

## CAROL ADELE WESSMAN

Department of Ecology and Evolutionary Biology &  
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Environmental Studies Program

### ADDRESS

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### EDUCATION

Ph.D. University of Wisconsin-Madison, Forest Ecology & Environmental Monitoring, 1987  
M.S. University of Wisconsin-Madison, Environmental Monitoring, 1984  
B.S. Colorado State University, Botany, 1977

### PROFESSIONAL EXPERIENCE

2016 – present *Director* – Environmental Studies Program  
2012 – 2015 *Associate Director of Undergraduate Studies* – Ecology & Evolutionary Biology  
2009 – present *Faculty Associate*, Environmental Studies (ENVS)  
2006 – present *Associate Director* – Ecosystem Science Division, Cooperative Institute for Research in Environmental Sciences (CIRES)  
2005-present *Professor*, Department of Ecology and Evolutionary Biology (EEB)  
University of Colorado, Boulder, Colorado  
1998 - 2005 *Associate Professor*, EEB  
*Fellow* - CIRES  
1991 - 1998 *Assistant Professor*, EEB  
*Fellow* - CIRES  
1987 - 1991 *Research Associate*, Center for the Study of Earth from Space, CIRES  
University of Colorado, Boulder, Colorado  
1985 - 1987 *Research Assistant*, Department of Forestry, University of Wisconsin-Madison  
1982 - 1985 *NASA Graduate Research Fellow*, Environmental Remote Sensing Center, University of Wisconsin; Jet Propulsion Laboratory, Pasadena, California

### RESEARCH INTERESTS

My research program seeks to gain insights on the dynamics between landscape structure and ecosystem functioning, with focus on understanding ecosystem resilience and response to multiple disturbances. My approach involves field studies, remote sensing methodologies investigating temporal and spatial heterogeneity in ecosystem properties, and landscape and ecosystem theory. Research projects include: Subalpine forest response to multiple disturbances; carbon sequestration in post-disturbance landscapes; ecosystem resilience; and social-ecological systems in urban environments.

### PROFESSIONAL FELLOWSHIPS, AWARDS AND HONORS

Faculty Fellowship, University of Colorado, 2006/2007  
Fellowship, Fulbright Senior Scholar, Germany, 2000  
Fellowship, Max-Planck-Institut für Biogeochemie, Jena, Germany, 2000  
NASA Graduate Research Fellow, 1982-85

### PROFESSIONAL AND HONORARY SOCIETIES

American Institute of Biological Sciences  
American Geophysical Union  
International Association for Ecology  
International Association for Landscape Ecology

## PUBLICATIONS

### **Journal Articles and Book Chapters**

(^ Post-doc, \* Graduate student, † undergraduate)

Adams<sup>†</sup>, M.S., R.B. Adams, C.A. Wessman, and B. Demmig-Adams. 2016. Nutritional cues tie living organisms to their environment and its sustainability. *Frontiers in Nutrition*.  
<http://dx.doi.org/10.3389/fnut.2016.00028>.

Beals, S.C., D.L. Preston, C.A. Wessman, and T.R. Seastedt. 2015. Urban prairie dog colony restoration: Predicting the effects of prairie dog removal by examining plague epizootics with remote sensing. *Ecosphere* 6(9):157. <http://dx.doi.org/10.1890/ES15-00244.1>

Gartner\*, M.H., T.T. Veblen, S. Leyk, C.A. Wessman. 2015. Detection of MPB-killed ponderosa pine in a heterogeneous landscape using high-resolution aerial imagery. *International Journal of Remote Sensing*.  
<http://dx.doi.org/10.1080/01431161.2015.1095369>.

Livneh B., J.S. Deems, B. Buma, J.J. Barsugli, D. Schneider, N.P. Molotch, K. Wolter, and C.A. Wessman. 2015. Catchment Response to Bark Beetle Outbreak in the Upper Colorado River Basin. *Journal of Hydrology* 523:196-210. DOI: 10.1016/j.jhydrol.2015.01.039

Jedd, T., W. D. Bowman, A. S. Cheng, D. Ojima, M. Smith, and C. Wessman (2014). Chapter 4 – Ecosystems Sector. In *Colorado Climate Change Vulnerability Study*, edited by Eric Gordon and Dennis Ojima. University of Colorado, Boulder, CO and Colorado State University, Fort Collins, CO.

Buma, B.\* , R. Poore, and C.A. Wessman. 2014. Disturbances, their interactions, and cumulative effects on carbon and charcoal stocks in a forested ecosystem. *Ecosystems* 17:947-959. DOI: 10.1007/s10021-014-9770-8.

Buma, B.\* , E.T. Pugh, and C.A. Wessman. 2013. Effect of the current major insect outbreaks on decadal phenological and LAI trends in southern Rocky Mountain forests. *International Journal of Remote Sensing* 34(20):7249-7247. DOI: 10.1080/01431161.2013.817717

Buma, B.\* Wessman, CA. 2013. Management, science, and disturbances as opportunities for adaptive transformation of forests. *The International Journal of Climate Change*. 4(3): 77-87.

Buma B.\* , and C.A. Wessman. 2013. Forest resilience, climate change, and opportunities for adaptation: A specific case of a general problem. *Forest Ecology and Management* 306:216-225.  
<http://dx.doi.org/10.1016/j.foreco.2013.06.044>.

Hinners\*, S.J., C.A. Kearns, and C.A. Wessman. 2012. Roles of scale, matrix and native habitat in supporting a diverse suburban pollinator assemblage. *Ecological Applications* 22(7):1923-1935.  
(<http://www.esajournals.org/doi/pdf/10.1890/11-1590.1>).

Golubiewski, N. and C. Wessman. 2012. Carbon hotspots in cities can ameliorate carbon loss due to urban sprawl. *GLP News, Global Land Project, International Project Office, Sao Paulo, Brazil*. 8:8-11.

Buma\*, B. and C.A. Wessman. 2012. Differential species responses to compounded perturbations and implications for landscape heterogeneity and resilience. *Forest Ecology and Management*. 266:25-33.

- Madronich\*, M., J.P. Greenberg, C.A. Wessman, A.B. Guenther. 2012. Monoterpene emissions from an understory species, *Pteridium aquilinum*. *Atmospheric Environment*. 54:308-312.
- Wessman, C.A., M. Caldwell, P.A. Matson, and J. Gamon. 2012. Prospects for scaling. *In* *Scaling Physiological Processes*. Ehleringer, J. and C. Field (editors). 388 pgs. Academic Press.
- Buma\*, B. and C.A. Wessman. 2011. Disturbance interactions can impact resilience mechanisms of forests. *Ecosphere*. 2(5):art64. doi:10.1890/ES11-00038.1.
- Golubiewski\*, N.E. and C.A. Wessman. 2010. Discriminating urban vegetation from a metropolitan matrix through partial unmixing with hyperspectral AVIRIS data. *Canadian Journal of Remote Sensing*. 36(3):261-275. (Special Issue: Recent developments in methodology and applications of urban remote sensing)
- Kokaly, R.F., G.P. Asner, S.V. Ollinger, M.E. Martin, and C.A. Wessman. 2009. Characterizing biochemistry from imaging spectrometer data for studying ecosystem processes. *Remote Sensing of Environment*. 113:S78-S91.
- Browning, D.M., S.R. Archer, G.P. Asner, M.P. McClaran, and C.A. Wessman. 2008. Woody plants in grasslands: Post-encroachment stand dynamics. *Ecological Applications* 18(4):928-944.
- ^Hughes, R.F., S. Archer, G.P. Asner, C.A. Wessman, C. McMurtry, J. Nelson, and R. James Ansley. 2006. Changes in aboveground primary production and carbon and nitrogen pools accompanying woody encroachment in a temperate savanna. *Global Change Biology*. 12(9):1733-1747.
- Wessman, C.A. and C.A. Bateson. 2006. Building up with a top-down approach: The role of remote sensing in deciphering functional and structural diversity. *In*: Wu, J., K.B. Jones, H. Li, and O.L. Loucks (eds.). *Scaling and Uncertainty Analysis in Ecology: Methods and Applications*. Springer, The Netherlands. Pp 147-164.
- Wessman, C.A., S. Archer, L.C. Johnson, and G.P. Asner. 2004. Woodland expansion in US grasslands: Assessing land-cover change and biogeochemical impacts. Pgs: 185-208. *In*: Gutman, G., A.C. Janetos, C.O. Justice, E.F. Moran, J.F. Mustard, R.R. Rindfuss, D. Skole, B.L. Turner II, M.A. Cochrane (eds.). *Land Change Science: Observing, Monitoring and Understanding Trajectories of Change on the Earth's Surface*. Kluwer Academic Publishers, Dordrecht.
- Mangan, J.M.\*, J.T. Overpeck, R.S. Webb, C. Wessman, and A.F.H. Goetz. 2004. Response of Nebraska Sand Hills natural vegetation to drought, fire, grazing, and plant functional type shifts as simulated by the Century model. *Climatic Change* 63:49-90.
- Hudak, A.T.\*, C.A. Wessman, and T.R. Seastedt. 2003. Woody overstory effects on carbon and nitrogen pools in South African savanna. *Austral Ecology* 28:173-181.
- Asner, G.P., S.Archer, R.F. Hughes^, R.J. Ansley, and C.A. Wessman. 2003. Net changes in regional woody cover and carbon storage in North Texas drylands, 1937-1999. *Global Change Biology* 9(3):316-335.
- Hudak, A.T.\* and C.A. Wessman. 2001. Textural analysis of high resolution imagery to quantify bush encroachment in Madikwe Game Reserve, South Africa, 1955-1996. *International Journal of Remote Sensing* 22(14):2731-2740.
- Asner, G.P., C.A. Wessman, and C.A. Bateson. 2000. Impact of tissue, canopy and landscape factors on reflectance variability of arid ecosystems. *Remote Sensing of Environment* 74:69-84.
- Hudak, A.T.\* and C.A. Wessman. 2000. Deforestation in Mwanza District, Malawi, Africa from 1981 to 1992 as determined from Landsat MSS imagery. *Applied Geography* 20:155-175.

- Bateson, C.A., G.P. Asner, and C.A. Wessman. 2000. Endmember bundles: A new approach to incorporating endmember variability into spectral mixture analysis. *Trans. on Geoscience and Remote Sensing* 38(2):1083-1094.
- Vierling, L.A.\* and C.A. Wessman. 2000. Photosynthetically active radiation heterogeneity within a monodominant Congolese rain forest canopy. *Agricultural and Forest Meteorology* 103:265-278.
- Wessman, C.A., W. Cramer, R.J. Gurney, P.H. Martin, W. Mauser, R. Nemani, J.M. Paruelo, J. Peñuelas, S.D. Prince, S.W. Running, and R.H. Waring. 1999. Dahlem Group Report: Remote sensing perspectives and insights for study of complex landscapes. In: Tenhunen, J.D. and P. Kabat (eds.). *Integrating Hydrology, Ecosystem Dynamics, and Biogeochemistry in Complex Landscapes*. John Wiley & Sons Ltd., Chichester, UK. Pp 89-103.
- Asner, G.P.\* , C.A. Bateson, J.L. Privette, N. Z. El Saleous, and C.A. Wessman. 1998. Estimating vegetation structural effects on carbon uptake using satellite data fusion and inverse modeling. *Journal of Geophysical Research* 103(D22):28,839-28,853.
- Asner, G.P.\* , B.H. Braswell, D.S. Schimel and C.A. Wessman. 1998. Ecological research needs from multi-angle remote sensing data. *Remote Sensing of Environment* 63:155-165.
- Asner, G.P.\* , C.A. Wessman and S. Archer. 1998. Scale dependence of PAR absorption in terrestrial ecosystems. *Ecological Applications* 8(4):1003-1021.
- Asner, G.P.\* , C.A. Wessman and D.S. Schimel. 1998. Heterogeneity of savanna canopy structure and function from imaging spectrometry and remote sensing. *Ecological Applications* 8(4):1022-1036.
- Asner, G.P.\* , C.A. Wessman, D.S. Schimel and S. Archer. 1998. Variability in leaf and litter optical properties: Implications for BRDF models and inversions using AVHRR, MODIS, and MISR. *Remote Sensing of Environment* 63:243-257.
- Burke, I.C., W.K. Lauenroth and C.A. Wessman. 1998. Progress in understanding biogeochemical cycles at regional and global scales. Pages 165-194. In: Groffman, P. and M. Pace, eds. *Successes, Limitations, and Frontiers in Ecosystem Ecology*.
- Hudak, A.T.\* and C.A. Wessman. 1998. Textural analysis of historical aerial photography to characterize woody plant encroachment in South African Savanna. 1998. *Remote Sensing of Environment* 66:317-330.
- Wessman, C.A. and G.P. Asner\*. 1998. Ecosystems and the problems of measurement at large spatial scales. Pages 346-371. In: Groffman, P. and M. Pace, eds. *Successes, Limitations, and Frontiers in Ecosystem Ecology*. Springer-Verlag, New York.
- Asner, G.P.\* and C.A. Wessman. 1997. Scaling PAR absorption from the leaf to landscape level in spatially heterogeneous ecosystems. *Ecological Modelling* 101:396-414.
- Asner, G.P.\* , C.A. Wessman and J.L. Privette. 1997. Unmixing the directional reflectances of AVHRR sub-pixel landcovers. *IEEE Transactions in Geoscience and Remote Sensing* 35:868-885.
- Wessman, C.A., C.A. Bateson and T.L. Benning. 1997. Detecting fire and grazing patterns in tallgrass prairie using spectral mixture analysis. *Ecological Applications* 7(2):493-511.
- Chapin, F.S., S. Diaz, M. Howden, J. Puigdefabregas, M. Stafford Smith, T. Benning, F. Bryant, B. Campbell, J. duToit, K. Galvin, E. Holland, L. Joyce, A.K. Knapp, P. Matson, R. Miller, D. Ojima, W. Polley, T. Seastedt, A. Suarez, T. Svejcar, C. Wessman. 1996. Rangelands in a changing climate: Impacts, adaptations, and mitigation. In: Watson, R.T., M.C. Zinyowera, R.H. Moss (eds.). *Climate Change 1995*

*Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses.*  
Intergovernmental Panel on Climate Change, Cambridge University Press, New York. pp 135-158.

Nel, E.M.\*, C.A. Wessman, and T.T. Veblen. 1994. Digital and visual analysis of Thematic Mapper imagery for differentiating old growth from younger spruce-fir stands. *Remote Sensing of Environment* 48:291-301.

Wessman, C.A. 1994. Remote sensing and the estimation of ecosystem parameters and functions. In: Hill, J. and J. M egier (ed.). *Imaging Spectrometry - a Tool for Environmental Observations*. Kluwer Academic, Dordrecht. pp 39-56.

Wessman, C.A. 1994. Estimating canopy biochemistry through imaging spectrometry. In: Hill, J. and J. M egier (ed.). *Imaging Spectrometry - a Tool for Environmental Observations*. Kluwer Academic, Dordrecht. pp 57-69.

Nel, E.M.\* and C.A. Wessman. 1993. Canopy transmittance models for estimating forest leaf area index. *Canadian Journal of Forest Research* 23(12):2579-2586.

Walker, D.A., J.C. Halfpenny, M.D. Walker and C.A. Wessman. 1993. Long-term studies of snow-vegetation interactions. *Bioscience* 43(5):287-301.

Caldwell, M., P.A. Matson, C.A. Wessman, and J. Gamon. 1993. Prospects for Scaling. In J. Ehleringer and C. Field (eds.). *Scaling Physiological Processes: Leaf to Globe*. Academic Press. pp 223-230.

Wessman, C.A. 1991. Remote sensing of soil processes. *Agriculture, Ecosystems and Environment* 34:479-493.

Ustin, S.L., C.A. Wessman, B. Curtiss, E. Kasischke, J. Way and M.C. Dobson. 1991. Opportunities for parameterization of ecosystem models using the Eos imaging spectrometer and synthetic aperture radar. *Ecology* 72(6):1934-1945.

Wessman, C.A. 1992. Spatial scales and global change: bridging the gap from plots to GCM grid cells. *Annual Review of Ecology and Systematics*. 23:175-200.

Wessman, C.A. 1992. Imaging spectrometry for remote sensing of ecosystem processes. *Advances in Space Research*. 12(7):361-368.

Aber, J.D., C.A. Wessman, D.L. Peterson, J.M. Melillo and J.H. Fownes. 1990. Remote sensing of litter and soil organic matter decomposition in forest ecosystems. In: Hobbs, R. and H. Mooney (eds.). *Remote Sensing of Biosphere Functioning*. Springer-Verlag, New York. pp 87-103.

Wessman, C.A. 1990. Evaluation of canopy biochemistry. In: Hobbs, R. and H. Mooney (eds.). *Remote Sensing of Biosphere Functioning*. Springer-Verlag, New York. pp 135-156.

Wessman, C.A. 1990. Landscape ecology: analytical approaches to pattern and process. In C.J. Edwards and H.A. Regier (eds.). *An ecosystem approach to the integrity of the Great Lakes in turbulent times*. Great Lakes Fish. Comm. Spec. Pub. 90-4: 285-299.

Wessman, C.A., J.D. Aber, and D.L. Peterson. 1989. An evaluation of imaging spectrometry for estimating forest canopy chemistry. *International Journal of Remote Sensing* 10(8):1293-1316.

Peterson, D.L., J.D. Aber, P.A. Matson, D.H. Card, N.A. Swanberg, C.A. Wessman, M. Spanner, and C. Hlavka. 1988. Remote sensing of forest canopy and leaf biochemical contents. *Remote Sensing of Environment* 24:85-108.

Wessman, C.A., J.D. Aber, D.L. Peterson, and J.M. Melillo. 1988. Foliar analysis using near infrared reflectance spectroscopy. *Canadian Journal of Forest Research* 18:6-11.

Wessman, C.A., J.D. Aber, D.L. Peterson, and J.M. Melillo. 1988. Remote sensing of canopy chemistry and nitrogen cycling in temperate forest ecosystems. *Nature* 335:154-156.

### **Papers In Review**

^Cattau, M. E., C. Wessman, A. Mahood, and J. Balch. Releasing the control of ignitions: Changing fire physical characteristics in the United States. Submitted to *Proceedings of the National Academy of Sciences*.

### **Papers In Prep**

^Cattau, M. E. and C. Wessman, C. Ecosystem resilience in the Southern Rockies: interacting effects of beetle, drought, and fire.

Wessman, C.A., B. Muller, B. Buma, M. Herris, T. Flohr, M. Mohammadbagher, and D. Ardalan. Phenology of green infrastructure in cities: A window into ecosystem services in urban environments. To be submitted to *Landscape and Urban Planning*.

### **Invited Reviews**

Wessman, C.A. 2007. Patterns in process: an intersection of landscape and ecosystem ecology. Book Review: *Ecosystem Function in Heterogeneous Landscapes*. Lovett, G.M., C.G. Jones, M.G. Turner, and K.C. Weathers (eds.) Springer, New York. xxiv + 489 p. *Ecology* 88(3):803-804.

Wessman, C.A. 1994. Book Review: *Introduction to Environmental Remote Sensing*. Third edition. E.C. Barrett and L.F. Curtis (eds.). Chapman and Hall, New York. xx + 426 p. *Ecology* 75(8):2464-2465.

Wessman, C.A. 1993. Towards a unification of forest carbon budgets. *Bull. Ecol. Soc. Am.* 74(1):45-47.

### **Invited Presentations**

Colorado State University. "Remote Sensing in Scaling Ecological Function and Structure". 2005

University of Washington. "Ecological systems from a bird's-eye view: Pattern in process". 2004.

CIRES Planetary Metabolism Theme Symposium: Environmental Response to Anthropogenic Perturbation. "Regional Production and Carbon Stocks in Southwestern USA Rangelands". 2003.

International Assoc. of Landscape Ecology, Lincoln, NE. "Spatially interactive landscape approaches: Scaling of transfers in complex landscapes". (co-authors: P.T. Stapp, F.S. Chapin III) 2002.

NASA Earth Observing System, Interdisciplinary Science Team. Keystone, CO. "Remote Sensing in Arid and Semi-Arid Systems: A Progress Report". 2001.

NSF LTER Landscape Scaling Workshop, Albuquerque, NM. Developing guidelines and strategies for scaling patterns and processes in heterogeneous landscapes: Applicability to current issues in ecology. "Quantifying Grassland-to-Woodland Transitions: Implications for Carbon and Nitrogen Dynamics in the Southwest United States". (Co-authors: S.R. Archer, G.P. Asner, R.F. Hughes, C.A. Bateson) 2001.

Sevilleta Research Symposium, Albuquerque, New Mexico. "Regional investigations of grassland-woodland transitions and ecotone dynamics". (Co-author: C.A. Bateson) 2001.

Max-Planck Institut für Biogeochemie, Jena, Germany “Remote sensing and issues in large-scale measurements”. 2000.

LTERR All Scientists Meeting, Snowbird, UT. “Quantifying grassland-to-woodland transitions: Implications for carbon and nitrogen dynamics in the Southwest United States”. (Co-authors: S.R. Archer, G.P. Asner, R.F. Hughes, C.A. Bateson) 2000.

Sevilleta LTER Principal Investigators Meeting, Albuquerque, New Mexico. “Remote sensing of landscape structure”. 2000.

Colorado State University, “Ecosystems and the Problems of Measurement at Large Scales”, 1999.

Sevilleta Research Symposium, Albuquerque, New Mexico. “Remote sensing of structural and biophysical attributes in spatially complex ecosystems”. 1999

International Forest Canopy Conference: Forest Canopies 98 – Global Perspectives, Sarasota, Florida, “Scaling Canopy-Atmosphere Interactions to the Landscape Using Remote Sensing”. 1998.

Seventh Cary Conference: Successes, Limitations, and Frontiers in Ecosystem Ecology, Institute of Ecosystem Studies, Millbrook, New York. “Ecosystems and the Problems of Measurement at Large Scales”.

*Prior to 1998:* Carnegie Institute of Washington-Stanford, Colorado State University, Committee on Space Research (COSPAR), Commission of European Communities Joint Research Center, Institute for Arctic and Alpine Research, International Rangeland Congress, International Satellite Land Surface Climatology (ISLSCP) Americas Workshop, National Center for Atmospheric Research, National Center for Ecological Analysis and Synthesis, NOAA Carbon Cycling Group, Stanford, Modern Techniques in Soil Ecology - University of Georgia, University of Wyoming,

### **Published Proceedings and Technical Reports**

Wessman, C.A. and R.W. Kiefer. 1985. The utility of dual polarization synthetic aperture radar imagery for vegetation type discrimination in Jamaica. *Proc. 51st Annual Meeting American Society of Photogrammetry*. Washington, D.C. pp. 393-403.

Wessman, C.A., J.D. Aber, and D.L. Peterson. 1987. Estimating key forest ecosystem parameters through remote sensing. *Proc. International Geoscience and Remote Sensing Symposium (IGARRS'87)*, 2:1189-1193.

Wessman, C.A., J.D. Aber, and D.L. Peterson. 1987. Estimation of forest canopy characteristics and nitrogen cycling using imaging spectrometry. In: Vane, G. (ed.) *Proc. SPIE International Society for Optical Engineering*. Vol. 834. Imaging Spectrometry II pp. 114-118.

Schimel, D., C. Wessman, W. Parton, B. Curtiss, A. Knapp, T. Seastedt. 1990. Modeling of terrestrial ecosystems with remotely sensed inputs. *Proc. International Geoscience and Remote Sensing Symposium (IGARSS '90)*, 1:557.

Goetz, A.F.H., B.C. Gao, C.A. Wessman and W.D. Bowman. 1990. Estimation of biochemical constituents from fresh, green leaves by spectrum matching techniques. *Proc. International Geoscience and Remote Sensing Symposium (IGARSS '90)*. 2:971-974.

Wessman, C.A., S. Ustin, and B. Curtiss. 1990. Potential for large-scale ecosystem modeling using parameters derived from imaging spectrometer data. *Proc. SPIE International Society for Optical Engineering*. Vol. 1298:164-170.

- Wessman, C.A., S. Ustin, B. Curtiss, and B.-C. Gao. 1991. A Conceptual Framework for Ecosystem Modeling Using Remotely Sensed Inputs. *Proceedings of the 5th International Colloquium on Physical Measurements and Signatures in Remote Sensing*, Courchevel, France. ESA SP-319:777-782.
- Goetz, A.F.H., C.O. Davis, J.D. Aber, K.L. Carder, R.N. Clark, S.A.W. Gerstl, J. Dozier, D.A. Landgrebe, H. Keiffer, L.C. Rowan, J.M. Melack, R.M. Welch, S.L. Ustin, and C.A. Wessman. 1991. HIRIS Science Requirements Document, JPL.
- Nel, E.M., C.A. Wessman, and T.T. Veblen. 1992. The use of digital image processing techniques in old-growth inventories. *Old-Growth Forests in the Rocky Mountains and Southwest Conference*. Rocky Mountain Forest and Range Experiment Station, General Techn. Report RM-213:135-138.
- Goetz, A.F.H., B.-C. Gao, and C. A. Wessman. 1992. Vegetation biochemistry: What can imaging spectrometry tell us about canopies? *Proc. 6th Australasian Remote Sensing Conference*, Wellington, New Zealand. pp 3-50 - 3-60.
- Ojima, D.S., T.G.F. Kittel, D.S. Schimel, C.A. Wessman, B. Curtiss, S. Archer, V.B. Brown, and W.J. Parton. 1992. Global arid and semi-arid ecosystems: linkage between process models and remote sensing. *Proc. International Geoscience and Remote Sensing Symposium (IGARSS'92)* 2:1027-1029.
- Williams, D.L., V.I. Kharuk, V.M. Jirin, B.N. Rock, K.J. Ranson, C.A. Wessman, B. Curtiss. 1992. Sayani '91: A joint United States / Commonwealth of Independent States field campaign to investigate forest decline damage in the Krasnoyarsk region of southcentral Siberia. *Proc. International Geoscience and Remote Sensing Symposium (IGARSS'92)* 2:1286-1288.
- Rock, B.N., D.L. Williams, V.I. Kharuk, C.A. Wessman, and D.M. Moss. 1992. Morphological, anatomical, and chemical characteristics of needle and branch samples of Siberian Fir (*Abies siberica*). *Proc. International Geoscience and Remote Sensing Symposium (IGARSS'92)* 2:1289-1291.
- Wessman, C.A., C.A. Bateson, B. Curtiss, and T.L. Benning. 1993. A comparison of spectral mixture analysis and NDVI for ascertaining ecological variables. In: Green, R.O. ed. *Summaries of the Fourth Annual JPL Airborne Geoscience Workshop*. JPL Publication 93-26. 1:193-196.
- Wessman, C.A. and E.M. Nel. 1994. The distant perspective: approaching sustainability in a regional context. In: *Sustainable Ecological Systems: Implementing an Ecological Approach to Land Management*. USDA Forest Service General Technical Report RM-247. pp 169-177.
- Wessman, C.A., D.S. Schimel, C.A. Bateson, B.H. Braswell, D.S. Ojima, and W.J. Parton. 1995. New technologies for remote sensing of ecosystem change in rangelands. *Fifth International Rangeland Congress*, Salt Lake City. Vol. II: 139-142.
- Asner, G.P., Privette, J.L., Wessman, C.A., and Bateson, C.A. 1996. Extracting sub-pixel vegetation endmember bidirectional reflectance for canopy model inversions using NOAA AVHRR satellite imagery. *Proc. International Geoscience and Remote Sensing (IGARRS'96)* 3: 1663-1665.
- Wessman, C.A., E.M. Nel and C.A. Bateson. 1996. Estimation of absolute FIPAR at landscape scales using remote sensing. In: Stuth, J.W. and S.M. Dudash, editors. *La Copita Research Area: 1996 Consolidated Progress Report*. Texas A&M University. p. 83-86.
- Hudak, A.T. and C.A. Wessman. 1997. Textural analysis of aerial photography to characterize large scale land cover change. *Proc. 1997 ESRI Users Conference*, San Diego, CA.



- Hudak, A.T. and C.W. Wessman. 1997. Using multitemporal aerial photography and satellite imagery to quantify bush encroachment in overgrazed South African savannas. *International Conference and Workshop on Interoperating Geographic Information Systems*, Santa Barbara, CA.
- Hudak, A.T., B.H. Brockett and C.A. Wessman. 1998. Fire management of semi-arid savanna rangelands. *Proc. International Geoscience and Remote Sensing Symposium (IGARSS'98)*.
- Wessman, C.A. and B.L. Turner II. Report of the Strategic Questions Breakout Group. NASA's Land Cover and Land Use Change (LCLUC) Second Science Team Meeting. Warrenton, Virginia, 30 Mar - 1 Apr 1998. 3 pp.
- Wessman, C.A., E.M. Nel, C.A. Bateson and G.P. Asner. 1999. A method to access absolute fIPAR of vegetation in spatially complex ecosystems. *Proceedings of the 7th Annual Airborne Earth Science Workshop*.
- Asner, G.P., C.A. Wessman and C.A. Bateson. 1999. Sources of variability in plant canopy hyperspectral data in a savanna ecosystem. *Proceedings of the 7th Annual Airborne Earth Science Workshop*.
- Bateson, C.A., G.P. Asner and C.A. Wessman. 1999. Incorporating endmember variability into spectral mixture analysis through endmember bundles. *Proceedings of the 7th Annual Airborne Earth Science Workshop*.
- Asner, G.P., C.A. Bateson, A.R. Townsend, and C.A. Wessman. 2000. Resolving vegetation condition and biogeochemical processes using hyperspectral-BRDF inverse modeling. *Proceedings of the 8th Annual Airborne Earth Science Workshop*.

**Meetings Attended (with published abstracts)**

- Evans, D.L., T.G. Farr, C.L. Werner and C.A. Wessman. 1984. Multiple polarization L-band SAR images. *Proc. International Symposium on Remote Sensing of the Environment*, Colorado Springs, Colorado.
- Wessman, C.A., J.D. Aber and D. L. Peterson. 1988. Estimation of forest canopy lignin and annual nitrogen mineralization rates using imaging spectrometry. Ecological Society of America Annual Meeting, Davis, California.
- Wessman, C.A, D.A. Walker, and M.D. Walker. 1989. Remotely sensed pattern to system process in the Front Range alpine. Fourth Annual Landscape Ecology Symposium: Linking Landscape Structure to Ecosystem Processes. Fort Collins, Colorado.
- Walker, D.A., L.M. Ayers, N. Cain, J.C. Halfpenny, N.D. Lederer, M.D. Walker, and C.A. Wessman. 1989. GIS methods for detecting long-term change in the Colorado alpine. Fourth Annual Landscape Ecology Symposium: Linking Landscape Structure to Ecosystem Processes, Fort Collins, Colorado.
- Wessman, C.A. and R.K. Monson. 1989. Photosynthetic rates, leaf nitrogen, chlorophyll, and spectral reflectance in winter wheat. Ecological Society of America Annual Meeting, Toronto, Canada.
- Wessman, C.A., B.C. Gao, A.F.H. Goetz and W.D. Bowman. 1990. Estimating abundance of major foliar biochemical constituents from leaf reflectance. Ecological Society of America Annual Meeting, Snowbird, Utah.
- Benning, T.L., T.R. Seastedt, and C.A. Wessman. 1992. Estimating NPP from transect data: A comparison using satellite-derived vegetation indices. Ecological Society of America Annual Meeting, Honolulu, Hawaii.

- Walker, D.A., M.D. Walker, C.A. Wessman, and N.A. Auerbach. 1992. Vegetation along regional gradients in arctic and alpine ecosystems: analysis using a hierarchic GIS. Ecological Society of America Annual Meeting, Honolulu, Hawaii.
- Wessman, C.A., T.L. Benning, and B. Curtiss. 1992. Evaluation of a nutrient gradient in tallgrass prairie using spectral mixture analysis of high spectral resolution imagery. Ecological Society of America Annual Meeting, Honolulu, Hawaii.
- Nel, E.M., C.A. Wessman, and T.T. Veblen. 1992. The use of remote sensing in the detection of old-growth forests in the Rocky Mountains. Association of American Geographers Annual Meeting, San Diego, California.
- Walker, D.A., W.B. Krantz, B.E. Lewis, E.T. Price, M.D. Walker, and C.A. Wessman. 1993. Snow-vegetation interactions in the Colorado alpine zone. Eastern and Western Snow Conference, June 8-10, Quebec City, Quebec, Canada.
- Walker, D.A., W.B. Krantz, B.E. Lewis, E.T. Price, R.D. Tabler, M.D. Walker, and C.A. Wessman. 1993. Multi-scale studies of snow-vegetation interactions in the alpine zone. LTER All Scientists Meeting and International Summit, Estes Park, Colorado.
- Wessman, C.A., E.M. Nel, C.A. Bateson, and M.D. Walker. 1993. Extrapolating production measurements across a heterogeneous alpine landscape. LTER All Scientists Meeting and International Summit, Estes Park, Colorado.
- Schimel, D.S., W.J. Parton, S. Archer, L. Band, J.S. Baron, B. Brown, K. Hibbard, T.K.G. Kittel, D.S. Ojima, R.A. Pielke, S.W. Running, C.A. Wessman, X. Xiao. 1994. Biospheric interactions with the hydrosphere and atmosphere. First Global Change and Terrestrial Ecosystems (GCTE) Science Conference, International Geosphere-Biosphere Programme, Woods Hole, MA.
- Asner, G.P. and Wessman, C.A. 1996. Scaling vegetation biophysical properties from the leaf to landscape level: Implications for PAR absorption and remote sensing of the biosphere. Ecological Society of America Annual Meeting, Providence, RI.
- Asner, G.P., J.L. Privette, C.A. Wessman and C.A. Bateson. 1997. A technique for applying 1-D BRDF model inversions to spatially heterogeneous environments. Workshop on Multi-angular Remote Sensing in the EOS Era, College Park, MD.
- Asner, G.P., C.A. Wessman and D.S. Schimel. 1997. Constraint of leaf and litter spectral properties in BRDF models and inversions: AVHRR, MODIS, and MISR optical channels. Workshop on Multi-angular Remote Sensing in the EOS Era, College Park, MD.
- Hudak, A.T. and C.A. Wessman. 1997. Landscape variations in canopy FIPAR-VI relationships due to fire and phenology in a semi-arid South African savanna. Ecological Society of America Annual Meeting, Albuquerque, NM.
- Asner, G.P., C.A. Wessman, S. Archer and D.S. Schimel. 1997. Scale dependence of PAR absorption in terrestrial ecosystems. Ecological Society of America Annual Meeting, Albuquerque, NM.
- Wessman, C.A. and G.P. Asner. 1997. Structural heterogeneity at regional scales and its effect on regional and global processes. Ecological Society of America Annual Meeting, Albuquerque, NM.
- Wessman, C.A. and G.P. Asner. 1998. Large scale measurement of vegetation and landscape structure: Beyond NDVI. GCTE-LUCC Open Science Conference. Barcelona, Spain.

- Golubiewski, N.E. and C.A. Wessman. 1999. Linking structure and function: the spectral unmixing of AVIRIS images for Sevilleta LTER. International Association of Landscape Ecologists (IALE) World Conference. Snowmass, CO.
- Hughes, R.F., S.A. Archer, G.P. Asner, D.S. Schimel, and C.A. Wessman. 1999. Ecosystem-level impacts of woody encroachment: How *Prosopis glandulosa* (honey mesquite) stand establishment and development alters storage and cycling of C and N in the Rolling Plains of northern Texas. Ecological Society of America Annual Meeting, Spokane, WA.
- Carrasco, J. and C.A. Wessman. 2000. Impacts of increased nitrogen deposition in nitrogen cycling and leaching losses of dissolved nitrogen from lodgepole pine and trembling aspen stands. Ecological Society of America Annual Meeting, Snowbird, Utah.
- Golubiewski, N.E. and C.A. Wessman. 2000. Urban sprawl in Colorado's Front Range: Consequences for carbon storage and productivity. Ecological Society of America Annual Meeting, Snowbird, Utah.
- Hughes, R.F., S.A. Archer, G.P. Asner, C.R. McMurtry, and C.A. Wessman. 2000. Ecosystem-level impacts of Mesquite (*Prosopis glandulosa*) encroachment on C and N pools in herbaceous vegetation and soils in North Texas rangelands. Ecological Society of America Annual Meeting, Snowbird, Utah.
- Rumbaitis-del Rio, C. and C.A. Wessman. 2000. The effect of windthrow disturbance and salvage logging on nitrogen cycling in a coniferous forest ecosystem. Ecological Society of America Annual Meeting, Snowbird, Utah.
- Carrasco, J.J. and C.A. Wessman. 2001. Dissolved organic matter fractions and corresponding sorption capacity of lodgepole pine (*Pinus contorta* var. *latifolia*) and trembling aspen (*Populus tremuloides* Michx.) soils. Ecological Society of America Annual Meeting, Madison, Wisconsin.
- Golubiewski, N.E. and C.A. Wessman. 2001. Regional shifts in ecosystem processes as a result of urban sprawl in Colorado's Front Range. Ecological Society of America Annual Meeting, Madison, Wisconsin.
- Rumbaitis-del Rio, C. and C.A. Wessman. 2001. Impact of compound disturbances on ecosystem processes and forest reorganization in a wind-disturbed and logged coniferous forest. Ecological Society of America Annual Meeting, Madison, Wisconsin.
- Wessman, C.A., G.P. Asner, N. Buchmann. 2001. Remote sensing of forest structure and biophysical properties indicating forest response to chronic nitrogen deposition. Ecological Society of America Annual Meeting, Madison, Wisconsin.
- Mangan, J.M., R.S. Webb, C. Wessman, and A.F.H. Goetz. 2002. Assessing Vegetation in Relation to Sand Dune Mobilization Potential in Nebraska: A Study Using Landsat TM Data, the CENTURY Ecosystem Model, and a Digital Elevation Model. Chapman Conference on Semiarid Landscapes, Taos, NM.
- Golubiewski, N.E. and C.A. Wessman. 2002. Carbon in a Colorado conurbation changes regional estimates of ecosystem properties. Ecological Society of America Annual Meeting. Tucson, Arizona.
- Rumbaitis-del Rio, C. and C.A. Wessman. 2002. Vegetation analysis of a wind-disturbed and salvage-logged subalpine forest. Ecological Society of America Annual Meeting. Tucson, Arizona.
- Wessman, C.A. P.T. Stapp, F.S. Chapin III. 2002. Spatially interactive approaches to scaling: Dynamics in motion. Ecological Society of America Annual Meeting. Tucson, Arizona.
- Rumbaitis-del Rio, C.M. and C.A. Wessman. 2002. Biogeochemical consequences of wind and salvage-logging disturbances in a spruce-fir forest ecosystem. *Eos Trans. AGU 83(47)*, Fall Meet. Suppl. Abstract B21A-0703.

- Wessman, C.A., S.R. Archer, G.P. Asner, C.A. Bateson, T. Boutton, and M. McClaran. 2003. Regional NPP and carbon stocks in Southwestern Rangelands: Land-use impacts on the grassland-woodland balance. Chapman Conference on Ecosystem Interactions with Land Use Change. Santa Fe, New Mexico.
- Golubiewski, N. and C.A. Wessman. 2003. Remote sensing of urban sprawl in semi-arid western grasslands: Discerning regional shifts in ANPP. Chapman Conference on Ecosystem Interactions with Land Use Change. Santa Fe, New Mexico.
- Rumbaitis-del Rio, C. and C.A. Wessman. 2003. Patterns of recovery of a wind disturbed and salvage-logged subalpine forest. Ecological Society of America Annual Meeting. Savannah, Georgia.
- Mennis, J., C.A. Wessman and N. Golubiewski. 2003. Data mining relationships among urban socioeconomic, land use, and remotely-sensed ecological data. American Geophysical Union Fall Meeting, San Francisco.
- Mennis, J. and C. Wessman. 2005. Urban development and the transformation of vegetation in Denver Colorado, 1990-2000. Association of American Geographers Annual Meeting, Denver, Colorado.
- Brandel, B.J. and C.A. Wessman. 2005. The distribution of soil carbon and nitrogen across a grassland-shrubland transition undergoing woody plant encroachment. Ecological Society of America Annual Meeting. Montreal, Canada.
- Browning, D., S. Archer, G. Asner, E. Hoggatt, M. McClaran, C. Wessman. 2005. Spatial rearrangement of woody plant (*Prosopis velutina*) cover over 60 years in a desert grassland. Ecological Society of America Annual Meeting. Montreal, Canada.
- Hinners, S.J., C.A. Kearns and C.A. Wessman. 2005. Pollination in an urbanizing environment: effects of habitat fragmentation on wild bee assemblages. Ecological Society of America Annual Meeting. Montreal, Canada.
- Rumbaitis-del Rio, C. and C.A. Wessman. 2005. Ecological memory – Do pre-fire disturbances influence post-fire nitrogen cycling and regeneration. Ecological Society of America Annual Meeting. Montreal, Canada.
- Baron, J., R. Conant, C. Wessman, N. Golubiewski, J. Hicke, R. Arnold, T. Owens, B. Langer. 2006. Carbon storage in the South Platte Basin of Colorado. Ecological Society of America Annual Meeting. Memphis, Tennessee.
- Brandel, B.J. and C.A. Wessman. 2006. Patterns of soil organic carbon and aboveground biomass carbon across a grassland-shrubland transition undergoing woody plant encroachment. Ecological Society of America Annual Meeting. Memphis, Tennessee.
- Kokaly, R.F., G.P. Asner, M.E. Martin, S.V. Ollinger, C.A. Wessman. 2006. Quantifying Non-Pigment Plant Components From Imaging Spectrometer Data: Using Biochemical Absorption Features to Study Ecosystem Processes. IEEE International Geoscience and Remote Sensing Symposium. Denver, Colorado.
- Wessman, C.A., C. Rumbaitis-del Rio, and K. Kemp. 2007. Legacies of recent disturbance history on post-fire regeneration of a Subalpine forest. Ecological Society of America Annual Meeting. San Jose, California.
- Madronich, M., J. Greenberg, A. Guenther and C. Wessman. 2007. Understory emissions: underestimated? The bracken fern story. Gordon Research Conference: Biogenic Hydrocarbons & the Atmosphere, Ventura, CA.

- Madronich, M., J. Greenberg, A. Guenther and C. Wessman. 2007. Understanding the role of understory terpenoid emissions. *EOS Trans. AGU*, 88(52), Fall Meet. Suppl., Abstract A11C-0595.
- Wessman, C., K. Morliengo-Bredlau, K. Kemp and P. Sitzmann. 2008. Ecological response to multiple severe disturbances in a Subalpine landscape. 2008 US-IALE Symposium: Landscape Patterns and Ecosystem Processes. Madison, Wisconsin.
- Wessman, C., K. Morlinego-Bredlau, K. Kemp, J. Hayes, C. Rumbaitis-del Rio. 2009. Impacts of multiple disturbances and their interactions on ecosystem recovery in a subalpine landscape. Ecological Society of America Annual Meeting. Albuquerque, NM. Invited.
- Madronich, M., C. Wessman, and A. Guenther. 2010. Monoterpene emissions from a ponderosa pine forest: Does landscape matter? Gordon Research Conference: Biogenic Hydrocarbons & the Atmosphere.
- Wessman, C.A., K. Morliengo-Bredlau, B. Buma, and J. Hayes. 2011. Biogeochemistry of subalpine forest soils following multiple, interacting disturbances. 2011 US-IALE Symposium, Portland, Oregon.
- Buma, B.J. and C.A. Wessman. 2011. Compounding disturbances and their impact on regeneration of subalpine tree species. Ecological Society of America Annual Meeting. Austin Texas.
- Madronich, M.B., C.A. Wessman, and A. Guenther. 2011. Influence of landscape configuration on monoterpene emissions from a Ponderosa Pine forest. Ecological Society of America Annual Meeting. Austin Texas.
- Kemp, K.B. and C.A. Wessman. 2011. *Multiple disturbance interactions and their effect on understory response after fire in subalpine forests of northern Colorado*. Oral Presentation: Association for Fire Ecology Interior West Fire Ecology Conference; Snowbird, UT.
- Madronich, M.B., C.A. Wessman, and A. Guenther. 2011. Monoterpene emissions from a Ponderosa Pine forest: Does age matter? *EOS Trans. AGU*, Fall Meet.. San Francisco, CA.
- Buma, B and C.A. Wessman. 2012. Resistance and resilience mediate disturbance interactions: A synthesis and modeling exercise. US-International Association of Landscape Ecology, Newport, RI. April 8-12.
- Buma, B and C.A. Wessman. 2012. Ecosystems and ecosystem services may have differing resilience to increasing disturbance rates and disturbance interactions. 4th International Conference on Climate Change in Seattle, July 12-13.
- Wessman, C.A., B. Muller, B.J. Buma, M.M. Bagher, T. Flohr, and M.P. Heris. 2012. Phenology of green infrastructure in cities: A window into ecosystem services in urban ecosystems. Ecological Society of America Annual Meeting. Portland, Oregon.
- Buma, B. and C.A. Wessman. 2012. Ecosystem services may outlast their ecosystems: Regional carbon stocks minimally affected by multiple disturbances and coniferous-to-deciduous regime change. Ecological Society of America Annual Meeting. Portland, Oregon.
- Livneh, B., J.S. Deems, B. Buma, C.A. Wessman. 2012. Interpreting changes to Upper Colorado River Basin hydrologic response via alternate climatic and land-cover scenarios. American Geophysical Union Annual Meeting. San Francisco, California.
- Livneh, B., J.S. Deems, B. Buma, J.J. Barsugli, D. Schneider, and C. Wessman, Upper Colorado River Basin Water Conference, Grand Junction, CO, Nov. 2012, Modeling Hydrologic Impacts of Bark Beetles and Desert Dust on Tributary Catchments of the Upper Colorado River Basin.

- Buma, B., R.E. Poore, C.A. Wessman. 2013. Compound disturbances and their impact on post-fire carbon and charcoal pools. US-International Association of Landscape Ecology, Austin, TX. April 14-18.
- Poore, R.E., B. Buma, C.A. Wessman. 2013. Black carbon additions to the soil and the role of multiple disturbances – 9 years after a severe fire. US-International Association of Landscape Ecology, Austin, TX. April 14-18.
- Poore, R.E., B. Buma, C.A. Wessman. 2013. The effects of fire severity on black carbon additions to forest soils 10 years post fire. American Geophysical Union Annual Meeting. San Francisco, California.
- B. Buma, B. Livneh, C. A. Wessman. 2014. Linking forest ecology, hydrology, and management to explore the implications of climate change on a critical ecosystem service. Alaskan Coastal Rainforest Center lecture series, University of Alaska Southeast, Juneau AK.
- Cumming, W.F.P., S.W. Beatty, C.A. Wessman. 2014. Detection of soil temperature and moisture variability at multiple scales. Canadian Society of Soil Science. Banff, AB. May 4-8.
- Caldwell, M., C. Wessman, R. Poore, and B. Buma. 2014. Compounding disturbance interactions in a Southern Rocky Mountain subalpine forest. American Geophysical Union Annual Meeting. San Francisco, California.
- Krause, K. 2014. Ecosystem Mapping Approaches Based on Vegetation Structure Using NEON Prototype Airborne LiDAR and Field Data. American Geophysical Union Annual Meeting. San Francisco, California.
- ^Cattau, M.E., A. Mahood, K. Kresek, N. Mietkiewicz, C.A. Wessman, and J.K. Balch. August 2017. COS 184-10 – *Pyromes of the US: Delineating fire regimes*. Oral presentation. Annual meeting, Ecological Society of America. Portland, Oregon.

## RESEARCH SUPPORT

### *Principal Investigator*

- NASA Estimating ecosystem biochemistry through hyperspectral analysis, 6/15/89 - 12/13/90, \$75,000.
- NASA Estimating ecosystem biochemistry through hyperspectral analysis, 12/14/90 - 12/14/91, \$95,000.
- NASA Estimating ecosystem biochemistry through hyperspectral analysis, 12/15/91 - 12/14/2001, \$10,715,000. EOS terminating 12/95 - HIRIS deselected. Received \$560,000 through 12/31/95.
- NASA Satellite remote sensing of ecosystem structural and functional changes: integrating spectral mixture analysis and BRDF inversions, 6/1/95 - 5/31/98, \$432,895.
- NASA Landscape structure and foliar chemistry in heterogeneous landscapes: an analysis of Lewis HSI and LEISA data for ecosystem process studies, 1/1/96 - 12/31/98, \$130,127.
- NASA Spatial remote sensing of ecosystem structural and functional change in spatially heterogeneous regions, Earth System Science Fellowship, 9/01/96 – 8/31/98, \$66,000. (GRA Greg Asner)
- NASA Quantifying grassland-to-woodland transitions and the implications for carbon and nitrogen dynamics in the Southwest United States, 5/1/97 – 1/31/01, \$550,000.
- NASA (OSU subcontract), Regional estimates of ecosystem attributes for the Colorado Front Range: Niwot Ridge/Green Lakes Valley and the Central Plains Experimental Range, 6/1/97 - 5/31/98. \$35,000.

- Univ New Mexico Ecotonal Mapping and Patch Analysis at the Sevilleta LTER, 11/15/00-9/30/01, \$22,022.
- NASA Spatial and Temporal Response to anthropogenic nitrogen deposition in a heterogeneous Rocky Mountain Watershed. 9/01/99 – 8/31/01. \$66,000. (GRA Jon Carrasco).
- NASA Regional NPP and carbon stocks in southwestern USA rangelands: Land-use impacts on the grassland-woodland balance, 9/01/01-8/31/06, \$965,834.
- NASA Regional scaling of biogeochemistry in a *Larrea tridentata* ecotone: implications for carbon sequestration in the southwestern United States, Earth System Science Fellowship. 9/01/03 – 8/31/07. \$72,000. (GRA Bryan Brandel).
- NSF Disturbance interactions, management, and implications for future carbon sequestration, 7/01/2011 – 6/30/2013, \$230,555. (1119819)

**Co-Principal Investigator**

- NASA (CSU subcontract), Using multi-sensor data to model factors limiting carbon in global grasslands, 6/15/89 - 12/31/90, \$159,000.
- NASA Using multi-sensor data to model factors limiting carbon in global arid and semi-arid lands, 01/01/91 - 12/14/2000, \$4,387,922. (PI on CU subcontract - \$1,208,529)
- CU President's Fund for Global Change and Environmental Quality, Remote sensing of vegetation under changing environmental conditions, 1/1/92 - 12/31/92, \$13,000.
- NSF Long-Term Ecological Research, Effects of climate change in the Colorado alpine: ecosystem response to altered snowpack and rainfall regimes, 10/15/92 - 10/14/98, \$3,540,000.
- EOSAT Integrating Landsat TM imagery and the Century ecosystem model, 10/1/93 - 8/31/94, \$25,000.
- USDA Forest Service, Stream and riparian restoration by beaver, 7/1/94 - 12/31/94, \$5,000.
- CU President's Fund for Global Change and Environmental Quality, The use of relictual ecosystems to monitor global change: parallel studies in the alpine and subalpine in the Front Range of Colorado and the Black Hills of South Dakota, 3/95 - 9/96, \$17,790.
- NSF The Niwot Ridge Long-Term Ecological Research Program 1998-2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 11/1/98 - 10/31/2004. \$4,200,000.
- NASA Analysis of EO-1, Landsat 7, and AVIRIS for estimating vegetation structure and function in arid ecosystems. 01/01/00-12/31/01. \$104,297.
- NSF Sevilleta LTER III: Long Term Ecological Research in a Biome Transition Zone. 10/15/00-10/14/02. \$4,200,000.
- CIRES Urban Ecology in the Colorado Front Range: Assessing Interdisciplinary Components and Functional Structure. \$17,994. 6/1/02 – 5/31/03.
- CIRES Initial Assessment of Wildfire, Blowdown, and Salvage-Logging Effects on Biogeochemical Cycling and Regeneration Dynamics in Routt National Forest, Colorado. \$22,144. 6/01/03-05/31/04.

- CIRES Innovative Research Program. Phenology of green infrastructure in cities: A window into ecosystem services in urban environments. \$20,566 6/01/10-10/31/11. (Co-PI with Brian Muller, Brian Buma)
- NSF Water, Sustainability and Climate Category 1: Sustainability or Collapse? Identifying a “Safe Operating Space” for the Colorado River System. \$150,000. 10/15/10-12/30/11. (Declined)
- CIRES Western Water Assessment. Snowmelt perturbations and water supply forecast errors across the Colorado headwaters. \$348,000. 7/1/11-6/30/13. (co-PI with Molotch, Deems, Barsulgi, Painter, Wolter).
- NSF MSB-ENSA: Macroscale Resilience: Understanding how forests recover after beetle-kill, fire, and drought by linking observations – from single trees to the western U.S. \$1,852,683. 6/1/2018 – 5/31/2023 (co-PI with Jennifer Balch, Brian Johnson, Megan Cattau, Nate Mietkiewicz). (pending)

### ***Co-Investigator***

- NSF An LTER-GIS symposium and completion of a pilot GIS for Niwot Ridge, 3/01/89 - 2/28/90, \$80,000.
- NSF Biological control of land-atmosphere exchange: an ecosystem approach, 3/15/89 - 8/31/90, \$300,000.
- NASA (UNH subcontract) High resolution imaging spectrometry investigations on remote sensing of canopy chemistry, 6/1/92 - 5/31/95, \$46,000.
- CU President’s Fund for Global Change and Environmental Quality, Status of the Canadian arctic tree-line as a test for global warming, 6/1/93 - 6/1/94, \$6,000.
- NASA Science Object-Oriented Local Data Access System (SOOLDAS), 7/1/94 - 6/30/96, \$900,000. (received \$56,000)
- NASA Hyperspectral imaging and related field methods: Building the science, 1/1/98 - 12/31/98, \$261,908.
- CIRES Direct Measurement of Evapotranspiration: A Novel and Superior Approach. \$14,000. 6/1/02 – 5/31/03.

## **TEACHING ACTIVITIES**

### ***Courses Taught***

- Plant Kingdom (EPOB 3500), Spring 1992-1995
- Global Ecology (EPOB 3180), Fall 1993-1996, 2002; Spring 1998, 1999, 2002 (EPOB 4100/5100, Fall 2003)
- Landscape Ecology (EPOB 4165/5165) Fall 1991, 2001; Spring 2001 (EPOB 4800/5800, Critical Thinking) Spring 1996, 1997, Fall 1997, 1998 (EPOB 4060/5060) Spring 2003, Fall 2003, 2005, Fall 2007-2012, Fall 2014-2018)
- Contributing Instructor, GEOG 4100/5100: Earth Analytics: Accelerating discovery with a view from Space, Spring 2016
- GTP EBIO Faculty Mentor and Co-Instructor of GTP pedagogy course, Spring 2015-2017.
- Land Use, Sustainability, & Climate Change (EBIO 4800/5800) Spring 2008 (new course), S2009-2012
- General Biology (EBIO 1220) Spring 2005, 2006
- Ecology and Conservation (EBIO 5310) Fall 2004.
- IGERT Carbon, Climate & Society, Fall 2002 – 2006



Field Methods in Remote Sensing (EPOB 6440) Fall 1998, 2002.

*Seminars*

Graduate seminar (EBIO 6100): Critical Transitions & Resilience, Spring 2015

Graduate seminar (EBIO 6100): Advanced Landscape Ecology: Disturbance, Fall 2010

Graduate Seminar: Ecological Scaling: Theory, Application and Techniques, Spring 1997

Graduate Seminar: Biosphere-Atmosphere Research Seminar Series, Spring 1998

***Ph.D. Dissertations Directed***

Shippert, Margaret, Ph.D. 1997. (Geography, Dr. Susan Beatty, co-advisor), "Spatial variability in methane emission from arctic tundra and its relationship to environmental variables". Current: Technical Scientist, Research Systems, Inc., Boulder, CO.

Asner, Gregory, Ph.D. 1997. "Structural and biophysical attributes of complex (savanna) ecosystems: large-scale measurement and implications for biogeochemistry". Current: Faculty Scientist, Department of Global Ecology, Carnegie Institute of Washington, Stanford, CA.

Vierling, Lee, Ph.D. 1999. "Interactions between light and tropical rain forest canopies and their implications for photosynthesis and isoprene emission". Current: Assoc. Professor, University of Idaho.

Hudak, Andrew, Ph.D. 1999. "The effect of woody plant encroachment on savanna carbon sequestration". Current: Research Forester, USFS Rocky Mountain Research Station, Moscow, ID.

Golubiewski, Nancy, Ph.D. 2003. "Carbon in conurbations: Afforestation and carbon storage as consequences of urban sprawl in Colorado's Front Range". Current: Research Researcher, Auckland Council, New Zealand.

Rumbaitis-del Rio, Cristina, Ph.D. 2004. "Compound disturbance in a managed landscape: ecological effects of catastrophic blowdown, salvage-logging, and wildfire in a subalpine forest". Current: Senior Research Associate, Rockefeller Foundation, New York.

Carrasco, Jonathon, Ph.D. 2005. "Soil carbon and nitrogen biogeochemistry and transport in Lodgepole Pine and Trembling Aspen forests". Current: Senior Data Scientist, Oracle, Denver, CO.

Kineman, John, Ph.D. 2007. (ENVS) "Theoretical treatment of ecosystem and information complexity for ecological management".

Hinners, Sarah, Ph.D. 2008. "Pollination in an urbanizing landscape: Effects of habitat fragmentation on wild bee assemblages" (co-advisor Dr. Carol Kearns).

Madronich, Monica, Ph.D. 2012. Landscape structure and plant age effects on terpenoid emissions from *Pinus ponderosa* and *Pteridium aquilinum*.

Buma, Brian, Ph.D. 2013. Disturbance interactions in subalpine forests, their impacts on forest resilience, carbon, and future carbon storage under a variety of management and climate change scenarios.

Jaeger, Deidre, Ph.D. Expected 2021.

Jaffe, Sarah, Ph.D. Expected 2021.

### ***Master's Theses Directed***

- Nel, Elizabeth, M.A. (Geography, Dr. Tom Veblen, co-advisor). 1992. The use of remote sensing in the detection of old-growth spruce-fir forests in the Rocky Mountains.
- Kennedy, Robert, M.A. 1994. Monitoring vegetation from space: The effects of spatial scale and heterogeneity.
- Harwood, Garth, M.B.S. 1995. Restoration of small watersheds by natural beaver activity: A suitability study and field assessment method.
- Zunker, Seth, B.A./M.A. 2000. Nutrient constraints on mesquite nitrogen fixation in North Texas.
- Kendra Morliengo-Bredlau, M.A. 2009. The effects of logging, fire and blowdown on Colorado Subalpine forest soil.
- Poore, Rebecca, M.A. 2014. Forest soil black carbon retention, a decade after a fire in northwestern Colorado.
- Gordon, Eric. M.A. 2016. Using land surface modeling to explore the influence of soil moisture on seedling recovery after wildfire.

### ***Non-Thesis Master's***

- Simms, Steven, M.B.S., 1994
- Van Everen, Heidi, M.B.S., 1995.
- Koenig, Jan, MA. 2013.

### ***Graduate Student Committees***

#### Ongoing (12)

Margaret Bowman PhD (ENVS), Teresa Chapman PhD (GEOG), Bryan Curtis MA (GEOG), Kelsey Elwood MA, Emily Fairfax PhD (Geology), Ashby Leavell PhD (ENVD/ENVS), Lisa Natale PhD, Kyle Rodman PhD (GEOG), Anna Spiers MA (EBIO), Alex Stum PhD (GEOG), Ashley Whipple MA (EBIO), Caitlin White MA (EBIO).

#### Completed

- 2018: Angela Boag PhD (ENVS), Sepideh Dadashi MA (GEOG),
- 2017: Amy Churchill PhD (EBIO)
- 2016: Eve Gasarch PhD (EBIO), Julia Hicks PhD (GEOG), Katherine Powell PhD (ENVS)
- 2015: Stower Beals PhD (EBIO), Chelsea Cook PhD (EBIO), Mari Elise Ewing PhD (ENVS), Meredith Gardner PhD (GEOG), Keith Krause PhD (Aerospace Engineering), Monica Rother PhD (GEOG), Kika Tarsi PhD (EBIO)
- 2014: Sarah Hart (GEOG) PhD.
- 2013: Ian Buller BA/MA, Joanna Chan (ENVS) PhD, Leigh Cooper PhD, Preston Cumming (Geography) PhD, Anna Maines MA.
- 2012: Kelli Archie (ENVS) PhD, Peter Erb MA, Heidi Guenther MA, James Meldrum (ENVS) PhD, Abbey Paulson MA.
- 2011: Lorine Giangola (ENVS) PhD.
- 2010: Anthony Darrouzet-Nardi PhD.
- 2009: Andrés Holz (Geography) PhD, Jia Hu PhD, David Knochel PhD, Juan Paritsis (Geography) PhD, Leticia Sanchez PhD.
- 2008: Nataly Ascarrunz PhD, Elisa Miller PhD, Nancy Pullen (Geography) MA.
- 2006: Andrés Holz (Geography) PhD, Daniel Liptzen PhD, Frank Witmer (Geography) PhD.
- 2005: Tina Bachmann PhD, David Conlin MA, Neil Frakes (Geography) MA, Bronwyn Owen (Geography) PhD, Heather Reed PhD, Laura Scott-Denton PhD, Jason Sibold (Geography) PhD.
- 2004: Kim Hye-Yin (Geology) MS, Karen Eisenhart (Geography) PhD, Brian Kurzel (Geography) MS, Kevin League (Geography) MA.
- 2003: J. Larson MA, Laura Mujica-Crapanzano PhD
- 2002: D. Kulakowski (Geography) PhD, J. Mangan (Geology) PhD.
- 2001: N. Khatib (Aerospace Engineering) PhD, D. Oline PhD, E. Paliouras (Aerospace Engineering) PhD.
- 2000: R. Cameron (Geography) MA.

1999: D. Bowling PhD, G. Gonzalez PhD, H. Grau (Geography) PhD, C. Richardson MA, S. Sherrod Ph.D.  
1998: W. Gould PhD, D. Hereid MA, A. Hopkins, PhD, K. Oleson (Aerospace Engineering) PhD, C. Ramos PhD, A. West PhD.

Prior to 1998

B. Bennett PhD, A. Hartz MA, N. Hedley (Geography) MA, N. Kelly (Geography) PhD, G. Asner (Geography) MA, P. Keating (Geography) PhD, J. Paruelo (Colorado State University, Rangeland Ecosystem Science) PhD, N. Auerbauch MBS. R. DeFusco PhD, J. Privette (Aerospace Engineering) PhD, T. Benning PhD, M. Shippert (Geology) MS.

### **Postdoctoral Associates**

Megan Cattau, 2016-2018, Earth Lab: Project Forest  
Ben Livneh, 2012-2013 (CIRES Visiting Postdoctoral Fellow)  
Greg Asner, 1998, ecosystem modeling in heterogeneous landscapes  
R. Flint Hughes 1999-2000, carbon pools in woody encroached grassland systems

### **Visiting CIRES Sabbatical Fellow**

David P. Turner, Integration of remote sensing and modeling for monitoring of terrestrial carbon flux. 2007/2008.

### **Undergraduate Education**

Honors Thesis Advisor:

Stine Skalmerud, EBIO, 2019.  
Michael Jones, ENVS, 2015: Your Golf Ball Isn't the Only Thing Going Into the Water: Examining Nutrient Enrichment in Aquatic Communities Downstream from Colorado Golf Courses. *Summa cum laude*  
Melanie Sarah Adams, General Studies, 2014: Outstanding Undergraduate of the College. Sustainable Production of Nutritious Food for Humanity: Food as the Nexus between Human Health, Environmental Resilience and Social Equity. *Summa cum laude*  
Sean Kuusinen, EBIO, 2014: Energy efficiency opportunity guide: a practical tool for reducing CO2 emissions and saving energy. *Summa cum laude*  
Cluckey, Danielle, ENVS, 2013: "Post-disturbance effects on snowmelt, soil moisture, and species composition in a subalpine conifer forest of Colorado". *Summa cum laude*.  
Regan, Brooke, EBIO, 2013: "Effects of logging on beetle kill forests of Northern Colorado". *Summa cum laude*.  
Bickham, Kelsey, EBIO, 2013: "Long-term effects of multiple disturbances on soil properties and regeneration in a Colorado subalpine forest". *Magna cum laude*.  
Katsos, Shannon, ENVS, 2013: "Short-term benthic macroinvertebrate response to fire and hydrologic event-induced changes in stream bed sediment in the Colorado Front Range". *Cum laude*.  
Rempel, Austin, EBIO, 2012: "Occurrence of forest remnants and patterns of conifer regeneration following multiple disturbances in the Colorado subalpine". *Summa cum laude*.  
Hayes, Julie, EBIO, 2009: "Spatial variation of soil moisture content in a multiply-disturbed Subalpine ecosystem of the Southern Rocky Mountains". *Cum laude*.  
Makar, Greg, EBIO, 2009: "Holmes, Transcendentalism, and Walden Pond: How the science of ecology influenced American legal precedent". *Magna cum laude*.  
Kemp, Kerry, EBIO, 2008: "The effects of compound disturbances on understory species composition in Subalpine forests of the Rocky Mountains". *Summa cum laude*.  
Jackson, Ashley, EBIO, 2008: "Factors affecting the spread of invasive American bullfrogs (*Rana catesbeiana*) throughout the landscape of North America", (co-advised with Alex Cruz). *Magna cum laude*.  
Sitzmann, Paul, EBIO, 2008: "Effects of multiple disturbances on the microclimate of a Subalpine forest".  
Klass, Jeremy, Environmental Studies, 2003. *Cum laude*.

Honor's Thesis Committees: 2019: Katelyn Sector, ENVD  
2017: Clea Bertholet, EBIO/GEOL

Torri Gladem, ENVS

2016: Jesse Nestler, Environmental Engineering and Geography  
 2016: Kate Wooley, EBIO  
 2011: Ashley Babcock, ENVS  
 2008: Jarvis, Dan, Geography  
 Marler, Justin Glen, Geography  
 2004: Sanderson, John Environmental Studies  
 1997: Sibold, Jason, Geography  
 1994: Sekardi, K., EPOB/Psychology  
 Hines, C., Geography

Independent Study/Research 17/18: Stine Skalmerud, Brianna Corsa  
 UCB Undergraduate 15/16: Genevieve Gaffigans, Miles Brous, Troy Zwolinski, Ryan Martin  
 Research Opportunities 13/14: Sean Kuusinen, Aaron Ramras, Matt Bitters, Scott Bucy, Eva Adler  
 12/13: Brooke Regen, Kelsey Bickham  
 11/12: Austin Rempel, Eva Adler, Danielle Cluckey  
 09/10: Roberto Gonzalez-Pita  
 08/09: Julie Hayes  
 07/08: Nina Xiong  
 05/06: Nathan Hawkey, Kerry Kemp, Julie Hayes  
 03/04: James Hurley, Loren Sackett, Sally Weyrauch  
 00/01: Paul Carpenter, Micah Lang, David Moerlein  
 99/00: Sarah Stanowicz, Kelley Miles

NSF Research Experiences 2004: James Hurley  
 For Undergraduates 2001: Micah Lang

## PROFESSIONAL SERVICE

### **National**

Reviewer: *Arctic, Antarctic, and Alpine Research; BioScience; Canadian Journal of Forest Research; Ecological Applications; Ecology; Ecosystems, Environmental Conservation; Global Change Biology, Global Ecology and Biogeography; Journal of Geophysical Research; Kluwer Publications; Photogrammetric Engineering & Remote Sensing; Remote Sensing of Environment*

*Environmental Research Letters*

Proposal Reviewer: National Aeronautics and Space Administration, National Science Foundation, U.S. Man and the Biosphere Program, National Geographic Society, Natural Sciences and Engineering Research Council of Canada, The Israel Science Foundation, US Department of Agriculture

Editorial Board: *Ecosystems* (1997- 2000), *Ecological Applications* (1998 – 2005)

### **Other:**

1988 Review Panel, NASA Earth Observing System, MODIS Team Members  
 1989 Invited Participant/Reviewer, US/EPA Environmental Monitoring and Assessment (EMAP): Workshop on Forest Indicators, Corvallis, Oregon.  
 1990-1993 Review Panel, NSF Ecosystem Studies Program  
 1994 Invited Participant/Reviewer, "Using inferential studies to assess ecosystem dynamics: a workshop in support of the IPCC process", SBI-EPA Cooperative Agreement for the Program on Global Climate Change", Research Triangle Park, North Carolina  
 1994-1997 Science Advisory Panel, NASA Earth Observing System Land Processes DAAC (Distributed Active Archive Center)

1997 Reviewer, NSF Sevilleta LTER Site Visit, New Mexico  
2004 Institute of International Education, U.S. Student Fulbright Program National Screening Committee  
2005 Institute of International Education, U.S. Student Fulbright Program National Screening Committee  
2005 National Ecological Observatory Network (NEON) Design Consortium: Facilities and Infrastructure Committee (Sensors and Sensor Networking Subcommittee)  
2006 Southern Plains Inventory and Monitoring Network, National Park Services, Vital Signs Prioritization Workshop  
2006 NEON Red Team Review, Denver, CO 11 May 2006.  
2007 Advisory team, NCAR/Earth Observing Lab CAPRIS program  
2007-2008 Committee for the Expert Review of SAP 4.3 (CERSAP), Climate Change Science Program Synthesis and Assessment: The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity.  
2008 NASA Astrobiology Institute Workshop: "New Paradigms for Remote Sensing and Monitoring of Microbial Ecosystems", M. Sogin (PI), Co-PIs: M. Mumma, N. Pace. Jan 2008, Boulder CO  
2012 Invited Reviewer, 2011 Lake Tahoe Threshold Evaluation Report prepared by the Tahoe Regional Planning Agency (TRPA)  
2012-2013 Member, Executive Board, NOAA/CIRES Western Water Assessment  
2016 Invited Expert Review, Tahoe Regional Planning Agency's 2015 Threshold Evaluation Report  
2016 External Program Reviewer, University of Wisconsin Nelson Institute for Environmental Studies

### **University of Colorado**

#### *Department/Institute*

1991 Member, Self-Study Review Team, CIRES  
1992-1993 Ball Aerospace Corporation Liason to EPOB  
1992 August Advising, EPOB  
1992-1999 EPOB Greenhouse & Plant Chambers Committee  
1992-1993 Honors Committee  
1992 Reappointment Committee for CIRES Fellow Shelley Copley  
1992-1996 Personnel Committee, CIRES  
1992-1996 Strategic Planning Committee, CIRES  
1992-1993 Search, Geophysicist, Geology/CIRES  
1993-1994 EPOB Executive Committee  
1993-1994 Search, Environmental Microbiologist, EPOB  
1994 Reappointment Committee for CIRES Fellow Howard Hansen  
1994 August Advising, EPOB  
1994 Chair, Instructor Reappointment Committee (LeMieux), EPOB  
1994-1995 Search Committee, Biogeochemist, EPOB/INSTAAR  
1994-1995 Chair, Search Committee, Environmental Microbiologist, EPOB/CIRES  
1995-1999 Steering Committee, Biosphere/Atmosphere Research Training Grant, EPOB  
1995-1999 CIRES Executive Committee  
1996 August Advising, EPOB  
1997 August Advising, EPOB  
1997-1998 EPOB Executive Committee  
1998-1999 EPOB Graduate Committee  
1998-1999 Search Committee, Climatologist/Remote Sensing, CIRES  
2001-2003 EPOB Teaching Evaluation Committee, Chair 2001-2002  
2001-present CIRES Theme Leader, Planetary Metabolism  
2002-2003 EPOB Executive Committee  
2002-2004 CIRES Executive Committee

2003-2004 EPOB Graduate Committee  
 2003-2006 CU Graduate Curriculum Committee  
 2004-2005 EBIO Executive Committee  
 2004-2005 Search Committee, Anthropogenic Perturbations of Ecosystems, CIRES  
 2004-2005 Co-Chair, CIRES Career Track Guidelines Committee  
 2005 EBIO Post-Tenure Review Committee  
 2005 EBIO Instructor Reappointment Committee Chair (John Basey)  
 2005-2006 EBIO Undergraduate Curriculum Committee  
 2006 EBIO Faculty Merit Committee  
 2005-2007 CIRES Associate Director, Environmental Biology Division  
 2007-present CIRES Associate Director, Ecosystem Science Division  
 2005-present CIRES Executive Committee  
 2006-2007 CIRES Faculty Search Committee, Director, Center for the Study of Earth from Space  
 2007-2008 EBIO Instructor Reappointment Committee (Stephanie Mayer)  
 2007-2008 CIRES New Fellows Committee  
 2008 EBIO Merit Committee  
 2008-2009 CIRES Visiting Fellows Committee  
 2008-2009 CIRES Professional Masters in Remote Sensing Committee  
 2009-2010 EBIO Merit Evaluation Committee  
 2009-2010 EBIO Promotion Committee – Sharon Collinge  
 2009-2010 EBIO Teaching Evaluation Committee  
 2010-2011 EBIO Barger Comprehensive Review Committee  
 2010-2011 EBIO Graduate Committee  
 2011 CIRES Visiting Fellows Committee  
 2011 Post-Tenure Review Committee: William M. Lewis  
 2011-2012 ENVS, Search Committee, Colorado Endowed Chair  
 2011-2012 EBIO Merit Evaluation Committee  
 2012-2013 ENVS Visioning Committee, Chair  
 2012-2013 CIRES Career Track Committee  
 2014-2015 CIRES Hydrologist Search Committee  
 2012 – 2015 EBIO Executive Committee  
 2012 – 2105 EBIO Associate Chair for Undergraduate Studies  
 2012 – 2015 EBIO Curriculum Committee, Chair  
 2014 – present ENVS Awards Committee  
 2016 CIRES Visiting Fellows Committee, Chair  
 2016 – present ENVS Director  
 2017 CIRES Director Reappointment Committee  
 2017 EBIO Fierer Promotion to Full Professor Committee  
 2016 – present Ex-Officio Advisory Board member, Masters of Environment  
 2017 – present MENV Curriculum Committee member  
 2017 – present MENV Operations Committee member

*College/University/Professional*

2004 Chair, CU PRP Geological Science Internal Review Committee  
 2005 Leadership Education for Advancement & Promotion (LEAP), Advanced Workshop  
 2006-present Director's Advisory Committee for the CU Boulder Environmental Program  
 2010-2011 Computer Science Internal Review Committee, Academic Review and Planning (ARP)  
 2010-present Provost's Grievance Committee  
 2007-2010 Vice Chancellor's Advisory Committee (VCAC)  
 2011-2015 Academic Review and Planning Advisory Committee (ARPAC).  
 2014, 2015 Dean's Graduate Student Research Grants selection committee  
 2014-2015 Chair, School for Environment and Sustainability, Environmental Science Working Group  
 2015-2016 Arts and Sciences Council ad hoc Core Revision Committee

2016 Provost's Advisory committee  
 2016 – present Campus Salary Equity Appeals Committee  
 2016 – present Community Engagement, Design and Research Center (CEDaR), Executive Committee  
 2016 – present SEEC Executive Committee  
 2017 – present Academic Futures Committee  
 2018 – present Provost Committee on Academic Reorganization, Steering Committee  
 2018 – present Foundations of Excellence Academic Advising Committee

**Other Activities**

1989-1991 Member, NASA's Land Aircraft Science Management Operations Working Group  
 1989-1994 Science Advisory Team Member, NASA Earth Observing System, High Resolution Imaging Spectrometer (HIRIS) Facility  
 1990 Invited participant, Workshop on Scaling Physiological Processes: Leaf to Globe, Snowbird, Utah.  
 1990 Invited participant, US/USSR Working Group Implementation Meeting for Monitoring Global Primary Productivity and Boreal Forest Studies. Durham, New Hampshire  
 1990 Invited participant, NASA's Oregon Ecosystem Transect Project OTTER, Eugene, OR  
 1990 Invited participant, NASA's Forest Ecosystem Dynamics Project (FED), Howland, ME  
 1991 Co-Chairperson, NASA Workshop on Remote Sensing of Biochemical Content of Plant Canopies, San Francisco, California  
 1991 NASA Boreal Ecosystem-Atmosphere Study (BOREAS), Planning Workshop, Saskatoon, Canada  
 1991 Invited participant, International Geosphere-Biosphere Program, Workshop on Requirements for Global Scale Terrestrial Biospheric Data, Toulouse, France  
 1991 Selected participant in Joint Soviet-American Sayans-91 Experiment, USSR  
 1992 NSF Long Term Ecological Research / NASA Joint Remote Sensing Workshop, Albuquerque, NM  
 1994 Session Chair, First Science Conference of the Global Change and Terrestrial Ecosystem (GCTE) Core Project of the International Geosphere-Biosphere Programme (IGBP), Woods Hole, MA  
 1994 NASA's Earth Observing System Investigator's Working Group, Baltimore, MD  
 1995 Chair, Session on "Observation and Monitoring", The Fifth Annual Global Change and Environmental Quality Program Symposium, Monitoring and Prediction of Global Environmental Change, University of Colorado, CO  
 1995-1998 Member, Science Advisory Team, TRW/NASA Lewis Instrument  
 1997 Investigator, NASA Jornada Prototype Validation Exercise (PROVE), Jornada LTER site, NM  
 1998 Invited participant, 82nd Dahlem Workshop on "Integrating Hydrology, Ecosystem Dynamics, and Biogeochemistry in Complex Landscapes", 18-23 January 1998, Berlin, Germany.  
 1998 Chair, Strategic Questions breakout group, NASA's LCLUC Second Science Team Meeting, Warrenton, Virginia.  
 1998 Scientific Expert, NASA's Earth Science Enterprise Post-2002 Missions. Land Cover and Terrestrial Ecology Research and Applications  
 2001 NSF LTER Workshop on Landscapes and Scaling. Sevilleta LTER Fieldstation, New Mexico. Invited participant.  
 2002 NASA Land Use/Land Cover Change program. PI Meeting. Baltimore, MD.  
 2003 Co-organizer of CIRES Planetary Metabolism Theme Symposium: "Environmental Responses to Anthropogenic Perturbations". 21 Feb 2003.  
 2004-2005 Institute of International Education, U.S. Fulbright Program National Screening Committee  
 2007 Proposal Reviewer, Canon National Parks Science Scholars Program for the Americas. National Park Service, Canon USA, and AAAS.  
 2007 Participant, BEACHON retreat (Bio-hydro-atmosphere interactions of Energy, Aerosols, Carbon, H<sub>2</sub>O, Organics and Nitrogen), NCAR, Colorado.  
 2008 NASA Astrobiology Institute Workshop: "New Paradigms for Remote Sensing and Monitoring of Microbial Ecosystems", M. Sogin (PI), Co-PIs: M. Mumma, N. Pace. Boulder CO

- 2009 CIRES Western Water Assessment, Making Connections: Pine Beetles, Water, Climate, Fire, and the Future Forest, David Skaggs Research Center, NOAA, 7 Dec 2009
- 2010 CIRES Western Water Assessment, Mountain Pine Beetle Science Symposium: Impacts on the Hydrologic Cycle and Water Quality, National Center for Atmospheric Research, 8 April 2010
- 2012 Invited speaker, ENVS Colloquium. Commentary on J. Timmons Roberts (Brown University), "Managing \$30 Billion for Sustainability: Tracking, Evaluating and Improving 'Fast Start' Climate Change Finance. April 25. CU.
- 2012 Participant. Fourth Forest Vegetation Simulator (FVS) Conference, Fort Collins, CO. April 17-19, 2012.
- 2012 Invited speaker, CU Peak to Peak Project Workshop, August 20, 2012. "Teaching sustainability: land resources, sustainability and climate change."
- 2012 Scientific Review Panel Member, Tahoe Regional Planning Agency's 2011 Threshold Evaluation Report, California Tahoe Conservancy.
- 2014 Scientific Review Panel Member, Upper Truckee River (UTR) and Marsh Restoration Project, Preferred Alternative Selection Criteria, California Tahoe Conservancy.
- 2016 Mentored BHS high school student on research project (Ben Webb); won 1<sup>st</sup> prize in Regional Science Fair in the plant science category