

Editorial Preface

Reflections on Carnegie African Diaspora Fellowship Program (CADFP) Sponsorship to Enhance Geospatial Technologies for Social Science Research in Africa

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INTRODUCTION

Teaching and application of geospatial technologies at social, human, and associated science programs in African universities are hampered by unavailability of academic professionals experienced in the field of geographic information science or commonly referred to us Geo-informatics. The use of cutting edge and state-of-the-art technologies to teach and conduct research in issues pertaining to human-environment interaction are lacking in most African universities. Recently, research in the social and human sciences are being strengthened by using geographic information system, remote sensing of the environment, and associated technologies (Asami and Longley, 2012; Janell and Goodchild, 2011; NRC, 2008; Peuquet, 2002). The availability of geospatial data, enhanced visualization tools, and advanced spatiotemporal methods had led to the promotion of myriad applications in human and social science research (Janell and Goodchild, 2011; Cromley and McLafferty, 2011). Geospatial technologies provide a unique and powerful lens through which to understand the human, social, and environmental relationships. Institutions of higher education that deliver geospatial technology courses are often ill equipped in terms of curricula and faculty to deal with the rapid change in *GIScience* technology and analysis techniques (Prager, 2012; DiBiase et al., 2006). Despite the unpreparedness in faculty and staff, college and university courses involving the analysis of spatial information continue to grow in number and diversity in universities (Wikle and Fagin, 2014).

Researchers have expressed the need for capacity building in GIS, remote sensing of the environment, global positioning, and surveying techniques (*i.e. geospatial technologies*) in Africa (Taylor 2004; NRC 2002). Notwithstanding the fact that GIS and related analyses may not be a panacea, the integrative nature of its links with spatial, temporal, and spatiotemporal analyses offer important means of better understanding the most pressing problems of our generation. GIS, remote sensing, and spatiotemporal analyses provide valuable tools for researchers and policy makers (Matthews, 2009). Research indicates that spatiotemporal perspective can be an incubator for interdisciplinary research (Goodchild & Janelle, 2004). The United Nations Initiative on Global Geospatial Information Management (UNGGIM) promotes the development and use of global geographic information to address key global challenges (UNGGIM 2015). African universities capacities to use geospatial technologies at higher level are weak. According to Okafor (2011) there are positive reports about geospatial technologies education in several African universities. In a research conducted by Coetzee and Eksteen (2012), geospatial technologies education at tertiary institutions in Africa is cloudy. They

suggested that Africa does not have the tertiary geospatial technologies education capacity to meet its current and future challenges.

The Carnegie African Diaspora Fellowship Program is designed to increase Africa's skilled labor, build capacity at the host institutions and develop long-term, mutually beneficial collaborations between universities in Africa and the United States and Canada. The program is funded by Carnegie Corporation of New York and managed by the Institute of International Education in collaboration with United States International University-Africa in Nairobi, Kenya, which coordinates the activities of the Advisory Council. Africa with its many natural resources, fast increasing population and accelerating economic development, (Mohamed and Plante 2002, Williams 2008, Davies 2010) need academics in the Diaspora to strengthen and bridge the knowledge gap between the universities in the Diaspora and the African universities. Geospatial technology programs continue to expand both in teaching and research in African universities. The challenge for faculty is to maintain currency and relevance of the curricula to meet the changing needs and demands of the industries and governments in respective countries. Research in African universities using GIS, remote sensing and related spatial technologies continue to be hampered due to lack of capacity. CADFP sponsored (*fellow- Dr. Samuel Adu-Prah*) with the host African institution Kwame Nkrumah University of Science and Technology (KNUST) (*Host Collaborator- Dr Divine Odame Appiah*) worked on a project to improve and enhance existing geospatial technologies curricula, share course modules and relevant literature, co-supervise masters and doctoral student, and collaborate on research initiatives. The project initiative was supposed to fill the gaps and strengthen faculty and staff in research, teaching, and students' supervision in the host university. It is envisioned that the project initiative will provide a conduit for a long-term partnership between the Diaspora university- *Department of Geography and Geology at Sam Houston State University in the United States* and the *Host Department of Geography and Rural Development at KNUST in Ghana*.

PROJECT OBJECTIVES

To address the knowledge gap in faculty and capability to teach and supervise the ever-increasing number of students at masters and doctoral levels in the field of geospatial technologies at KNUST in Ghana, the project sought to address the following objectives:

1. Enhance the curriculum for teaching GIS and remote sensing in the department of Geography and Rural Development at the host university;
2. Organize and teach six weeks Summer course for graduate students and faculty in geospatial applications for social science research;
3. Identify potential faculty to collaborate on applied geospatial technologies research.

METHODS/APPROACH

The Department of Geography and Rural Development at KNUST, Ghana offers Bachelor of Arts programs in Geography and Rural Development, and Culture and Tourism. At the postgraduate level, the Department offers MPhil (Master of Philosophy) and PhD in Geography and Rural Development. GIS and Remote Sensing courses are offered to support the degree courses. At the core of this project is training and enhancing curriculum in geospatial technologies to support social science research in the host university. The project used curriculum design and improvement techniques and summer class offering to achieve the objectives. A virtual meeting with faculty responsible for teaching related courses was held. The meeting discussed possible improvement and enhancement in the curriculum. The instructional approach was used to provide a six weeks course at the host university- KNUST. Both lectures and hands-on computer laboratory exercises approach were used for the summer training

Figure 1. (a) Host collaborator (Dr. Divine Odame Appiah, Kwame Nkrumah University of Science and Technology), (b) CADFP fellow (Dr. Samuel Adu-Prah, Sam Houston State University, Texas, USA)



workshop. Faculty with research foci in geospatial technologies were identified through face-to-face discussion and dialogue.

PROJECT OUTCOMES

Figure 1 a and b show the host collaborator and the CADF fellow respectively during one of the opening sessions in the workshop. An intensive six-week training workshop in geospatial technologies was organized for faculty and graduate students (PhD and Masters). As part of the project outcome a thorough review of the GIS and Remote Sensing courses offered at the host department was conducted with the faculty responsible for teaching the courses. We recommended that all geospatial technology courses should have a computer lab exercises to provide students the needed skills for research and the job market. Consequentially, this poses a challenge because the department lacks the needed GIS computer laboratory for students to complete the assigned laboratory exercises (hands-on). Figure 2 shows the proposed GIS laboratory and a section of the training participants. The participants came from diverse disciplines including geography, tourism, history, architecture and planning, information technology, and electrical engineering.

To support the teaching of the courses, I agreed to provide the requisite hands-on materials currently used in teaching similar courses in my diaspora institution. Recently published textbooks on geospatial technologies were handed over to the department. Some of the topical areas covered in the training workshop included: Introduction to ArcGIS software; GIS a unique way of understanding, visualizing, and exploring our world; GIS data collection and model; GIS workflow and major GIS operations; Creating and maintaining geographic databases; Cartography and map production; and the Remote Sensing process. In addition to the lecture materials, each topic covered had associated hands-on exercises. A full functional Environmental Systems Research Institute (ESRI) ArcGIS 10.x one-year student version software was given to all participants in the workshop through the collaboration of Environmental Systems Research Institute (ESRI, California) and Sam Houston State University, Texas. Furthermore, participants of the workshop were awarded “Certificate of Participation” for completing the training. Figure 3 shows a group picture of the participants and the fellow.

The faculty who participated in the workshop promised to use geospatial technologies in their respective research areas. The topical faculty research areas identified included: land use and land cover change; environmental hazards; environment, water and sanitation; climate, agriculture and food

Figure 2. Proposed room for GIS laboratory at the Department of Geography and Rural Development, KNUST. A section of the training workshop participants with their personal laptops during the training.



Figure 3. Participants in the geospatial technologies training workshop (graduates, postgraduate, and faculty) from the Host Institution and the fellow (Dr. Samuel Adu-Prah)



security; health and development; and tourism and development. The faculty agreed to collaborate to continue research in their respective areas using GIS and remote sensing.

The host department was excited of the initiative by CADFP and the training workshop offered and wish it continues to be an annual (every summer) to support teaching and research. The challenge for the host department- Geography and Rural Development is lack of an equipped GIS Laboratory. There is a critical need for the department to have a GIS laboratory, an indispensable component of teaching and research in geospatial technologies to serve students and faculty.

REFLECTIONS ON OUTCOMES

The project has created avenues for masters and doctoral students' supervision and gateway for collaboration. I continue to review masters and doctoral dissertations for students from the host universities. Some of the students have also expressed interest in pursuing further studies in geospatial technologies with possible admission in Sam Houston State University. Collaboration on potential

Figure 4. A group of the workshop participants using global positioning systems (GPS) for data collection



research areas identified with the faculty in the Department of Geography and Rural Development at KNUST is progressing after the project. A shared database has been created to be accessed by faculty and students for research articles to support research in the host university. The workshop participants continue to have access to the one-year ESRI ArcGIS software license to be renewable annually in collaboration with ESRI- California and Sam Houston State University. Faculty continue to publish in the International Journal for Applied Geospatial Research. Some of the challenges in executing the project objectives at the Host University included 1) fitting programs to already busy schedules, and 2) non-existence of GIS laboratory. These challenges are often reminiscent of African universities developing geospatial programs. Despite the challenges the outcomes and methodology for this project can be duplicated in other African universities pursuing programs in geospatial technologies and related applications. CADFP also continues to assist African higher education institutions to build capacity to enhance curriculum and research through African scholars in the Diaspora.

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REFERENCES

- Asami, Y., & Longley, P. A. (2012). Spatial thinking and geographic information science. *Environment and Planning, B, Planning & Design*, 39(6), 975–977. doi:10.1068/b3906ge
- Coetzee, S., & Eksteen, S. (2012). Tertiary education institutions in Africa: Cloudy with a chance of GIS education in some countries. *South African Journal of Geomatics*, 1(2), 119–132.
- Cromley, E., & McLafferty, S. (2011). *GIS and public health* (2nd ed.). New York, NY: Guilford Press.
- Davies, T. C. (2010). Geoscientific environmental health issues in Africa. *International Geology Review*, 52(7–8), 873–897. doi:10.1080/00206811003679869
- DiBiase, D., DeMers, M., Johnson, A., Kemp, K., Luck, A. T., & Plewe, B. (2006). *Geographic Information Science and Technology Body of Knowledge* (1st ed.). Washington, DC: Association of American Geographers and University Consortium for Geographic Information Science.
- Goodchild, M. F., & Janelle, D. G. (2004). *Spatially integrated social science*. New York, NY: Oxford University Press.
- Janelle, D. G., & Goodchild, M. F. (2011). Concepts, Principles, Tools, and Challenges in Spatially Integrated Social Science. In T. L. Nyerges, H. Couclelis, & R. McMaster (Eds.), *The Sage Handbook of GIS & Society* (pp. 27–45). Sage Publications. doi:10.4135/9781446201046.n2
- Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2011). *Geographic information systems and science* (3rd ed.). Hoboken, NJ: Wiley & Sons.
- Matthews, S. A., Moudoun, A. V., & Daniel, M. (2009). Using geographic information system (GIS) for enhancing research relevant to policy on diet, physical activity, and weight. *American Journal of Preventive Medicine*, 36(44S), S171–S176. doi:10.1016/j.amepre.2009.01.011 PMID:19285210
- Mohamed, M., & Plante, R. (2002). Remote sensing and geographic information systems (GIS) for developing countries, *IEEE International Geoscience and Remote Sensing Symposium (IGARSS '02)*, 2285–2287. doi:10.1109/IGARSS.2002.1026520
- NRC - National Research Council. (2002). *Down to Earth; Geographic Information for Sustainable Development in Africa*. Washington, DC: The National Academies Press.
- NRC - National Research Council. (2008). Committee on Enhancing the Master's Degree in the National Sciences, Board on Higher Education and Workforce Policy and Global Affairs, *Science Professionals: Master's education for a competitive world*. Washington, DC: The National Academies Press.
- Okafor, U. G. O. (2011, October). Country Report on the development and innovations of the Namibian National Geospatial Information System. In *High Level Forum on Global Geospatial Information Management, Seoul, Republic of Korea*, 1–10.
- Peuquet, D. J. (2002). *Representations of Space and Time*. New York, NY: Guilford.
- Prager, S. (2012). Using the GIS&T Body of Knowledge for curriculum design: Different design for different contexts. In D. J. Unwin, K. E Foote, N. J. Tate, & D. DiBiase (Eds.), *Teaching Geographic Information Science and Technology in Higher Education*, New York, NY: John Wiley and Sons: 63–80.
- Taylor, D. R. F. (2004). Capacity Building and Geographic Information Technologies in African Development. In S. D. Brunn, S. L. Cutter, & J. W. Harrington (Eds.), *Geography and Technology* (pp. 491–519). Dordrecht, The Netherlands: Kluwer Academic Publishers. doi:10.1007/978-1-4020-2353-8_22
- United Nations Global Geospatial Information Management (UN GGIM). (2015). Retrieved from <http://ggim.un.org/>
- Wikle, T. A., & Fagin, T. D. (2014). GIS Course Planning: A Comparison of syllabi at US College and Universities. *Transactions in GIS*, 18(4), 574–585. doi:10.1111/tgis.12048
- Williams, J. J. (2008). The significance of geographical information systems for development planning. *Development Southern Africa*, 16(2), 345–356. doi:10.1080/03768359908440082