

Acknowledgments

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List of Abbreviations and Acronyms

Africover	Digital georeferenced database on land cover for Africa produced by FAO and country partners	IWMI	International Water Management Institute
ALRMP	Arid Lands Resource Management Project, Kenya	KATO	Kenya Association of Tour Operators
CBS	Central Bureau of Statistics, Kenya	kg	kilogram
DRSRS	Department of Resource Surveys and Remote Sensing, Kenya	KIPPRA	Kenya Institute for Public Policy Research and Analysis
EBA	Endemic Bird Area	km	kilometer
ESDA	Energy for Sustainable Development Africa, Kenya	Ksh	Kenyan Shilling
ESRI	Environmental Systems Research Institute	KWS	Kenya Wildlife Service
FAO	Food and Agriculture Organization of the United Nations	MDGs	Millennium Development Goals
FEWS NET	Famine Early Warning System Network	RCMRD	Regional Centre for Mapping of Resources for Development
GBM	Green Belt Movement	RF	Rockefeller Foundation
GDP	Gross Domestic Product	RFF	Resources for the Future
IBA	Important Bird Area	sq. km	square kilometer
ICPAC	IGAD Climate Prediction and Applications Centre	Tegemeo	Tegemeo Institute of Agricultural Policy and Development, Kenya
ICRAF	World Agroforestry Centre	TLU	Tropical Livestock Unit (equal to an animal weight of 250 kilograms)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics	TNC	The Nature Conservancy
IDRC	International Development Research Centre	UoN	University of Nairobi
IGAD	Intergovernmental Authority on Development	US\$	US Dollar
ILRI	International Livestock Research Institute	USAID	United States Agency for International Development
IUCN	The World Conservation Union	WFP	United Nations World Food Programme
		WRI	World Resources Institute

Sources

Chapter 1 Ecosystems and Ecosystem Services

BIGGS, R., E. BOHENSKY, P.V. DESANKER, C. FABRICIUS, T. LYNAM, A. A. MISSELHORN, C. MUSVOTO, M. MUTALE, B. REYERS, R.J. SCHOLES, S. SHIKONGO, AND A.S. VAN JAARSVELD. 2004. *Nature Supporting People, The Southern African Millennium Ecosystem Assessment, Integrated Report. A Contribution to the Millennium Ecosystem Assessment, Prepared by the Southern African Millennium Ecosystem Assessment Team.* Pretoria: Council for Scientific and Industrial Research. Online at www.maweb.org/safma

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2001. *Population Distribution by Administrative Areas and Urban Centres, Kenya 1999 Population and Housing Census. Vol. 1.* Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2002. *Kenya 1999 Population and Housing Census GIS Database.* Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2003. *Geographic Dimensions of Well-Being in Kenya: Where are the Poor? From Districts to Locations. Vol. 1.* Nairobi: CBS. Online at http://www.worldbank.org/research/poverty_maps/kenya/volume_index.htm

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2004. *Economic Survey 2004.* Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2005. *Economic Survey 2005.* Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2006. *Kenya Facts and Figures, 2006 Edition.* 2006. Nairobi: CBS. Online at <http://www.cbs.go.ke/downloads/pdf/Kenyafacts2006.pdf>

DEPARTMENT OF RESOURCE SURVEYS AND REMOTE SENSING (DRSRS), MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES. 2003. *DRSRS GIS Database.* Nairobi: DRSRS.

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2000. *Africover Multipurpose Land Cover Databases for Kenya.* Rome: FAO. Online at www.africover.org

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2005. "Kenya Country Report." In: *Irrigation in Africa in Figures, AQUASTAT Survey 2005.* Rome: FAO. Online at <http://www.fao.org/ag/agl/aglw/aquastat/countries/kenya/index.stm>

GOVERNMENT OF KENYA (GoK). 2003. *Economic Recovery Strategy for Wealth and Employment Creation 2003-2007.* Nairobi: GoK. Online at http://www.planning.go.ke/publication/economic_recovery_plan.pdf

GRUNBLATT, J., M. SAID, P. WARGUTE, AND S.C. KIFUGO. 1995. *DRSRS Data Summary Report: Kenyan Rangelands 1977-1994.* Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

GRUNBLATT, J., M. SAID, AND P. WARGUTE. 1996. *DRSRS National Rangelands Report: Summary of Population Estimates for Wildlife and Livestock, Kenyan Rangelands 1977-1994.* Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

HIJMANS, R.J., S. CAMERON, AND J. PARRA. 2005. *WorldClim Climate Surfaces, Version 1.4.* Online at <http://www.worldclim.org/>

MILLENNIUM ECOSYSTEM ASSESSMENT (MA). 2003. *Ecosystems and Human Well-Being: A Framework for Assessment.* Washington, DC: Island Press. Online at <http://www.maweb.org/en/Framework.aspx>

MILLENNIUM ECOSYSTEM ASSESSMENT (MA). 2005. *Ecosystems and Human Well-Being: Synthesis.* Washington, DC: Island Press. Online at <http://www.maweb.org/en/Synthesis.aspx>

MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT (MoPND), UNITED NATIONS DEVELOPMENT PROGRAMME, AND GOVERNMENT OF FINLAND. 2005. *Millennium Development Goals in Kenya, Needs & Costs.* Nairobi: Government of Kenya. Online at <http://www.ke.undp.org/KenyaMDGNeedsAssessment.pdf>

MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992. *The Study on the National Water Master Plan. GIS Data of Drainage and Subdrainage Areas.* Nairobi, Kenya: MoWD, JICA, and International Livestock Research Institute.

NATIONAL IMAGERY AND MAPPING AGENCY OF THE UNITED STATES (NIMA). 1997. *VMAP_1V10 - Vector Map Level 0 (Digital Chart of the World).* Washington, DC: NIMA.

REPUBLIC OF KENYA (RoK). 2006. *Medium Term Expenditure Framework 2006/2007-2008/2009. Report for the Agriculture and Rural Development (ARD) Sector: Final Draft. February 2006.* Nairobi: RoK Online at http://www.treasury.go.ke/sector_reports/ARD_Sector%20_Report_2007%20_Draft.pdf

SURVEY OF KENYA (SoK). 2003. *National Atlas of Kenya, Fifth Edition.* Nairobi: Survey of Kenya.

SURVEY OF KENYA (SoK) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 2000. *Cities, Towns, and Market Centers GIS Database.* Digitized by ILRI from Survey of Kenya's 1:250,000 topographic sheets (for northern Kenya) and 1:50,000 topographic sheets for the rest of the country. Nairobi: SoK and ILRI.

SURVEY OF KENYA (SoK), JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 1996. *250-meter Digital Elevation Model.* Created by ILRI and JICA, derived from SoK 1:250,000 Topographic Map. Nairobi: ILRI.

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP). 2001. *An Assessment of the Status of the World's Remaining Closed Forests.* Nairobi: UNEP. Online at <http://grid2.cr.usgs.gov/publications/closedforest.pdf#search=%20assessment%20of%20the%20worlds%20remaining%20closed%20forests%22>

WORLD CONSERVATION UNION (IUCN) AND UNITED NATIONS ENVIRONMENT PROGRAMME/WORLD CONSERVATION MONITORING CENTRE (UNEP/WCMC). 2006. *2006 World Database on Protected Areas.* Cambridge, United Kingdom: IUCN and UNEP/WCMC.

WORLD GAZETTEER. 2006. *Kenya: Largest Cities and Towns.* Online at <http://www.world-gazetteer.com/wg.php?x=&men=gcis&lng=en&dat=32&srt=pan&col=ahq&geo=-112>

Chapter 2 Spatial Patterns of Poverty and Human Well-Being

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 1994. *Kenya Population Census 1989. Vol. 1.* Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 1995. *Kenya Population Census of 1989.* This GIS coverage was created jointly by International Livestock Research Institute (ILRI) GIS unit, Famine Early Warning Systems (FEWS), and Tropical Soil Biological and Fertility Programme (TSBF). Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2001. *Population Distribution by Administrative Areas and Urban Centres, Kenya 1999 Population and Housing Census. Vol. 1.* Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2002. *Kenya 1999 Population and Housing Census GIS Database*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2003. *Geographic Dimensions of Well-Being in Kenya: Where are the Poor? From Districts to Locations. Vol. I*. Nairobi: CBS. Online at http://www.worldbank.org/research/povertymaps/kenya/volume_index.htm

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2005. *Geographic Dimensions of Well-Being in Kenya: Who and Where are the Poor? A Constituency Level Profile. Vol. II*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2006. *Kenya Facts and Figures, 2006 Edition*. Nairobi: CBS. Online at <http://www.cbs.go.ke/downloads/pdf/Kenyafacts2006.pdf>

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2000. *Africover Multipurpose Land Cover Databases for Kenya*. Rome: FAO. Online at www.africover.org

MILLENNIUM ECOSYSTEM ASSESSMENT (MA). 2005. *Ecosystems and Human Well-Being: Synthesis*. Washington, DC: Island Press. Online at <http://www.maweb.org/en/Synthesis.aspx>

RAVALLION, M. 1992. *Poverty Comparisons, A Guide to Concepts and Methods, LSMS Working Paper Number 88*. Washington, DC: The World Bank.

SEN, A. 1999. *Development and Freedom*. Oxford: Oxford University Press.

SURVEY OF KENYA (SoK) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 2000. *Cities, Towns, and Market Centers GIS Database*. Digitized by ILRI from Survey of Kenya's 1:250,000 topographic sheets (for northern Kenya) and 1:50,000 topographic sheets for the rest of the country. Nairobi: SoK and ILRI.

WORLD CONSERVATION UNION (IUCN) AND UNITED NATIONS ENVIRONMENT PROGRAMME/WORLD CONSERVATION MONITORING CENTRE (UNEP/WCMC). 2006. *2006 World Database on Protected Areas*. Cambridge, United Kingdom: IUCN and UNEP/WCMC.

Chapter 3 Water

AKOTSI E. AND M. GACHANJA. 2004. *Changes in Forest Cover in Kenya's Five Water Towers 2000-2003*. Nairobi: Department of Resource Surveys and Remote Sensing and Kenya Forest Working Group. Online at http://www.unep.org/dewa/assessments/EcoSystems/Land/mountain/pdf/forest_catchment_2003_report.pdf

AMISSAH-ARTHUR, A., S. JAGAP, AND C. ROSENZWEIG. 2002. "Spatio-Temporal Effects of El Niño Events on Rainfall and Maize Yields in Kenya." *International Journal of Climatology*, 22, 1849-1860.

BALLA, P.T. 2006. National Study on Small Hydro Power Development: Status and Potential of Small Hydro Power Development in the Tea Industry in Kenya. Online at <http://greeningtea.unep.org/downloads/>

BRAKENRIDGE, G.R., E. ANDERSON, AND S. CAQUARD. 2006. *Global Active Archive of Large Flood Events*. Data selected for Kenya, 2002-2006. Hanover, USA: Dartmouth Flood Observatory. Online at <http://www.dartmouth.edu/~floods/2003282.html>

CAMPBELL, D.J., D.P. LUSCH, T. SMUCKER, AND E.E. WANGUI. 2003. *Root Causes of Land Use Change in the Loitokitok Area, Kajiado District, Kenya*, LUCID Working Paper 19. East Lansing, Michigan: Michigan State University. Online at <http://www.lucideastafrica.org/publications.htm>

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2002. *Kenya 1999 Population and Housing Census GIS Database*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2003. *Geographic Dimensions of Well-Being in Kenya: Where are the Poor? From Districts to Locations. Vol. I*. Nairobi: CBS. Online at http://www.worldbank.org/research/povertymaps/kenya/volume_index.htm

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2006. *Kenya Facts and Figures, 2006 Edition*. Nairobi: CBS. Online at <http://www.cbs.go.ke/downloads/pdf/Kenyafacts2006.pdf>

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF HEALTH (MOH), AND ORC MACRO. 2004. *Kenya Demographic and Health Survey 2003*. Calverton, Maryland: CBS, MOH, and ORC Macro. Online at http://www.statcompiler.com/pubs/pub_details.cfm?ID=462&srchTp=advanced

DEPARTMENT OF RESOURCE SURVEYS AND REMOTE SENSING (DRSRS), MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES. 2003. *DRSRS GIS Database*. Nairobi: DRSRS.

EMERTON, L. AND F. VORHIES. 1998. *Wetlands Services - Getting Customers to Pay. Paper presented to the Second International Conference on Wetlands and Development*. Dakar, Senegal: World Conservation Union (IUCN), Economics Service Unit.

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2000a. *Africover Multipurpose Land Cover Databases for Kenya*. Rome: FAO. Online at: www.africover.org

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2000b. *Crop and Food Supply Situation in Kenya, FAO Global Information and Early Warning System on Food and Agriculture, Special Report, 10 July 2000*. Online at <http://www.fao.org/docrep/004/x7697e/x7697e00.htm>

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2005. "Kenya Country Report." In: *Irrigation in Africa in Figures, AQUASTAT Survey 2005*. Rome: FAO. Online at <http://www.fao.org/ag/agl/aglw/aquastat/countries/kenya/index.stm>

GOVERNMENT OF KENYA (GoK). 2003. *Economic Recovery Strategy for Wealth and Employment Creation 2003-2007*. Nairobi: GoK. Online at http://www.planning.go.ke/publication/economic_recovery_plan.pdf

GRUNBLATT, J., M. SAID, P. WARGUTE, AND S.C. KIFUGO. 1995. *DRSRS Data Summary Report: Kenyan Rangelands 1977-1994*. Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

GRUNBLATT, J., M. SAID, AND P. WARGUTE. 1996. *DRSRS National Rangelands Report: Summary of Population Estimates for Wildlife and Livestock, Kenyan Rangelands 1977-1994*. Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

HIJMANS, R.J., S. CAMERON, AND J. PARRA. 2005. *WorldClim Climate Surfaces, Version 1.4*. Online at <http://www.worldclim.org/>

INTERMEDIATE TECHNOLOGY DEVELOPMENT GROUP (ITDG) AND ENERGY FOR SUSTAINABLE DEVELOPMENT AFRICA (ESDA). 2005. "Table of Existing and Potential Micro-Hydropower Sites in Kenya." Nairobi: ITDG and ESDA.

JONES P.G. AND P.K. THORNTON. 1999. "Unpublished Maps and Data of Bimodal Climates in Africa, Latin America, and Asia."

KATUI-KATUA, M. 2004. *Drawers of Water II: Thirty Years of Change in Domestic Water Use and Environmental Health in East Africa-Kenya Country Study*. London: International Institute for Environment and Development (IIED). Online at <http://www.iied.org/pubs/pdf/full/9050IIED.pdf>

KENYA ELECTRICITY GENERATING COMPANY (KENGEN) LIMITED. 2006. *Prospectus*. Online at http://www.kengen.co.ke/IPO/full_prospectus.pdf

KENYA FOOD SECURITY STEERING GROUP (KFSSG). 2006. *Kenya Short Rains Assessment Report 2005, 9 February 2006, Consolidated Interagency Report*. Nairobi: KFSSG. Online at <http://documents.wfp.org/stellent/groups/public/documents/ena/wfp087348.pdf>

MILLENNIUM ECOSYSTEM ASSESSMENT (MA). 2005. *Ecosystems and Human Well-Being: Wetlands and Water Synthesis*. Washington, DC: World Resources Institute. Online at <http://www.maweb.org/en/Synthesis.aspx>

MINISTRY OF AGRICULTURE AND LIVESTOCK DEVELOPMENT (MoALD). 1995. *District Profiles of Irrigation and Drainage in Kenya (All Districts)*. Nairobi: MoALD, Irrigation and Drainage Branch.

MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992a. *The Study on the National Water Master Plan. GIS Data of Drainage and Subdrainage Areas*. Nairobi: MoWD, JICA, and International Livestock Research Institute.

MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992b. *The Study on the National Water Master Plan*. "Table 4.7.2: Balance between Water Demands and Potential Available Water." Nairobi: MoWD and JICA.

MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992c. *The Study on the National Water Master Plan*. "Figure M10.1: Location Map of Potential and Existing Damsites." Nairobi: MoWD and JICA.

- MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992d. *The Study on the National Water Master Plan*. "Figure M10.2: Water Transfer Scheme." Nairobi: MoWD and JICA.
- MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992e. *The Study on the National Water Master Plan*. "Map U-1: Nairobi." Nairobi: MoWD and JICA.
- MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992f. *The Study on the National Water Master Plan*. "Map U-32: Mombasa." Nairobi: MoWD and JICA.
- MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992g. *The Study on the National Water Master Plan*. "Map U-25: Watamu." Nairobi: MoWD and JICA.
- MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992h. *The Study on the National Water Master Plan*. "Table 4.5: Hydropower Projects to be Implemented by 2010." Nairobi: MoWD and JICA.
- MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992i. *The Study on the National Water Master Plan*. "Figure 4.4: National Power Grid Map." Nairobi: MoWD and JICA.
- MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992j. *The Study on the National Water Master Plan*. "Table 4.3: Major Irrigation Projects to be Implemented by 2010." Nairobi: MoWD and JICA.
- MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992k. *The Study on the National Water Master Plan*. "Figure 4.3: Location of Selected Large-Scale Irrigation Schemes." Nairobi: MoWD and JICA.
- MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992l. *The Study on the National Water Master Plan*. "Section 2.4: Daily Water Consumptions for Major Species." Nairobi: MoWD and JICA.
- MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992m. *Main Report*. Nairobi: MoWD and JICA.
- MUNGA, D., J.U. KITHEKA, S.M. MWAGUNI, H.S. MASSA, B.M. MWASHOTE, S. MWANGI, H. ONG'ANDA, M.M. MUTHUKA, F. MDOE, S.J. CHIDAGAYA, AND G. OPELLO. 2004. *Pollution and Vulnerability of Water Supply Aquifers in Mombasa, Kenya: Interim Progress Report*. Mombasa: Kenya Marine and Fisheries Research Institute, Coast Development Authority, Ministry of Water Resources Development and Management, Municipal Council of Mombasa, and Government Chemistry Department. Online at www.unep.org/groundwaterproject/Archives/Kenya-midReport.pdf
- NAIROBI CITY COUNCIL. 2006. "Water and Sewerage." Online at <http://www.nairobi.org/departments/default2.asp?search=sewerage>
- NAKAGAWA, H., S. IKEBUCHI, S. KOHSAKI, K.S. MAKHANU, AND K. WAKABAYASHI. 1994. *21st Century Water Challenges in Kenya. Proceedings from the 20th WEDC Conference on Affordable Water Supply and Sanitation, Colombo, Sri Lanka*. Online at <http://www.lboro.ac.uk/departments/cv/wedc/papers/20/session/nakagawa.pdf>
- NATIONAL IMAGERY AND MAPPING AGENCY OF THE UNITED STATES (NIMA). 1997. *VMAP_1V10 - Vector Map Level 0 (Digital Chart of the World)*. Washington, DC: NIMA.
- NJUGUNA-GITHINJI, W. 1991. "Kenya." In *ITT Industries Guidebook to Global Water Issues*. Online at <http://www.itt.com/waterbook/>
- NYAORO, J.R. 1999. "Case Study on Kenya River Watershed Management and Arising Conflicts." In *Report on the Conference on Cooperation or Conflict: Ways of Managing Scarce Natural Resources in Africa, 18-23 June 1999*. Maputo, Mozambique: Civil Society Conflict Prevention Network and Citizens' Security Council (KATU). Online at <http://www.katunet.fi/suomi/pdf/NATURAL%20RESOURCE%20REPORT.pdf>
- OINDO B.O. AND A.K. SKIDMORE. 2002. "Interannual Variability of NDVI and Species Richness in Kenya." *International Journal of Remote Sensing*, 23, 285-298.
- ONJALA, J. 2001. *Water Pricing Options in Kenya: Cases of Mwea and West Kano Irrigation Schemes*. CDR Working Paper 01.9, December 2001. Copenhagen: Centre for Development Research. Online at http://www.diiis.dk/graphics/CDR_Publications/cdr_publications/working_papers/wp-01-9.pdf
- ONJALA, J. 2002. *Managing Water Scarcity in Kenya: Industrial Response to Tariffs and Regulatory Enforcement*. Ph.D. Dissertation, Roskilde University, Denmark. Online at http://diggy.ruc.dk/bitstream/1800/470/1/managing_water_scarcity.pdf
- OWORE, D. 2004. "The Water Distribution Factor in Karen." *Network for Water and Sanitation (NETWAS) Newsletter*. Online at <http://www.netwas.org/newsletter/articles/2004/01/6>
- PEDEN D., G. TADESSE, AND M. MAMMO. 2003. "Improving the Water Productivity of Livestock: An Opportunity for Poverty Reduction." In P.G. McCornick, A.B. Kamara, and G. Tadesse (editors). *Integrated Water and Land Management Research and Capacity Building Priorities for Ethiopia. Proceedings of a MoWR/EARO/IWMI/ILRI International Workshop held at ILRI, Addis Ababa, Ethiopia, 2-4 December 2002*. Colombo, Sri Lanka and Nairobi: International Water Management Institute (IWMI) and International Livestock Research Institute (ILRI). Online at http://www.ilri.org/publications/cdrom/integratedwater/IWMI/Documents/Print_version/IWMI_Pro.pdf
- PEDEN, D. 2004. *Water and Livestock, A Framework for Water and Livestock Investment and Initial Findings. Paper presented at the World Water Week Seminars on 19-20th August 2004*. Stockholm.
- RELIEFWEB. 2005. *International Federation of Red Cross and Red Crescent Societies (IFRC) Report Flooding in Kenya, 31 May 2005*. Online at <http://www.reliefweb.int/rw/RWB.NSF/db900SID/EGUA-6CWKSN?OpenDocument>
- SURVEY OF KENYA (SoK). 1971. *Directorate of Overseas Surveys: 1:50,000 Topographical Maps. Series Y731*. Nairobi: SoK.
- SURVEY OF KENYA (SoK). 2003. *National Atlas of Kenya, Fifth Edition*. Nairobi: SoK.
- SURVEY OF KENYA (SoK) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 1997. *Road Network GIS Database*. Digitized by ILRI from Survey of Kenya's 1:50,000 topographic sheets for 1978-1997. Nairobi: SoK and ILRI.
- SURVEY OF KENYA (SoK) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 2000. *Cities, Towns, and Market Centers GIS Database*. Digitized by ILRI from Survey of Kenya's 1:250,000 topographic sheets (for northern Kenya) and 1:50,000 topographic sheets for the rest of the country. Nairobi: SoK and ILRI.
- SURVEY OF KENYA (SoK), JAPAN INTERNATIONAL COOPERATION AGENCY (JICA), AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 1996. *250-meter Digital Elevation Model*. Created by ILRI and JICA, derived from SoK 1:250,000 Topographic Map. Nairobi: ILRI.
- THOMPSON J., I. PORRAS, M. KATUI-KATUA, M. MUJWAHUIZI, J. TUMWINE, N. JOHNSTONE, AND L. WOOD. 2001. *Drawers of Water II: Thirty Years of Change in Domestic Water Use and Environmental Health in East Africa, Summary*. London: International Institute for Environment and Development (IIED). Online at <http://www.iied.org/pubs/pdf/full/9049IIED.pdf>
- UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP), INTERMEDIATE TECHNOLOGY DEVELOPMENT GROUP (ITDG), AND ENERGY FOR SUSTAINABLE DEVELOPMENT AFRICA (ESDA). 2005. *Kenya Energy Atlas*. Nairobi: United Nations Development Programme (UNDP) and Global Village Energy Partnership. Online at <http://www.ke.undp.org/KenyaEnrgyAtlasFinal-UN.pdf>
- UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP). 2001. *An Assessment of the Status of the World's Remaining Closed Forests*. Nairobi: UNEP. Online at <http://grid2.cr.usgs.gov/publications/closedforest.pdf#search=%22an%20assessment%20of%20the%20worlds%20remaining%20closed%20forests%22>
- UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP). 2006. *Africa Environment Outlook 2 - 2006*. Nairobi: UNEP. Online at http://www.unep.org/DEWA/Africa/AEO2_Launch/index.asp
- UNITED STATES GEOLOGICAL SURVEY (USGS). 2004. *90-meter Digital Elevation Model based on Shuttle Radar Topography Mission (SRTM)*. Online at <http://www.landcover.org>
- WAMBUA, S. 2003. "Yatta Canal: The 'Nile' of Northern Machakos." *Network for Water and Sanitation (NETWAS) Newsletter*. Online at <http://www.netwas.org/newsletter/articles/2003/09/8>
- WERE, E., B. SWALLOW, AND J. ROY. *Water, Women and Local Social Organization in the Western Kenya Highlands. ICRAF Working Paper No. 12*. Nairobi: World Agroforestry Centre (ICRAF). Online at <http://www.worldagroforestry.org/water/downloads/Watershed%20Publications/2006%20were,%20swallow%20and%20roy.pdf>
- WORLD BANK. 2004. "Towards a Water-Secure Kenya: Water Resources Sector Memorandum" cited in D. Grey and C.W. Sadoff. *Water for Growth and Development*. Thematic Documents of the IV World Water Forum. Comision Nacional del Agua: Mexico City. 2006. Online at http://siteresources.worldbank.org/INTWRD/Resources/FINAL_0601_SUBMITTED_Water_for_Growth_and_Development.pdf

WORLD CONSERVATION UNION (IUCN). 2003. *Tana River, Kenya: Integrating Downstream Values into Hydropower Planning. Case Studies in Wetland Valuation Number 6, May 2003*. IUCN. Online at <http://www.iucn.org/themes/wani/econ/CaseStudy06Tana.pdf>

WORLD CONSERVATION UNION (IUCN) AND UNITED NATIONS ENVIRONMENT PROGRAMME/WORLD CONSERVATION MONITORING CENTRE (UNEP/WCMC). 2006. *2006 World Database on Protected Areas*. Cambridge, United Kingdom: IUCN and UNEP/WCMC.

ZECCHINI, A. 2000. "Clash of Interests in Masai Country: Kenya's Battle for Biodiversity." *Le Monde Diplomatique*, November 2000. Online at <http://mondediplo.com/2000/11/21masai>

Chapter 4 Food

ARID LANDS RESOURCE MANAGEMENT PROJECT (ALRMP), UNITED NATIONS WORLD FOOD PROGRAMME/VULNERABILITY ANALYSIS AND MAPPING (WFP/VAM), FAMINE EARLY WARNING SYSTEMS NETWORK (FEWS NET), AND MINISTRY OF AGRICULTURE (MoA). 2006. *Kenya Livelihood Mapping GIS Database, 2003-05*. Nairobi: ALRMP, WFP/VAM, FEWS NET, and MoA.

BALTENWECK I., S. STAAL, L. NJOROGE, F. WANYOIKE, P. OCHUNGO, AND E. KARIUKI. 2005. *Targeting Pro-Poor Investment in the Kenyan Dairy Sub-Sector: Report prepared by the International Livestock Research Institute (ILRI) for IFAD and the Government of Kenya*. Nairobi, Kenya: ILRI.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 1986. *1986 Statistical Abstract*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 1995. *1995 Statistical Abstract*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2001. *2001 Statistical Abstract*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2002. *Kenya 1999 Population and Housing Census GIS Database*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2003. *Geographic Dimensions of Well-Being in Kenya: Where are the Poor? From Districts to Locations. Vol. I*. Nairobi: CBS. Online at http://www.worldbank.org/research/povertymaps/kenya/volume_index.htm

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2004. *Economic Survey 2004*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2005. *Economic Survey 2005*. Nairobi: CBS.

DE GROOTE, H., G. OWUOR, C. DOSS, J. OUMA, L. MUHAMMAD, AND K. DANDA. 2005. "The Maize Green Revolution in Kenya Revisited." *electronic Journal of Agricultural and Development Economics (eJADE)* 2: 32-49. Online at: <ftp://ftp.fao.org/docrep/fao/008/ae692e/ae692e00.pdf>

DELGADO, C.L., A.N. CLARE, AND M.T. MARITES. 2003. *Policy, Technical, and Environmental Determinants and Implications of the Scaling-Up of Livestock Production in Four Fast-Growing Developing Countries: A Synthesis*. Washington DC: IFPRI and FAO. Online at: <http://www.fao.org/WAIRDOCS/LEAD/X6170E/X6170E00.HTM>

DEPARTMENT OF RESOURCE SURVEYS AND REMOTE SENSING (DRSRS), MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES. 2003. *DRSRS GIS Database*. Nairobi: DRSRS.

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2000. *Africover Multipurpose Land Cover Databases for Kenya*. Rome: FAO. Online at: www.africover.org

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2006. *FAO STAT*. Online at <http://faostat.fao.org/site/291/default.aspx>

GBERU, G. AND J. McPEAK. 2004. *Herd Accumulation: A Pastoral Strategy to Reduce Risk Exposure. Global Livestock Collaborative Research Support Program. PARIMA Research Brief 04-05*. Davis, California: University of California-Davis. Online at: <http://glcrsp.ucdavis.edu/publications/parima/04-05-PARIMA.pdf>

GOVERNMENT OF KENYA (GoK). 2003. *Economic Recovery Strategy for Wealth and Employment Creation 2003-2007*. Nairobi: GoK. Online at http://www.planning.go.ke/publication/economic_recovery_plan.pdf

GRUNBLATT, J., M. SAID, P. WARGUTE, AND S.C. KIFUGO. 1995. *DRSRS Data Summary Report: Kenyan Rangelands 1977-1994*. Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

GRUNBLATT, J., M. SAID, AND P. WARGUTE. 1996. *DRSRS National Rangelands Report: Summary of Population Estimates for Wildlife and Livestock, Kenyan Rangelands 1977-1994*. Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

HIJMANS, R.J., S. CAMERON, AND J. PARRA. 2005. *WorldClim Climate Surfaces, Version 1.4*. Online at <http://www.worldclim.org/>

JAYNE, T. S., T. YAMANO, J. NYORO, AND T. AWUOR. 2000. *Do Farmers Really Benefit from High Food Prices? Balancing Rural Interests in Kenya's Maize Pricing and Marketing Policy*. Tegemeo Institute of Agricultural Policy and Development. Policy Brief No.1. Nairobi: Tegemeo. Online at: www.tegemeo.org

KRISTJANSON P., M. RADENY, D. NKEDIANYE, R. KRUSKA, R. REID, H. GICHOHI, F. ATIENO, AND R. SANFORD. 2002. *Valuing Alternative Land Use Options in the Kitengela Wildlife Dispersal Area of Kenya. International Livestock Research Institute (ILRI) Impact Assessment Series 10*. Nairobi: ILRI. Online at: www.ilri.org

LAMPREY, R. AND R.S. REID. 2004. "Expansion of Human Settlement in Kenya's Maasai Mara: What Future for Pastoralism and Wildlife?" *Journal of Biogeography* 31: 997-1032.

MATIRU, V. 1999. *Forest Cover and Forest Reserves in Kenya: Policy and Practice*. Nairobi: World Conservation Union (IUCN), Eastern African Regional Office. Online at <http://www.iucn.org/places/earo/pubs/forest/forestcover.pdf>

MINISTRY OF LIVESTOCK AND FISHERIES DEVELOPMENT (MoLFD). 2001. *Fisberies Department Annual Report 2001*. Nairobi: MoLFD.

MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT (MoPND), UNITED NATIONS DEVELOPMENT PROGRAMME, AND GOVERNMENT OF FINLAND. 2005. *Millennium Development Goals in Kenya, Needs & Costs*. Nairobi: Government of Kenya. Online at <http://www.ke.undp.org/KenyaMDGNeedsAssessment.pdf>

MUENDO, K.M., D. TSCHIRLEY, AND M.T. WEBER. 2004. *Improving Kenya's Domestic Horticultural Production and Marketing System: Current Competitiveness, Forces of Change, and Challenges for the Future*. Tegemeo Institute of Agricultural Policy and Development. Working Paper No. 8. Nairobi: Tegemeo. Online at: www.tegemeo.org

MUTUNGA, N. 2006. Personal Communication, September 2006.

NKEDIANYE, D.O. 2003. *Testing the Attitudinal Impact of a Conservation Tool outside a Protected Area: The Case of the Kitengela Wildlife Conservation Lease Programme for Nairobi National Park. MA Thesis*. Nairobi: University of Nairobi, Department of Rural Sociology and Community Development.

NORTON-GRIFFITHS, M., M.Y. SAID, S. SERNEELS, D.S. KAELO, M. COUGHENOUR, R.H. LAMPREY, D.M. THOMPSON, AND R.S. REID. (in press). "Land Use Economics in the Mara Area of the Serengeti Ecosystem." In: A.R.E. Sinclair and J.F. Fryxell (editors). *Serengeti III: The Future of an Ecosystem*. Chicago: University of Chicago Press.

NYORO, J.K., L. KIRIMI, AND T.S. JAYNE. 2004. *Competitiveness of Kenyan and Ugandan Maize Production: Challenges for the Future*. Tegemeo Institute of Agricultural Policy and Development. Working Paper No. 10. Nairobi: Tegemeo. Online at: www.tegemeo.org

PFLANZ, M. 2005. "Small Game, Big Problem as Poaching Grows in Kenya." *Christian Science Monitor, January 31, 2005*. Online at <http://www.csmonitor.com/2005/0131/p07s01-woaf.html>

REPUBLIC OF KENYA (RoK). 2006. *Medium Term Expenditure Framework 2006, 2007-2008/2009. Report for the Agriculture and Rural Development (ARD) Sector. Final Draft. February 2006*. Nairobi: RoK Online at http://www.treasury.go.ke/sector_reports/ARD_Sector%20_Report_2007%20_Draft.pdf

SERNEELS, S. AND E.F. LAMBIN. 2001. "Impact of Land-Use Changes on the Wildebeest Migration in the Northern Part of the Serengeti-Mara Ecosystem." *Journal of Biogeography* 28: 391-407.

STAAL, S. 2004a. *The Demand for Dairy Products in Kenya. Smallholder Dairy Project Policy Brief 1*. Nairobi: ILRI. Online at: <http://www.smallholderdairy.org/publications/Policy%20briefs/SDP%20BRIEF%201%20-FINAL%20R.pdf>

STAAL, S. 2004b. *Employment Generation in the Kenya Dairy Industry. Smallholder Dairy Project Policy Brief 2*. Nairobi: ILRI. Online at: <http://www.smallholderdairy.org/publications/Policy%20briefs/SDP%20BRIEF%202%20-UPDATE.pdf>

STEVE, S., J. OMITI, C. DELGADO, F. WANYOIKE, AND L. NJOROGE. 2006. *Differential Impacts of Policy and Scale Factors in Livestock Production in Kenya: The Case of Dairy and Poultry Farming*. Nairobi: ILRI and IFPRI.

SURVEY OF KENYA (SoK). 2003. *National Atlas of Kenya, Fifth Edition*. Nairobi: Survey of Kenya.

SURVEY OF KENYA (SoK) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 2000. *Cities, Towns, and Market Centers GIS Database*. Digitized by ILRI from Survey of Kenya's 1:250,000 topographic sheets (for northern Kenya) and 1:50,000 topographic sheets for the rest of the country. Nairobi: SoK and ILRI.

TRAFFIC EAST AND SOUTHERN AFRICA. 2000. *The Utilization of Wild Meat in Eastern and Southern Africa*. Harare and Nairobi: TRAFFIC. Online at <http://www.traffic.org/bushmeat/overview.pdf>

URBAN HARVEST. 2004. *Urban Agriculture*. Online at <http://www.cipotato.org/urbanharvest/home.htm>

WORLD AGROFORESTRY CENTRE (ICRAF) AND DEPARTMENT OF RESOURCE SURVEYS AND REMOTE SENSING (DRSRS), MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES. 2001. *GIS Database of Land Use and Land Cover for Kenya's Medium to High Potential Districts*. DRSRS interpretation of 5,747 aerial photographs from transects flown in 1997. Approach summarized in report prepared for ICRAF and African Highlands Initiative (E.C. Njuguna. 2001. *Aerial Survey Sample Photo Interpretation, Report on Land Use and Land Cover For Medium to High Potential Districts of Kenya*. Nairobi: DRSRS). Nairobi: ICRAF and DRSRS.

WORLD CONSERVATION UNION (IUCN) AND UNITED NATIONS ENVIRONMENT PROGRAMME/WORLD CONSERVATION MONITORING CENTRE (UNEP/WCMC). 2006. *2006 World Database on Protected Areas*. Cambridge, United Kingdom: IUCN and UNEP/WCMC.

Chapter 5 Biodiversity

ACHIENG, A.P. 1990. "The Impact of the Introduction of Nile Perch, *Lates niloticus* (L.), on the Fisheries of Lake Victoria." *Journal of Fish Biology* 37(Supplement A): 17-23.

ADANJE, S.A. AND W.K. OTTICHILO. 1999. "Population Status and Feeding Habits of the Translocated Sub-Population of Hunter's Antelope or Hirola (*Beatragus hunteri*, Scalter, 1889) in Tsavo National Park, Kenya." *African Journal of Ecology*, 37: 38-48.

AFRICAN BIRD CLUB. 2006. *Important Bird Areas*. Online at <http://www.africanbirdclub.org/countries/Kenya/ibas.html>

BENNUN, L. AND P. NJOROGE. 1999. *Important Bird Areas in Kenya*. Nairobi: Nature Kenya, The East Africa Natural History Society.

BIGALKE, R.C. 1978. "Present-day Mammals of Africa." In V.J. Magio and H.B.S. Cooke (editors). *Evolution of African Mammals*. Cambridge, Massachusetts: Harvard University Press.

BIGGS, R., E. BOHENSKY, P.V. DESANKER, C. FABRICIUS, T. LYNAM, A. A. MISSELHORN, C. MUSVOTO, M. MUTALE, B. REYERS, R.J. SCHOLE, S. SHIKONGO, AND A.S. VAN JAARSVELD. 2004. *Nature Supporting People, The Southern African Millennium Ecosystem Assessment, Integrated Report. A Contribution to the Millennium Ecosystem Assessment, Prepared by the Southern African Millennium Ecosystem Assessment Team*. Pretoria: Council for Scientific and Industrial Research. Online at <http://www.maweb.org/safma>

BIRDLIFE INTERNATIONAL. 2006. *EBAs in Kenya*. Online at <http://www.birdlife.org/datazone/ebas/index.html?acton=EbaHTMFindResults.asp&INam=&Cty=110&z=1>

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2001. *Population Distribution by Administrative Areas and Urban Centres, Kenya 1999 Population and Housing Census. Vol. 1*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2002. *Kenya 1999 Population and Housing Census GIS Database*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2003. *Geographic Dimensions of Well-Being in Kenya: Where are the Poor? From Districts to Locations. Vol. I*. Nairobi: CBS. Online at http://www.worldbank.org/research/poverty-maps/kenya/volume_index.htm

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2005. *Geographic Dimensions of Well-Being in Kenya: Who and Where are the Poor? A Constituency Level Profile. Vol. II*. Nairobi: CBS.

DAWSON, J. 2004. "Can the Lion Lie Down with the Lamb?" *Earth Island Journal* 19 (2). Online at http://www.earthisland.org/eijournal/new_articles.cfm?articleID=878&journalID=79

DE LEEUW, J., M.N. WAWERU, O.O. OKELLO, M. MALOBA, P. NGURU, M.Y. SAID, H.M. ALIGULA, I. M. HEITKONIG, AND R.S. REID. 2001. "Distribution and Diversity of Wildlife in Northern Kenya in Relation to Livestock and Permanent Water Points." *Biological Conservation* 100: 297-306.

DEPARTMENT OF RESOURCE SURVEYS AND REMOTE SENSING (DRSRS), MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES. 2003. *DRSRS GIS Database*. Nairobi: DRSRS.

FISHPOOL, L.D.C., AND M.I. EVANS. 2001. *Important Bird Areas in Africa and Associated Islands: Priority Sites for Conservation*. Cambridge, United Kingdom: BirdLife International.

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2000. *Africover Multipurpose Land Cover Databases for Kenya*. Rome: FAO. Online at: www.africover.org

GEORGIADIS, N. AND G. OJWANG'. 1997, 1999, and 2001. *Laikipia Sample Survey Report*. Unpublished reports.

GEORGIADIS, N., J.G.N. OLWERO, AND G. OJWANG'. 2003. *Laikipia Sample Survey Report*. Unpublished report.

GERMAN TECHNICAL COOPERATION (GTZ). 1996. *The North Kenya GIS Database*. United Nations Environment Programme (UNEP)/GRID-Nairobi. Nairobi: UNEP/GRID-Nairobi.

GICHOHI, H.W. 1996. *The Ecology of a Truncated Ecosystem: The Athi-Kapiti Plains*. Ph.D. Thesis. Leicester: University of Leicester.

GICHOHI, H. 2003. *Direct Payments as a Mechanism for Conserving Important Wildlife Corridor Links Between Nairobi National Park and its Wider Ecosystem: The Wildlife Conservation Lease Program*. Presentation to the Fifth World Parks Congress, Durban, South Africa, September 2003. Online at http://www.conservaionfinance.org/WPC/WPC_documents/Apps_09_Gichohi_v2.pdf

GRUNBLATT, J., M. SAID, P. WARGUTE, AND S.C. KIFUGO. 1995. *DRSRS Data Summary Report: Kenyan Rangelands 1977-1994*. Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

GRUNBLATT, J., M. SAID, AND P. WARGUTE. 1996. *DRSRS National Rangelands Report: Summary of Population Estimates for Wildlife and Livestock, Kenyan Rangelands 1977-1994*. Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

HANSEN, A.J., M.Y. SAID, J.O. OGUTU, R.S. REID, R. DEFRIES, J. DEMPFWOLF, J.F. ROBINSON-COX, S.A.R. MDUMA, AND J.G.C. HOPCRAFT. Submitted. "Land-Use Change Around Protected Areas: Effects on Large Mammal Populations in Maasailand of East Africa." *Landscape Ecology*.

HANSEN, M., R. DEFRIES, J.R. TOWNSHEND, M. CARROLL, C. DIMICELI, AND R. SOHLBERG. 2003. *500m MODIS Vegetation Continuous Fields Version 1.0*. College Park, Maryland: The Global Land Cover Facility.

INSTITUTE OF APPLIED ECOLOGY (IEA). 1998. *African Mammals Databank, A Databank for the Conservation and Management of the African Mammals. Vol. 1 and 2*. Brussels: European Commission Directorate.

KAUFMAN, L. 1992. "Catastrophic Change in Species-Rich Freshwater Ecosystems: The Lessons from Lake Victoria." *Bioscience* 42: 846-858.

KENNEDY, T.A., S. NAEEM, K.M. HOWE, J.M.H. KNOPS, D. TILMAN, AND P. REICH. 2002. "Biodiversity as a Barrier to Ecological Invasion." *Nature* 417: 636-638.

LAMPREY, R. AND R.S. REID. 2004. "Expansion of Human Settlement in Kenya's Maasai Mara: What Future for Pastoralism and Wildlife?" *Journal of Biogeography* 31: 997-1032.

MILLENNIUM ECOSYSTEM ASSESSMENT (MA). 2003. *Ecosystems and Human Well-Being: A Framework for Assessment*. Washington, DC: Island Press. Online at <http://www.maweb.org/en/Framework.aspx>

MOEHLMAN, P.D. (EDITOR). 2002. *Equids: Zebra, Asses and Horses. Status Survey and Conservation Action Plan*. Gland, Switzerland and Cambridge, United Kingdom: IUCN/SSC Equid Specialist Group.

NG'WENO, F., P. MATIKU, AND N. OTIENO (EDITORS). 2004. *Kenya's Important Bird Areas, Status and Trends 2004*. Nairobi: Nature Kenya, the East Africa Natural History Society. Online at http://www.birdlife.org/action/science/indicators/pdfs/kenya_iba_trends.pdf

NORTON-GRIFFITHS, M. 1998. "The Economics of Wildlife Conservation Policy in Kenya." In: E. J. Milner-Gullard and R.P. Mace (editors). *Conservation of Biological Resources: 279-293*. Oxford: Blackwell Science Ltd.

NORTON-GRIFFITHS, M., M.Y. SAID, S. SERNEELS, D.S. KAELO, M. COUGHENOUR, R.H. LAMPREY, D.M. THOMPSON, AND R.S. REID. (in press). "Land Use Economics in the Mara Area of the Serengeti Ecosystem." In: A.R.E. Sinclair and J.F. Fryxell (editors). *Serengeti III: The Future of an Ecosystem*. Chicago: University of Chicago Press.

OGARI, J. 2001. *Impact of Exotic Fish Species and Invasive Water Weeds such as the Water Hyacinth on Lake Victoria Fisheries*. Paper presented at the Lake Victoria Environmental Management Project (LVEMP) conference, Kisumu, Kenya.

REID, R.S., C.J. WILSON, R.L. KRUSKA, AND W. MULATU. 1997. "Impacts of Tsetse Control and Land-Use on Vegetative Structure and Tree Species Composition in Southwestern Ethiopia." *Journal of Applied Ecology* 34: 731-747.

REID, R.S., M.E. RAINY, J. OGUTU, R. KRUSKA, L.K. KIMANI, M. NYABENGE, M. MCCARTNEY, M. KSHATRIYA, J.S. WORDEN, L. NG'ANG'A, J. OWUOR, J. KINOTI, E. NJUGUNA, C.J. WILSON, AND R.H. LAMPREY. 2003. *People, Wildlife and Livestock in the Mara Ecosystem: the Mara Count 2002*. Nairobi: International Livestock Research Institute. Online at www.maasaimaracount.org

REID, R.S., H. GICHOHLI, M.Y. SAID, D. NKEDIANYE, J.O. OGUTU, M. KSHATRIYA, P. KRISTJANSON, S.C. KIFUGO, J.L. AGATSIVA, S.A. ADANJE, AND R. BAGINE. 2006. "Fragmentation of a Periurban Savanna, Athi-Kaputiei Plains, Kenya." In: K.A. Galvin, R.S. Reid, R.H. Behnke, and N.T. Hobbs (editors). *Fragmentation in Semi-arid and Arid Landscapes: Consequences for Human and Natural Systems*. Dordrecht: Kluwer Academic.

REVENGA, C., J. BRUNNER, N. HENNINGER, K. KASSEM, AND R. PAYNE. 2000. *Pilot Analysis of Global Ecosystems, Freshwater Systems*. Washington, DC: World Resources Institute. Online at http://pdf.wri.org/page_freshwater.pdf

SAID, M.Y., R.N. CHUNGE, C.G. CRAIG, C.R. THOULESS, R.F. BARNES, AND H.T. DUBLIN. 1995. *African Elephant Database 1995*. Gland, Switzerland: World Conservation Union (IUCN).

SERNEELS, S. AND E.F. LAMBIN. 2001. "Impact of Land-Use Changes on the Wildebeest Migration in the Northern Part of the Serengeti-Mara Ecosystem." *Journal of Biogeography* 28: 391-407.

STATTERSFIELD, A.J., M.J. CROSBY, A.J. LONG, AND D.C. WEGE. 1998. *Endemic Bird Areas of the World: Priorities for Biodiversity Conservation*. Cambridge, United Kingdom: BirdLife International.

SURVEY OF KENYA (SoK). 2003. *National Atlas of Kenya, Fifth Edition*. Nairobi: Survey of Kenya.

SURVEY OF KENYA (SoK) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 1997. *Road Network GIS Database*. Digitized by ILRI from Survey of Kenya's 1:50,000 topographic sheets for 1978-1997. Nairobi: SoK and ILRI.

SURVEY OF KENYA (SoK) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 2000. *Cities, Towns, and Market Centers GIS Database*. Digitized by ILRI from Survey of Kenya's 1:250,000 topographic sheets (for northern Kenya) and 1:50,000 topographic sheets for the rest of the country. Nairobi: SoK and ILRI.

TILMAN, D., D. WEDIN, AND J. KNOPS. 1996. "Productivity and Sustainability Influenced by Biodiversity in Grassland Ecosystems." *Nature* 379: 718-720.

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP). 2001. *An Assessment of the Status of the World's Remaining Closed Forests*. Nairobi: UNEP. Online at <http://grid2.cr.usgs.gov/publications/closedforest.pdf#search=%22an%20assessment%20of%20the%20worlds%20remaining%20closed%20forests%22>

WARGUTE, P.W. AND M.Y. SAID. 1997. *The Population and Distribution Trend of Grevy's Zebra (Equus grevyi Oustalet, 1882). Department of Resource Surveys and Remote Sensing, Technical Report*. Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

WHITE, F. 1983. *The Vegetation of Africa, a Descriptive Memoir to Accompany the UNESCO/AETFAT/UNSO Vegetation Map of Africa*. Paris: UNESCO.

WILLIAMS, S.D. 1998. *Grevy's Zebra: Ecology in a Heterogeneous Environment. Ph.D. Thesis*. London: University College.

WILSON, C.J., R.S. REID, N.L. STANTON, AND B.D. PERRY. 1997. "Ecological Consequences of Controlling the Tsetse Fly in Southwestern Ethiopia: Effects of Land-Use on Bird Species Diversity." *Conservation Biology* 11: 435-447.

WORLD AGROFORESTRY CENTRE (ICRAF) AND DEPARTMENT OF RESOURCE SURVEYS AND REMOTE SENSING (DRSRS), MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES. 2001. *GIS Database of Land Use and Land Cover for Kenya's Medium to High Potential Districts*. DRSRS interpretation of 5,747 aerial photographs from transects flown in 1997. Approach summarized in report prepared for ICRAF and African Highlands Initiative (E.C. Njuguna. 2001. *Aerial Survey Sample Photo Interpretation, Report on Land Use Land Cover For Medium to High Potential Districts of Kenya*. Nairobi: DRSRS). Nairobi: ICRAF and DRSRS.

WORLD CONSERVATION UNION (IUCN) AND UNITED NATIONS ENVIRONMENT PROGRAMME/WORLD CONSERVATION MONITORING CENTRE (UNEP/WCMC). 2006. *2006 World Database on Protected Areas*. Cambridge, United Kingdom: IUCN and UNEP/WCMC.

WORLD CONSERVATION UNION (IUCN). 2006. *2006 IUCN Red List of Threatened Species*. Online at: www.iucnredlist.org.

Chapter 6 Tourism

ARABUKO-SOKOKE FOREST MANAGEMENT TEAM. 2002. *Arabuko-Sokoke Strategic Forest Management Plan 2002-2007*. Available online at http://www.birdlife.org/action/ground/arabuko/arabuko_sokoke_plan.pdf

BELAU, D. 2003. *The Impact of the 2001-2002 Crisis on the Hotel and Tourism Industry*. Geneva: International Labour Organization (ILO). Online at <http://www.ilo.org/public/english/dialogue/sector/papers/tourism/impact.pdf>

BENNUN, L. AND P. NJOROGE. 1999. *Important Bird Areas in Kenya*. Nairobi: Nature Kenya, The East Africa Natural History Society.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2002. *Kenya 1999 Population and Housing Census GIS Database*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2003. *Geographic Dimensions of Well-Being in Kenya: Where are the Poor? From Districts to Locations. Vol. I*. Nairobi: CBS. Online at http://www.worldbank.org/research/povertymaps/kenya/volume_index.htm

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2004. *Economic Survey 2004*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2006. *Economic Survey 2006*. Nairobi: CBS.

DEPARTMENT OF RESOURCE SURVEYS AND REMOTE SENSING (DRSRS), MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES. 2003. *DRSRS GIS Database*. Nairobi: DRSRS.

ECOTOURISM SOCIETY OF KENYA (ESOK). 2005. *National Inventory of Ecotourism Projects in Kenya 2003-2005*. Nairobi: ESOK.

FILION, F.L., J.P. FOLEY, AND A.J. JACQUEMOT. 1994. "The Economics of Global Ecotourism." In M. Munasinghe and J. McNeely (editors). *Protected Area Economics and Policy: Linking Conservation and Sustainable Development*. Washington DC: World Bank.

FISHPOOL, L.D.C., AND M.I. EVANS. 2001. *Important Bird Areas in Africa and Associated Islands: Priority Sites for Conservation*. Cambridge, United Kingdom: BirdLife International.

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2000. *Africover Multipurpose Land Cover Databases for Kenya*. Rome: FAO. Online at www.africover.org

GRUNBLATT, J., M. SAID, P. WARGUTE, AND S.C. KIFUGO. 1995. *DRSRS Data Summary Report: Kenyan Rangelands 1977-1994*. Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

GRUNBLATT, J., M. SAID, AND P. WARGUTE. 1996. *DRSRS National Rangelands Report: Summary of Population Estimates for Wildlife and Livestock, Kenyan Rangelands 1977-1994*. Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS), Ministry of Planning and National Development.

GOVERNMENT OF KENYA (GoK). 1995. *The Study on the National Tourism Master Plan in the Republic of Kenya (Volume 1)*. Nairobi: GoK.

GOVERNMENT OF KENYA (GoK). 2003. *Economic Recovery Strategy for Wealth and Employment Creation 2003-2007*. Nairobi: GoK. Online at http://www.planning.go.ke/publication/economic_recovery_plan.pdf

IEXPLORE. 2006. "Kenya Destination Guide" at <http://pta.iexplore.com/dmap/Kenya/Overview> and [http://pta.iexplore.com/dmap/Kenya/Where+to+Go;\\$sessionid\\$HLWYVYQACEVI2P2MN5XCFEQ](http://pta.iexplore.com/dmap/Kenya/Where+to+Go;$sessionid$HLWYVYQACEVI2P2MN5XCFEQ)

IKIARA, M. 2001. *Policy Framework of Kenya's Tourism Sector since Independence and Emerging Policy Concerns*. Kenya Institute for Public Policy Research and Analysis (KIPPRA) Working Paper No.2. Nairobi: KIPPRA. Online at <http://www.kippira.org/resources/publications.asp>

IKIARA, M. AND C. OKECH. 2002. *Impact of Tourism on Environment in Kenya: Status and Policy*. Kenya Institute for Public Policy Research and Analysis (KIPPRA) Discussion Paper No. 19. Nairobi: KIPPRA. Online at <http://www.kippira.org/resources/publications.asp>

KAHATA, J. AND J. IMBANGA. 2002. *Sustainable Tourism. A Report on the Civil Society Review of the Implementation of Agenda 21 in Kenya, Kenya NGO Earth Summit 2002 Forum*. Online at <http://www.worldsummit2002.org/texts/KENYAtourism.pdf>

KENYA WILDLIFE SERVICE (KWS). 2005. "Major Parks Yearly Report" (KWS internal document) and Sammy Towett (KWS), personal communication.

KENYA.COM. 2006. "Shimba Hill, Description." Online at <http://www.kenya.com/shimbahills.html>

LAIKIPIA WILDLIFE FORUM. 2006. "Description of Species, Tour Operators, and Ecotourism" Online at http://www.laikipia.org/safari_laikipia.htm

MACMILLAN EDUCATION LTD. 1993. *Kenya Traveller's Map, Third Edition*. London and Oxford: MacMillan Education Ltd.

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA). 2003. *State of the Environment (SoE) Report for Kenya, 2003, Summary*. Nairobi: NEMA. Online at <http://www.nema.go.ke/downloads/SOE03summary.pdf>

NATIONAL IMAGERY AND MAPPING AGENCY OF THE UNITED STATES (NIMA). 1997. *VMAP_1V10 - Vector Map Level 0 (Digital Chart of the World)*. Washington, DC: NIMA.

OJWANG, G., M.Y. SAID, P.W. WARGUTE, AND R. REID. 2006. *Dry Season Census of Large Herbivores in the Mara Ecosystem and Adjoining Areas 2000-2002*. Department of Resource Surveys and Remote Sensing (DRSRS) Technical Report. Nairobi: DRSRS.

OTTICHILO, W.K., J. DE LEEUW, A.K. SKIDMORE, H.H.T. PRINS, AND M.Y. SAID. 2001. "Population Trends of Large Non-Migratory Wild Herbivores and Livestock in the Masai Mara Ecosystem, Kenya, between 1977 and 1997." *African Journal of Ecology* 38: 202-216.

REPUBLIC OF KENYA (RoK). 2003. *Gazette Notice. 3976. The Hotels and Restaurants (Classification of Hotels and Restaurants) Regulations, 1988. Vol. CV, No. 62*. Nairobi: RoK.

SCHOLES, R.J. AND R. BIGGS (EDITORS). 2004. *Ecosystem Services in Southern Africa: A Regional Assessment. A Contribution to the Millennium Ecosystem Assessment, Prepared by the Regional-Scale Team of the Southern African Millennium Ecosystem Assessment 2004*. Pretoria: Council for Scientific and Industrial Research (CSIR). Online at <http://www.maweb.org/safma>

SERNEELS, S. AND E.F. LAMBIN. 2001. "Impact of Land-Use Changes on the Wildebeest Migration in the Northern Part of the Serengeti-Mara Ecosystem." *Journal of Biogeography* 28: 391-407.

SURVEY OF KENYA (SoK), JAPAN INTERNATIONAL COOPERATION AGENCY (JICA), AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 1996. *250-meter Digital Elevation Model*. Created by ILRI and JICA, derived from SoK 1:250,000 Topographic Map. Nairobi: ILRI.

SURVEY OF KENYA (SoK) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 2000. *Cities, Towns, and Market Centers GIS Database*. Digitized by ILRI from Survey of Kenya's 1:250,000 topographic sheets (for northern Kenya) and 1:50,000 topographic sheets for the rest of the country. Nairobi: SoK and ILRI.

UNITED NATIONS. 2002. *Kenya Country Profile, Johannesburg Summit 2002*. Online at www.un.org/esa/agenda21/natlinfo/wssd/kenya.pdf

UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP), KENYA MARINE AND FISHERIES RESEARCH INSTITUTE (KMFRI), AND GEOLOGICAL SURVEY OF DENMARK AND GREENLAND (GEUS). 2006. *KenSea, Environmental Sensitivity Atlas for Coastal Area of Kenya*. Copenhagen: UNDP, KMFRI, and GEUS. Online at http://www.geus.dk/program-areas/nature-environment/international/reports/kensea/kensea_rapport.pdf

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP)/GRID-NAIROBI. 1998. *Eastern Africa Coastal and Marine Resources Database*. Nairobi: UNEP/GRID-Nairobi. Project description online at <http://www.unep.org/efatlas/dbke.htm>

WORLD CONSERVATION UNION (IUCN) AND UNITED NATIONS ENVIRONMENT PROGRAMME/WORLD CONSERVATION MONITORING CENTRE (UNEP/WCMC). 2006. *2006 World Database on Protected Areas*. Cambridge, United Kingdom: IUCN and UNEP/WCMC.

Chapter 7 Wood

AFRICAN BIRD CLUB. 2006. *Important Bird Areas*. Online at <http://www.africanbirdclub.org/countries/Kenya/ibas.html>

AKOTSI, E. AND M. GACHANJA. 2004. *Changes in Forest Cover in Kenya's Five Water Towers 2000-2003*. Nairobi: Department of Resource Surveys and Remote Sensing (DRSRS) and Kenya Forest Working Group (KFWG). Online at http://www.unep.org/dewa/assessments/EcoSystems/Land/mountain/pdf/forest_catchment_2003_report.pdf

ARID LANDS RESOURCE MANAGEMENT PROJECT (ALRMP), UNITED NATIONS WORLD FOOD PROGRAMME/VULNERABILITY ANALYSIS AND MAPPING (WFP/VAM), FAMINE EARLY WARNING SYSTEMS NETWORK (FEWS NET), AND MINISTRY OF AGRICULTURE (MoA). 2006. *Kenya Livelihood Mapping GIS Database, 2003-05*. Nairobi: ALRMP, WFP/VAM, FEWS NET, and MoA.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2002. *Kenya 1999 Population and Housing Census GIS Database*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2003. *Geographic Dimensions of Well-Being in Kenya: Where are the Poor? From Districts to Locations. Vol. I*. Nairobi: CBS. Online at http://www.worldbank.org/research/povertymaps/kenya/volume_index.htm

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2004. *Economic Survey 2004*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2006. *Economic Survey 2006*. Nairobi: CBS.

CHOGE, S.K., A.B. CUNNINGHAM, AND F.W. ELLERY. 2002. "Sustaining the Wood Carving in Kenya: Issues and Challenges." In *Proceedings: Natural Forests and Savanna Woodlands Symposium III: 6-9 May 2002, University of Natal, South Africa*. Online at http://dwafapp4.dwaf.gov.za/dwaf/download.asp?f=4160__section3sustaining+the+woodcarving+industry+336.pdf&docId=4160

ENERGY FOR SUSTAINABLE DEVELOPMENT AFRICA (ESDA). 2005a. *National Charcoal Survey: Exploring the Potential for a Sustainable Charcoal Industry in Kenya*. Nairobi: ESDA.

ENERGY FOR SUSTAINABLE DEVELOPMENT AFRICA (ESDA). 2005b. *National Charcoal Survey: Summary Report. Exploring the Potential for a Sustainable Charcoal Industry in Kenya*. Nairobi: ESDA.

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2000. *Africover Multipurpose Land Cover Databases for Kenya*. Rome: FAO. Online at: www.africover.org

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2005. *Global Forest Resources Assessment 2005 (FRA 2005). Progress Towards Sustainable Forest Management, FAO Forestry Paper 147*. Rome: FAO. Online at <http://www.fao.org/docrep/008/a0400e/a0400e00.htm>

GATHAARA, G.N. 1999. *Aerial Survey of the Destruction of Mount Kenya, Imenti, and Ngare Ndare Forest Reserves, February-June 1999*. Nairobi: Kenya Wildlife Service. Online at <http://www.kenyaforests.org/reports/MtKenya99.pdf>

HANSEN, M., R. DEFRIES, J.R. TOWNSHEND, M. CARROLL, C. DIMICELI, AND R. SOHLBERG. 2003. *500 meter MODIS Vegetation Continuous Fields Version 1.0*. College Park, Maryland: The Global Land Cover Facility. Online at <http://glcf.umd.edu/data/vcf/>

HOLDING ANYONGE, C. AND J.M. ROSHETKO. 2003. "Farm-Level Timber Production: Orienting Farmers Towards the Market". *Unasylva* 212: 48-56. Online at <ftp://ftp.fao.org/docrep/fao/005/y4744e/y4744e11.pdf>

JAYNE, T. S., T. YAMANO, J. NYORO, AND T. AWUOR. 2000. *Do Farmers Really Benefit from High Food Prices? Balancing Rural Interests in Kenya's Maize Pricing and Marketing Policy. Tegemeo Institute of Agricultural Policy and Development. Policy Brief No.1*. Nairobi: Tegemeo. Online at: www.tegemeo.org

KAMERI-MBOTE, P. 2005. *Land Tenure, Land Use and Sustainability in Kenya: Towards Innovative Use of Property Rights in Wildlife Management. IELRC Working Paper 2005 - 4*. Geneva, Switzerland: International Environmental Law Research Centre (IELRC). Online at <http://www.ielrc.org/content/w0504.pdf>

LAMBRECHTS C., B. WOODLEY, C. CHURCH, AND M. GACHANJA. 2003. *Aerial Survey of the Destruction of the Aberdare Range Forests*. Nairobi: United Nations Environment Programme (UNEP). Online at <http://www.kenyaforests.org/reports/report%20Final.pdf>

LAMPREY, R. AND R.S. REID. 2004. "Expansion of Human Settlement in Kenya's Maasai Mara: What Future for Pastoralism and Wildlife?" *Journal of Biogeography* 31: 997-1032.

MATIRU, V. 1999. *Forest Cover and Forest Reserves in Kenya: Policy and Practice*. Nairobi: World Conservation Union (IUCN), Eastern African Regional Office. Online at <http://www.iucn.org/places/earo/pubs/forest/forestcover.pdf>

MATIRU, V. AND S. MUTIMBA. 2002. "Legalise It." *Ecoforum*, Long Rains, 34.

MBUGUA, D. 2000. *Forest Outlook Studies in Africa (FOSA), Kenya*. Rome: Food and Agriculture Organization (FAO) of the United Nations. Online at <ftp://ftp.fao.org/docrep/fao/003/AB569E/AB569E00.pdf>

MINISTRY OF ENERGY (MoE). 2002. *Study on Kenya's Energy Demand, Supply and Policy Strategy for Households, Small Scale Industries and Service Establishments, Final Report, September 2002*. Nairobi: MoE and Kamfor Company Limited.

NATIONAL IMAGERY AND MAPPING AGENCY OF THE UNITED STATES (NIMA). 1997. *VMAP_1V10 - Vector Map Level 0 (Digital Chart of the World)*. Washington, DC: NIMA.

NORTON-GRIFFITHS, M., M.Y. SAID, S. SERNEELS, D.S. KAELO, M. COUGHENOUR, R.H. LAMPREY, D.M. THOMPSON, AND R.S. REID. (IN PRESS). "Land Use Economics in the Mara Area of the Serengeti Ecosystem." In: A.R.E. Sinclair and J.F. Fryxell (editors). *Serengeti III: The Future of an Ecosystem*. Chicago: University of Chicago Press.

SERNEELS, S. AND E.F. LAMBIN. 2001. "Impact of Land-Use Changes on the Wildebeest Migration in the Northern Part of the Serengeti-Mara Ecosystem." *Journal of Biogeography* 28: 391-407.

SURVEY OF KENYA (SoK) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 1997. *Road Network GIS Database*. Digitized by ILRI from Survey of Kenya's 1:50,000 topographic sheets for 1978-1997. Nairobi: SoK and ILRI.

SURVEY OF KENYA (SoK) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 2000. *Cities, Towns, and Market Centers GIS Database*. Digitized by ILRI from Survey of Kenya's 1:250,000 topographic sheets (for northern Kenya) and 1:50,000 topographic sheets for the rest of the country. Nairobi: SoK and ILRI.

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP). 2001. *An Assessment of the Status of the World's Remaining Closed Forests*. Nairobi: UNEP. Online at <http://grid2.cr.usgs.gov/publications/closedforest.pdf#search=%22an%20assessment%20of%20the%20worlds%20remaining%20closed%20forests%22>

VANLEEUWE, H.B., C. WOODLEY, M. LAMBRECHTS, AND M. GACHANJA. 2003. *Changes in the State of Conservation of Mount Kenya Forests: 1999-2002. An Interim Report February 2003*. Nairobi: DICE - University of Canterbury, Kenya Wildlife Service, and United Nations Environment Programme. Online at <http://www.kenyaforests.org/reports/Mt.Kenya.pdf>

WASS, P. 1995. *Kenya's Indigenous Forests, Status, Management and Conservation*. Gland, Switzerland: World Conservation Union (IUCN).

WASS, P. 2000. *Kenya's Forest Resource Assessment, Data Collection and Analysis for Sustainable Forest Management in ACP Countries - Linking National and International Efforts*. Addis Ababa: European Commission Directorate-General VIII Development and Food and Agriculture Organization. Online at <ftp://ftp.fao.org/docrep/fao/004/X6809E/X6809E00.pdf>

WORLD AGROFORESTRY CENTRE (ICRAF) AND DEPARTMENT OF RESOURCE SURVEYS AND REMOTE SENSING (DRSRS), MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES. 2001. *GIS Database of Land Use and Land Cover for Kenya's Medium to High Potential Districts*. DRSRS interpretation of 5,747 aerial photographs from transects flown in 1997. Approach summarized in report prepared for ICRAF and African Highlands Initiative (E.C. Njuguna. 2001. *Aerial Survey Sample Photo Interpretation, Report on Land Use Land Cover For Medium to High Potential Districts of Kenya*. Nairobi: DRSRS). Nairobi: ICRAF and DRSRS.

WORLD BANK AND GOVERNMENT OF KENYA (GoK). 1999. *The Status of Plantation Grown Timber and its Implications on Sustainable Management and Rational Utilization of the Resource, Implementation, and Completion Report*. Nairobi: World Bank and GoK.

WORLD CONSERVATION UNION (IUCN) AND UNITED NATIONS ENVIRONMENT PROGRAMME/WORLD CONSERVATION MONITORING CENTRE (UNEP/WCMC). 2006. *2006 World Database on Protected Areas*. Cambridge, United Kingdom: IUCN and UNEP/WCMC.

Chapter 8 The Upper Tana: Patterns of Ecosystem Services and Poverty

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2002. *Kenya 1999 Population and Housing Census GIS Database*. Nairobi: CBS.

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2003. *Geographic Dimensions of Well-Being in Kenya: Where are the Poor? From Districts to Locations. Vol. I*. Nairobi: CBS. Online at http://www.worldbank.org/research/povertymaps/kenya/volume_index.htm

FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UNITED NATIONS. 2000. *Africover Multipurpose Land Cover Databases for Kenya*. Rome: FAO. Online at: www.africover.org

GOVERNMENT OF KENYA (GoK). 2003. *Economic Recovery Strategy for Wealth and Employment Creation 2003-2007*. Nairobi: GoK. Online at http://www.planning.go.ke/publication/economic_recovery_plan.pdf

JAYNE, T.S., T. YAMANO, J. NYORO, AND T. AWUOR. 2000. *Do Farmers Really Benefit from High Food Prices? Balancing Rural Interests in Kenya's Maize Pricing and Marketing Policy*. Tegemeo Institute of Agricultural Policy and Development. Policy Brief No.1. Nairobi: Tegemeo. Online at: www.tegemeo.org

KENYA FORESTS WORKING GROUP (KFWG). 2001. "Kenya Government Gives Away 5 Percent of Its Forests." Press Release from the Kenya Forests Working Group. Nairobi: KFWG, 2 November 2001.

MINISTRY OF ENERGY (MoE). 2002. *Study on Kenya's Energy Demand, Supply and Policy Strategy for Households, Small Scale Industries and Service Establishments, Final Report, September 2002*. Nairobi: MoE and Kamfor Company Limited.

MINISTRY OF WATER DEVELOPMENT (MoWD) AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA). 1992. *The Study on the National Water Master Plan. GIS Data of Drainage and Subdrainage Areas*. Nairobi: MoWD, JICA, and International Livestock Research Institute.

NATIONAL IMAGERY AND MAPPING AGENCY OF THE UNITED STATES (NIMA). 1997. *VMAP_1V10 - Vector Map Level 0 (Digital Chart of the World)*. Washington, DC: NIMA.

OLSON, J.M. 2004. *Multi-Scale Analysis of Land Use and Management Change on the Eastern Slopes of Mount Kenya*. LUCID Working Paper 20. East Lansing, Michigan: Michigan State University. Online at <http://www.lucideastafrica.org/publications.htm>

SURVEY OF KENYA (SoK), JAPAN INTERNATIONAL COOPERATION AGENCY (JICA), AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 1996. *250-meter Digital Elevation Model*. Created by ILRI and JICA, derived from SoK 1:250,000 Topographic Map. Nairobi: ILRI.

Lessons Learned and Next Steps

BIGGS, R., E. BOHENSKY, P.V. DESANKER, C. FABRICIUS, T. LYNAM, A. A. MISSELHORN, C. MUSVOTO, M. MUTALE, B. REYERS, R.J. SCHOLES, S. SHIKONGO, AND A.S. VAN JAARSVELD. 2004. *Nature Supporting People, The Southern African Millennium Ecosystem Assessment, Integrated Report. A Contribution to the Millennium Ecosystem Assessment, Prepared by the Southern African Millennium Ecosystem Assessment Team*. Pretoria: Council for Scientific and Industrial Research. Online at <http://www.maweb.org/safma>

CENTRAL BUREAU OF STATISTICS (CBS), MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT. 2005. *Geographic Dimensions of Well-Being in Kenya: Who and Where are the Poor? A Constituency Level Profile. Vol. II*. Nairobi: CBS.

GOVERNMENT OF KENYA (GoK). 2003. *Economic Recovery Strategy for Wealth and Employment Creation 2003-2007*. Nairobi: GoK. Online at http://www.planning.go.ke/publication/economic_recovery_plan.pdf

MILLENNIUM ECOSYSTEM ASSESSMENT (MA). 2005. *Ecosystems and Human Well-Being: Synthesis*. Washington, DC: Island Press. Online at <http://www.maweb.org/en/Synthesis.aspx>

MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT (MoPND), UNITED NATIONS DEVELOPMENT PROGRAMME, AND GOVERNMENT OF FINLAND. 2005. *Millennium Development Goals in Kenya, Needs & Costs*. Nairobi: Government of Kenya. Online at <http://www.ke.undp.org/KenyaMDGNeedsAssessment.pdf>

REPUBLIC OF KENYA (RoK). 2006. *Medium Term Expenditure Framework 2006. 2007-2008/2009. Report for the Agriculture and Rural Development (ARD) Sector. Final Draft. February 2006*. Nairobi: RoK Online at http://www.treasury.go.ke/sector_reports/ARD_Sector%20_Report_2007%20_Draft.pdf

SCHOLES, R.J. AND R. BIGGS (EDITORS). 2004. *Ecosystem Services in Southern Africa: A Regional Assessment. A Contribution to the Millennium Ecosystem Assessment, Prepared by the Regional-Scale Team of the Southern African Millennium Ecosystem Assessment 2004*. Pretoria: Council for Scientific and Industrial Research (CSIR). Online at <http://www.maweb.org/safma>

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The Department of Resource Surveys and Remote Sensing (DRSRS) had its beginning in 1976 as the Kenya Rangeland Ecological Monitoring Unit and has since evolved into a full department with the mandate to collect data and monitor the status of natural resources in Kenya. Its main functions are to:

- ▶ Provide data on natural resources.
- ▶ Collect information on the distribution of wildlife and livestock in Kenya's rangelands.
- ▶ Provide land-use and land-cover information for vegetation mapping and forest planning.
- ▶ Supply early warning information for food and disaster management.

In particular, DRSRS is concerned with gathering and analyzing information on wildlife and livestock population trends, human dwellings, vegetative cover, land use, land degradation, crop forecasting, and other environmental variables. DRSRS has developed a geospatial databank based on aerial surveys, aerial photography, high-resolution remote sensing images, and ground sampling data covering the last 30 years. Researchers and analysts at the Department rely on a combination of remote sensing techniques, ground sampling, and geographic information systems to develop structured databases for resource use, modeling, planning, and management geared to address poverty reduction and reverse environmental degradation.



Department of Resource Surveys
and Remote Sensing
Ministry of Environment and Natural Resources

CENTRAL BUREAU OF STATISTICS MINISTRY OF PLANNING AND NATIONAL DEVELOPMENT

Herufi House, 1st Floor
P.O. Box 30266
Nairobi 00100, Kenya
www.cbs.go.ke

The Central Bureau of Statistics (CBS) is located in the Ministry of Planning and National Development. The mission of CBS is to: coordinate and supervise the National Statistical System; produce and disseminate comprehensive, integrated, accurate, and timely statistics required mainly to inform National Development initiatives and processes; and develop and maintain a comprehensive socio-economic national database.

CBS is mandated by law to collect, analyze, and disseminate socio-economic statistics needed for planning and policy formulation in the country. The functions of CBS fall into the following four categories:

- ▶ Data collection in the areas of industry, labor, population, health, education, agriculture, nutrition, environment, and economics.
- ▶ Data analysis and production of official statistics.
- ▶ Dissemination of results to users and producers.
- ▶ Archiving of survey and census results data.

The Bureau coordinates and supervises Kenya's national statistical system. For data collection, it relies on statistical officers and trained enumerators in every District. Statistical officers are also posted in various Government ministries to augment data collection and analysis in those institutions. CBS is the custodian of all government statistical information including all national household surveys and the National Population and Housing Censuses.



Central Bureau of Statistics
Ministry of Planning and National Development

INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

P.O. Box 30709
Nairobi 00100, Kenya
www.ilri.org

The International Livestock Research Institute (ILRI) works at the intersection of livestock and poverty, bringing high-quality science and capacity-building to bear on poverty reduction and sustainable development.

ILRI's strategy is to place poverty at the centre of an output-oriented agenda. ILRI's strategy focuses on three livestock-mediated pathways out of poverty: (1) securing the assets of the poor; (2) improving the productivity of livestock systems; and (3) improving market opportunities.

ILRI's research portfolio comprises four issue-oriented themes:

- ▶ Targeting and innovation.
- ▶ Improving market opportunities.
- ▶ Using biotechnology to secure livestock assets.
- ▶ People, livestock, and the environment.

ILRI also coordinates the Systemwide Livestock Programme of the Consultative Group on International Agricultural Research (CGIAR).

To achieve its goals, ILRI works in partnerships with other national and international organizations in livestock research, training, and information. ILRI works in all tropical developing regions of Africa, Asia and Latin America and the Caribbean.



World Resources Institute

Department of Resource Surveys and Remote Sensing, Ministry of Environment and Natural Resources, Kenya

Central Bureau of Statistics, Ministry of Planning and National Development, Kenya

International Livestock Research Institute

