Final progress report for South Dakota State University's NASA grant number NNX08AL99G entitled Land Cover and Land Use Change program grant, PRODUCING COMPOSITE IMAGERY AND FOREST COVER AND CHANGE CHARACTERIZATIONS FOR THE HUMID TROPICS - A CONTRIBUTION TO THE MDGLS ACTIVITY, submitted by project PI, Matthew C. Hansen.

This project led to first of their kind Landsat scale quantification of gross global forest cover extent and loss the Democratic Republic of Congo, Indonesia and European Russia. Analyses led by Matthew Hansen, Professor at SDSU, Peter Potapov, Research Assistant Professor, SDSU, and Mark Broich, PhD student at SDSU, resulted in the following publications:

Broich, M., Hansen, M., Stolle, F., Potapov, P., Margono, B.A. and Adusei, B., 2011, Remotely sensed forest cover loss shows high spatial and temporal variation across Sumatra and Kalimantan, Indonesia 2000-2008, *Environmental Research Letters*, 6(1), doi:10.1088/1748-9326/6/1/014010.

Broich, M., Hansen, M.C., Potapov, P., Adusei, B., Lindquist, E., Stehman, S.V., 2011, Time-series analysis of multi-resolution optical imagery for quantifying forest cover loss in Sumatra and Kalimantan, Indonesia, *International Journal of Applied Earth Observation and Geoinformation*, 13, 277-291.

Potapov, P., Turubanova S., Hansen M.C., 2011, Regional-scale boreal forest cover and change mapping using Landsat data composites for European Russia, *Remote Sensing of Environment, 115*, 548-561

Bankanza, J-R.B., Hansen, M.C., Roy, D.P., DeGrandi, G., and Justice, C.O., 2009, Wetland mapping in the Congo Basin using optical and radar remotely sensed data and derived topographical indices, *Remote Sensing of Environment*, 114, 73-86.

Lindquist, E. J., Hansen, M. C., Roy, D.P., and Justice, C.O., 2008, The suitability of decadal image data sets for mapping tropical forest cover change in the Democratic Republic of Congo: implications for the global land survey, *International Journal of Remote Sensing*, 29, 7269-7275.

Hansen, M.C., Roy, D., Lindquist, E., Justice, C.O., and Altstaat, A., 2008, A method for integrating MODIS and Landsat data for systematic monitoring of forest cover and change in the Congo Basin, *Remote Sensing of Environment*, 112, 2495-2513.

In addition, numerous presentations on our global forest monitoring work were made, with the following as examples:

Hansen, M.C., Potapov, P., Broich, M., Turubanova, S., Adusei, B., and Arunarwati, B., National scale disturbance mapping in support of REDD monitoring systems, American Geophysical Union Annual Meeting, San Francisco, CA, December 13-17, 2010.

Hansen, M.C., Google Earth Engine, UNFCCC Conference of the Parties 16 side-event sponsored by Google, (presented on Landsat data policy and cloud computing, with Mexico example), Cancun, Mexico, December 2, 2010.

Hansen, M.C., Fundamentals of remote sensing and forest cover and change mapping, Technical Training and Planning Workshop – Quantifying Forest Degradation and Associated Greenhouse Gas Emissions in the Republic of Congo, Brazzaville, Republic of Congo, October 12-18, 2010.

Hansen, M.C., Mane, L., and Souza, C., Présentation des méthodologies de mesure et de suivi des changements de la couverture forestière et de la dégradation, Technical Training and Planning Workshop – Quantifying Forest Degradation and Associated Greenhouse Gas Emissions in the Republic of Congo, Brazzaville, Republic of Congo, October 12-18, 2010.

Hansen, M.C., Potapov, P.V., Broich, M., and Arunarwati, B., Monitoring Indonesia forest cover and change, U.S. Forest Service meeting on REDD Monitoring, Reporting and Verification in Indonesia, Boise, ID, September 14, 2010, (via teleconference)..

Hansen, M.C., Potapov, P.V., Stehman, S.V., Broich, M., and Arunarwati, B., Forest mapping and monitoring with Landsat data, REDD MRV Workshop, Ford Foundation, Jakarta, Indonesia, July 20, 2010.

Hansen, M., Potapov, P., Broich, M., Turubanova, S., Adusei, B.., Arunarwati, B., and Stehman, S., Global forest change monitoring system using multi-resolution and multi-temporal remotely sensed data, Living Planet Symposium, Bergen, Norway, June 27 – July 2, 2010.

Hansen, M., Potapov, P., Broich, M., Turubanova, S., Adusei, B. Arunarwati, B., Lindquist, E., Roy, D., Altstatt, A., Mane, L., Justice, C., and Goetz, S., GEO Forest Carbon Tracking Task and Science Data Summit, Woods Hole Research Center, Woods Hole, MA, May 11-12, 2010.

Hansen, M., Potapov, P., Broich, M., Stehman, S., Turubanova, S., Adusei, B., Arunarwati, B., Lindquist, E., and Goetz, S., Producing Composite Imagery and Forest Cover and Change Characterizations, NASA LCLUC program meeting, Bethesda, MD, April 20-22, 2010.

Hansen, M., Potapov, P., Broich, M., Lindquist, E., and Adusei, B., Mass Processing Landsat for Monitoring Forest Cover Changes in the Humid Tropical and Boreal Biomes, Landsat Science Team Meeting, Mountain View, CA, January 19-21, 2010.

Hansen, M., Potapov, P., Stehman, S., Broich, M., Adusei, B., and Lindquist, E., Global Forest Change Monitoring System Using Multi-Resolution and Multi-Temporal Remotely Sensed Data, Norwegian Space Center, Oslo, Norway, January 11-12, 2010, (via teleconference).

Hansen, M., Methods for mapping cloud and shadow cover in Landsat imagery, Training workshop on Landsat mapping in support of INCAS, Indonesian Space Agency (LAPAN), Jakarta, Indonesia, December 14-17, 2009.

Hansen, M., Stehman, S., Potapov, P., Broich, M., Lindquist, E., Adusei, B. and Arunarwati, B., Methods for monitoring large area forest cover change – OSFAC's implementation in support of CARPE, OSFAC (Observatoire Satellital des Forêts d'Afrique Centrale), Kinshasa, Democratic Republic of the Congo, October 21, 2009.

Hansen, M., Potapov, P., Broich, M., and Lindquist. E., Mass Processing Landsat for Forest Change Estimation, American Society of Photogrammetry and Remote Sensing Upper Midwest Chapter Meeting, USGS EROS, Garretson, SD, October 5-7, 2009.

Hansen, M., Potapov, P., Broich, M., Turubanova, S., Adusei, B., and Lindquist, E., Global forest monitoring using Landsat, Landsat User Workshop, USGS EROS, Garretson, SD, September 21, 2009.

Hansen, M., Mapping algorithms and themes for forest cover mapping using multi-spectral data sets, Training workshop on MODIS and Landsat mapping in support of INCAS, Indonesian Space Agency (LAPAN), Jakarta, Indonesia, August 18-21, 2009.

Hansen, M., Bankanza, B., Munzimi, Y., Broich, M., Lindquist, E., and Potapov, P., Congo Basin forest cover in global and regional contexts, Central Africa Forests and Institutions (CAFI) research project advisory meeting, Ann Arbor, MI, May 7-8, 2009.

Hansen, M. and Potapov, P., Global tree cover mapping and Landsat sample block staging, FRA2010 Remote Sensing Survey workshop, Rome, Italy, March 30 – April 3, 2009.

Hansen, M.C., Stehman, S.V., Potapov, P.V., Arunarwati, Usman, A.B., Rahman, S.,Sari, R., Napitupulu, D., Lindquist, E., Broich, M., and Bankanza, B., Using MODIS and Landsat to monitor forest cover: examples in support of Indonesia forest monitoring, Remote Sensing Meeting in Support of the Indonesian National Carbon Accounting System, February 9-11, 2009.

Hansen, M.C., Stehman. S.V. and Potapov, P.V., Global forest cover loss, 2000-2005, REDD Capacity Development Workshop on: Forest Area Change Assesssment: The Experience of Existing Operational Systems, INPE, San Jose dos Campos, Brazil, February 4-6, 2009.

Hansen, M.C., Stehman, S.V., Potapov, P.V., Arunarwati, Usman, A.B., Rahman, S.,Sari, R., Napitupulu, D., Lindquist, E., Broich, M., and Bankanza, B., Indonesia and the Democratic Republic of Congo: Using MODIS and Landsat to monitor forest cover change, REDD Capacity Development Workshop on: Forest Area Change Assesssment: The Experience of Existing Operational Systems, INPE, San Jose dos Campos, Brazil, February 4-6, 2009.

Hansen, M.C., Justice, C.O., Potapov, P.V., Stehman, S.V., Lindquist, E., and Broich, M., Using MODIS and Landsat for monitoring forest cover and change, NASA-LCLUC Science Team Joint Meeting with MAIRS, GOFC-GOLD and SEA START Programs on Land-Cover/Land-Use Change Processes in Monsoon Asia Region, Khon Kaen, Thailand, January 12-17, 2009.

Hansen, M.C., Stehman, S.V., Potapov, P.V., Lindquist, E., and Broich, M., Monitoring large area forest cover change using multi-resolution satellite data sets, American Geophysical Union fall meeting, San Francisco, CA. December 15-19, 2008.

Hansen, M.C., Stehman, S. V., and Potapov, P. V., Mapping the Boreal zone – forest cover and forest cover loss 2000 to 2005, 3rd GOFC-GOLD Land Cover Symposium, Jena, Germany, October 12-17, 2008.

Hansen, M.C., Accuracy assessment of land cover change products – MODIS/Landsat, 3rd GOFC-GOLD Land Cover Symposium, Jena, Germany, October 12-17, 2008.

Hansen, M.C., MODIS/Landsat monitoring, 3rd GOFC-GOLD Land Cover Symposium, Jena, Germany, October 12-17, 2008.

Hansen, M.C., Forest monitoring integrating MODIS and Landsat data sets, Forest Resources Information System Workshop, Ministry of Forestry, Indonesia, Jakarta, Indonesia, September 11, 2008.

Hansen, M.C., Potapov, P., Stehman, S., Pittman, K., Loveland, T., Carroll, M., and DiMiceli, C., Mapping the Boreal zone – forest cover and forest cover loss 2000 to 2005, 2008 NASA Carbon Cycle and Ecosystems Joint Science Workshop, April 28-May 2, 2008, Adelphi, MD.

Hansen, M.C. et al., CARPE monitoring of the Congo Basin – results and ideas for REDD monitoring, CBFP-COMIFAC Workshop on REDD, Paris, France, April 10-14, 2008.

Data products derived from this project are available at the following website:

globalmonitoring.sdstate.edu/projects/gfm

Please use this as evidence of our performance on this research grant, NASA code NNX08AL99G.

Matthew C. Hansen, Co-Director, Professor, South Dakota State University