

**State v. Taylor**  
**Declaration of Steven W. Running**  
**Exhibit 1**

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## **Steven W. Running**

**Regents Professor/Director, 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

### **Society Affiliations:**

American Geophysical Union  
American Meteorological Society  
Ecological Society of America  
American Association for the Advancement of Science

### **Awards, Honors:**

NASA-USGS 2015 William T. Pecora Award  
ISI World's Most Influential Minds, Geosciences 2014  
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-  
Fellow of the American Geophysical Union, 2002  
University of Montana BN Faculty Achievement Award, 1991  
University of Montana, Distinguished Scholar, 1990

### **Invited International Speaking**

Thailand, Tiawan, Sweden, Austria, India, United Kingdom, Portugal, Italy, S. Korea, Australia

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

NASA Science Committee 2013 - 2015  
NASA Earth Science Subcommittee 2009 – 2015, Chair 2013- 2015  
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

**Experience:**

2007-	Regents Professor, University of Montana
2008	Visiting Professor, Universitat de Bodenkultur, Vienna, Austria
1988-present	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

**Publications in last 5 years:**

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. Terrestrial ecosystem process model .Biome-BGCMuSo v4.0: summary of improvements and new modeling possibilities. *Geosci. Model Dev.*, 9, 4405–4437, 2016.

Sanchez-Ruiz, Sergio, Alvaro Moreno, Maria Piles, Fabio Maselli, Arnaud Carrara, Steven Running & 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, F.S., Hebblewhite, M., Smith, B., Running, S.W., Post, E., 2016. Dynamic complexity and stability of herbivore populations at the species distribution scale. *Ecology*, 97(11): 3184-3194.

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. Accelerating net terrestrial carbon uptake during the warming hiatus due to reduced respiration. *NATURE Climate* DOI: 0.1038/2034

Yu, Zhen, Jingxin Wang, Shirong Liu, Shilong Piao, Philippe Ciais, Steven W. Running, Benjamin Poulter, James S. Rentch and Pengsen Sun. Decrease in winter respiration explains 25% of the annual northern forest carbon sink enhancement over the last 30 years. *Global Ecology and Biogeography*, (Global Ecol. Biogeogr.) (2016) DOI: 10.1111/geb.12441.

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Satellite detection of soil moisture related water stress impacts on ecosystem productivity using the MODIS-based photochemical reflectance index. *Remote Sensing of Environment* 186 (2016) 173–183.

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.

Zhang, KE, John S. Kimball and Steven W. Running. A review of remote sensing based actual evapotranspiration estimation. *WIREs Water* 2016. 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>.

Allred, B. W., Smith W. K., Twidwell D., Haggerty J. H., Running S. W., Naugle D. E., and Fuhlendorf S. D. Ecosystem services lost to oil and gas in North America. (2015) *Science*, Volume 348, Issue 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, Volume 13, Issue 6, (2015)

Running, S. W. 2014. A regional look at HANPP: human consumption is increasing, NPP is not. *Environmental Research Letters*, 11/2014, Volume 9, Issue 11.

Reeves, M. C., Moreno A. L., Bagne K. E., and Running S. W. Estimating climate change effects on net primary production of rangelands in the United States, *Climatic Change*, 09/2014, Volume 126, Issue 3–4, (2014)

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, Volume 42, Issue 1,

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. Contribution of semi-arid ecosystems to interannual variability of the global carbon cycle., *Nature*, 04/2014, Volume 509, Number 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. Improving ecosystem productivity modeling through spatially explicit estimation of optimal light use efficiency, *Journal of Geophysical Research: Biogeosciences*, 08/2014, Volume 119, p.1–15, (2014)

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. Modeling and Monitoring Terrestrial Primary Production in a Changing Global Environment: Toward a Multiscale Synthesis of Observation and Simulation, *Advances in Meteorology*, 04/2014, Volume 2014, Number 965936, p.1–17, (2014)

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, Sukyoung Hong (2014). [Effects of spatial and temporal climatic variability on terrestrial carbon and water fluxes in the Pacific Northwest, USA](#). ENVIRONMENTAL MODELLING & SOFTWARE Volume: 51 Pages: 228-

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. (2014) Int. J. Climatology. DOI 10.1002/joc.4127.

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, , Volume 118, Issue 3, Number 3, p.1247–1255,

Ruhoff, A. L.; Paz, A. R.; Aragao, L. E. O. C.; Mu, Q., 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-JOURNAL DES SCIENCES HYDROLOGIQUES Volume: 58 Issue: 8 Pages: 1658-1676