

Kenyatta University: A Lighthouse of Geospatial knowledge in Sub-Saharan Africa. Prof Simon Onywere shines the Torch of GIS from KU

Kenyatta University is now a regional and sub-Saharan Africa education site license ESRI reference account providing a real case study on how to successfully implement a site license. The university is now a continental lighthouse who's GIS light is beaming far and wide. Now more and more universities are contacting Esri Eastern Africa wanting them to do to them what they have done to KU. Valuable insights that the university has provided on an education site license implementation are:

- a) The critical role of an enlightened internal GIS champion who offers his/her time, dedication and commitment helping others in the university to envision the benefits and possibilities with GIS and start moving forward.
- b) The need for university-wide capacity building support to drive quicker adoption of GIS and use of the availed licenses across all Schools.
- c) Executive support from Top University Management and Especially the Vice Chancellor should exist. Otherwise adopting GIS at the enterprise level within the university will not be possible.
- d) The ICT Directorate is an invaluable cog as the directorate provides all the ICT infrastructure and technical support to successfully implement a site license.

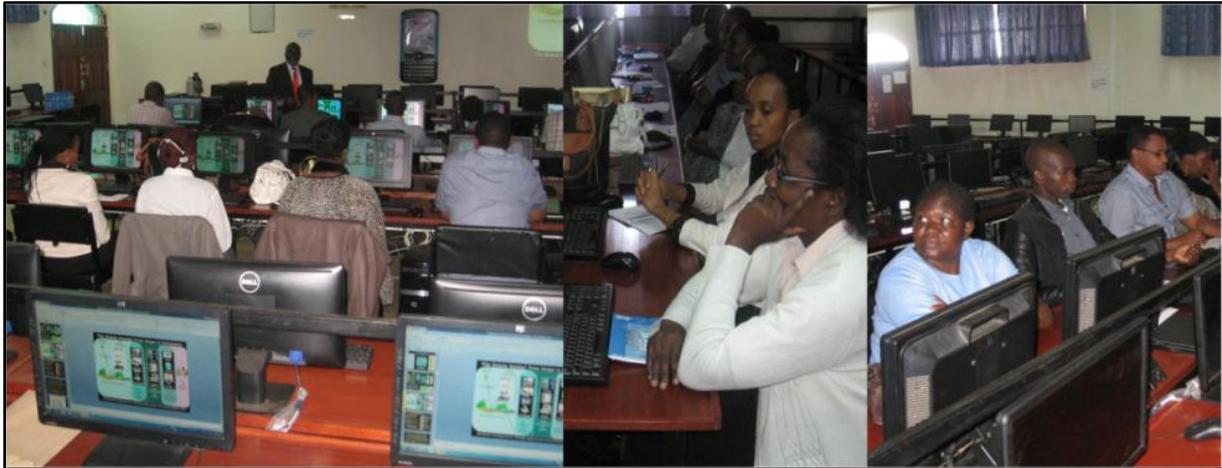
Prof. Simon Onywere of the Department of Environmental Planning and Management is the ESRI site license administrator at KU. For his role in sensitising the university community on the site licence and the visibility this has created for Kenyatta University he was crowned the 2014 ESRI GIS Champion in Eastern Africa Region and indeed in the sub-Saharan Africa. He and his small team of GIS technical support and training team now receives invitations from other universities to provide thought leadership on GIS, Esri's 100 Africa Universities Program and ArcGIS education site license implementation. The African universities now seeking the support of ESRI 100 African Universities programme are borrowing from the experience of Kenyatta University in the implementation process.



The KU GIS Team from left: Prof. Simon Onywere, Solomon Mwenda, Elizabeth Maende and Anthony Gakobo

In November 2014 Prof Onywere lead a delegation of 8 Kenyatta University Participants to the 2nd Esri Eastern Africa GIS Education User Conference, held at the University of Dar Es Salaam where the team demonstrated how as an Esri ArcGIS licensed education user Kenyatta University has managed to impart spatial knowledge in teaching and Research. The conference brought together 21 Universities and geospatial users from the East African Region. The KU GIS Team also mounted a very successful GIS Day celebrated every Wednesday of the 3rd week of November each year. 2014 GIS Day theme was on "Discovering the World through GIS". The KU GIS team has also conducted a number of

training workshops in KU. The 1st Esri Eastern Africa GIS Education User Conference had been hosted by KU in 2013.



Prof. Onywere taking participants through a GIS and remote sensing training in disease mapping at the Business and Students Service Centre lab.

Personal GIS Testimony: Prof Simon M Onywere (Department of Environmental Planning and Management).

My Journey in the geospatial knowledge platform began way back in 1988 when in a masters class of 4 students, Prof. Steve Jesse Gachiri of the Department of Geology, University of Nairobi took us through a 1st Year unit on Photogeology. Then, I got curious that from an aerial photograph one could map the geology of an area and use the data to discriminate the land cover that is often a reflection of the underlying rocks. It was possible from the data to understand the ecology, landforms, the surface morphology, land structure and how these influence the drainage patterns and therefore the development processes. The message then was that the interpretation can even be done better using satellite remotely sensed data from a combination of reflectance signals covering certain portions of the sun's electromagnetic spectrum. I resolved then that I must do my research thesis using such data and I did! "Application of Remote Sensing Techniques in Geological Mapping of the Nairobi-Kajiado-Machakos area." Was my thesis title: <http://erepository.uonbi.ac.ke:8080/xmlui/handle/123456789/56780>: 1990. My remote sensing knowledge was what secured me a Job as an assistant lecture at Department of Geography, Egerton University. I was later, in 1997 to accomplish my PhD research under the title "Structural Analysis of the Drainage Basin of Kenyan Rift Valley Lakes within the Aberdare Detachment Using Satellite Data, GIS and Field Observations." <http://erepository.uonbi.ac.ke:8080/xmlui/handle/123456789/20768>.

Numerous training opportunities in both GIS and remote sensing have come my way since I first developed interest. The most significant ones being: Research visit for 11 months during my PhD to the University of Cape Town, South Africa at the Centre for Interactive Graphical Computing (CIGC) where I worked on the Gondwana GIS; 3 months DAAD Research study visit with the Remote Sensing Working Group (AGF) at Ludwig Maximilians, University of Munich, Germany; AAU supported 3 months visit and training on Remote Sensing and GIS Visualization Tools, at the School of Mines, University of Zambia; and Participated in the Ninth United Nations International Course on Remote Sensing Education for Educators, Department of Physical Geography (Remote Sensing Laboratory), Stockholm

University, Sweden. My publications and conference presentations attest to my interest and knowledge on GIS and Remote sensing applications.

After 11 years of teaching and research in the Department of Geography at Egerton University, I left in 2001 for Kenyatta University, Department of Environmental Planning and Management after having set up a small postgraduate GIS lab with ArcView ESRI software using research resources. It has been a long and slow journey with GIS training at Kenyatta University despite the initial interest and support from the then Vice Chancellor, Prof George Eshiwani. With no GIS Tools it has been difficult and expensive to impart GIS and remote sensing tools to students a situation that led me to spearhead establishment of an MoU with the Regional Centre for Mapping of Resources for Development (RCMRD). This would, since 2005 when the MoU was signed between KU and RCMRD, provide a platform for practical training of those students willing to go an extra mile albeit in an organised way and with a highly subsidised training cost. The experience of some of my students through this training is illustrated in the testimonies below.

Kenyatta University made a break through with GIS following the signing of an MoU with ESRI Eastern Africa in June 2012 that had the backing of the Vice Chancellor, Prof. Olive Mugenda. With this MoU Kenyatta University was awarded USD100,000 worth of software support by ESRI with an enterprise site licence that gives campus-wide access to geospatial tools to all staff and students on KU Intranet. There were 100 such licences to be awarded to 100 African universities under the ESRI call made in Abuja, Nigeria in 2011. Kenyatta University was the first university in Africa to receive the award and fully started its utilization in September 2013. The university has since facilitated access to the licence through a number of computer laboratories at: 844 EF03 Environmental Studies lab, Engineering and Technology lab, Geography lab, Computer and Information Technology Lab, the Business and Students Service Centre Lab, Post Modern Library Lab, Hospitality and Tourism Lab and the Arts Complex Twin Tower lab.

The University has also created awareness and sensitivity on the availability of ArcGIS Site licence in KU. Those who are aware are now directly demanding exposure to GIS Knowledge for its role in teaching and research and the opportunities the knowledge and ability it offers in the job market. The KU community has realised that GIS is a necessary spatial tool that cuts across all disciplines and they are voluntarily requesting to be trained. This transformation is what has put KU on the World Map of Geospatial Education Centre and indeed a lighthouse of GIS in the region. I am happy to be associated with and to have been part of this History Making at Kenyatta University. See <http://www.ku.ac.ke/schools/environmental/index.php/component/content/article/109-gis/299-arc-gis-and-remote-sensing-programme>.

GIS Testimony of Student 1: N36/1484/2006, James Chacha Maroa (Tullow Oil BV)

When I look back to April 2007 at the end of my First Year in at Kenyatta University, I still fill the same gut spirit in me standing at Prof. Onywere's office door undecided whether to knock and walk in or walk away. Now I smile knowing I made a knock that has continued to change my career and make my work easier. The knock gave me an opportunity to pursue a two months course in GIS and remote sensing at the Regional Centre for Mapping of Resources for Development (RCMRD) through their MoU with Kenyatta University which I came to learn later was initiated by Prof. Onywere. At my 4th Year in the University I implemented a research project on "*A GIS and remote sensing assessment of vegetation cover*

change and its impact on community livelihoods: the case of Taranga'nya Location, Kuria District”

Since leaving the University, I have found GIS and Remote Sensing relevant in my daily duties. Working as Environmental Health Safety and Social (EHSS) expert on several infrastructural projects as a consultant with GIBB International Ltd and Currently Tullow Oil BV a corporate organization, I have used GIS and Remote sensing in capturing data remotely and undertaking preliminary Environmental and Social Impact Screening. With this I generate environmental and social sensitivity maps that guide study teams on areas to focus on and further collaborate assessment findings. Through use of high resolution satellite images and aerial photography, it has made it easier to monitor environmental restoration works on degraded areas and quantify potential project impacts on biodiversity and wetland resources.

In undertaking social studies like resettlement action plans, community needs assessments, socioeconomic survey on linear projects like roads, irrigation schemes, power lines, I found GIS useful in mapping settlements and affected persons along these infrastructure and interlinking this data into one database with the possibility of spatially presenting it in a way that speaks volumes. There is no better tool in the current generation that is useful than GIS and Remote Sensing and I would encourage all students to pursue it. Thanks to Kenyatta University, ESRI and RCMRD and particularly to Prof. Onywere for making it possible for me with spatial knowledge.

GIS Testimony of Student 2: N50/10312/2007, Wambugu Geoffrey Mwangi (Karatina University)

I got interested in GIS and Remote Sensing during my masters studies at Kenyatta University. There existed an MoU between Kenyatta University and the Regional Centre for Mapping of Resources for Development (RCMRD) signed in 2005 and to which Prof Onywere encouraged the class to make use of for our practical skills with GIS and Remote Sensing at RCMRD. This enabled me to attain advanced GIS training at highly subsidized rates. I went on to utilize GIS and remote sensing to do my masters project “*Simulating the effectiveness of two forest management scenarios in a multiple-use Kenyan Coastal Environment: the Case of Kwale District*”. After graduation, I was employed in a research institution where my GIS knowledge was further utilized and shared in diverse projects. Currently, as an academic staff at Karatina University, I continue to apply GIS in teaching, research and outreach.

In a fast changing world faced with diverse environmental issues, GIS and Remote Sensing provides one of the most robust yet cost effective methods for monitoring, evaluation and decision support. Therefore, it is vital that students acquire this knowledge at an early stage in their careers in any field to enable them to make informed decisions on earth and environmental issues.

GIS Testimony of Student 3: N36/3199/2008 Gladys Jebiwot Mosomtai (ICIPE Earth Observation Unit)

My first encounter with GIS and Remote Sensing was in third year when we covered a unit called Remote Sensing as I pursued my bachelor degree in environmental planning and management. Prof. Onywere taught us the unit and inspired us throughout his lectures. He not only taught us the theory part but also took time to show us the practical part despite the fact

that KU then didn't have the GIS lab. We also got an opportunity to go to the field and be able to interpret the remote sensing data with what is on the ground.

The department was also able to set up a MoU with Regional Centre for Mapping of Resources for Development (RCMRD) to allow students to undergo training at subsidized prices to further their practical skills in GIS and remote sensing. I was among the first students who took that opportunity and expounded my knowledge and skills in remote sensing software called ERDAS IMAGINE. I expounded my knowledge further when conducting my undergraduate project work. I applied remote sensing and GIS in trying to understand the impact of development within Molo River catchment and how it is affecting water quality and quantity. Through the guidance of Prof. Onywere I was able to get hands on experience in using earth observation data, I also got introduced into research field where currently am working on. The experience gained in my undergraduate work landed me my first job.

Currently am working as a research assistant in ICIPE under the Earth Observation Unit. My work involves training PhD students and scientist on integrating GIS and remote sensing in their work, generating maps and data sets for various projects conducted within the institution. My major research work at the moment is mapping vector habitats in Rift Valley Fever prone areas in Kenya, a GIS/remote sensing application in disease mapping. I have also applied remote sensing in mapping forest cover in Kenya and through the gained knowledge I have acquired over time I have been able to also conduct consultancy work and conducted successful training on species distribution modelling in ILRI.



Gladys Mosomtai (standing) taking participants through Ecological Niche Modelling workshop at ILRI.

GIS/remote sensing is no longer applied to environmental field only, a company in business wants to know which is the best location to open up branches based on the population, road networks, public amenities in order to gain the most profit, a bank like equity wants to know where the various branches and agents are located as well. Application of GIS and remote sensing is limitless for one reason, everything on this planet is at a specific location or point, thus any information that is attributed to a location becomes a geographic information which can be analysed, and displayed in GIS therefore no matter the field you have chosen to pursue having knowledge in GIS and remote sensing places you at a better position in the job market.

GIS Testimony of Student 4: N50/13008/2009, David Masereti Makori (ICIPE Earth Observation Unit)

I was privileged to be in the class of GIS when I was doing my masters in EPM at Kenyatta University. Initially I had learnt about GIS when I was doing my undergraduate studies at Jomo Kenyatta University of Agriculture and Technology (JKUAT), but it was not until I was in Prof. Onywere's class that I came to learn how robust GIS/RS is. Because of the "complex" nature of GIS, especially when doing it in theory, I shared my challenges with Prof Onywere who recommended that I do an internship in the Department of Resources Surveys and Remote Sensing (DRSRS). This was the turning point for me in geospatial knowledge. I was able to apply what I learnt in theory into practice with the additional help from Dr. James Kinyanjui and Ms. Faith Mutwiri of DRSRS, where we used NDVI to predict pasture availability in Northern Kenya. From this experience my Masters project "*Effects of Mining on Biodiversity in East Africa Portland Cement Company, Athi River Mining area, Kenya*" was GIS based which proved to be a very helpful tool.

After graduating, I got a contract with the Regional Centre for Mapping of Resources for Development (RCMRD), the best GIS/RS organization South of the Sahara and which serves more than 15 countries in Eastern, Southern and Central Africa. Here I worked on different projects for two years before joining ICIPE's Earth Observation Unit where I am using Hyperspectral Remote Sensing data to map flowering plants in Africa. The project will culminate to my PhD.



Mr David Makori and (right in second photo) in some of the field assignments with Prof. Onywere (at his back)

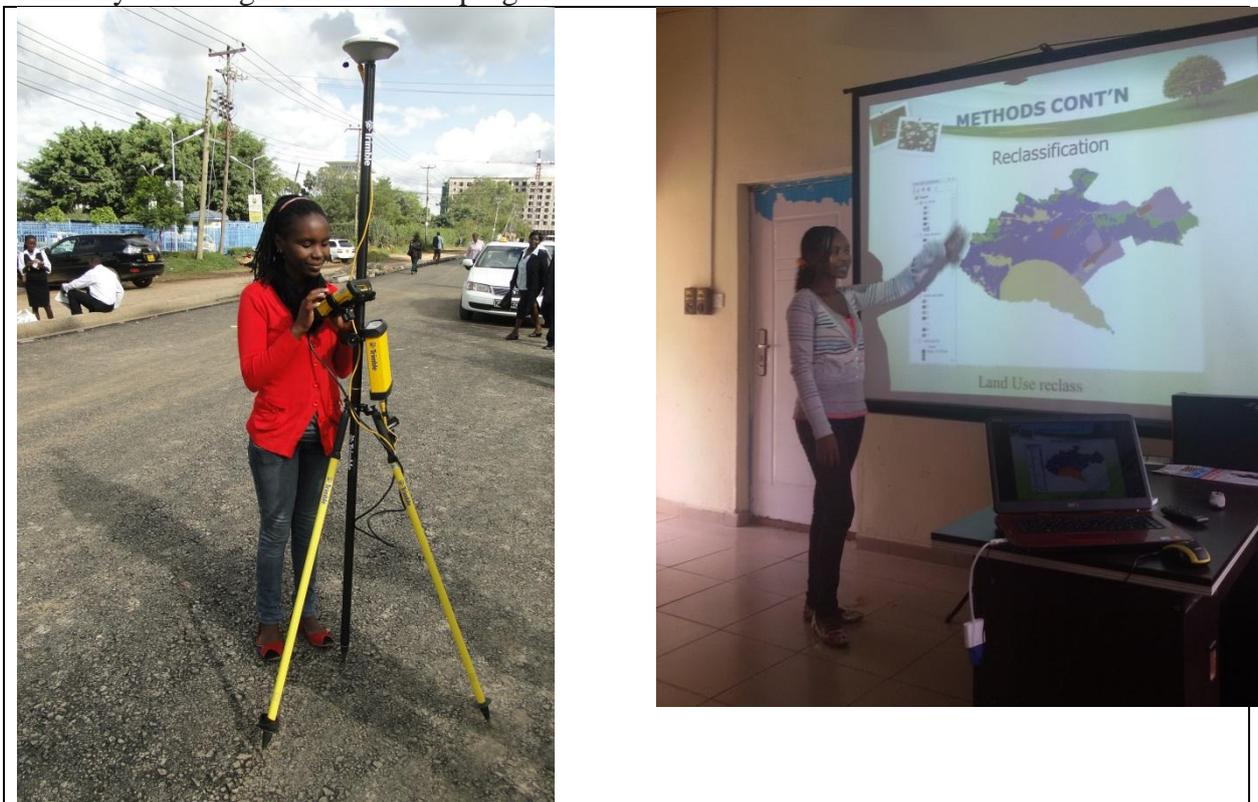
I have been mentored my time by Prof. Onywere who in many occasions has asked me to accompany him to the field on many of the projects he does. Over the time I have worked with GIS tools I have come to learn that GIS/RS is a field that is important and can be integrated into any field including business (banking) and medicine. I have had a chance to lecture students in various departments on the same GIS subject. I think GIS training should be part of an introductory course to any student joining a university to give them spatial orientation in their area of specialisation. For the GIS capacity I have I am truly grateful to Kenyatta University and Prof. Onywere for the introduction initiation and motivation into this field.

GIS Testimony of Student 5: N38S/16455/2009 Joyce Wanjiru Kimani (Institute of Natural Resources, Environment and Sustainable Development (INRES), University of Port Harcourt, Nigeria)

My name is Joyce Kimani - M.Sc. student at the University of Port Harcourt, Nigeria. I first encountered Geographical Information Systems (G.I.S) as a 3rd year student at the Department of Environmental Science in Kenyatta University. I got involved in a project which made use of GIS to analyse Land Cover Changes in Imenti Forest Blocks between 1990 and 2013. This resulted in Prof Onywere, my instructor, encouraging me to present my GIS project at the first Esri Eastern Africa Education User conference. Buoyed by the positive reaction to my presentation, I later underwent 2 weeks training at RCMRD (Regional Centre for Mapping of Resource for Development) on GIS and Remote Sensing (RS). After graduating, I was fortunate to land a 4 month internship at Esri Eastern Africa where I got greater exposure to the Esri suite of products and was also trained on online web mapping techniques using ArcGIS Online, resulting in 7 GIS related certificates. Armed with this knowledge, I was empowered to do the following projects.

- An assessment of Kenya's water towers - a project by the Kenya Water Tower Agency through the Department of Resource Surveys and Remote Sensing (DRSRS)
- A Carbon sequestration project by FAO through the Kenya Forestry Research Institute

I later got a job at Geo AgroEnvi solutions International as a GIS and Remote Sensing analyst consultant for GTZ where I was responsible for the mapping of water service providers' in the 47 counties in Kenya before leaving the country early this year to pursue my M.Sc.degree at the Centre for Natural Resources and Environmental Management, University of Port Harcourt, Nigeria. I had taken advantage of information circulated to students by Prof Onywere and applied and was lucky to be selected as one of the 8 African citizen students on scholarship awarded by the Directorate of Technical Cooperation in Africa (DTCA), Nigeria Ministry of Foreign Affairs to the programme.



Joyce Kimani, picking high accuracy GPS coordinates and making a project presentation

As you may be able to tell from my story - knowledge of GIS gives students a competitive edge in the job market. It is a fact that up to 70% of all information in circulation possesses a common denominator: geography or location. In a world where information is key, an individual who is able to make decisions based upon geographical information is extremely valuable. As time progresses, GIS will continue to find applications in every conceivable area of business activity with its impeccable logic – determining how to deliver the right product or service to the right place at the right time.

GIS Testimony of Student 6: N36/2281/2009 Susan Malaso Kotikot (Alabama State University, Hartsville)

It was not until I took my first course on Remote Sensing for Environmental Planning and Management with Prof Onywere that I learnt of GIS and Remote Sensing. From the demonstration of maps and Remote Sensing imagery by Prof Onywere some kind of inspired in me a great admiration for the potential of GIS for spatial analysis and scientific research applications and the hidden knowledge in images and remote sensing data. From Prof Onywere's research experiences demonstrated in class through many illustrations, I was motivated to learn more which lead me to pursue an internship at the Regional Centre for Mapping of Resources for Development (RCMRD). Here I accessed the necessary software and data and one thing lead to another.

During the course of my internship at RCMRD, I acquired more skills and took the challenge to carry out my final undergraduate research project on the Application of GIS and Remote Sensing on Frost Risk Mapping for Improved Agricultural Productivity, a project that earned me a My Community Our Earth (MyCOEServir) Award and Prof. Onywere appointed my Mentor in the award. In my Project I applied my newly acquired GIS skills in land cover mapping and Land Surface Temperature analysis. I have come to appreciate the fact that everything is interconnected in space and time, and in order to get a good understanding of many of the Earth's phenomena, spatial analysis is important.



Susan Malaso presenting at the AAG in Tampa Florida, USA in April 2014



Presentation at the 1st ESRI East Africa Education Users Conference 2013 at KU

With the good mentorship by Prof Onywere my research project was voted one of the 14 projects out of 120 world-wide, under MyCOEServir Support and I was invited to Tampa Florida, USA for the 2014 Association of American Geographers (AAG). I was given a full travel grant and had the opportunity to meet top Scientist in the GIS Arena, Visit NSA Headquarters and also USAID Headquarters. My passion and motivation was recognised by

the MyCOEServir Director and was offered a Masters Scholarship to Alabama State University Hartsville in the Earth systems programme. This I took up Since July 2014.

To Prof Onywere, your fatherly advice, determination, work ethics and above all knowledge in the field gave me a focus and determination too and it has paid off. To students in KU, you can determine your destination if only you pick and run away with something that excites you! Go for GIS knowledge.

GIS Testimony of Student 7: N36/2579/2011 Carole Akoth Otiwa (Current Kenyatta University Student)

My first introduction to GIS was in 2013 in my 2nd year of studies at the university when it was offered as a unit GIS and remote Sensing for environmental planning and management. It was made clear to us that we were to supplement theory with practical training at RCMRD that required a 2 week GIS and remote sensing training at a cost of KShs 10,000 with an additional huddle of making a class of a minimum 20 students. Taking advantage of this opportunity I attended two-weeks training at the Regional Centre for Mapping of Resources for Development (RCMRD).

Since my training at RCMRD there has been a great improvement in the availability of Geospatial knowledge tools at Kenyatta University, Courtesy of Prof Onywere's efforts. It was after the University received the ESRI site license that I had a first-hand experience in practising with GIS. The introductory training was a great insight. I learnt and practiced GIS and remote sensing during the first training and improved on it during the second subsequent training where we went out to field, collected data and made maps for various uses. I practiced using GIS in my class work throughout my 1st semester 2014/2015 in my year 4 and especially in urban planning and design assignments. It was through this practice that I truly experienced the power of GIS.

Later I set out to carry out my final year research project titled "**Using GIS to Map Urban Flooding Challenges in Ruiru Town, Kiambu County**" which is being supervised by Prof Onywere. For the project I'm making use of GIS in analysis of the existing storm water management practices as well as in building models. This will be used in curbing the socio-economic impacts of the urban floods experienced in Ruiru Town during the rainy seasons.

In practice, I am employing the use of GIS in creating story maps (here is sample: <http://bit.ly/1x2oSu8>) for tourist websites such as "Jambonairobi.co.ke". This makes it easy to illustrate certain aspects of interests for local or international tourists to experience. Discovering the wonders of GIS has been effective in helping me find various innovative ways through which environmental problems can be solved.



Kelvin Mugambi of KU receiving ESRI gift from Dr. Chauda of Ardhi University at the Education Users conference in Dar Es Salaam



Carol Akoth(left) and Nancy Wachiuri of KU with Dr. Michael Gould of ESRI USA at the Education Users conference in Dar Es Salaam

GIS Testimony of Student 8: N39S/15978/2010 Mugambi Kelvin Mwenda (Current Kenyatta University Student)

I was first introduced to GIS by Prof. Simon Onywere during my final undergraduate research project, where he is mentoring me on the application of GIS technology to healthcare management systems. Currently I am working on “Improving Patient admission in Kenyatta National Hospitals using GIS Technology” as my undergraduate research. In 2014, through the help of Prof. Onywere I made a presentation of my project idea at the annual ESRI Eastern Africa User Conference in Dar es Salaam where I qualified for an internship program at ESRI Eastern Africa. The intensity and time line of the internship has helped me to develop and apply new GIS skills in my career. The outcome and feedback are always promising, encouraging and therefore enhancing my personal resources dramatically in solving spatial problems in environmental management and community development issues.

The ESRI Educational campus-wide site license in KU is ideal for any student within Kenyatta University in elevating their GIS skills from GIS classrooms theory to software user and lastly to a professional practitioner. I intend to continue honing my GIS skills and climb the ladder of success. Use of the ESRI Educational site license at KU was my first rung. My sincere thanks to Prof. Simon Onywere and the GIS Technical team at KU. I am also grateful to ESRI EA Team!

GIS Testimony of a Staff member Esther Munyiri Kathure, School of Hospitality and Tourism

I learnt about the ArcGIS training in Kenyatta University through numerous posters all over the university in April 2014. Prof Onywere and the team had done a lot of publicity for the upcoming trainings, and almost everybody in the university had come across the name ‘ArcGIS’. I thought it a good idea to enrol and train. The first introductory phase training was a great eye opener and immediately I realized that this was the missing link in profiling hospitality and tourism resources. The second application phase brought even greater light into the connection between GIS and hospitality and tourism.

Upon completion of the two phases, the participants from the School of Hospitality and Tourism formed a research group with the aim of continuously mapping hospitality and tourism resources in Kenya and Nigeria. Nigeria was included because 20% of the members came from Nigeria. The project will run from September 2014 to September 2034 with the aim of using GIS to map hospitality and tourism for sustainable research, planning, management and marketing. Past, current, and future static and interactive; spatial and non-spatial maps on hospitality and tourism will be provided. This will be achieved with collaboration with key stakeholders.