

Susan E. Trumbore

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Education B.S. (1981) Geology, University of Delaware
M. A. (1983), M. Phil. (1987), and PhD. (1989) Geochemistry, Columbia University.

Honors 1993-98 National Young Investigator (National Science Foundation)
1993 University of Delaware Presidential Citation for Outstanding Achievement
1996 Distinguished Assistant Professor Award for Research, UC Irvine
1997 - 98 Bullard Fellow, Harvard University
1997, 2004 Editor's Citation for Excellence in Refereeing (*Global Biogeochem. Cycles*)
1999 Clara Barton Spectrum Award for Outstanding Women in Orange County -
Environment Award (Red Cross of Orange County)
2002-2004 Elected President, Biogeosciences Section, American Geophysical Union
2005 Elected Fellow of the American Geophysical Union
2006 Fellow AAAS

Research Interests Use of isotopes and tracers to study the sources, transformations, and fate of important atmospheric trace gases. Application of accelerator mass spectrometry measurements of ^{14}C to problems in ecology, soil biogeochemistry and terrestrial C cycling.

Employment

Assistant Professor (1991- 1996), Associate Professor (1996 -2000) and Professor of Earth System Science. University of California, Irvine.

Post-doctoral Researcher, Center for Accelerator Mass Spectrometry, Lawrence Livermore Laboratory, 1989 - 1991.

Post-doctoral Researcher, Lamont-Doherty Geological Observatory and Swiss Federal Institute of Technology 1988 - 1989 .

Graduate Research Assistant (Columbia University LDGO), 1981 - 1988.

Service

Committees: AGU Paleoclimatology and Paleoclimate Committee (1996-2000); AGU Committee on Global Environmental Change (2000-2001), AAAS nominating committee, Geology and Geography Section (2002-2005; Chair in 2005); 2004-5 NRC Committee on Metrics for Global Change Research, UCAR Visiting Scientist Program steering committee (2004-2006).

President: American Geophysical Union Biogeochemistry Section (7/02-7/04)

Advisory Boards: University of California Institute for Geophysics and Planetary Physics; NOSAMS Accelerator Mass Spectrometry facility, Woods Hole Oceanographic Institution, NASA ESAAC (Earth Science and Applications Advisory Board), Fachbeirat for Max Planck Institute for Biogeochemistry (Jena, Germany)

Editorial Board: Geology Magazine (1994-1997)

Contributions to Assessments: IPCC Land use, Land Use Change, and Forestry (2001)

Education:

Founding member, Dept of Earth System Science, UC Irvine. Courses developed and taught include:

ESS1 The Physical Environment (earth system science breadth course for nonscientists)

H90 The Idiom of Science (honors course in earth system science for nonscientists)

ESS 14 Geology. Geology course for non-scientists.

ESS 101/201 Earth Systems: The Atmosphere (core course for graduate curriculum and undergraduate Major and Minor in Earth System Science)

ESS 20E, F The Global Environment I and II (non-science majors course in global environmental topics, satisfies UCI's science breadth requirement)

ESS51 Land Interactions, core course for the Earth and Environmental Science major.

ESS 231 Topics in Biogeochemistry (Graduate): Isotopes and tracers in trace gas biogeochemistry (1995); Biosphere-Atmosphere Trace Gas Exchange (1996); The Carbon Cycle (1998)

ESS 202 Atmospheric and Environmental Chemistry.

Lecturer for the Short Course, *Stable Isotopes in Ecology*, University of Utah, 1996-2002 (organized by Jim Ehleringer).

Co-teacher of Short Course, *Stable Isotopes in Environmental Science*, Universidad Federal do Acre, Rio Branco, Acre, Brazil, July, 1999 (in portuguese).

Organizer (with Ted Schuur, Univ. Florida Gainesville) of a short course: Radiocarbon in Ecology and Earth System Science, taught annually (starting 2004) at the WM Keck Accelerator Mass Spectrometry Facility.

Postdoctoral Researchers

Dr. Margaret Torn (9/94 – 9/97) Now at Lawrence Berkeley Laboratory/ Adjunct at UC Berkeley

Dr. Andrea Cook (partial; 3/97 - 3/98)

Dr. Jeffrey Q. Chambers (6/98- 3/02) Now Asst. Prof. Tulane University

Dr. Edward A. G. Schuur (6/99 – 1/02) Now Asst. Prof. University of Florida

Dr. Tibisay Pérez (10/99 – 8/02) Now Professor, IVIC, Caracas, Venezuela

Dr. Claudia Czimczik (7/03 – present)

Dr. Christiane Kramer (10/05 – present)

Ph.D. Students: Tibisay Pérez (Ph.D. 8/99), Adam Hirsch (Ph. D. 1/01), Julia Gaudsinki (Ph. D. 2/01), Enir Salazar da Costa (MSc 6/02), Luz Maria Cisneros Dozal (Ph.D 12/05), Mariah Carbone (continuing), Nichole Nowinski (continuing).

Peer-Reviewed Publications

- Peng, T.-H., W. S. Broecker, H. D. Freyer and Susan Trumbore, A deconvolution of the tree ring based ^{13}C record: *Journal of Geophysical Research* 88:3609 – 3620 (1983).
- Toggweiler, J. R., and Susan Trumbore, Bomb-test ^{90}Sr in Pacific and Indian Ocean surface water as recorded by banded corals: *Earth Plan. Sci. Lett.*, 74: 306 – 314 (1985).

1989

- Trumbore, S. E., *Carbon cycling and gas exchange in soils*: PhD thesis, Columbia University, 194p (1989).
- Trumbore, S. E., J. S. Vogel, J. R. Southon, AMS ^{14}C measurements of fractionated soil organic matter: an approach to deciphering the soil carbon cycle, *Radiocarbon* 31: 644-654 (1989).
- Damon, P. E. and 20 others, Radiocarbon dating of the Shroud of Turin: *Nature* 337:611-615 (1989).
- Broecker, W. S., S. Trumbore, G. Bonani, W. Wölfli and M. Klas, Anomalous AMS radiocarbon ages for foraminifera from high-deposition rate ocean sediments, *Radiocarbon* 31:157-162 (1989).
- Broecker, W. S., J. P. Kennett, J. Teller, S. Trumbore, G. Bonani and W. Wölfli, The routing of Laurentide ice-sheet meltwater during the Younger Dryas cold event, *Nature* 341:318 – 321 (1989).

1990

- Trumbore, S. E., G. Bonani and W. Wölfli, The rates of carbon cycling in several soils from AMS ^{14}C measurements of fractionated soil organic matter, in, A.F. Bouwman, ed, *Soils and the Greenhouse Effect*, J. Wiley and Sons, p. 407-414 (1990).
- Trumbore, S. E., S. C. Wofsy, M. Keller, and J. M. da Costa, Measurements of soil and canopy exchange rates in the Amazon rain forest using ^{222}Rn , *Journal of Geophysical Research* 95: 16,865 - 16,875 (1990).
- Anderson, R. F., Y. Lao, W. S. Broecker, S. E. Trumbore, H. J. Hofmann, and W. Wölfli, Boundary scavenging in the Pacific Ocean: a comparison of ^{10}Be and ^{231}Pa , *Earth Plan. Sci. Lett.* 96: 287-304 (1990).
- Bakwin, P. S., S. C. Wofsy, S-M Fan, M. Keller, S. Trumbore and J. M. da Costa, Emission of nitric oxide (NO) from tropical forest soils and exchange of NO between the forest canopy and atmospheric boundary layers, *Journal of Geophysical Research* 95: 16,745 - 16,755 (1990).
- Broecker, W. S., M. Klas, E., S. Trumbore, G. Bonani, and W. Wölfli, Accelerator Mass Spectrometric Measurements on foraminifera from deep ocean sediments, *Radiocarbon* 32: 119-135 (1990).
- Schiff, S. L., R. Aravena, S. E. Trumbore, and P. J. Dillon, Contribution of carbon isotopes to the understanding of the cycling of dissolved organic carbon in forested water sheds, *Water Resources Research* 26: 2949-2957 (1990).

Broecker, W. S., T.-H. Peng, S. Trumbore, B. Bonani, W. Wölfli, The distribution of Radiocarbon in the Glacial Ocean, *Global Biogeochemical Cycles* 4: 103-117 (1990).

1991

Trumbore, S. E., S. S. Jacobs and W. M. Smethie, Jr., Chlorofluorocarbon evidence for rapid ventilation of the Ross Sea, *Deep-Sea Research* 38:845-871 (1991).

Trumbore, S. E., J. R. Southon, R. C. Finkel, M. W. Caffee and J. S. Vogel, AMS Research in Global Climate Change: *Energy and Technology Review* (LLNL publication), May-June issue (1991).

Loyd, D., J. S. Vogel and S. E. Trumbore, Lithium contamination in AMS measurements of ^{14}C : *Radiocarbon* 33:297-301 (1991).

1992

Trumbore, S. E., S. Schiff, R. Aravena, R. Elgood and P. Dillon, Sources of dissolved organic carbon in surface and groundwaters in a forested catchment: the role of soils. *Radiocarbon* 34: 626-635 (1992).

Aravena, R., S. L. Schiff, S. E. Trumbore and R. Elgood, Evaluating Dissolved Inorganic Carbon in Forested Lake Watershed Using Carbon Isotopes: *Radiocarbon* 34: 636-645 (1992).

Lao Y, R F Anderson, W S Broecker, S E Trumbore, H J Hofmann and W Wölfli, Average flux of ^{10}Be in the Pacific Ocean: implication for higher average global production rate of ^{10}Be during the Last Glacial Maximum. *Nature* 357:576 –578 (1992).

Lao Y, R F Anderson, W S Broecker, S E Trumbore, H J Hofmann and W Wölfli, Transport and Burial rates of ^{10}Be and ^{231}Pa in the Pacific Ocean during the Holocene period, *Earth Planetary Science Lett.* 113: 173-189 (1992).

Van Geen, A, S N Luoma, R Anima, H E Clifton and S Trumbore, Cd/Ca ratios in foraminifera from San Francisco Bay: Evidence for decreased upwelling off California over the past 4000 years. *Nature* 358:54-56 (1992).

Southon, J. R., J. S. Vogel, S. E. Trumbore, J. C. Davis, and others, 1992. Progress in AMS measurements at the LLNL spectrometer. *Radiocarbon* 34:473-477 (1992).

1993

Trumbore, S. E., Comparison of carbon dynamics in two soils using measurements of radiocarbon in pre-and post-bomb soils. *Global Biogeochemical Cycles* 7:275-290 (1993).

Mayer, L. M., P. A. Jumars, G. L. Taghon, S. A. Macko and S. Trumbore, Low-density particles as potential nitrogenous foods for benthos. *Journal of Marine Research* 51: 373-389 (1993).

Wang, Y., R. Amundson and S. Trumbore, Processes controlling the ^{14}C content of soil carbon dioxide: Model development. *Chemical Geology* 107:225-226 (1993).

1994

- Anderson, R. F., G. T. Rowe, P. Kemp, S. Trumbore, and P. E. Biscaye, Carbon Budget for the Mid-Slope Depocenter of the Middle Atlantic Bight: A Test of the Shelf Export Hypothesis: *Deep-Sea Research II* 41: 669-703 (1994).
- Amundson, R. A., O. Chadwick, L. McFadden, S. Trumbore, S. Wells and M. DeNiro, Factors affecting the Carbon-14 content of pedogenic carbonate in desert soils, *Earth and Planetary Science Letters*, 125: 385-405 (1994).
- Wang, Y., R. Amundson and S. Trumbore, A model for soil $^{14}\text{CO}_2$ and its implications for using ^{14}C to date pedogenic carbonate, *Geochimica et Cosmochimica Acta*, 58:393-399 (1994).
- Pendall, E. G., J. W. Harden, S. E. Trumbore and O. Chadwick, Isotopic approach to soil-carbonate dynamics: implications for paleoclimatic interpretations, *Quaternary Research*, 42:60-71 (1994).
- Nepstad, D. C., C. Reis de Carvalho, E. Davidson, P. Jipp, P. Lefebvre, G. H. Negreiros, E. Dias da Silva, T. Stone, S. Trumbore and S. Vieira, Deforestation effects on water and carbon cycles in the Amazon Basin: the role of deep roots, *Nature* 372: 666-669 (1994)

1995

- Trumbore, S. E., Use of isotopes and tracers in the study of emission and consumption of trace gases in terrestrial environments, chapter 9 in: Matson, P and Harriss, R, (eds). *Biogenic Trace Gases: Measuring Emissions from Soil and Water*, Blackwell, Oxford, p. 291-326 (1995).
- Trumbore, S. E. and E. R. M. Druffel, Carbon isotopes for characterizing sources and turnover of non-living organic matter, in, Zepp, R. G. and Ch. Sonntag, (eds) *Role of Non-Living Organic Matter in the Earth's Carbon Cycle*, John Wiley and Sons, p. 7-22 (1995).
- Trumbore, S. E., E. A. Davidson, P. B. de Camargo, D. C. Nepstad and L. A. Martinelli, Belowground cycling of carbon in forests and pastures of Eastern Amazonia, *Global Biogeochemical Cycles* 9:515-528 (1995).
- Davidson, E. A. and S. E. Trumbore. Gas diffusivity and production of CO_2 in deep soils of the eastern Amazon, *Tellus*. 47B: 550-565 (1995).
- Townsend, A. R., P. M. Vitousek and S. E. Trumbore, Soil organic matter dynamics along gradients of temperature and land-use on the Island of Hawai'i, *Ecology*, 76:721-733 (1995).
- Santschi, P. H., L. Guo, M. Baskaran, S. Trumbore, J. R. Southon, T. S. Bianchi, B. Honeyman, and L. Cifuentes, Isotopic and biochemical evidence for the recent origin of colloidal organic matter in the ocean, *Geochim. Cosmochim. Acta*.59: 625-631 (1995).
- Camargo, P.B., R. de P. Salomão, S. Trumbore and L. A. Martinelli, How old are large Brazil-nut trees (*Bertholletia excelsa*) in the Amazon?, *Scientia Agricola* 51:389-391 (1995).
- Davidson, E. A., D. C. Nepstad, C. Klink and S. Trumbore, Pasture soils as carbon sinks, *Nature* 376: 472-473 (1995).
- Victoria RL, Fernandez FA, Martinelli LA, Piccolo MC, Camargo PB, and Trumbore S., Past Vegetation Changes in the Brazilian Pantanal Arboreal-Grassy Savannah

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- ONeill, K.P., J.W. Harden, S.E. Trumbore, M.O. Bentley, G.W. Winston, and B.B. Stephens. 1995a. Boreal Ecosystem Atmosphere Study (BOREAS):1993 site descriptions and field notes; Thompson, Manitoba. U.S.Geological Society Open-File Report 95-488 .
- ONeill, K.P., J.W. Harden, S.E. Trumbore. 1995b.Boreal-Ecosystem-Atmosphere Study (BOREAS): 1993 laboratory data and notes; Thompson, Manitoba. U.S. Geological Survey Open-File Report 95-565.

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- Trumbore, S. E. Measurement of cosmogenic isotopes by accelerator mass spectrometry: applications to soil science, p. 311-340 in *Mass Spectrometry of Soils*, T. Boutton and S. Yamasaki, eds, Marcel Dekker (New York) (1996).
- Overpeck, J. T., D. Anderson, S. Trumbore and W. Prell, The southeast Indian monsoon over the last 18,000 years: *Climate Dynamics, 99*: 213-225 (1996).
- Hughen, K. A., J. T. Overpeck, L. C. Peterson, and S. Trumbore, Rapid climate changes in the tropical Atlantic region during the last deglaciation, *Nature 380*: 51-54 (1996).
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- Wang, Y., R. Amundson and S. Trumbore, Radiocarbon dating of soil organic matter. *Quaternary Research 45*:282-288.
- Guo, L., P. H. Santschi, L. A. Cifuentes, S. Trumbore and J. Southon, Cycling of high molecular weight dissolved organic matter in the Middle Atlantic Bight, *Limnology and Oceanography 41*:1242-1252 (1996).

1997

- Trumbore, S. E., Potential Responses of Soil carbon to Global Change, *Proceedings Natl. Acad. Sciences 94*: 8,284-8,291 (1997).
- *Torn, M. S., S. E Trumbore, O. A. Chadwick, P. M. Vitousek and D. Hendricks, Mineral control of soil organic carbon storage, *Nature 389*:170-173 (1997).
- Trumbore, S E, and Zheng, S. Comparison of fractionation methods for soil ¹⁴C analysis, *Radiocarbon 38*:219-229 (1997).
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- Winston, G., E. T. Sundquist, B. B. Stephen and S. E. Trumbore, Winter CO₂ fluxes in a boreal forest, *JGR Atmospheres* 102:28,795-28,804 (1997).
- Schiff, S. L., R. Aravena, S. E. Trumbore, M. J. Hinton, R. Elgood, P. J. Dillon, Export of DOC from forested catchments on the Precambrian Shield of Central Ontario: Clues from ¹³C and ¹⁴C, *Biogeochemistry* 36:43-65 (1997).
- Lin, H-L, L. C. Peterson, J. T. Overpeck, S. E. Trumbore, D. W. Murray, Late Quaternary climate change from 18O records of multiple species of planktonic foraminifera: high-resolution records from the anoxic Cariaco Basin, Venezuela, *Paleoceanography* 12:415-427 (1977).
- Zimov, S. A., Y.V. Voropaev, I.P. Semiletov, S.P. Davidov, S.F. Prosiannikov, F.S. Chapin, III, M.C. Chapin, S. Trumbore, and S. Tyler. North Siberian Lakes: A Significant Methane Source Fueled by Pleistocene Carbon, *Science* 277:800-802 (1997).

1998

- Goulden, M. L., S. C. Wofsy, J. W. Harden, S. E. Trumbore, P. M. Crill, S. T. Gower, T. Fries, B. C. Daube, S-M. Fan, D. J. Sutoon, A. Bazzaz, J. W. Munger. Sensitivity of boreal forest carbon balance to soil thaw, *Science* 279:214-217 (1998).
- Trumbore, S.E., Radiocarbon geochronology, in, J. M. Sowers, J. S. Noller and W. R. Lettis, eds., *Dating and Earthquakes: Review of Quaternary Geochronology and its Application to Paleoseismology*: NUREG-5562, US Nuclear Regulatory Commission, Washington DC, pp.2-69 – 2-101 (1998).
- *Rapalee, G., S. E. Trumbore, E. A. Davidson, J. W. Harden and H. Veldhuis, Scaling soil C stocks and fluxes in a boreal forest landscape, *Global Biogeochemical Cycles*, 12: 687-701 (1998).
- Schiff, S., Aravena, R., Mewhinney, E., Elgood, R., and others, Precambrian shield wetlands: Hydrologic control of the sources and export of dissolved organic matter, *Climatic Change*, 40: 167-188., 1998.
- Wang, Y., T. G. Huntington, L. J. Osher, L. I. Wassenaar, S. E. Trumbore, R. G. Amundson, J. W. Harden, D. M. McNight, S. L. Schiff, G. R. Aiken, W. B. Lyons, R. O. Aravena and J. S. Baron, Carbon Cycling in Terrestrial Environments, in, C. Kendall and J. J. McDonnell, eds., *Isotope Tracers in Catchment Hydrology*, Elsevier Science B.V., 1998., pp.577-610.

1999

- Camargo, P, S E Trumbore, LA Martinelli, E A Davidson, D C Nepstad, R Victoria, Carbon Dynamics in Regrowing Forest of Eastern Amazonia, *Global Change Biology* V5(N6):693-702 (1999).
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- in soils. *Global Biogeochemical Cycles* 13:47-58 (1999).
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- *Chambers, J Q and S. E. Trumbore, An age old problem. *Trends in Plant Science* 4:385-386 (1999).
- Richter, D. D., D. Markewitz, S. E. Trumbore and C. G. Wells, Rapid carbon accumulation and turnover in an aggrading forest, *Nature* 400:56-58 (1999).

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- *Chambers, J. Q., N. Higuchi, E. S. Tribuzy, S. Trumbore, Carbon sink for a century, *Nature* V410: 429 (2001).
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2002

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- *Schuur, E. A. G., Michelle C. Mack, Jennifer W. Harden, and Susan E. Trumbore, The isotopic composition of carbon dioxide from a boreal forest fire: inferring carbon loss from measurements and modeling, *Global Biogeochem. Cycles* Vol. 17 No. 110.1029/2001GB00184 (2003).
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 - *Telles, E., P. Camargo, L. M. Martinelli, S. E. Trumbore, E. Salazar da Costa, J. dos Santos, N. Higuchi, R. Cosme Oliveira, Influence of Soil Texture on Carbon Dynamics and Storage Potential in Tropical Forest Soils of Amazônia, *Global Biogeochemical Cycles* (2003)
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Biographical Sketch – Susan Trumbore

Susan Trumbore is Professor of Earth System Science and Director of the new UCI branch of the UC Institute for Geophysics and Planetary Physics. She received a B.S. in geology from University of Delaware (1981) and Ph.D. in geology and geochemistry from Columbia University's Lamont-Doherty Geological Observatory (1989). After postdoctoral work at the Swiss Federal Institute of Technology and Lawrence Livermore National Laboratory, she joined the Earth System Science faculty at UC Irvine as a founding member in 1991. Trumbore studies how the Earth's natural exchanges of carbon among ocean, land and atmosphere are altered by human activity. She uses the distribution of radiocarbon added to the atmosphere in the 1960s during nuclear weapons testing to determine the time scale of carbon exchange between ecosystems (plants and soils) and the atmosphere. With Ellen Druffel and John Southon, she established the W.M. Keck Carbon Cycle Accelerator Mass Spectrometry Facility at Irvine in 2002. She has authored more than ninety articles in scientific journals.

Professor Trumbore was honored by the National Science Foundation in 1993 when she was selected to receive the prestigious National Young Investigator award. She has also been recognized with awards from the University of Delaware and UC Irvine. She served as the first elected President of the Biogeosciences Section of the American Geophysical Union (2002-2004) and was elected a Fellow of the AGU and AAAS in 2005.