

Towards an Inventory of Historical Aerial Photos of Kenya, Tanzania and Uganda

Brian Kuns, Stockholm University

Summary

In fulfillment of the CREATING project terms of reference, this memo presents a preliminary overview of archival resources containing historical aerial photographs of East Africa, plus recommendations on how one could conduct a more thorough inventory of such resources. The information presented in this memo is a synthesis of historical research, information available on the internet, and information gained from email exchanges and/or conversations and interviews with researchers in Africa and researchers or library and museum staff in the United Kingdom.

A general observation is that finding information on archives in Africa has been difficult, as African land survey authorities and universities have less of a web-presence than their European counterparts. For example, the land survey authorities in Tanzania and Uganda do not have a web presence at all. While information has been found on African archives, the information presented here remains fragmentary and subject to confirmation. There is more concrete information regarding British archives of historical aerial photos of East Africa and this will be presented below. It must be said however that producing a proper inventory of historical aerial photos of East Africa would naturally require time spent in Kenya, Tanzania, Uganda and in the United Kingdom. The original project did not foresee such activities, so the present document should best be seen as reflections and recommendations on how one could produce such an inventory.

This memo is divided into four sections. The first presents historical background information on aerial photography in East Africa. The second section concerns information on existing sources or archives in Kenya, Tanzania and Uganda. The third section presents information on non-African archives, mostly in the UK. The fourth section consists of recommendations on how one could proceed to collect more comprehensive inventory of historical aerial photos of East Africa. Finally, two appendices are appended: one lists recent scientific literature on East Africa in which historical aerial photos were used, and the other lists contact information for the different Survey and Mapping Departments in Kenya, Uganda and Tanzania and contact information for NGOs or institutions whose mission in some way involves tracking land use and landscape change.

Section 1: Historical Background

A historical note is appropriate, since understanding who took aerial photos in East Africa and when and where can naturally provide some insight into the question of where those photos can be found now. This historical section will mostly discuss the activities and photo archives of the British Directorate of Overseas Surveys (DOS), which is a main source of historical aerial photos of East Africa particularly during the 1950s. The DOS was originally the Directorate of Colonial Surveys (DCS), which was established in 1946 after long discussions within the British military and colonial apparatus on the optimal way, organizationally, technically and financially, to map

Africa using the new possibilities offered by aerial photography¹. The DCS changed its name to the DOS in 1957 in anticipation of the independence of British colonies in Africa. Under the aegis of the Overseas Development Administration (Now Department for International Development -- DFID), and later the British Ordnance Survey, the DOS continued to map and conduct aerial surveys of Africa well into the post-independence period. In the 1990s, the DOS was pared down, becoming essentially an international consultancy unit within the British Ordnance Survey. Even this unit was disbanded in 2001.

The era of systematic aerial mapping of East Africa thus began with the post-WWII establishment of the DCS/DOS. However, according to Gerald McGrath, who has written several histories of the surveying and mapping of Africa², limited aerial surveys were conducted before the establishment of the DCS/DOS. First, before WWII as aerial photography was being developed in Europe, some British colonies experimented with the new technology, though a variety of concerns, not least among them cost, the ongoing global economic depression and a lack of technical skills, prevented more systematic adoption of the new technology. In East Africa, Tanganyika stands out as an early experimenter with aerial photography, and various regions were photographed in the 1930s.³ There were also some early, though again sporadic, experiments in other parts of British East Africa.⁴ WWII made the question of mapping Africa more urgent. As a result, the Royal Air Force (RAF) conducted more extensive aerial surveys in East Africa, though again complete coverage was not achieved. Because of its proximity to Italian forces in Ethiopia and Somalia, Kenya was mapped more extensively during the war, as were coastal areas in Kenya and Tanganyika.⁵ Finally, towards the end of the war, colonial administrations began asking the RAF to conduct aerial surveys for the purpose of colonial development, though not much was done before the reconnaissance units returned home following the conclusion of the war.⁶

Section 2: Available Sources of Aerial Photos (Africa):

Following independence, there appear various new actors conducting aerial surveys, though the DOS continued its activities. Among the new actors are the various organizations in and/or mapping agencies of the respective independent countries. Also, bilateral donor agencies have funded, at different times, aerial surveys. The Japanese International Cooperation Agency was

¹ McGrath, Gerald, 1976, "The Survey and Mapping of British East Africa: 1890-1946," *Cartographica*, Monograph 18, pp 82-102. See also the following web-page from the British Ordnance Survey:

www.ordnancesurvey.co.uk/oswebsite/aboutus/international/collection/history.html.

² *Ibid* and McGrath, 1983, "Mapping for Development: The Contribution of the Directorate of Overseas Surveys," *Cartographica*, 20 (1/2).

³ While not providing a definitive list, McGrath mentions large-scale aerial photographs taken during the 1930s of Pangani, Dar es Salaam harbour, the delta of the Rufiji river, Zanzibar, Pemba, and the Uluguru Mountains. See McGrath, "The Survey and Mapping of British East Africa: 1890-1946," pp 84-85.

⁴ See *Ibid*, p. 90.

⁵ *Ibid*, pp. 95-101.

⁶ *Ibid*, pp. 101.

mentioned by several respondents in this regard. What follows is a summary of the institutions that, according to various respondents, have some archive of aerial photos.

- **Kenya.** Respondents referred to three institutions in Kenya that possess historical aerial photos. The first one is the Survey of Kenya, with a large archive that is generally accessible. It is possible to copy or scan images. One respondent stated that some photos at the Survey of Kenya archive, particularly older ones are in increasingly bad condition. While this respondent had not conducted a thorough inventory of what pictures the Survey of Kenya had, it was his impression that there are more aerial photos there from before independence until 1970s than there are aerial photos from the 1980s and 1990s. Another organization with an archive of aerial photos is the Department for Remote Sensing and Resource Surveys (DRSRS), which is a part of the Kenyan Ministry of Environment and Natural Resources. The DRSRS has conducted repeat aerial surveys of agricultural areas (in Kenya) since the 1970s. Finally, the Kenyan National Archives possesses historical aerial photos. The photos at the National Archive are mostly from the 1950s, though they have photos from the 1940s to the 1970s. Some of the photos at the National Archives were taken by the Kenyan Wildlife Service for tracking wildlife populations.
- **Tanzania.** Various institutions in Tanzania have some sort of archive of aerial photos, including both the Department of Maps and Surveys and the Tanzanian National Archives, the latter possessing, according to one respondent, historical oblique photos of most of the country. The Institute of Resource Assessment (IRA)⁷ at the University of Dar es Salaam has an archive of aerial photos going back to the 1950s and covering some 60% of the country. The National Museum in Dar es Salaam also has aerial photos, and according to one respondent there is an effort underway to digitize these photos. Finally, Maelezo (National Information Office for Dar es Salaam) has historical aerial photos of Dar es Salaam.
- **Uganda.** A variety of institutions in Uganda have archives of aerial photos. The Forestry Department, which monitors Uganda's rain forest, has, according to one respondent, the largest archive, while the Survey and Mapping Department in Entebbe also has a large archive, including photos from the 1954-1956 national survey conducted by the DOS. The earliest photos available are from 1949 and 1950, though these early photos do not cover the whole country.

Section 3: Sources of Historic Aerial or Satellite Photos outside of Africa

Over the years the DOS developed a large archive of aerial photos and other material, which was housed at the British Ordnance Survey. However, as the DOS was reorganized, downsized and ultimately disbanded, this archive was divided up and transferred to a number of different institutions. The full collection of aerial photographs, totaling some two to three million aerial photos, was given to the British Empire and Commonwealth Museum, while duplicates of these images were given to the Bodleian Library at Rhodes House, Oxford University. Also negatives

⁷ <http://www.ira.udsm.ac.tz/index.php>, Tel: +255 22 2410144

of all these images were transferred to the respective African survey departments. More on this division of material can be found at the British Ordnance Survey web-site.⁸

- Images of Empire (The British Empire and Commonwealth Museum).⁹ With respect to Kenya, Tanzania and Uganda, the British Empire and Commonwealth Museum has 1,352 boxes of aerial photos of Tanzania from 1947 to 1978 (each box containing roughly 150 photos); 1,438 boxes of aerial photos of Kenya from 1948 to 1987; and 484 boxes of aerial photos of Uganda from 1947 to 1977. In pure numerical terms the museum has roughly 202,000 images of Tanzania, 215,000 images of Kenya and 72,000 images of Uganda. Importantly, they have the flight plan maps for all photos. It is possible to make copies or a scan, which costs roughly 80 pence per copy/scan, and the photos are ready in 2 to 3 days. The services of an archivists cost 50 pounds/day. The museum is currently closed, as they prepare a move from Bristol to London, but the archives, still in Bristol for the rest of the year and probably the next, are open for researchers by appointment (using the email provided in footnote 6). Also of potential interest, the museum collection includes oral histories with former colonial agricultural and forestry officers, plus survey officials involved with the colonial-era mapping of Africa.
- Bodleian Library, Rhodes House, Oxford University.¹⁰ In its possessions, the Bodleian library of Oxford University has duplicates of the Directorate of Overseas Surveys' archive. A project to catalogue these photos and construct an internet interface to allow viewing and downloading was stopped several years ago for lack of funding and there is no prospect of this project being renewed. However, it is of course possible to visit the archive in person. The collection includes ordnance survey maps, information from which is necessary for finding flight path codes which then correspond to boxes with aerial photos. The collection is apparently quite extensive, occupying one kilometer of shelf space (though this presumably includes aerial photos outside of Africa). According to one of the librarians, most of the photos are in reasonably good condition, though some might have folds. The collection of photos that used to belong to University of London's School of Oriental and African Studies (SOAS) has been transferred to the Bodleian Library.
- The Royal Geographic Society (RGS).¹¹ The DOS map library was transferred to the RGS. This excludes aerial photos but includes DOS annual reports and a wealth of map material. According to the British Ordnance Survey, "a small-scale guide to the main areas of [aerial] photography is given by the maps at the back of the DOS Annual Reports from 1951 to 1984."¹² In theory the DOS's annual reports were public documents and distributed to a variety of institutions in Europe.

⁸ See

<http://www.ordnancesurvey.co.uk/oswebsite/aboutus/international/collection/dispersal.html>.

⁹ www.imagesofempire.com (www.empiremuseum.co.uk), E-mail: info@imagesofempire.com.

¹⁰ <http://aerial.mj-services.com/index.php>. Note, this link is to the web-site that was to be the portal for accessing and downloading images from the Bodleian archive. However, this web-site is essentially defunct. It only contains some information about the archive, and does not actually allow one to download any photos.

¹¹ www.rgs.org.

¹² <http://www.ordnancesurvey.co.uk/oswebsite/aboutus/international/collection/history.html>

Other potential resources or archives outside of Africa and not connected to the DCS/DOS archive, are:

- The Aerial Reconnaissance Archives, Scotland.¹³ The Royal Commission on the Ancient and Historical Monuments of Scotland contains the Aerial Reconnaissance Archives (TARA), which mostly contain aerial reconnaissance photos from WWII. However, this archive also contains Joint Air Reconnaissance Intelligence Centre (JARIC) Worldwide Imagery, from 1938 to 1989. This apparently includes many photographs taken over Africa, usually with some sort of military connection, e.g. the archive apparently contains photos taken during the Mau Mau rebellion in Kenya during the 1950s. Unfortunately however, cataloguing of these photographs is at a very early stage. Aerial photographs of Africa are not organized geographically, but by flight mission number or sortie number. Such flight or sortie information is theoretically available in the National Archives in London, though it would probably require a prohibitively exhausting search to find it. Thus, at present, the TARA probably does not represent a realistic near-term option for finding historical aerial photos of Africa, but it is still important to know that this resource exists.
- Early American Reconnaissance / Intelligence Satellite Data.¹⁴ This is an archive of declassified satellite images with world wide coverage from the 1960s and 1970s from the first American intelligence satellites. Resolution is relatively low, and quality varies, particularly as there are many scenes with clouds. Nevertheless, depending on the African region of interest, it should be possible to find one or more decent quality images. Images are not digitized and thus not available for download. One can however order images from USGS's Earth Explorer. The cost is \$30 per frame, plus international shipping.

Several questions remain concerning historical aerial photos. One question is does the DOS archive at the British Commonwealth and Empire Museum or the Bodleian Library contain photos from the early experiments with aerial photography in the 1930s, and from the RAF's surveying of East Africa during the Second World War. If not, are the latter at the TARA in Scotland, or in Africa? A second, related question concerns the post-WWII relationship between the DOS and the RAF. According to the British Ordnance Survey, between 1946 and 1953, DCS/DOS mapping was actually conducted by the RAF.¹⁵ After 1953, the DCS/DOS contracted with private firms to conduct aerial surveys. There are however indications that the RAF and Royal Navy continued to conduct their own aerial mapping (for strictly military purposes). Are these photos interesting in terms of recreating past African landscapes, and if so are they stored at TARA, somewhere in Africa and/or somewhere else? Finally, the British Ordnance Survey web-site states that most of these photos are vertical, mono-chromatic photos suitable for stereoscopic viewing and taken for the purpose of topographic mapping. There are also apparently, some infrared and other color shots. It would be interesting to find out when the DOS began taking infrared and color photos, and how many of these photos are still available.

Section 4: Recommendations on Collecting More Information on Aerial Photo Archives

¹³ http://aerial.rcahms.gov.uk/isadg/isadg.php?refNo=GB_551_20

¹⁴ Earthexplorer.usgs.gov, click on declassified data, declass 1 (1996) and declass 2 (2002).

¹⁵ <http://www.ordnancesurvey.co.uk/oswebsite/aboutus/international/collection/history.html>

Ultimately, conducting a thorough inventory of historical aerial photo resources in and of East Africa will require in-person visits to the various organizations in Africa and in the UK to determine size and quality of collections, how and if they are used, and what preservation efforts are underway. In the near term, such resources are unlikely to be available. Thus, several low cost ideas are presented below for gathering more information about potential archival resources of East African historical aerial photos.

- (1) Questionnaire. A questionnaire could be distributed by email to researchers who have used historical East African aerial photos in their published work. Today published research generally includes email contact information for the corresponding author, so it should not be difficult to collect contact information. In those cases where the researcher is no longer employed at the institution indicated in the publication, it should be possible, at least for some of the researchers, to find that researcher's current institution through a simple internet search. This list could then be complemented by the names and contact information of other researchers who are known by members of the CREATING network to have used or visited archives of East African aerial photos. Although questions should be relatively straightforward, so as to increase chances that these questions are answered, there should also be space for general reflection for those who wish to expand on their answers. The answers that come in would then ideally be synthesized into one document, which could then be sent out to the participating researchers. There should be willingness to take part since other researchers would presumably have every interest in finding out if there are more archives of aerial photos out there, and what condition the photos are in. The pool of questionnaire-recipients could potentially be broadened to include researchers who have worked with historical aerial photos of other African countries. Appendix One below contains a preliminary (but not definitive) bibliography of recent research on Kenya, Tanzania or Uganda, which has made use of historical aerial photos.
- (2) One week archival research in the UK. Again, while ultimately it will be necessary to visit Kenya, Tanzania and Uganda to conduct a thorough, proper inventory of aerial photo archives, a short research trip to the U.K. visiting the institutions listed above would for a variety of reasons be worthwhile. First, one would (obviously) get a sense of the areas and time periods covered by photos in British archives. Second, while DOS annual reports can possibly be found outside the UK (and perhaps even borrowed through interlibrary loan), it will be easier to access the DOS annual reports and other documents in the UK. As mentioned above, these reports contain maps showing where DOS conducted surveys. Finally, because the DOS was involved in training African land survey departments, reviewing DOS documents might shed light on the early activities of these national survey departments (where their first aerial surveys were conducted and when). Such information could then be of assistance in visiting archives in Africa.
- (3) An Aerial Photo Archive Wiki. A decentralized "wiki" approach may be appropriate for mapping out historical aerial photo resources, since even if the necessary resources were budgeted, it still may not be possible for one person or even a small group to visit all archives of historical aerial photo in Kenya, Uganda and Tanzania, especially in one research trip. Following the model of Wikipedia, a web-site could be created which allows registered users – in this case researchers or students who use historical aerial

photos of Africa in their work – to continuously update online descriptions about the quality and status of different collections of African aerial photos. The purpose of this wiki would be to describe where aerial photo archives are, what the rules of access are, what condition the photos are in. It would ideally not be a forum for critical comments, for example with respect to possible poor handling of archival resources. Someone would thus probably have to perform a moderating function – as happens with Wikipedia – to make sure that contributions are not overly critical and otherwise in line with the purpose of the web-site. If one expands the list of countries of interest to include all or most of Africa, the difficulty of visiting all archives of aerial photos becomes greater. A wiki approach would be even more appropriate in other words for an enlarged inventory of African historical aerial photos.

Conclusion

Two general observations can be made from the comments of respondents whose responses otherwise related to specific countries and archives. First, the idea of doing an inventory of historical aerial photos struck many respondents as a necessary and important project. One African respondent was particularly interested to learn of resources available in the UK. This suggests that a proper inventory would, beyond mapping out archives in Africa, also seek to relate African and British archives (and any other archives out there) to each other. A second general observation was that many older aerial photos in African archives are in increasingly bad condition and some sort of preservation effort needs to be undertaken.

Appendix 1: List of Works Citing or Using Historical Aerial Photos

Note: no claim is made that this bibliography contains *all* recent published research concerning East Africa which uses historical aerial photos. The list below should rather be viewed as the beginning to a more definitive bibliography. Note also that, in some cases, complete bibliographic information (for an article) was missing. If it was possible to download the article anyway, it has been included in the list below.

KENYA

Lamprey, Richard and Robin S. Reid. 2004. "Expansion of Human Settlement in Kenya's Maasai Mara: What future for pastoralism and wildlife." *Journal of Biogeography*, 31: 997-1032.

Correspondence: Richard H. Lamprey, Uganda
Wildlife Authority, PO Box 3530, Kampala,
Uganda. Tel.: +256 77 704596.
E-mail: lamprey@infocom.co.ug

Hurskainen, P. and P. Pellikka. 2004. "Change Detection of Informal Settlements Using Multi-temporal Aerial Photographs – the case of Voi, SE-Kenya"

e-mail: pekka.hurskainen@helsinki.fi

F. Dahdouh-Guebas^{1,2,*}, I. Van Pottelbergh¹, J. G. Kairo^{3,1}, S. Cannicci⁴, N. Koedam. 2004. "Human-impacted mangroves in Gazi (Kenya): predicting future vegetation based on retrospective remote sensing, social surveys, and tree distribution." *Marine Ecology Progress Series*. 272: 77-92.

- 1) Biocomplexity Research Team, Laboratory of General Botany and Nature Management, Mangrove Management Group, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium
- 2) Uitgegeven met steun van de Universitaire Stichting van België, Egmontstraat 11, 1000 Brussels, Belgium
- 3) Kenya Marine and Fisheries Research Institute, PO Box 81651, Mombasa, Kenya
- 4) Dipartimento di Biologia Animale e Genetica 'Leo Pardi', Università degli Studi di Firenze, Via Romana 17, 50125 Firenze, Italy

*Email: fdahdouh@vub.ac.be

Imbernon, Jacques. 1999. "Pattern and development of land-use changes in the Kenyan highlands since the 1950s." *Agriculture, Eco-Systems and Environment*, 76: 67-73.

E-mail address: imbernon@cirad.fr

TANZANIA

Bajijuka, F.P.^{a,b}, N. de Ridder^{b,*}, K.F. Masuko^c, K.E. Giller^b. 2005. "Dynamics of banana-based farming systems in Bukoba district, Tanzania: changes in land use, cropping and cattle keeping." *Agriculture, Eco-Systems and Environment*, 106: 395-406.

a) Lake Zone Agricultural Research Institute Maruku, P.O. Box 127, Bukoba, Tanzania

b) Plant Production Systems, Wageningen University, P.O. Box 430, 6700 AK Wageningen, The Netherlands

c) Agricultural Research Institute Mlingano, P.O. Box 5088, Tango, Tanzania
*Corresponding Author: nico@deridder.wur.nl

Soini, Eija. 2002. Changing landscapes on the southern slopes of Mt. Kilimanjaro, Tanzania: An aerial photo interpretation between 1961 and 2000. Natural Resource Problems, Priorities and Policies Working Paper Series (#1). World Agroforestry Centre (ICRAF).

Email: E.Soini@cgiar.org

Lonnie G. Thompson^{1,2*}, Ellen Mosley-Thompson^{1,3}, Mary E. Davis^{1,2}, Keith A. Henderson^{1,2}, Henry H. Brecher¹, Victor S. Zagorodnov^{1,2}, Tracy A. Mashiotta¹, Ping-Nan Lin¹, Vladimir N. Mikhalenko⁴, Douglas R. Hardy⁵, Ju"rg Beer⁶. 2002. "Kilimanjaro Ice Core Records: Evidence of Holocene Climate Change in Tropical Africa." *Science*. 298: 598-593.

(1) Byrd Polar Research Center, (2) Department of Geological Sciences, (3) Department of Geography, The Ohio State University, Columbus, OH 43210, USA. (4) Institute of Geography, Moscow, Russia. (5) Department of Geosciences, University of Massachusetts, Amherst, MA 01003-9297, USA. (6) Swiss Federal Institute for Environmental Science and Technology (EAWAG) Duebendorf, Switzerland.

*Correspondence to: thompson.3@osu.edu

McDonagh, J.F., T. Birch Thomsen and J. Magid. 2001. Soil Organic Matter Decline and Compositional Change Associated with Cereal Cropping in Southern Tanzania. *Land Degradation and Development*, 12 (1): 13-26.

School of Development Studies, University of East Anglia, Norwich, UK
Institute of Geography, University of Copenhagen, Denmark
Department of Soil Science and Plant Nutrition, Royal Veterinary and Agricultural University, Fredericksberg, Copenhagen, Denmark

*Correspondence to: j.mcdonagh@uea.ac.uk

Torben Birch-Thomsen, Pia Frederiksen, Hans-Otto Sano. 2001. A Livelihood Perspective on Natural Resource Management and Environmental Change in Semiarid Tanzania. *Economic Geography*. 77 (1): 41-66.

tbt@geogr.ku.dk,
pfr@dmu.dk,
hos@humanrights.dk

Briggs, John and Davis Mwamfupe. 2000. "Peri-urban Development in an Era of Structural Adjustment in Africa: the City of Dar es Salaam, Tanzania." *Urban Studies*, 37 (4): 797-809.

John Briggs, Department of Geography and Topographic Science, University of Glasgow, jbriggs@geog.gla.ac.uk
Davis Mwamfupe, Department of Geography, University of Dar es Salaam

St"omquist, Lennart, Pius Yanda, Paul Msemwa, Clas Lindberg, Louise Simonsson Forsberg. 1999. Utilizing Landscape Information to Analyze and Predict Environmental Change: The Extended Baseline Perspective: Two Tanzanian Examples. *Ambio*, 28 (5): 436-443.

Lennart.stromquist@kultgeog.uu.se

Pius Yanda, TANRIC, IRA, tanric@udsm.ac.tz
Paul Msemwa, Director, Village Museum, Dar es Salaam, staff@twiga.com
Clas.lindberg@kultgeog.uu.se
Louise.simonsson@geo.uu.se

Eriksson, Mats. G. 1999. "Influence of crustal movements on landforms, erosion and sediment deposition in the Irangi Hills, central Tanzania," in *Uplift, Erosion and Stability: perspectives on long-term landscape development*, B.J. Smith, W. B. Whalley and P.A. Warke (eds.), Geological Society Special Publication no. 162

Mats.eriksson@geol.lu.se

Strömquist, Lennart. 1992. "Environmental Impact Assessment of Natural Disasters, a Case Study of the Recent Lake Babati Floods in Northern Tanzania," *Geografiska Annaler Series A*, 74 (2/3): 81-91.

UGANDA

Mulley, Brad G.^{a,c}, and Jon D. Unruh^{b,c,*}. 2004. The role of off-farm employment in tropical forest conservation: labor, migration, and smallholder attitudes toward land in western Uganda. *Journal of Environmental Management*. 71 (3): 193-205.

(a) Department of Geography, Indiana University, Room 120 Student Building, Bloomington, IN 47408, USA

(b) Department of Geography, McGill University, 805 Sherbrooke St. W. Montreal Quebec, Canada H3A 2K6

(c) Center for the study of Institutions, Population and Environmental change (CIPEC), 408 N. Indiana Ave, Indiana University, Bloomington IN 47048, USA

* Corresponding author. Tel.: þ1-812-855-6303; fax: þ1-812-855-1661.

E-mail address: junruh@indiana.edu (J.D. Unruh).

Mugisha, Samuel. 2002. Patterns and Root Causes of Land Cover/Use Change in Uganda: An Account of the Past 100 Years. LUCID Working Paper Series Number: 14.

Samuel Mugisha
Makerere University
Institute of Environment and Natural Resources
P. O Box 7298
Kampala, Uganda
sammugisha@yahoo.com
smugisha@muenr.mak.ac.ug

Huising, E. J. 2001. "Wetland Monitoring in Uganda."

Institute of Environment and Natural Resources

A.Y. Banana¹ and M. Tweheyo². 2001. *The ecological changes of Echuya afromontane bamboo forest, Uganda*. African Journal of Ecology, 39 (4): 366-373.

(1) Department of Forest Product Engineering, PO Box 7062, Makerere University and (2) Department of Forest Biology and Ecosystems Management, PO Box 7062, Makerere University, Kampala, Uganda

Plumptre, A.J. 1996. "Changes following 60 years of selective timber harvesting in the Budongo Forest Reserve, Uganda." *Forest Ecology and Management*, 89: 101-113.

Mugisha, S., 1994. *Land Cover/Use Around Kibale National Park Analysis of 1988 Aerial Photographs*, Uganda Forestry Department (Sheet no. BP 1939). MUIENR, RS/GIS Lab, Kampala, Uganda.

Place, Frank and Keiji Otsuka. 2000. Population Pressure, Land Tenure, and Tree Resource Management in Uganda. *Land Economics*. 76 (2): 233-251.

The authors are, respectively, economist, International Centre for Research, Research in Agroforestry, Nairobi, Kenya, and professor of economics, Tokyo Metropolitan University and research fellow, International Food Policy Research Institute, Washington, D.C

OTHER

Emmanuel Krieke

http://blogs.princeton.edu/itsacademic/2008/03/beyond_words_environmental_history_digitization_and_gis.html

Krieke is an environmental historian at Princeton University in the US, who has done extensive research on colonial and independent Namibia and Angola. The above link is to a lecture he held in 2008 at Princeton in which he discusses ways in which historical aerial photos can be used in a GIS for historical analysis (beyond just using the images for illustrative purposes). He discusses how he geo-referenced historical aerial photos (using a Quickbird image), and how he went about analyzing the images and using them for an environmental history of colonial southwestern Africa. He does not however discuss the sources of his images. The above link, which describes his lecture, contains links to a MP3 file of the lecture, plus a PDF file with some of the images.

Appendix 2: Survey Departments, and other organizations

Survey Departments in Kenya, Tanzania, and Uganda:

UGANDA

Survey and Mapping Department
Lands and Surveys
PO Box 1
Entebbe

Phone: (+256) 41 320 304
Fax: (+256) 41 320 810
Email: campus@imul.com

TANZANIA

Surveys & Mapping Division (SMD)
P.O. Box 9201
Dar es Salaam

Ph: (+255) 22 212 12 41
Fax: (+255) 22 213 89 62
Email: smd@raha.com

KENYA

Survey of Kenya
P.O. Box 30046
00100 Nairobi GPO

Ph: (+254) 20 271 80 50
Fax: (+254) 20 271 75 53
Email: dirtsok@ardhi.go.ke
Web: www.knsdi.go.ke/sokfinal/index.html

Other Organizations

Somalia Water and Land Information Management Project (SWALIM)
<http://faoswalim.org>

World Agroforestry Center,
<http://www.worldagroforestry.org/af/index.php>

LUCID East Africa (Land Use Change Analysis as an Approach for Investigating Biodiversity Loss and Land Degradation Project)
<http://www.lucideastafrica.org/index.htm>

International Livestock Research Institute (ILRI)
www.ilri.org

Regional Center for Mapping of Resources for Development
<http://rcmrd.org/>

Kenya Forestry Research Institute
<http://www.kefri.org/index.html>