Curriculum Vitae

Cassidy J. Rankine

Ph.D., Remote Sensing of the Environment

Chief Scientist and Chief Technology Officer, Skymatics Ltd.

Calgary, Alberta, Canada

email: crankine@ualberta.ca

www.linkedin.com/in/cassidy-rankine

tel: (780) 238-1870

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SUMMARY

I am the Chief Scientist and CTO of Skymatics Ltd, a technology solutions firm based in Calgary, Alberta that focuses on solving land and water management challenges using unmanned aerial systems (UAS). My research interests focus on the integration of ground based, airborne, and orbital remote sensing technologies to better understand land surface and atmospheric exchanges of water and carbon for the valuation and conservation of ecosystem services, with a focus on regenerating forest ecosystems. I worked for many years with the renowned global change scientist Dr. Arturo Sanchez-Azofeifa, current PI and director of the Tropi-Dry Research Network and Center for Earth Observation Sciences at the University of Alberta where we development some of the world's first outdoor wireless sensor networks (WSNs) for ongoing calibration and validation of global satellite observations of spectral vegetation indices, plant leaf area (LAI) and the fraction of absorbed photosynthetic active radiation (FAPAR). My research pioneered the use of advanced very high resolution spatio-temporal remote sensing technologies such as unmanned aerial vehicles, LiDAR and optical WSNs to reveal how ecosystem structure and function relate through climate-plant phenology and biometeorology. I was also directly involved in the development of the University of Alberta's environmental IoT database cyber-infrastructure (Enviro-Net ©) capable of delivering in-situ remote sensing data products in near-real time to land management collaborators in government, industry, and academia around the world. Since 2011, I have been working on establishing advanced tools for geomatics and ecosystem health monitoring technologies for natural resource management in Alberta, Canada.

UNIVERSITY EDUCATION

Degree	Institute	Year
Ph.D., Earth Sciences	University of Alberta, Earth and Atmospheric Science Department, Center for Earth Observation Sciences	2015

- Dissertation: Wireless Sensor Networks for Real-Time Environmental Monitoring
  1) *Near-surface remote sensing of climate-forest biophysical interactions in a semi-arid tropical dry forest during regeneration*
  2) *Land-surface satellite product ground validation in seasonal forests*

B.Sc., Biology *(Honours)*	University of Alberta Biological Sciences	2010

- Focus on conservation biology and environmental physiology

FUNDING, SCHOLARSHIPS AND AWARDS	**VALUE (CAD)**
● Tecterra Industry Investment Program *2016-2018, Government of Alberta*	$340,000
● MITACS Industry Accelerator *2017, Government of Alberta*	$40,000
● University of Alberta's Graduate Student Teaching Award *2014-2015*	*NA*
● President's Doctoral Prize of Distinction Faculty of Graduate Studies and Research *2014 & 2013 Institutional Competition*- University of Alberta	*$15,000*
● Natural Sciences and Engineering Research Council of Canada Alexander Graham Bell Canada Graduate Scholarship (CGS D) *2014 & 2013 National Competition*	*$70,000*
● Alberta Innovates Technology Futures *2011 Provincial Competition*	*$12,000*
● *Walter H Johns Graduate Fellowship* *$5,000* Faculty of Graduate Studies and Research *2011 Institutional Competition*- University of Alberta	
● Natural Sciences and Engineering Research Council of Canada Alexander Graham Bell Canada Graduate Scholarship (CGS M) *2011 National Competition*	*$17,500*
● Natural Sciences and Engineering Research Council of Canada Undergraduate Student Research Award (USRA) *2009 National Competition*	*$7,500*
● University of Alberta Academic Excellence Scholarship *2005/2006*	*$1,250*

NOTABLE SCIENTIFIC PUBLICATIONS

- C. Rankine, N Sabzevar. **The Power of Computer Vision and AI for Drones in Agriculture**. AUVSI Xponential 2018 Conference Proceedings, May 2 2018, Denver Colorado. pp. 1419-1428.
- Sanchez-Azofeifa, GA, JA Guzman, CA Campos, S Castro, V Garcia-Millan, J Nightingale, C Rankine. **Twenty-first century remote sensing technologies are revolutionizing the study of tropical forests.** Biotropica, Review. Vol. 49 (5), 2017, pp. 604-619.
- Rankine, C, GA Sanchez-Azofeifa, JA Guzman, MM Espirito-Santo. **Linking tropical dry forest stand age structure to biometeorological functions during secondary succession**. Agriculture and Forest Meteorology, Submitted 2017, in review.
- Rankine, C, GA Sanchez-Azofeifa, GA, JA Guzman, MM Espirito-Santo, I Sharp. **Comparing MODIS and near-surface vegetation indexes for monitoring tropical dry forest phenology along a successional gradient using optical phenology towers**. Environmental Research Letters, Vol. 12 (10), 2017.
- Rankine, C, A Sanchez-Azofeifa, & MH MacGregor. 2014. **Seasonal wireless sensor network link performance in boreal forest phenology monitoring**. IEEE International Conference on Sensing, Communications, and Networking, Singapore, p.302-310.
- Rankine, C, GA Sanchez-Azofeifa, MM Espirito-Santo, & M Vieira. 2012. **Optical wireless sensor networks observe leaf phenology and photosynthetic radiation interception in a Brazilian tropical dry forest**. IEEE International Geoscience and Remote Sensing Symposium, 22-27 July: 6914-6915.
- Neufeld, C, and C. Rankine. **Cuticle and muscle variation underlying phenotypic plasticity in barnacle feeding leg and penis form**. Invertebrate Biology, June 131: *96-109.* (Featured on journal cover)
- Sánchez-Azofeifa, A, C Rankine, MM Espirito Santo, R Fatland, M Garcia. 2011. **Wireless Sensing Networks for Environmental Monitoring: Two case studies from tropical forests**. Proceedings – 2011 7th IEEE International Conference e-Science. Art. No. 6123261, 70-76.
- Sanchez-Azofeifa, A, and C Rankine. 2011. **Technology Review: Ground-based (In-Situ) Environmental Monitoring Systems**. A report for the Alberta Terrestrial Imaging Centre Corporation, Lethbridge Alberta, Canada.

PRESENTATIONS AT CONFERENCES AND SCIENTIFIC MEETINGS

- C. Rankine. **Invited** Panel Member at North 51 - **A Meeting of Geospatial Technology Leaders**. Banff Conference Center, Feb 5-7 2018.

- A. Sanchez-Azofeifa, C. Portillo-Quintero, C. Rankine, S. Castro. The global carbon cycle, extremes and droughts in dry environments. **United Nations Framework Convention on Climate Change (UNFCCC), Bonn, Germany, 2014.**

- A. Sanchez-Azofeifa, M. MacGregor, P. Musilek, C. Portillo-Quintero, C. Rankine, S. Castro. Enviro-Net: Sensing our changing environment. 2014 **Geospatial Monitoring and Analytics Forum, April 2014, Calgary, Canada.**

- C. Rankine & A. Sanchez-Azofeifa. The use of synchronized wireless sensor networks for explicit in-situ FAPAR monitoring. Land Product Validation 1st Workshop on the Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) Sub-Group. **European Commission Joint Research Center, January 23-24 2014, Ispra, Italy**

- C. Rankine. Wireless sensor networks for Earth observation sciences. Geoscience Seminar Series, January 2014, **Ludwig-Maximillian University, Munich, Germany (Invited)**

- C. Rankine. Merging ecology with cutting edge technology: Wireless sensor networks for monitoring primary productivity and micro-meteorology in seasonal forests. **University of New South Wales, Sydney, Australia (Invited).**

- C. Rankine. Enviro-Net: A web-based environmental sensor data management tool. Water and Mining Learning Seminar, Sept. 2013, Edmonton, Alberta.

- C. Rankine. The future of monitoring secondary tropical dry forests using wireless sensor networks. 50th **Conference of the Association for Tropical Biology and Conservation, June 2013, San Jose, Costa Rica**

- C. Rankine. Optical wireless sensor networks observe leaf phenology and photosynthetic radiation interception in a Brazilian tropical dry forest. **IEEE International Geoscience and Remote Sensing Symposium, 22-27 July 2012, Munich, Germany.**

- A. Sánchez-Azofeifa, C Rankine. Wireless sensor networks in the context of the Australian Terrestrial Ecosystem Network. **CSIRO Land and Water, Melbourne, Australia. June 2012**

- C. Rankine. Optical wireless sensor networks for long-term hyper-temporal monitoring of

canopy leaf dynamics. **Smithsonian Center for Tropical Forest Science, Smithsonian Institution Global Earth Observatories lecture series, Panama City, Panama.**

- C. Rankine. Ground monitoring Neotropical dry forests: a sensor network for forest and microclimate dynamics in semi-arid environments (Enviro-Net). **2012 American Geophysical Union Fall Meeting, December 2012, San Francisco, USA.**

- C. Rankine. Monitoring tropical dry forest phenology using wireless sensor networks. **13th Annual Bio-Symposium, April 2012, Montes Claros, Brazil (Invited)**

- C. Rankine, GA Sanchez-Azofeifa. A tropical monitoring program using wireless sensing networks. June 2011. **Harvard Center for Tropical Forest Science Working Group on Instrumentation, Smithsonian Institution Global Earth Observatories, June 2011, Boston, USA.**

- C. Rankine. Wireless Sensing Networks in Ecological Monitoring: Improving in situ measurements of primary productivity in tropical forest environments. April 2011, ATLAS Symposium, Edmonton, Canada

- C. Rankine. Wireless Sensing Networks in Ecological Monitoring: Remote Sensing of Primary Productivity in Tropical Dry Forest Succession. **CONFOR West 2011: Ecosystems in Perspective: Integrating Environment, Society & Economy, February 2011, Jasper, Canada**

- C Rankine. Monitoring Phenology in Tropical Dry Forests: Leaf Flush Cues. Tropi-Dry Meeting of the Americas, September 2010, Edmonton, Canada

TEACHING EXPERIENCE

Lecture and lab instructional sessions at the University of Alberta, curriculum development, and exam/assignment creation and grading responsibilities. Additional experience creating course material and teaching field school curriculums for advanced technologies for ecology and geosciences.

Course	Title	Year
GEOG 2437	Biogeography: guest lecturer	2018
EAS221	Guest Lectures: Introduction to GIS and Remote Sensing	2014
EAS351	Environmental Applications of GIS	2011 - 2014

	Laboratory component (8hrs instruction/week)	
Field School	Glacio-X: Wireless Sensor Networks *Kananaskis Provincial Park – Canada*	July 2013
Field School	Emerging Technology for Tropical Ecology *Mata Seca State Park - Brazil*	2010 - 2011
EAS451	Guest Lectures: Advanced Digital Remote Sensing	2012

PROFESSIONAL DEVELOPMENT

- Data Carpentry Workshop. Programming with Python for Big Data Management. August 2015, University of Alberta.
- SPLIT Remote Sensing Summer School 2015. Unmanned Aerial Vehicle – photogrammetry and LiDAR data management. Thessaloniki, Greece. June 2015.
- Level 1 Graduate Teaching Training Certificate, University of Alberta
- Unmanned Vehicles Seminar. Alberta Center for Advanced Micro-NanoTechnology Products, March 2014, Calgary, Alberta.
- Large Aperture Scintillometer Workshop: A Comparison to Eddy Covariance. Campbell Scientific Training Seminar, November 2014, Edmonton, Alberta.
- Stream Computing for Real-Time Big Data Analytics, IBM Watson Laboratory, September 2014. Mt. Kisco, New York.
- Training workshop on software tools for sensor networks. Long-Term Ecological Research Network, University of New Mexico, Albuquerque, May 1-4 2012
- Optical Remote Sensing: Basics and Applications Workshop. IEEE International Geoscience and Remote Sensing Symposium, 22-27 July 2012, Munich, Germany.
- IAI International Summer Seminar for Wireless Sensing Networks. Center for Earth Observation Sciences, July 2009, Edmonton, Alberta, Canada.

PUBLIC SCIENCE COMMUNICATION AND MEDIA FEATURES

- IBM Smart Planet promotional video interview on streaming data analytics for environmental management decision making
- Enviro-Net promotional video for the UN Framework Convention on Climate Change in Lima, Chile
- U of A Faculty of Science, Science Spotlight Feature – Research Interview
- Newspaper article feature on preventing 16.000sq.km of deforestation in Brazil at Supreme Court decision based on Tropi-Dry research.

FIELD RESEARCH CAMPAIGNS AND SITE MANAGEMENT

Country	Study Sites	Years
United Kingdom	Wytham Woods, Oxford	2015
Australia	Tumbarumba State Forest, NSW	2013
	Rushworth State Forest, VIC	2012
Costa Rica	Santa Rosa National Park, GC	2013-2015
Panama	Barro Colorado Island	2012
Brazil	Parque Estadual do Mata Seca, MG	2009-2012
	Parque Nacional de Serra do Cipo, MG	2009-2012
	Pandeiros Protected Area, MG	2009-2012
	UNESP Research Park, SP	2009
Mexico	Chamela-Quixmala Biosphere Reserve, JA	2010
Canada	EMEND-DMI Boreal Forest, AB	2012-2015
	Coal Valley Mountain, AB	2013-2014
	Ministic Game Bird Reserve, AB	2013-2014
	Bamfield Marine Science Center, BC	2008

Professional Certifications

- Wilderness First Aid and CPR
- All-Terrain Vehicle Operation
- Pleasure Craft Operators Licence
- Canadian Center for Unmanned Aerial Vehicles
- Fall Safety Training
- Aeronautical Radio Licence
- Defensive Driving Course

Outreach and Community Involvement

- U of A Math Mornings – High school outreach volunteer work for career counseling prospects in math and sciences
- University of Alberta Centennial Festival of Ideas: What's Up with the U. 'Monitoring the Lungs of the Earth'. November 2012. Science education.
- Science 10-12 secondary school guest lectures on applied science careers
- U-School volunteer: mentor elementary school children in forest ecology and the importance of sustainable living
- Co-Founder of Earth-Vibe, a student sustainability education group
- Currently mentoring two Brazilian undergraduate student at the University of Montes Claros in ecological remote sensing and co-supervising their graduation research projects

Professional Associations

- Alberta Geomatics Group
- American Geophysical Union
- American Meteorological Society
- American Society of Naturalists
- Association for Tropical Biology and Conservation
- Geospatial Information & Technology Association
- Golden Key International Honour Society
- IEEE Communications Society
- IEEE Geoscience and Remote Sensing Society
- International Society of Biometeorology
- Planetary Society

Peer Review Contributions

Sensors	2018
International Journal of Remote Sensing	2018
Canadian Journal of Remote Sensing	2017
IEEE Xplore	2016

REFERRALS

Dr. Arturo G. Sánchez-Azofeifa
Associate Dean of International & Graduate Affairs
Associate Professor, Department of Earth and Atmospheric Science
Director and PI of UofA CEOS and Tropi-Dry
Email: arturo.sanchez@ualberta.ca
(Ph.D. Advisor)

Dr. Mike H. MacGregor
Acting Vice-Provost & Associate Vice-President Information Technology
Professor, Department of Computing Science
University of Alberta
Email: mike.macgregor@ualberta.ca
(CEOS project member)

Dr. Mário Marcos do Espírito Santo
Professor, Department of Biological Sciences
University of Montes Claros, Brazil
Evolutionary Ecology Laboratory
Email: mario.marcos@unimontes.br
(Lead collaborator in Brazil)

Letters of support may be produced upon request