

## ATTACHMENT 1: DR. RUNNING CURRICULUM VITAE

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**Steven W. Running**  
**Regents Professor/Director Emeritus, Numerical Terradynamic Simulation Group**  
**(NTSG)**  
**College of Forestry & Conservation, University of Montana, Missoula, MT 59812**  
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Born: April 18, 1950; U.S. Citizen; Marital Status: Married, 2 children  
Home: 1419 Khanabad Drive, Missoula, MT 59802, Tel: (406) 721-5096

### Education:

Ph.D. Forest Ecophysiology; Colorado State University, Fort Collins, 1979  
M.S. Forest Management; Oregon State University, Corvallis, 1973  
B.S. Botany; Oregon State University, Corvallis, 1972

### Experience:

2017 - Regents Professor Emeritus  
2007-2017 Regents Professor, University of Montana  
2008 Visiting Professor, Universitat de Bodenkultur, Vienna, Austria  
1988-2007 Professor, Forest Ecology, College of Forestry & Conservation, University of Montana  
2005 Visiting Professor, University of Firenze, Florence, Italy  
2003 Professor, Visiting McMaster Fellow, CSIRO Land and Water, Canberra, ACT Australia  
1993 Visiting Sabbatical Scientist, Dept of Plant Ecology, Lund University, Sweden  
1986-87 Visiting Sabbatical Scientist, CSIRO Division of Forest Research, Canberra, Australia  
1983-1988 Associate Professor, Forest Ecophysiology, School of Forestry, University of Montana  
1979-1983 Assistant Professor, Forest Ecophysiology, School of Forestry, University of Montana  
1979 Senior Research Associate, Natural Resource Ecology Laboratory, Colorado State University  
1976-1979 Research Forester, Forest, and Mtn Meteorology Project, Rocky Mtn Forest and Range Experiment Station, Fort Collins, Colorado  
1976-1979 Graduate Research Assistant, Dept. of Forest and Wood Sciences, Colorado State University  
1974-1976 Research Assistant, Coniferous Forest Biome, Oregon State University  
1973-1974 Forest Ecologist, Environmental Associates Inc., Corvallis, Oregon

**Society Affiliations:**

American Geophysical Union  
American Meteorological Society  
Ecological Society of America

**Awards, Honors:**

Personal Audience Her Royal Highness Princess Maha Chakri Sirindhorn, Bangkok, Thailand  
NASA-USGS 2015 William T. Pecora Award  
ISI World's Most Influential Minds, Geosciences 2014, 2015, 2017  
Montana Environmental Information Center Conservationist of the Year 2012  
Doctor Honoris Causa University of Natural Resources and Life Sciences, Vienna Austria 2012  
Honorary Professor, Environment Institute and Dept. of Geography, University College London 2009  
Oregon State University Distinguished Alumni Fellow 2009  
E. O. Wilson Biodiversity Technology Pioneer Award 2009  
Chapter lead author of IPCC 2007 report, awarded the Nobel Peace Prize 2007  
Univ. Of Montana Presidential Scholar 2008  
University of Montana, Lud Browman Award for scientific writing, 2007  
Oregon State Univ. College of Forestry, Distinguished Alumni, 2006  
Burk-Brandenburg Montana Conservation Award, 2006  
ISI Highly Cited Scientist Designation 2004-2013  
Fellow of the American Geophysical Union, 2002  
University of Montana BN Faculty Achievement Award, 1991  
University of Montana, Distinguished Scholar, 1990

**Nat'l/Int'l Committee Appointments:**

NASA Science Committee 2013 - 2017  
NASA Earth Science Subcommittee 2009 – 2015, Chair 2013- 2017  
NOAA Climate Working Group, 2009 - 2014  
National Academy of Sciences, NRC Committee on Ecological Impacts of Climate Change, 2008.  
NCAR CCSM Land Model Working Group (LMWG) Co-Chair, 2006-2008.  
AGU Committee of Fellows 2006-2008.  
Dept of Energy, Terrestrial Carbon Science Research Program, Co-Chair, 2005-2006.  
National Research Council, NASA Earth Science Decadal Survey, 2005-2006.  
NRC Committee on Environmental Satellite Data Utilization 2002-2005.  
Intergovernmental Panel on Climate Change, Chapter Lead Author 2004-2007.  
International Geosphere-Biosphere Programme Science Executive Committee 2004-2007.  
National Research Council: Committee on Earth Studies 2004-2006.  
NCAR CCSM Land Model Working Group (LMWG) Co-Chair, 2002-2004.  
Interagency Carbon Cycle Science Committee 2002 – 2005.  
NAS-NRC Review of NASA Earth Science Enterprise Science Plan for 2000-2010.

NASA - Earth Observing System MODIS Science Team Member, 1989-2007.  
NCAR Climate System Model (CSM) Advisory Board, 1996-2000.  
NASA Mission to Planet Earth Biennial Review Panel, 1997.  
Terrestrial Observation Panel for Climate of the World Meteorological Organization, 1995-2001.  
National Academy of Sciences, NRC, Climate Research Committee, 1995-2001.  
NRC Panel on Climate Observing System Status, 1998.  
NSF - National Center for Ecological Analysis and Synthesis, Science Advisor Board, 1994-1997.  
NASA Earth Observing System, Land Science Panel, Chair 1994-2000.  
World Climate Research Program, International Land Surface Climatology Science Panel, 1994-1996.  
World Climate Research Program, Global Terrestrial Observing System Committee, 1994-1995.  
International Geosphere-Biosphere Program, Biospheric Aspects of the Hydrologic Cycle, Vice-Chair, 1991-1996.  
National Science Foundation, Ecosystem Studies Program panel member 1991-1993.  
World Climate Research Program - WCRP/IGBP Land Surface Experiments, 1990-1994.  
NASA Earth Science and Applications Advisory Subcommittee, 1990-1993.  
NASA Boreal Forest Ecosystem-Atmosphere Study (BOREAS) Steering Committee, 1989-1991.  
International Geosphere-Biosphere Program - Committee on Global Hydrology, 1988-1990.  
NASA - Terrestrial Ecosystems Program Advisory Group, 1988-1990.  
NASA - Management Operations Working Group, 1988-1990.  
NASA - Interdisciplinary Studies Review Panel, 1986.  
NASA - MODIS Instrument Panel, 1984-1986.  
NASA - Global Biology Review Panel, 1983-1984.  
National Academy of Sciences, Space Science Board participant, 1982-1984.  
NASA - Land Related Global Habitability Program Planning, 1982-1983.

**Proposal Reviewer:**

American Institute of Biological Sciences  
California Space Institute  
Canada Foundation for Innovation  
National Aeronautics and Space Administration  
National Oceanic and Atmospheric Administration  
National Environmental Research Council of the United Kingdom  
National Science Foundation  
Natural Sciences and Engineering Research Council of Canada  
U.S. Dept. of Energy  
U.S. Environmental Protection Agency  
U.S. Geological Survey  
U.S.D.A. Cooperative Research Program  
Western Regional Center of the National Institute for Global Environmental change

**Journal Referee:**

Agricultural and Forest Meteorology  
Agronomy Journal  
AI Applications in Natural Resource Management  
American Naturalist  
Australian Journal of Forest Research  
Bioscience  
Canadian Journal of Botany  
Canadian Journal of Forest Research  
Canadian Journal of Remote Sensing  
Climatic Change  
Climate Research  
Ecological Applications  
Ecology  
Forest Science  
Global Change Biology  
Int'l Journal of Hydrological Processes  
Int'l Journal of Remote Sensing  
Journal of Applied Meteorology  
Journal of Climate  
Journal of Environmental Quality  
Journal of Geophysical Research  
Journal of Hydrology  
Journal of Range Management  
National Geographic Research and Exploration  
Nature  
Northwest Science  
Remote Sensing of Environment  
Science  
Tellus  
The National Academies  
Tree Physiology  
USFS Intermountain Forest and Range Experiment Station  
USFS Pacific Northwest Forest and Range Experiment Station  
USFS Rocky Mountain Forest and Range Experiment Station  
Water, Air and Soil Pollution  
Water Resources Research

### ATTACHMENT 3: LIST OF PUBLICATIONS (LAST TEN YEARS)

#### STEVEN RUNNING

- 2022 Hidy, D., Barcza, Z., Hollós, R., Dobor, L., Ács, T., Zacháry, D., ... & Fodor, N. (2022). Soil-related developments of the Biome-BGCMuSo v6. 2 terrestrial ecosystem model. *Geoscientific Model Development* (Online), 15(5).
- 2021 Camps-Valls, G., Campos-Taberner, M., Moreno-Martínez, Á., Walther, S., Duveiller, G., Cescatti, A., ... & Running, S. W. (2021). A unified vegetation index for quantifying the terrestrial biosphere. *Science Advances*, 7(9), eabc7447.
- 2020 Weltzin, J. F., Betancourt, J. L., Cook, B. I., Crimmins, T. M., Enquist, C. A., Gerst, M. D., ... & Running, S. W. (2020). Seasonality of biological and physical systems as indicators of climatic variation and change. *Climatic Change*, 163(4), 1755-1771.
- Jones, M. O., Running, S. W., Kimball, J. S., Robinson, N. P., & Allred, B. W. (2020). Terrestrial primary productivity indicators for inclusion in the National Climate Indicators System. *Climatic Change*, 163(4), 1855-1868.
- Moreno-Martínez, Á., Izquierdo-Verdiguier, E., Maneta, M. P., Camps-Valls, G., Robinson, N., Muñoz-Marí, J., ... & Running, S. W. (2020). Multispectral high resolution sensor fusion for smoothing and gap-filling in the cloud. *Remote Sensing of Environment*, 247, 111901.
- Pan, S., Pan, N., Tian, H., Friedlingstein, P., Sitch, S., Shi, H., ... & Running, S. W. (2020). Evaluation of global terrestrial evapotranspiration using state-of-the-art approaches in remote sensing, machine learning and land surface modeling. *Hydrology and Earth System Sciences*, 24(3), 1485-1509.
- 2019 He, M., Kimball, J. S., Yi, Y., Running, S. W., Guan, K., Moreno, A., ... & Maneta, M. (2019). Satellite data-driven modeling of field scale evapotranspiration in croplands using the MOD16 algorithm framework. *Remote Sensing of Environment*, 230, 111201.
- He, M., Kimball, J. S., Yi, Y., Running, S., Guan, K., Jenco, K., ... & Maneta, M. (2019). Impacts of the 2017 flash drought in the US Northern plains informed by satellite-based evapotranspiration and solar-induced fluorescence. *Environmental Research Letters*, 14(7), 074019.
- 2018 Moreno-Martínez, Á., Camps-Valls, G., Kattge, J., Robinson, N., Reichstein, M., van Bodegom, P., ... & Running, S. W. (2018). A methodology to derive global maps of leaf traits using remote sensing and climate data. *Remote sensing of environment*, 218, 69-88.
- Campos-Taberner, M., Moreno-Martínez, Á., García-Haro, F. J., Camps-Valls, G., Robinson, N. P., Kattge, J., & Running, S. W. (2018). Global estimation of biophysical variables from Google Earth Engine platform. *Remote Sensing*, 10(8), 1167.

- Hu, Z., Shi, H., Cheng, K., Wang, Y. P., Piao, S., Li, Y., ... & Yu, G. (2018). Joint structural and physiological control on the interannual variation in productivity in a temperate grassland: A data-model comparison. *Global Change Biology*, 24(7), 2965-2979.
- Madani, N., Kimball, J. S., Ballantyne, A. P., Affleck, D. L., Van Bodegom, P. M., Reich, P. B., ... & Running, S. W. (2018). Future global productivity will be affected by plant trait response to climate. *Scientific reports*, 8(1), 1-10.
- Mildrexler, D. J., Zhao, M., Cohen, W. B., Running, S. W., Song, X. P., & Jones, M. O. (2018). Thermal anomalies detect critical global land surface changes. *Journal of Applied Meteorology and Climatology*, 57(2), 391-411.
- Jones, M.O., S.W. Running, J.S. Kimball, N.P. Robinson, and B.W. Allred. (2018). Terrestrial primary productivity indicators for inclusion in the National Climate Indicators System. *Climatic Change* <https://doi.org/10.1007/s10584-018-2155-9>.
- 2017 Kimball, H. L., Selmants, P. C., Moreno, A., Running, S. W., & Giardina, C. P. (2017). Evaluating the role of land cover and climate uncertainties in computing gross primary production in Hawaiian Island ecosystems. *PloS one*, 12(9), e0184466.
- Robinson, N. P., Allred, B. W., Jones, M. O., Moreno, A., Kimball, J. S., Naugle, D. E., Running, S. & Richardson, A. D. (2017). A Dynamic Landsat Derived Normalized Difference Vegetation Index (NDVI) Product for the Conterminous United States. *Remote Sensing*, 9(8), 863.
- Hasenauer, H., Neumann, M., Moreno, A., & Running, S. (2017). Assessing the resources and mitigation potential of European forests. *Energy Procedia*, 125, 372-378.
- Madani, N., Kimball, J. S., & Running, S. W. (2017). Improving Global Gross Primary Productivity Estimates by Computing Optimum Light Use Efficiencies Using Flux Tower Data. *Journal of Geophysical Research: Biogeosciences*, 122(11), 2939-2951.
- Mildrexler, D. J., Zhao, M., Cohen, W. B., Running, S. W., Song, X. P., & Jones, M. O. (2017). Thermal anomalies detect critical global land surface changes. *Journal of Applied Meteorology and Climatology*, DOI: 10.1175/JAMC-D-17-0093.1  
2018.
- Ballantyne, Ashley, William Smith, William Anderegg, Pekka Kauppi, Jorge Sarmiento, Pieter Tans, Elena Shevliakova, Yude Pan, Benjamin Poulter, Alessandro Anav, Pierre Friedlingstein, Richard Houghton, and Steven Running. (2017) Accelerating net terrestrial carbon uptake during the warming hiatus due to reduced respiration. *Nature Climate Change*, doi: 0.1038/2034

- Wang, J., J. Dong, Y. Yi, G. Lu, J. Oyler, W. K. Smith, M. Zhao, J. Liu, and S. Running. (2017). Decreasing net primary production due to drought and slight decreases in solar radiation in China from 2000 to 2012. *J. Geophys. Res. Biogeosci.*, 122, 261–278, doi:10.1002/2016JG003417.
- 2016 Hidy, Dóra, Zoltán Barcza, Hrvoje Marjanovi, Maša Zorana Ostrogovi Sever, Laura Dobor, Györgyi Gelybó, Nándor Fodor, Krisztina Pintér, Galina Churkina, Steven Running, Peter Thornton, Gianni Bellocchi, László Haszpra, Ferenc Horváth, Andrew Suyker, and Zoltán Nagy. (2016). Terrestrial ecosystem process model Biome-BGCMuSo v4.0: summary of improvements and new modeling possibilities. *Geosci. Model Dev.*, 9, 4405–4437.
- Sanchez-Ruiz, Sergio, Alvaro Moreno, Maria Piles, Fabio Maselli, Arnaud Carrara, Steven Running, and Maria Amparo Gilabert. (2016). Quantifying water stress effect on daily light use efficiency in Mediterranean ecosystems using satellite data. *International Journal of Digital Earth*, DOI: 10.1080/17538947.2016.1247301.
- Ahrestani, Farshid S., Mark Hebblewhite, William Smith, Steven Running, and Eric Post. (2016). Dynamic complexity and stability of herbivore populations at the species distribution scale. *Ecology*, 97(11): 3184-3194.
- Yu, Zhen, Jingxin Wang, Shirong Liu, Shilong Piao, Philippe Ciais, Steven W. Running, Benjamin Poulter, James S. Rentch and Pengsen Sun. (2016) Decrease in winter respiration explains 25% of the annual northern forest carbon sink enhancement over the last 30 years. *Global Ecology and Biogeography*, doi: 10.1111/geb.12441.
- He, Mingzhu, John S. Kimball, Steven Running, Ashley Ballantyne, Kaiyu Guan, and Fred Huemmrich. (2016) Satellite detection of soil moisture related water stress impacts on ecosystem productivity using the MODIS-based photochemical reflectance index. *Remote Sensing of Environment*, 186: 173–183.
- Zhang, KE, John S. Kimball, and Steven W. Running. (2016) A review of remote sensing based actual evapotranspiration estimation. *WIREs Water*, doi: 10.1002/wat2.1168.
- Oyler, J.W., S.Z. Dobrowski, Z.A. Holden, and S.W. Running. (2016) Remotely sensed land skin temperature as a spatial predictor of air temperature across the conterminous United States. *J. Appl. Meteorol. Climatol.*, <http://dx.doi.org/10.1175/JAMC-D-15-0276.1>.
- 2015 Allred, B. W., Smith W. K., Twidwell D., Haggerty J. H., Running S. W., Naugle D. E., and Fuhlendorf S. D. (2015) Ecosystem services lost to oil and gas in North America. *Science*, 348(6233).
- McDowell, N., Coops N. C., Beck P., Chambers J. Q., Gangodagamage C., Hicke J. A., Huang C., Kennedy R. E., Krofcheck D. J., Litvak M., Meddens A. J. H., Muss J., Litvak M., Negron-Juarez R., Peng C., Schwantes A. M., Swenson J. J., Vernon L. J., Williams

- A. P., Xu C., Zhao M., Running S. W., and Allen C. D. (2015). Global satellite monitoring of climate-induced vegetation disturbances. *Trends in Plant Science*, 20(2): 114-123.
- Mora, C., Caldwell I. R., Caldwell J. M., Fisher M. R., Genco B. M., and Running S. W. (2015) Suitable Days for Plant Growth Disappear under Projected Climate Change: Potential Human and Biotic Vulnerability. *PLoS Biol*, 06/2015, 13(6).
- Oyler, J. W., Dobrowski S. Z., Ballantyne A. P., Klene A. E., and Running S. W. (2015) Artificial amplification of warming trends across the mountains of the western United States. *Geophysical Research Letters*, 01/2015, 42(1).
- 2014 Running, S. W. (2014) A regional look at HANPP: human consumption is increasing, NPP is not. *Environmental Research Letters*, 11/2014, 9(11).
- Reeves, M. C., Moreno A. L., Bagne K. E., and Running S. W. (2014) Estimating climate change effects on net primary production of rangelands in the United States. *Climatic Change*, 09/2014, 126(3—4).
- Poulter, B., Frank D., Ciais P., Myneni R. B., Andela N., Bi J., Broquet G., Canadell J. G., Chevallier F., Liu Y. Y., et al. (2014) Contribution of semi-arid ecosystems to interannual variability of the global carbon cycle. *Nature*, 04/2014, 509(7502): p.600–603.
- Madani, N., Kimball J. S., Affleck D. L. R., Kattge J., Graham J. S., van Bodegom P. M., Reich P. B., and Running S. W. (2014) Improving ecosystem productivity modeling through spatially explicit estimation of optimal light use efficiency. *Journal of Geophysical Research: Biogeosciences*, 08/2014, 119: 1–15.
- Hansen, A.J. N. Piekielek, C. Davis, J. Haas, D. M. Theobald, J. E. Gross, W.B Monahan, T. Oliff, and S. W. Running. (2014). Exposure of U.S. National Parks to land use and climate change 1900 – 2100. *Ecological Applications*, 24(3): 484-502.
- Pan, S., Tian H., Dangal S. R. S., Ouyang Z., Tao B., Ren W., Lu C., and Running S. W. (2014) Modeling and Monitoring Terrestrial Primary Production in a Changing Global Environment: Toward a Multiscale Synthesis of Observation and Simulation. *Advances in Meteorology*, 04/2014, 2014(965936): 1–17.
- Smith, W. K., C. C. Cleveland, S. C. Reed, and S. W. Running. (2014) Agricultural conversion without external water and nutrient inputs reduces terrestrial vegetation productivity. *Geophys. Res. Lett.*, 41, doi:10.1002/2013GL058857.
- Kang, Sinkyu; Running, Steven W.; Kimball, John S. Daniel B. Fagre, Andrew Michaelis, David L. Peterson, Jessica E. Halofsky, and Sukyoung Hong. (2014). Effects of spatial and temporal climatic variability on terrestrial carbon and water fluxes in the Pacific Northwest, USA. *Environmental modelling & software*, 51: 228-239.



- Oyler, J.W., A.P. Ballantyne, K. Jencso, M.Sweet, and S.W.Running. (2014) Creating a daily air temperature dataset for the conterminous United States using homogenized station data and remotely sensed skin temperature. *Int. J. Climatology*, DOI 10.1002/joc.4127.
- Reeves, M. C., Moreno A. L., Bagne K. E., and Running S. W. (2014) Estimating climate change effects on net primary production of rangelands in the United States. *Climatic Change*, 09/2014, 126(3-4).
- 2013 Bastos, A., Running S. W., Gouveia C., and Trigo R. M. (2013) The global NPP dependence on ENSO: La Niña and the extraordinary year of 2011. *Journal of Geophysical Research: Biogeosciences*, 118(3): 1247–1255.
- Ruhoff, A. L.; Paz, A. R.; Aragao, L. E. O. C.; Mu, Q., and Running, S.W. (2013) Assessment of the MODIS global evapotranspiration algorithm using eddy covariance measurements and hydrological modelling in the Rio Grande basin. *Hydrological sciences journal*, 58(8): 1658-1676.
- Haberl, Helmut; Erb, Karl-Heinz; Krausmann, Fridolin; Smith, W.K., and Running, S.W. (2013). Bioenergy: how much can we expect for 2050? *Environmental Research Letters*, 8(3): 031004.
- Mills, L. Scott; Zimova, Marketa; Oyler, Jared; and Running, S.W. (2013) Camouflage mismatch in seasonal coat color due to decreased snow duration. *Proceedings of the National Academy of Sciences*, 110: 7360-7365.
- Bohn, Theodore J.; Livneh, Ben; Oyler, Jared W.; Running, S.W. (2013) Global evaluation of MTCLIM and related algorithms for forcing of ecological and hydrological models. *Agricultural and Forest Meteorology*, 176: 38-49.
- Cleveland, C.C., B.Z Houlton, WKSmith, AR Marklein, S.C Reed, W.P.Parton, S.J.DelGrasso, and S.W.Running (2013) Patterns of new versus recycled primary production in the terrestrial biosphere. *Proc Nat Acad Sci*, 110: 12733 - 12737.
- Running, S.W. (2013). Book Review: Approaching the Limits. *Science*, 339: 1276-1277.
- Mu, Q., M. Zhao, J. S. Kimball, N. G. McDowell, and S. W. Running. (2013) A Remotely Sensed Global Terrestrial Drought Severity Index. *Bulletin of the American Meteorological Society*, 94: 83-98.