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Mini Review

Review of Literature on Sources of Remotely Sensed Data for Utilization of Land Resources

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Abstract

In Nigeria aerial photographs and other remotely sensed data can be obtained from Federal Survey Department, this unit acquires and archives aerial photograph of different parts of the country. Oil prospecting companies operating in Nigeria such as Shell Petroleum Development Company of Nigeria Limited, Elf Plc, Chevron and AGIP also acquires and store aerial photos. Satellite imageries (particularly Landsat and SPOT) may be obtained through Regional Centre for Training in Aerospace Surveys (RECTAS), Ile Ife; international Institute for Tropical Agriculture (IITA), Ibadan; Federal Department of Water Resources, Kaduna; etc. even if required remotely sensed data is not in stock the imagery of an area on the earth's surface which is of particular interest to a client, SSC satellitbild can programme the SPOT satellite to record an image of the area in question provided that he (the client) can identify the area in terms of latitude and longitude.

Introduction

Data can be defined as basic raw facts and figures, unprocessed information, about any activity or an area which have been recorded, such as the aerial sizes of urban land use and land cover data. when data has been processed or worked upon, then information are extracted. Information obtained must be correct, accurate, adequately useful, fresh and timely otherwise, it becomes meaningless and misleading to the users. Good information should therefore be complete, accurate, explicit and current. Remote sensing is a data gathering technique where data is acquired from an area without physical touch or contact with the target (Atubi, Awaretefe & Ashima, 2018). Remotely sensed Image or imagery refers to representative of a scene recorded by a remote sensing system (Ndukwe, 1997). When the scene is recorded specifically by reflection through a lens, such as camera, it is referred to as photograph. Most remotely sensed data are either in form of imageries such as analogue images and digital images or in form of quantitative data such as quantitative measurement of radiant energy surface. In areas of land use and land cover Ejemeyovwi (2015) carried out change detection in Landuse/Landcover Mapping in Asaba, Niger Delta between 1996 and 2015 using remote sensing and GIS approach and the various sector s of land composition were spelt out. Several works have been carried out for land application researchers using remotely sensed data include Ejemeyovwi and Akpovwovwo on Malaria Mapping in Abraka, Delta State, Nigeria using ssatellite image and geographic information systems data. The affected land area was segmented into areas of high, medium and low infected areas. Furthermore, Ejemeyovwi, & Ashima (2020 a &b) mapped the lineament patterns and as well a used them for ground water targeting in North West of Talata Mafara, Zamfara State, Nigeria using remote Sensing technique. infected areas. Also, Ejemeyovwi (2020 c) worked on drainage basin morphometry and the Influence of landforms characteristic using remote sensing and GIS in Udi Awgu Cuesta, South Eastern Nigeria and Ejemeyovwi (2020d) tested Hortonian laws using bivariate relationship with basin Morphometric data in Udi Awgu Cuesta, Cuesta, South Eastern Nigeria .based on remote sensing data and GIS approach. In the area of climate change Ejemeyovwi and Ashima (2020e) worked Climate Change Global Warming Implications and Effects in Warri, Nigeria. Finally, Ejemeyovwi (2020f) modelled the drainage basin in Udi - Awgu Cuesta, South Eastern Nigeria using Remote Sensing and GIS.

Interpretation of Remotely Sensed Data

Remotely sensed data must be interpreted and analyzed to extract useful information from them to make logical decisions. Interpretation of remotely sensed data refers to a systematic process of identifying features or objects judging their significance, and extracting required information (Wolf,1983. Town planners and Land resources utilization experts usually talk about ghettos, slumps, reconstruction, renewal, development, land reclamations, illegal structures, planned and unplanned areas. Adequate, timely and reliable data and from the field is required before proper and adequate planning could be carried out. Re-designing and development of any area or location are usually based on observation and data from the field such as remotely sensed data. Information such as land use/ land cover information derivable from remotely sensed data in form of maps and other spatial data (locational) are very vital for physical planning and utilization of land resources (Adeniyi, P.O. 1983, Bockstael N. 1996, R. Manonmani, G. Mary Divya Suganya, 2010). The three commonly used remotely sensed data sets in Nigeria are aerial photographs, Landsat imageries, Spot imageries, radar imageries and thermal infrared imageries.

Image Sources

The ability to use remotely sensed data to undertake any study is determined by the availability or accessibility of reliable and relevant data; aerial photograph or other aerospace images. There are several sources of remotely sensed data. Aerial photographs can be obtained from governments units charged with the responsibility of acquiring aerial photos for mapping and other activities. They may also be obtained from corporate bodies and private commercial companies involved in mapping and related activities. In Nigeria, aerial photographs can be obtained from Office of the Surveyor-General of the Federation; this unit acquires and archives aerial photographs of different parts of the Nigeria. Oil prospecting and Exploration Companies such as Elf Plc., Chevron (Nig.), Shell Petroleum Development Company of Nigeria also acquire and store aerial photos. Satellite images (particularly Landsat and SPOT) may be obtained through Regional Centre for Training in Aerospace Surveys (RECTAS), Ile Ife, Nigeria; International Institute for Tropical Agriculture (IITA), Ibadan, Nigeria, Federal Department of Water Resources, Kaduna, Nigeria and Daimler Geographics', Lagos, Nigeria. Prominent among other foreign sources are: Global and Land Cover Facility (GLCF) of University of Maryland, USA, Google Earth.

The history of remote sensing dates back to aerial photography taken from a balloon in 1858. During the World War I, aerial photography became the most important source of remotely sensed data utilized in the planning and execution of war. In the 1950's and until recently black and white aerial photographs were the basis of mapping the earth's surface (Asiyabola, 2014). The literature indicates that aerial photographs are no longer the only available source of remotely sensed data. Satellite and radar images now complement aerial photographs as sources of remotely sensed data. Most commonly utilized data source today is Landsat Earth observation satellites. Landsat now provides digital images in the visible and infrared parts of the electromagnetic spectrum (Teeuw, Whiteside, McWilliam, Zukowskyj, Hourigan, Mount & Jonathan, 2005). Satellite digital images have a number of advantages over aerial photographs; they can be easily stored and retrieved with computers. State of the art Global Positioning System (GPS) receivers, improved digital compressors software and internet facilities have improved the transfer and mobilization of remotely sensed data globally. Satellite remote sensing techniques have provided multi-temporal, multi-spectral and multi-resolution range of images for efficient and appropriate land information required for change detection, trend analysis and diverse land use and land cover analysis.

Landsat series

Landsat (meaning land & Satellite) images have been available since 1972 from six satellites in the Landsat series. Satellites are a major component of National Aeronautics and Space Administration's Earth observation program of the United States of America, with three primary sensors evolving over thirty years: MSS (Multi-Spectral Scanner), TM (Thematic Mapper), and ETM+ (Enhanced Thematic Mapper Plus). Landsat supplies high resolution visible and infrared imagery, with thermal imagery and a panchromatic image also available from the ETM+ sensor.

Table 1: below indicates; Landsat Data Series: Satellite, Sensor, Bands, Spectral Range, Scene Size and Pixel Resolution.

Satellite	Sensor	Bands	Spectral Range	Scene Size	Pixel Res.
L 1-4	MSS multi-spectral	1,2,3,4	0.5 – 1.1 µm	185 X 185 km	60 meter
L 4-5	TM multi-spectral	1,2,3,4,5,7	0.45 – 2.35 µm		30 meter
L 4-5	TM thermal	6	10.40 – 12.50 µm		12 meter
L 7	ETM + multi-spectral	1,2,3,4,5,7	0.450 – 2.35 µm		30 meter
L7	ETM + thermal	6.1, 6.2	10.40 – 12.50 µm		60 meter
Panchr-omatic	ETM + thermal	8	0.52 – 0.90 µm		15 meter

Source: National Aeronautics and Space Administration, (2003)

Satellites in Africa:

Table 2: Below shows satellites in Africa, country, year of first launch, first satellite, and payloads in orbits, January 2013.

S/N	Country	Year of First launch	First Satellite	Payloads in orbit as of January 2013
1	Egypt	1998	Nilesat 101	4
2	South Africa	1999	SUNSAT	2
3	Morocco	2001	Maroc-Tubsat	1
4	Algeria	2002	Alsat	1
5	Nigeria	2003	Nigeriasat	5

Source: www.ccsenet.org/jgg (2013).

Sources of Remotely Sensed Satellite Images Most Frequently Consulted by Researchers in Nigeria.

They include United States National and Space Administration (NASA), National Centre for Remote Sensing, Jos, Nigeria, Global Land Cover Facility (GLCF) of the university of Maryland, Maryland, USA, National Space Research and Development (NARSDA), Abuja, Nigeria, Google Earth imagery, www.digitalglobe.com, institute of food security, Ministry of Agriculture, Natural Resources and Rural Development, Federal department of Forestry (FORMECU), Nigeria. There are several sources of remotely sensed data aerial photographs in Nigeria. Aerial photographs can be obtained from government departments or units charged with the responsibility of acquiring aerial photos for mapping and other activities. They may also be obtained from corporate bodies or private commercial companies involved with mapping and related operations. There are other influential private sources of remotely sensed data such as Daimler Geographic's archives, of the University of Lagos, Nigeria (+2348033228622). Daimler Geographic's archives, Lagos, Nigeria acquires, processes and advices clients on remotely sensed data usage, interpretation and analysis. Daimler Geographic's archives, Lagos, Nigeria also offers extensive user- training courses for individuals and user organization in remote sensing and GIS.

In Nigeria, aerial photographs can be obtained from Federal Survey Department this unit acquires and archives aerial photographs of different parts of the country. Oil Prospecting Companies Operating in Nigeria such as Shell Petroleum Development Company of Nigeria Limited, Elf Plc., Chevron (Nig.), also acquire and store aerial photos. Satellite imageries (particularly Landsat and SPOT) may be obtained through Regional Centre for Training in Aerospace Surveys (RECTAS), Ile Ife; International Institute for Tropical Agriculture (IITA), Ibadan; Federal Department of Water Resources, Kaduna; etc. Landsat imageries and photographs from the early US manned satellites may be obtained from NOAA's EROS Data Center (EDC), Sioux Falls, South Dakota 57198 for fees. Imageries may also be ordered from Earth Observation Satellite (EOSAT) Company International Headquarters 4300 Forbes Blvd., Langham, MD 20706, USA or the US Department ofAgricu1 Aerial Photography Field Office, Administrative Services Division, P.O. Box 30010, Salt Lake City, Utah 84115. In Canada, images may be purchased 'from the Canadian Centre for Remote Sensing (CCRS), 717 Belfast Road, Ottawa, Ontario, KIA 0Y7. In Europe and Australia satellite imageries may be obtained from European Space Agency (ESA), Via Galileo Galilei, 00044 Frascati, Italy and Australian Landsat Station, P.O. Box 28, Belconnen Australia, respectively. SPOT satellite data are managed and distributed by SPOT Image Company this specialized company was set up in 1982 to promote the SPOT system, to undertake data reproduction and Processing and to distribute such data on the worldwide basis. User wishing to obtain SPOT imagery are expected to complete a form specifically designed for that purpose. Among other information to be supplied by user in the form are geographic location of area of interest, period of scene acquisition, spectral mode (XS or P or XS + P), the theme of study for which scene is required (e.g. land use studies, agriculture, forestry, etc). SPOT image price list and other additional information may be obtained from Technical Marketing and Development Department, SPOT Image, 16 Bis Avenue, Edouard Belin, B.P. 4359, Toulouse Cedex, France. SPOT satellite data can also be obtained from designated distributors elsewhere in the world. For instance, in the United Kingdom, the National Remote Sensing Centre (NRSC) and the Nigel Press Associates (NPA) have distribution rights.

In, France, the SPOT Image distributes SPOT satellite data while GDTA company, offers user-training courses for remote sensing users who want to acquire a knowledge of SPOT imagery and extensive training on the SPOT system designed to meet the training needs for user organizations.

SPOT data are available in the following formats and media adapted to users' needs;

i. CCT – SPOT scenes are available on standard Computér4 Compatible Tapes (CCTs). This offers the widest ranges of possibilities to users. Format options are offered depending upon user's data processing facilities.

ii. *Photographic Films* – All SPOT scenes are available on photographic films. These may be Colour or black and white high precision films. In addition to whole scenes covering 60 x 60 km, quarter scenes covering approximately 30 km by 30 km are available on film too.

iii. *Paper Prints* – All SPOT scenes can also be supplied on photographic paper. Two types are available, namely, black and white prints and Colour composites corresponding to multi-channel images at different scale ranging from 1:25,000 to 1:400,000.

Another influential company that produces and markets SPOT satellite imageries is the SSC Satellitbild company, which is a subsidiary of the Swedish Space Corporation

(SSC), an organization responsible for the implementation of the Swedish space programme Sweden is a part owner of the SPOT satellite system and SSC Satellitbild operates one of the two main ground receiving stations in the global system. The companies headquarter is favorably located at Kiruna (a city north of the Arctic Circle) where it has pund tracking stations. That receive data from all polar-orbiting observation satellites (PUS). Operating from their base in Kiruna, Sweden, the main functions of the company include: tracking of earth observation satellites, acquisition of up-to-date data, preparation of imageries as well as cataloguing and archiving, processing and analyzing, sales and delivery of aerospace imageries. SSC Satellitbild claims to be the leading company in turning satellite data into useful operational tools and placing on the world market a wide range of aerospace products for various applications. SSC satellitbild can receive and process data from a variety of observation satellite families including SPOT, Landsat, Meteosat, NOAA and MOS systems. So, different types of imageries of any part of the earth can be obtained from them. Even if they do not have in stock the imagery of an area on the earth's surface which is of particular interest to a client, they can programme the SPOT satellite to record an image of the area in question provided that he (the client) can identify the area in terms of latitude and longitude.

Nigeria Center for Remote Sensing

In 1998, the Nigeria Government established a comprehensive remote sensing center with its permanent headquarters in Jos and a satellite ground receiving station at Kerang, near Panyam, Plateau State (site of the defunct Aerostat Balloon project. It also operates in Abuja, the Federal Capital Territory at Obasanjo Space Centre opposite Pyakasa junction, Km 17 Airport Road, P.M.B 473, Garki Abuja, Nigeria. The National remote sensing center took off in October 1995 and operates under the aegis of the National Space Research and Development Agency (NASRDA), with a broad objective to pursue the development and application of science and technology for socio-economic benefits of Nigeria. It is expected that this agency will make the expected impact as an establishment for acquisition, processing archiving and dissemination of satellite data to meet users' requirements within and outside the country. Numerous studies in the area of Urban planning and utilization of land resources emanating notably from United States of America, Europe, China, India and more recently Africa and Nigeria in the past five decades have demonstrated beyond reasonable doubt, great potential of remote sensing to provide timely, current, cost effective and reliable information for spatial planning and utilization of land resources. (Wagner, 1963; Avery, 1965; Falkner, 1968; Dueker & Horton, 1971; Adeniyi, 1979; Adeniyi, 1980; Adeniyi, 1983; Anderson B., 1996; Adeniyi, 1999, Atubi, 2004; Gabral, 2008; Narayanan & Hanjagi, 2009; Ejemeyovwi, 2010; Eludoyin, Wokocha & Ayolagha, 2010, Tahir, Imam & Hussain, 2012; Ogunbadewa, 2012; Oriye, 2013, Ade, & Afolabi, 2013; Monte & Farhan, 2013; Asiyabola, R.A., 2014 (Augustus Orovwigho Atubi, Daniel Onome Awaritefe, Ashima Babs Toyon, 2018).

Conclusion

The paper explored and identified various sources of remotely sensed data in parts of the world, Europe, United States and emerging sources in Africa and especially Nigeria. Effective planning is rendered difficult in many developing countries such as Nigeria owing to lack of current information on land and means of acquiring such information. The application of remotely sensed data in conjunction with GIS have demonstrated beyond reasonable doubt, the potentials of remotely sensed data in decision making in planning and management of land resources.

However, the ability to use remotely sensed data for any research or study is determined by the availability or accessibility of data sources. Local data sourcing is strongly recommended in Nigeria due to the dwindling budgetary allocations to planning and research. In addition, the instability and constant upward swing of the foreign exchange makes local acquisition and processing imperative.

Appendix: List of Abbreviation's and Acronyms

RECTAS - Regional Centre for training in aerospace surveys;
Landsat - Land and satellite;
MSS - Multi-Spectral Scanner ;
TM - Thematic mapper;
NASA - National Aeronautics and Space Administration;
SPOT - Satellite Probatoire de l'Observation de la Terre;
NOAA - National Oceanic and Atmospheric Administration;
EROS - Earth Resources Observing Service;
EDC - Eros Data Center;
EOSAT - Earth Observation Satellite Company;
CCRS - Canada Centre for Remote Sensing;
ESA - European Space Agency;
NRSC - National Remote Sensing Center;
CCT - Computer Compatible Tape;
MOS - Marine Observation Satellite;
RADAR - Radio Detection and Ranging.

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