer Resources

Graduate Student Computing

The GSCE philosophy is to provide advanced computing systems in support of graduate students to facilitate efficient completion of their research work and expose them to a variety of computational environments and solutions. Each graduate student enrolled in the GSCE has a dedicated workstation to perform their research. Their workstations provide access to the GSCE's research clusters and dedicated servers used by their research group. The availability of these computing resources enables students to apply and validate multiple computational and statistical approaches using large datasets.

Computing Facilities

Computing is central to GSCE research and instruction activities, involving dedicated research computing systems for large volume satellite data processing, storage, and geographic information analysis and modeling, in addition to personal computers for communication and instructional and research material preparation. The GSCE computing resources are architected, built and administered by Anil Kommareddy.

The GSCE has nationally competitive computing resources. The GSCE research systems have approximately 2 PB of online storage, spanning several clusters and dedicated servers, that currently provide one of the nation's leading university departmental online satellite data storage systems. The GSCE research computing is undertaken on Linux and Windows servers to perform large scale image processing tasks that are CPU and throughput intensive.

Teaching Labs

The GSCE teaching laboratories are equipped with Windows computers and the latest versions of Remote Sensing, GIS and statistical software. The labs are computationally among the best on campus. The software are maintained and updated each semester and the computers are frequently upgraded. Students trained on the GSCE system are well prepared to face today's competitive work environment. The GSCE graduate labs are used as dual purpose labs with capabilities to support temporary research in addition to being used for graduate courses.

Computer Resources

Research Computing

The GSCE has one of the nations most advanced computational research capabilities for geospatial analysis and data storage. Currently there are more than 36 servers connected to 2 PB of online storage connected via a 4Gbps and 8Gbps storage area network. Approximately 85% of the servers and 90% of the online storage space are dedicated to specific federally funded research projects, and the remaining servers and storage are shared with the department research users.

A high performance GSCE computing architecture with a high throughput backbone was designed to efficiently process large continental and global scale satellite data. The GSCE research computers have high speed connectivity (1Gbps) at the workstation and 10Gbps network connectivity to research compute servers. The research compute servers are used to transfer large data sets among GSCE servers and also with other agencies which are connected to Internet2. The campus has 10Gbps Internet2 connectivity with other academic, government and non-commercial organizations making it easier to collaborate with other research agencies such as NASA, EROS Data Center, USDSA and other federal labs. The high speed 10Gbps network connectivity to the servers and 1Gbps network connectivity to workstations are provided by the university Office of Information technology.

To date the most compute intensive GSCE project has been the NASA funded Web Enabled Landsat Data (WELD) project. This picture shows all the 30m Landsat 5 and 7 pixels acquired by the USGS Landsat project for 2010 reprojected into a sinusoidal global projection and converted to visible surface reflectance to show what the Earth looks like from space with the human eye. It is composed of more than 260,000,000,000 pixels. It was generated in less than one day by the WELD team working with NASA AMES California scientists using NASA's fastest supercomputer, the NASA Earth Exchange (NEX). Despite the considerable GSCE computer resources the same data took more than a month to generate on the GSCE WELD project computers.

21.9% Increase in grant expenditures since last triennium
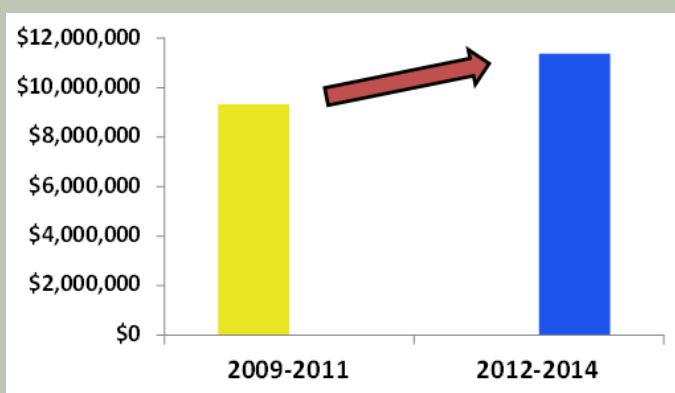
In the current triennium (2012-2014) the GSCE faculty has continued to be highly successful in attracting external funding for their research projects. Over this period $12,856,158 of funding was awarded by external sponsors. Grant expenditures during the current triennium increased by 21.9% over the previous triennium, with monthly expenditures averaging $315,000.

Grant expenditures
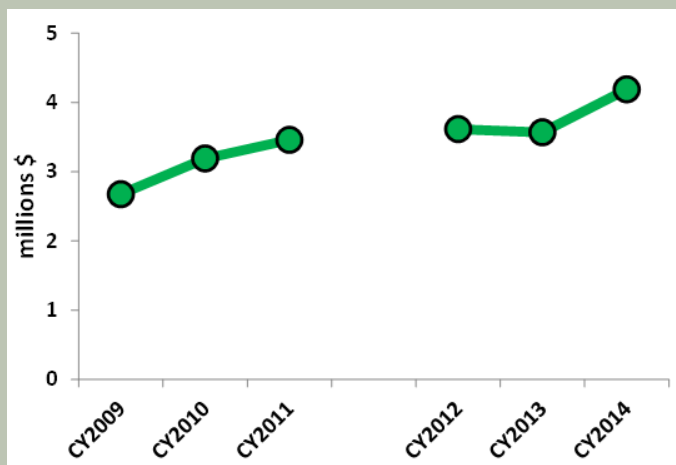
While the majority of our research dollars continued to originate from the National Aeronautics and Space Administration (NASA), each Senior Scientist has funding from at least two different agencies. In addition, two of our Assistant Research Professors, Dr. Izaya Numata and Dr. Christopher Wright, received new funding during this period. Additional sponsors of research at the GSCE during 2012-2014 included the National Science Foundation (NSF), the National Institutes of Health/National Institute of Allergy and Infectious Diseases (NIH/NIAID), the US Geological Survey (USGS), the US Forest Service (USFS), the US Agency for International Development (USAID), and more. This diversification of funding sources illustrates the interdisciplinarity that is a hallmark of the geospatial sciences practiced at the GSCE.

Glancing Back, Looking Forward

When I sat down just over three years ago to write up this section for the last triennial report, I had been serving as interim Co-Director for less than six months. Many notable changes have occurred in the past three years that merit review. Foremost is our new name: the Geospatial Sciences Center of Excellence or GSCE. Although the new name appears just a tweak away from the original Geographic Information Science Center of Excellence, it is a difference that counts. During SDSU's strategic planning process in 2013-2014, we sought to clarify who we are and what we do. One product of that effort was our mission statement, which includes these words: Our mission is to address fundamental questions about the functioning of the biosphere and its implications for the environment and human welfare in a rapidly-changing world. The name change reinforces that the Center focuses on interdisciplinary research using a range of geospatial approaches. Indeed, two of our senior scientists have their academic homes in the department of Geography and the other four are associated with the department of Natural Resource Management.

Another important change in the last triennium was the 2013 hiring of Dr. Xiaoyang Zhang, a remote sensing scientist of an international renown, who brings deep experience in transforming basic research into operational products for NOAA to support their programs in weather forecasting and climate prediction. In the past two years, Dr. Zhang has made a significant impact at the Center, broadening and deepening its research base and outreach. In 2013 Dr. David Roy was recognized by SDSU with its highest honor for research excellence, the F.O. Butler award, for his efforts to unleash the Landsat archive. As a member of the Landsat Science Team, he was in California in February 2013 to witness the successful launch of Landsat 8. In 2014 Dr. Mike Wimberly was recognized by SDSU for his international research efforts in Ethiopia and Ghana, which have been supported by NIH and USDA/USFS, respectively.

The Center was inaugurated in September 2005. Thus, the 2015-2016 Academic Year marks the 10th anniversary of the Center. We are planning some special events to mark this past decade of achievements, which include the many millions of dollars in nationally competitive grants and cooperative agreements awarded to Center scientists that have produced hundreds of presentations, hundreds of publications, and over 24K citations. The Center has seen 32 post-doctoral fellows trained, 15 Ph.D. students graduated, as well as mentoring of many MS students and undergraduate research scholars. Since 2006 nine of our Ph.D. students have been awarded prestigious competitive Earth and Space Sciences Fellowships from NASA, which places SDSU in the top 20% of research universities nationwide.

Given this remarkable record of achievement, what may the next triennial hold? As I write, there are proposals before Congress to slash research funding for earth sciences at NASA, NSF, and DOE and social sciences at NSF. These misguided attempts to politicize science funding, coupled with already declining budgets at the major funding agencies, may lead to an even more challenging funding environment. However, we have been up to the challenge in the past, and I expect we will be able to continue to bring in nationally competitive research funding in the next several years.

Finally, notes of thanks and welcome. Since the earliest days of the Center, Anil Kommareddy guided the growth and development of the Center's computing resources from a single server with 12TB of storage in 2005 to the current and growing configuration of 40 servers hosting more than 2PB of active storage and dozens of workstations for faculty, staff, and students. In early 2015 Dr. Kommareddy moved to the University of Maryland-College Park to oversee a new computing initiative in the College of Behavioral and Social Sciences. The GSCE Computing resources are now overseen by Adam Dosch, who was previously a senior Linux systems administrator at the USGS Earth Resources Observation and Science (EROS) Center.

Geoff Henebry, May 2015
Co-Director, Geospatial Sciences Center of Excellence
Professor, Natural Resource Management

Appendix I: Alumni Faculty and Staff

Bernard Adusei — *Geospatial Analyst, now Geospatial Analyst, Department of Geographical Sciences, University of Maryland, USA.*

Dr. Giuseppe Amatulli — *Postdoctoral Fellow, now a Geospatial Analyst & Trainer, Department of Ecology and Evolutionary Biology, Yale University , USA.*

Dr. Kwabena Asante — *Adjunct Professor, USGS EROS Research Physical Scientist, now an Independent Consultant, Climatus LLC, Mountain View, CA, USA.*

Adam Baer — *Geospatial Analyst, now a Geospatial Intelligence Officer, Department of Defense, MO, USA.*

Dr. Kirsten de Beurs — *Postdoctoral Fellow, now an Associate Professor, University of Oklahoma, OK, USA.*

Dr. Jiyul Chang — *Postdoctoral Fellow, now a Postdoctoral Researcher, Department of Plant Science, South Dakota State University, SD, USA.*

Dr. Ting-Wu Chuang — *Postdoctoral Fellow, now Assistant Professor, Taipei Medical University, Taiwan.*

Claudia Cochrane — *Research Coordinator, Resigned, USA.*

Marcela Doubková — *Geospatial Analyst, now a Geospatial Analyst, Technical University of Vienna, Vienna, Austria.*

Dr. Ahmed Elaksher — *Postdoctoral Fellow, now an instructor, St. Cloud State University, MN, USA.*

Dr. Bingxuan Guo — *Postdoctoral Fellow, now a Postdoctoral Fellow at George Mason University, VA, USA.*

Dr. Matthew Hansen — *Senior Scientist and Co-Director, now a Professor, University of Maryland College Park, MD, USA.*

JoAnn Jorgensen — *Senior Secretary, resigned, USA.*

Dr. Junchang Ju — *Assistant Research Professor, now a Senior Scientific Programmer, NOAA/ NESDIS Camp Springs, VA, USA.*

Aashis Lamsal — *Geospatial Analyst, now WebGIS Programmer, USFS Remote Sensing Applications Center, Salt Lake City, UT, USA.*

Appendix I: Alumni Faculty and Staff

Dr. Zhe Li — *Postdoctoral Fellow, now a Visiting Scientist, Agriculture and Agri-food Canada.*

Dr. Akihiko Michimi — *Postdoctoral Fellow, now an Assistant Professor, Western Kentucky University, KY, USA.*

Dr. Brett Murphy — *Assistant Research Professor, now Research Scientist, The University of Melbourne , Australia.*

Dr. Jordan Muss — *Postdoctoral Researcher, Los Alamos National Laboratory, Los Alamos, NM, USA.*

Kyle Pitman — *Geospatial Analyst, now a Computer Services Consultant, Durham, NC, USA.*

Dr. Peter Potapov — *Assistant Research Professor, now a Research Associate Professor, University of Maryland College Park, MD, USA.*

Marcia Prouty — *Senior Secretary, resigned, USA.*

Dr. Yuchu Qin — *Postdoctoral Fellow, now affiliated with MATIS, IGN, France.*

Dr. Eric Ariel Salas — *Postdoctoral Fellow, now Postdoctoral Researcher, Department of Fish, Wildlife, and Conservation Ecology, New Mexico State University, Las Cruces, New Mexico, USA.*

Dr. Mirela Tulbure — *Postdoctoral Fellow, now an Assistant Professor, University of New South Wales, Sydney, Australia.*

Dr. Svetlana Turubanova — *Postdoctoral Fellow, now a Research Associate, University of Maryland College Park, MD, USA.*

Dr. Jess Walker — *Postdoctoral Fellow, now affiliated with USGS in Tucson, Arizona, USA.*

Dr. Xiaolei Wang — *Postdoctoral Fellow, now a Postdoctoral Researcher, University of Oklahoma, OK, USA.*

Dr. Jong-min Yeom — *Postdoctoral Fellow, now a Research Scientist, Korean Aerospace Research Institute (KARI), South Korea.*

Dr. Chunsun Zhang — *Associate Professor, now a Research Scientist, University of Melbourne, Australia.*
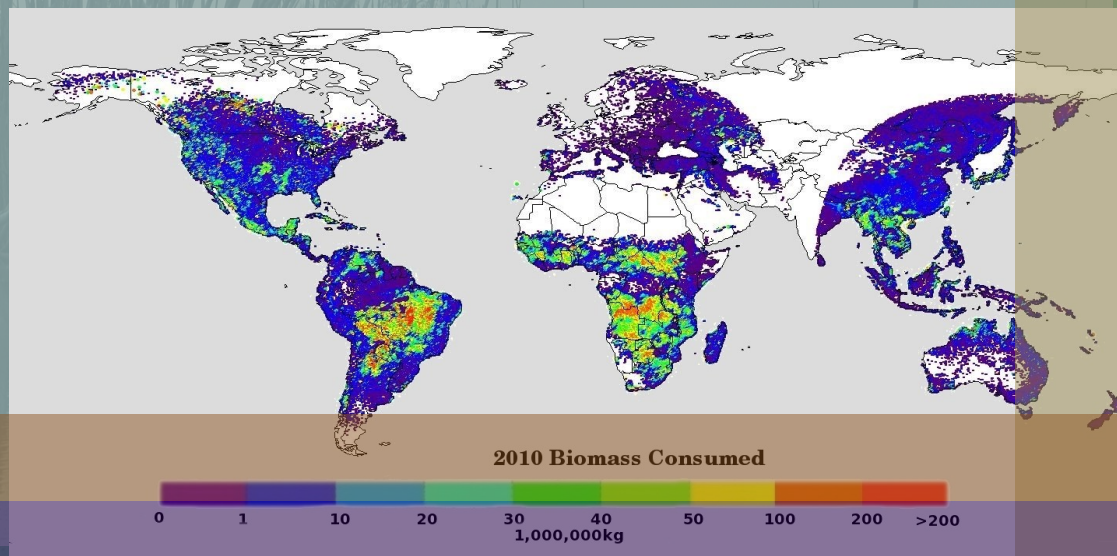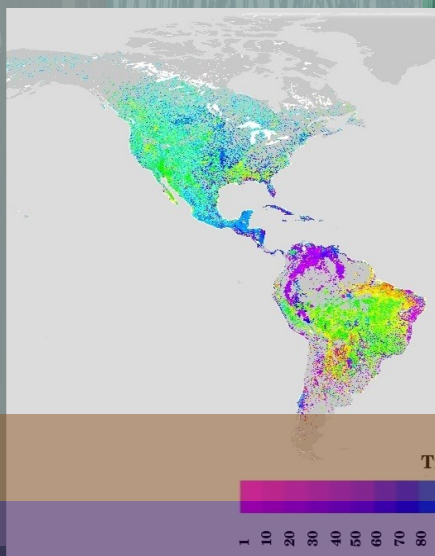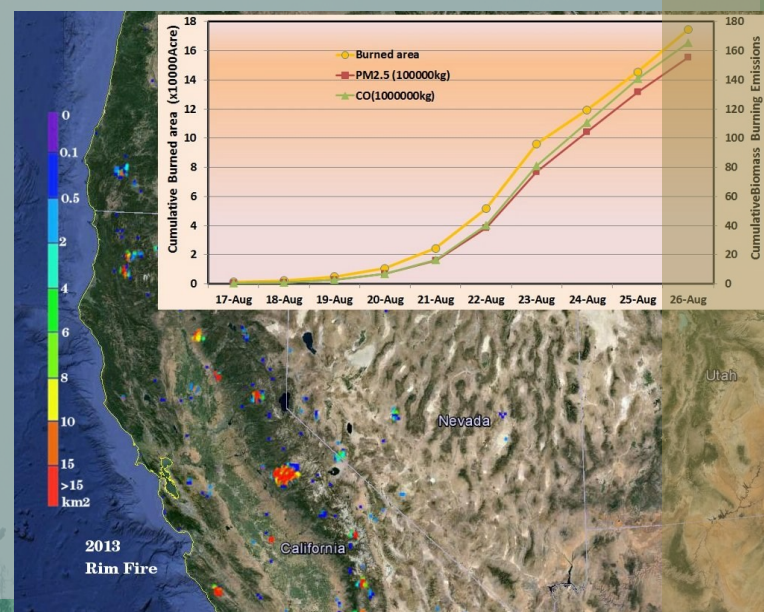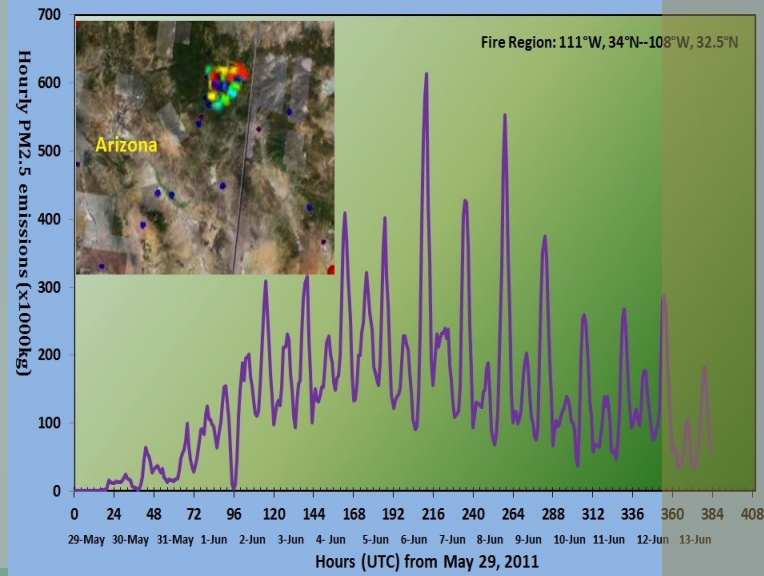
Dr. Zhiliang Zhu — *Adjunct Professor, USGS EROS Research Physical Scientist, now a USGS federal government employee, USGS, Reston, VA, USA.*

Global Biomass Burning Emissions and Fire Seasonality

Biomass burning contributes more than one third of the total global carbonaceous aerosols, black carbon, and carbon dioxide. However, accurately calculating biomass burning emissions is challenging. Dr. Zhang has been studying regional and global biomass burning emissions and fire seasonality with support from the National Oceanic and Atmospheric Administration (NOAA). His research uses a network of geostationary satellites to monitor the quantity of biomass burning emissions and the variability of fire seasonality. The network consists of geostationary satellites operated by NOAA, the European Organization for the Exploitation of Meteorological Satellites, and by the Japan Meteorological Agency. These satellite systems observe wildfires at an interval of 15 to 30 minutes and provide a direct measurement of the amount of radiant heat energy emitted per unit time, termed the fire radiative power (FRP).

The FRP has been demonstrated to be related to the rate at which fuel is consumed and smoke produced. Dr. Zhang is using geostationary satellite FRP data to generate global inventories of biomass burning emissions and fire seasonality. He is also using FRP from near real time satellite observations to produce diurnal biomass burning emissions for operational air quality forecasting in support of human health applications.

Landsat 8 on United Launch Alliance Atlas V rocket prior to launch.
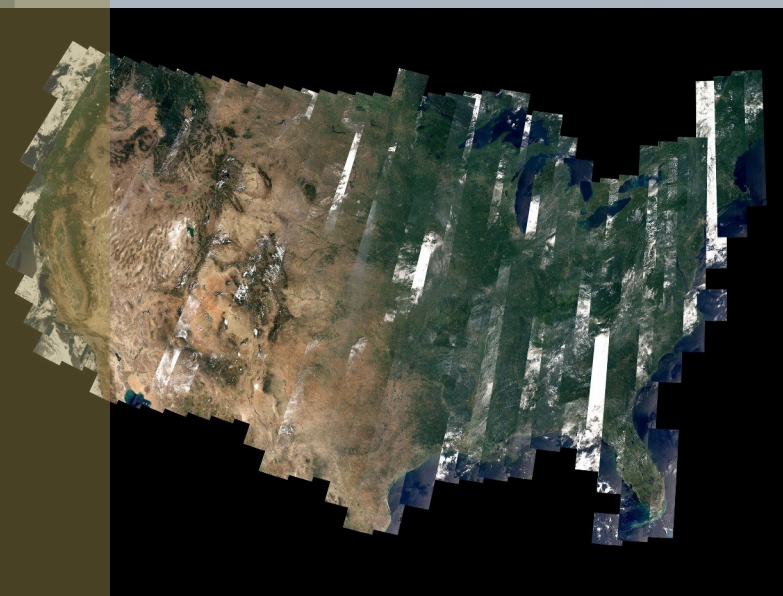
This 11-billion-pixel composite map of the United States was made by analyzing a month's worth of data from Landsat 8. In that amount of time, the satellite covered the area in 115-mile wide strips two times over. The most cloud-free pixels were chosen for the final, nearly cloudless image. A digital version of this image is available at http://www.wired.com/2014/02/earth-from-space-landsat-8-first-year/

Landsat 8

At over 40 years, the Landsat series of satellites provides the longest temporal record of space-based surface observations. Landsat 1 was launched in 1972 and was followed by a series of consecutive, temporally overlapping, Landsat observatories (Landsat 2, 3, 4, 5 and 7) that have provided near-global coverage reflective and thermal wavelength observations with increasing spectral and spatial fidelity. Remarkably, the Landsat record is unbroken, with most land locations acquired at least once per year since 1972, capturing a period when the global human population has more than doubled and evidence for climate change has become discernible. The economic benefits of Landsat are estimated as $2.19 billion/year in support of applications including water resource analysis and management, agriculture and forest analysis and management, homeland security, infrastructure analysis, disaster management, climate change science, wetland protection, and monitoring land cover change.

The Landsat record was continued with the successful February 11th 2013 launch of Landsat 8 from Vandenburg Air Force Base, California. Several members of the GSCE including Tom Loveland, Val Kovalsky y, Sanath Kumar, David Roy, and Jim Vogelmann attended the launch.

Today, Landsat 8 data complement the now more than five million scenes acquired by previous Landsat missions that are stored in the U.S. Landsat archive and are freely available via the internet.

The Landsat 8 data are being used by David Roy, Val Kovalskyy, and Indu Kommareddy's Landsat Science Team funded research to generate continental Web Enabled Landsat Data (WELD) products that have been featured in the media including WIRED and Slate magazines.

Landsat 8 Successful Launch
(this is how it looked through a quality camera zoom from where members of the GSCE were standing 9 miles away)

Automated U.S. Crop Field Extraction From Multi-Temporal Landsat Data

The spatial distribution of agricultural fields is a fundamental description of rural landscapes and the location and extent of fields is needed to establish the area of land utilized for agricultural yield prediction, resource allocation, and economic planning. Field size distributions and their changes have not been studied over large areas as field size datasets are not publicly available. Changing field sizes may have significant impacts on landscape spatial configuration and land use diversity with ecological and biogeochemical consequences.

Satellite data and, in particular, the data provided by the near-global long term Landsat series, provide the potential to monitor field size changes and provide geographic context for observed changes. Recent NASA funded research has enabled Drs. Lin Yan and David Roy to develop computer vision approaches to extract field sizes automatically from Landsat 30m time series. The resulting data are being used by Dr. Roy's Ph.D. student Emma White to study the nature of field size changes across the United States.
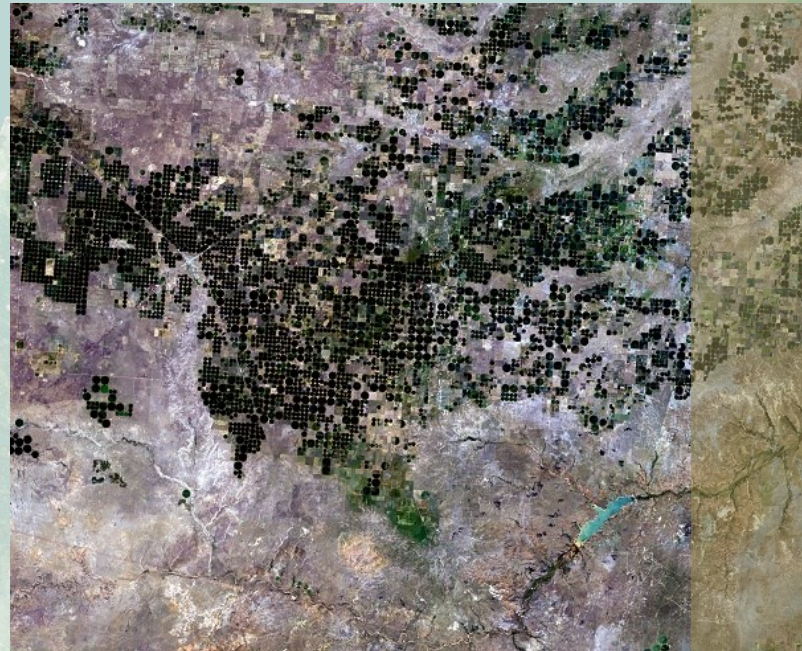
Summer Web Enabled Landsat satellite image composite of a 150 × 150 km agricultural region in the Northern Texas Panhandle

Automated agricultural field extraction results. The colors denote different fields labels and black show where no fields were extracted.
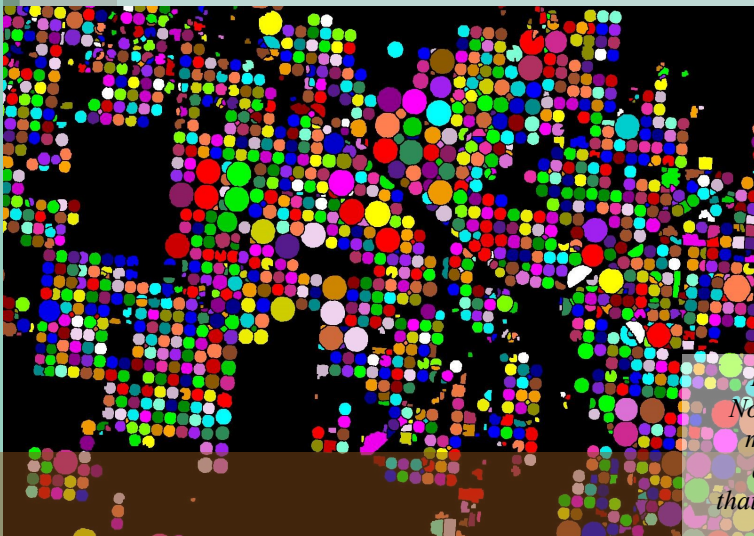
Detailed automated agricultural field extraction results for a 45 x 34 km Northern Texas Panhandle region. Circular pivot irrigation fields with 0.24 mile and 0.49 mile radii that correspond to the radii required to irrigate quarter section fields (0.5 × 0.5 mile) and full section fields (1 × 1 mile) that were originally surveyed in much of the western United States are evident.

Locations in North Dakota suitable to support large apiaries in 2002: Suitable (red), Suitable because of conservation lands (green)

Commercial Apiary

U.S. Honey Bees

Major losses of honey bees to Colony Collapse Disorder have brought pollination services into national focus in recent years. The U.S. agricultural industry is heavily reliant on honey bees and is the world's most active market for their pollination services. Dr. Gallant and colleagues from the U.S. Geological Survey, U.S. Department of Agriculture, University of Minnesota, U.S. Fish & Wildlife Service, and the beekeeping industry have been studying how land cover and land management affect honey bee nutrition and health. More than half the bee colonies needed to pollinate commercial crops in the United States are raised in the Northern Plains. Landscapes that offer a variety of flowering plants with pollen and nectar suitable for honey bees enable beekeepers to rear healthier and larger bee colonies that are more resistant to the rigors of being transported around the country to pollinate crops. Dr. Gallant and her colleagues are assessing how national policies and programs (such as from the Farm Bill) that influence annual land-management decisions in the Northern Plains can, in turn, affect the availability and condition of bee colonies for pollinating crops elsewhere in the United States.

U.S. Great Plains West Nile Virus

Despite a cold temperate climate and low human population density, the Northern Great Plains has become a persistent hot spot for human West Nile virus (WNV) disease in North America. WNV is a mosquito borne disease that primarily affects wild birds, but can also be transmitted to humans and cause severe disease. GSCE senior scientist Mike Wimberly conducts disease ecology research that seeks to understand the spatial and temporal patterns of WNV along with the environmental factors that affect mosquito and bird populations and can lead to disease outbreaks in humans. This work has involved collaborators from multiple academic departments at SDSU as well as the South Dakota Department of Health and local public health and mosquito control specialists. Results have been applied to develop maps and predictive forecasting models of WNV risk for South Dakota and the broader northern Great Plains region.
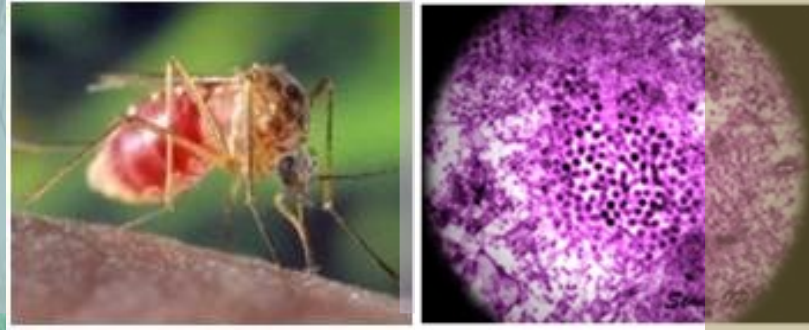
Cases of Human West Nile Virus Diseases in South Dakota: 2012
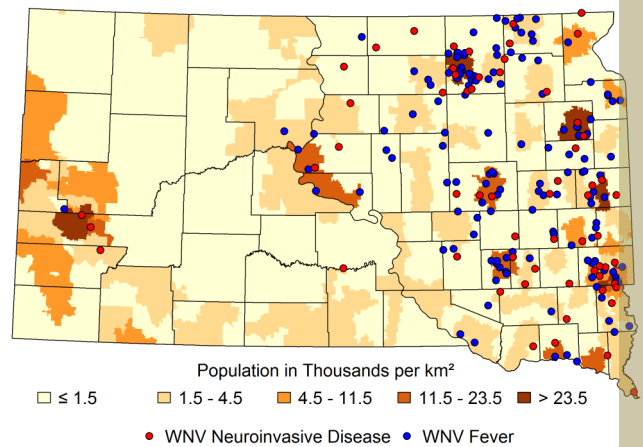
Population in Thousands per km²

≤ 1.5   1.5 - 4.5   4.5 - 11.5   11.5 - 23.5   > 23.5

● WNV Neuroinvasive Disease   ● WNV Fever

Geospatial Sciences Center of Excellence, South Dakota State University
http://globalmonitoring.sdstate.edu/eastweb

Climate Change, Pastoral Resources and Livestock in Sahelian West Africa

The rangelands of the Sahel extend in a narrow band across northern Africa between the Sahara desert and the rain-fed agricultural zones of West and Central Africa. The Sahel is the epicenter of livestock production in the region but is sensitive to periodic drought cycles that may become more frequent and more severe with anthropogenic climate change. Drs. Hanan, Prihodko and Kaptue are working with an interdisciplinary team of Malian, Senegalese and US researchers, students and NGOs to improve our understanding of how climate change will impact pastoralist communities in future decades. The research includes intensive modeling of Sahelian pastoral systems (vegetation dynamics, livestock and surface water responses to climate change), assessment of land use change and agricultural encroachment into pastoral lands, and GPS tracking of herd migration pathways. GSCE personnel based in West Africa (Peter Shapland & Tamara Johnson) have worked with NGO partners to survey pastoralist communities in Senegal and Mali to determine how (and in what form) information on future trends in pastoral resources will be of most value. The project is funded by USAID through the Livestock & Climate Change Innovation Laboratory managed by Colorado State University.

Late dry season range in the seasonal wetlands of the Niger Delta (1/20/2012 - 6/10/2012)

Water stop at grazing area of another transhumant group (10/25/2011)

Wet Season Range Seno Plains (7/17/2011 - 10/16/2011)

Early dry season range in the Niger Delta south of Mopti (11/19/2011 - 01/11/2012)

○ Wet season range
○ Early dry season range
○ Late dry season range
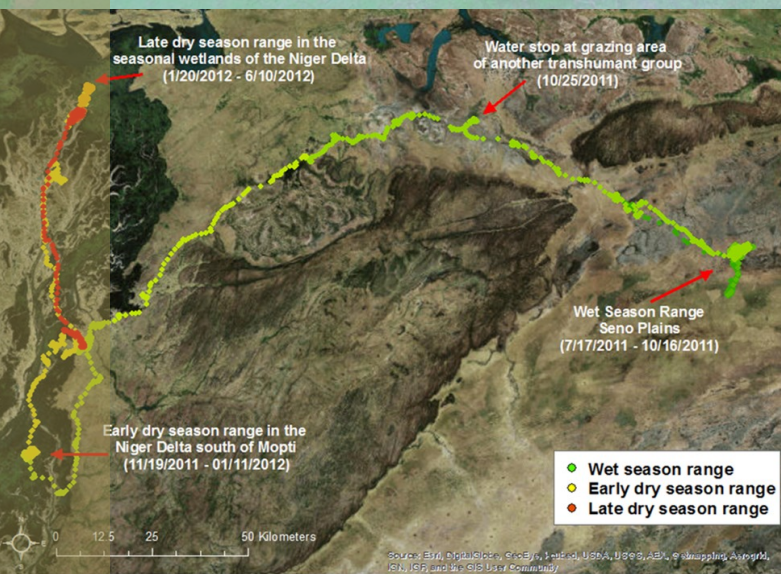
Changing Landscapes in the Post-Soviet Period

The abrupt disintegration of the Soviet Union in 1991 generated a vast but unintended landscape experiment. In the absence of the centrally-allocated subsidies that sustained the agricultural sector, cultivation slowed, production fell, trade collapsed, and the consequences of this simultaneous shift in land management could be seen from space. Dr. Geoff Henebry and colleagues have been working with NASA funding since 2001 to document and understand this phenomenon and its many consequences, from changes in vegetation seasonality and regional climate to shifts in food security and livelihoods. A recent trip to Uzbekistan underscored the challenges of sustaining agriculture in an arid environment where agriculture requires irrigation but the soils are susceptible to salinization. The white on the ground in the pictures is not snow but salt.

Land Cover Land Use Change in Upper Guinean Forests

The Upper Guinean forests once covered more than 103 million acres from southern Guinea into Sierra Leone, through Liberia and southern Côte d'Ivoire, into Ghana and western Togo, but rapid population growth and expansion of agriculture has fueled deforestation of more than 80 percent of the original forest cover. GSCE scientists led by Dr. Mike Wimberly are conducting research to map regional patterns of forest loss and degradation, determine the major drivers of land cover and land use change, and project future landscape changes that may result from climate change and population growth.

The research is supported by the USDA Forest Service and integrates field work, remote sensing data analysis, and spatial simulation models. GSE Ph.D. student Francis Dwomoh was recently awarded a NASA Earth and Space Science Fellowship to study the vulnerability of the remaining forest fragments in this region to human encroachment, climate change, and fire.

Forests support LIVELIHOOD Prevent Wild fires

Fire in Tropical Peatlands

Episodic uncontrolled fires within drained peat-swamp forests are causing the loss of deep organic soils storing vast amounts of carbon and have made Indonesia the 4th largest CO_2 emitter over the last half century. Dr. Cochrane is leading interdisciplinary research, investigating the chains of social and bio-physical events leading to these deep-peat fires. In collaboration with the Indonesian government, research is underway within the 120,000 ha Kalimantan Forests and Climate Partnership (KFCP) Reduced Emissions from Deforestation and forest Degradation (REDD+) project to develop a prototype peat-fire emissions module for incorporation into national Measuring, Reporting and Verification (MRV) efforts. Accurate accounting of peat-fire carbon emissions requires understanding how fire presence, depth of burning, and spread rates relate to the interplay of climate, weather, land use, land cover, drainage status, disturbance history, fire type, peat depth and composition. Integration of remote sensing data with field-derived measurements of fire emissions and biophysical factors influencing regional fire dynamics are being used to model and assess the health impacts and total global warming potential (GWP) of these emissions.

Non-Academic Fun Things To Do

Camping and Sports

Parks and playgrounds provide the best place for summer festivals, family picnic, camping, and sports.

Fishing

Whether you want a perch, bass, walleye, or catfish, lakes around the Brookings area offer great fishing.
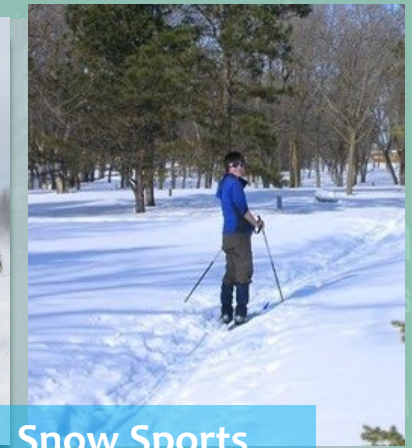
Snow Sports

Winter months in Brookings, South Dakota also mean a great time to go cross-country skiing, ice skating, mushing, snowmobiling, or even ice fishing.

Appendix III

Non-Academic Fun Things To Do

Canoeing & Kayaking

Windsurfing & Kiteboarding

Water-sport enthusiasts can enjoy the many lakes and rivers around Brookings.

Flying

South Dakota is one of the nation's cheapest places to learn to fly, both powered and non-powered flight, and several GSCE students are applying for and have received pilot licenses.

Appendix IV

Refereed Journal Articles: 2012

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Appendix IV

Refereed Journal Articles: 2013

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Appendix IV

Books, Book Chapters, Monographs, White Papers: 2013

Chen, J., Wan, S., **Henebry, G.M.**, Qi, J., Gutman, G., Sun, G., Kappas, M. editors. 2013. *Dryland East Asia: Land Dynamics Amid Social and Climate Change,* Published in China by Higher Education Press and in the rest of the world by De Gruyter. 470 pp. http://dx.doi.org/10.1515/9783110287912

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Senay: *Bahir Dar, Ethiopia*

Mosase , *Gaborone, Botsawa*

Kahiu: *Thika, Kenya*

Ramachandran: *Bangalore, India*

Salas: *Cebu, Philippines*

Appendix VI

How to Get to the GSCE

Driving from Sioux Falls Regional Airport :

1. Head **southeast** on **N Jaycee Ln** (0.2 mi)
2. Continue straight to stay on **N Jaycee Ln** (0.2 mi)
3. Slight **right** at **N Minnesota Ave** (0.8 mi)
4. Turn **right** at **W Russell St** (2.1 mi)
5. Take the ramp onto **I-29 N** (52.4 mi)
6. Take exit **132** for **US-14/I-29** toward **Huron/Brookings** (0.3 mi)
7. Turn **left** at **6th St/US-14** (1.6 mi)
8. Turn **right** at **Medary Ave** (0.5 mi)

Destination will be on the left between Harvey Dunn St and 11th St. (58.1 mi—about 55 minutes)

Physical Address: 1021 Medary Avenue, Wecota Hall, Brookings, SD 57007-3510.

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