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EMERGING TECHNOLOGY & PRACTICE FOR CONSERVATION COMMUNICATIONS IN AFRICA

A REPORT ON THE STATE OF THE ART AND TRENDS WITH RECOMMENDATIONS FOR USAID

June 2012

Version 1.1

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COVER PHOTO: From “Putting People First” - 2005

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ACRONYMS

ABCG	Africa Biodiversity Collaborative Group
AIDS	Auto-Immune Deficiency Syndrome
AWF	African Wildlife Foundation
BATS	Biodiversity Analysis and Technical Support program
BROSDI	Buoga Rural Open Source Development Institute
BSP	Biodiversity Support Program
CARPE	Central Africa Regional Program for the Environment
CBFP	Congo Basin Forest Partnership
CBNRM	Community-based Natural Resource Management
CDMA	Code Division Multiple Access
CGAP	Consultative Group to Assist the Poor
CGIAR	Consultative Group on International Agricultural Research
CI	Conservation International
CIFOR	Center for International Forestry Research
CMS	Content Management System
CoP	community of practice
DRC	Democratic Republic of the Congo
EASSy	Eastern Africa Submarine Cable System
ERZ	Extractive Resource Zones
GBIF	Global Biodiversity Information Facility
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Geographical Positioning System
ICT	Information and Communication Technology
IDA	International Development Agency
IMT	Information Management Tool
INCEF	International Conservation and Education Fund
ISP	Internet Service Provider
IT	Information technology
IUCN	International Union for Conservation of Nature

JGI	Jane Goodall Institute
KM4Dev	Knowledge Management for Development
MTN	South Africa-based multinational mobile telecommunications company
M-PESA	M (mobile) + Pesa (Swahili for money)
NGO	Non-governmental Organization
ODK	Open Data Kit
OECD	Organization of Economic Cooperation and Development
PA	Protected Area
PMP	Project/Performance Management Plan
OSS	Open Source Software
PEPFAR	President's Emergency Program for AIDS Relief
PVT	parallel vote tabulation
REDD	Reducing Emissions from Deforestation and Forest Degradation
SAFE	Links the SAT3 cable system to Asia
SAT3	South Atlantic 3/West Africa Submarine Cable
SEACOM	a private venture that owns and operates a submarine cable connecting south and east Africa
SERVIR	NASA-supported geospatial data collection and analysis center
SIM	Subscriber Identity Module is a smart card for mobile phones
SMS	Short Message System
STEWARD	Sustainable and Thriving Environments for West African Regional Development
TRAC	Treatment and Research AIDS Center
USAID	US Agency for International Development
USB	Universal Serial Bus
VSAT	Very Small Aperture Terminal
WCS	Wildlife Conservation Society
WIZZIT	South Africa-based provider of basic banking services for the unbanked and underbanked
WRI	World Resources Institute
WSR	Whole-System-in-the-Room
WWF	World Wildlife Fund

EXECUTIVE SUMMARY

Twenty-five years ago, information and communications technologies (ICTs) were not well integrated into the development policy agenda and were largely overlooked by development agencies.[1] In the past decade, ICTs have experienced unprecedented growth, due to a complex of technological and economic factors including economic globalization, the rapid advance of the Internet and advances in telephonic technology that have greatly increased performance while dramatically dropping production and operating costs. ICTs, by themselves, do not equate to economic development but are becoming ever more integral to broad-based development strategies. There has been a growing recognition of the potential value of integrating ICTs into development project designs as a cost-effective means for public awareness, outreach, social and business transactions, knowledge sharing and education and performance monitoring and accountability. ICTs' transformational capabilities have been especially evident in governance, health, finance and agricultural interventions in Africa. The conservation community also has increasingly used ICTs in many different activities but opportunities for faster and greater impact from the use of ICTs also exist.

PRINCIPAL FINDINGS

In Section 1 of this study, we discuss the rapidly growing number of mobile and Internet-based applications for developing and sharing information and knowledge recognizing that computers, scanners, email, SMS, mailing lists, web sites, and internet telephony are ICT technologies already in widespread practice in Africa, not the case even five years ago. Not only have these applications greatly facilitated research and data analysis but they have been very important in public awareness and education from local communities to national and international decision makers. The tremendous diversification of both ICT devices and software combined with falling costs for equipment and subscriptions have opened up many new markets and tremendously expanded the number of users of ICT in less than 10 years in much of sub-Saharan Africa.

In Section 2, we focus on emerging information and communication technologies being used for conservation. Because many of the high conservation sites are also relatively remote and undeveloped with respect to infrastructure, the use of ICT directly in conservation activities has been limited. However, with respect to management of research and monitoring data, remote sensing and communications, public awareness and education, a steady increase in the use of ICT for conservation can be observed. As Internet and high density mobile networks spread across the African continent it is highly likely that ICT will play an increasing role in conservation activities.

In Section 3, we step away from the conservation focus to analyze the roles of ICT in various non-conservation sectors (finance, agriculture, health, and governance) as well as looking at their roles in e-learning and knowledge management. If anything, mobile telephony has begun to assume a prominent role in both affluent and poor communities, providing critical services in supply chains, public and private services, social networking and analyses. The explosive growth of ICT use in Africa is less than ten years old. It began with the most developed nations in sub-Saharan Africa, especially the Republic of South Africa but has quickly spread to other nations with relatively more developed economies like Kenya, Uganda, Nigeria, Ghana and Senegal. The use of ICT and especially mobile phone applications is especially prominent in applications that are transactions-based, especially electronic payments systems, mobile money and supply and value chain relationships. However applications that are relatively data

[1] OECD Report, 33

intensive such as health, elections and a few other fields have also seen a significant rise in the use of mobile forms of ICT. On the other hand, due to costly infrastructure and the relative unavailability of cable and satellite feeds the spread of high bandwidth Internet has been slow, though this may change within the next decade.

In Section 4, two important African regional conservation programs, CARPE and STEWARD are analyzed with respect to their use of ICT. The kinds of ICT tools used and the way in which they were used has been largely influenced by the mission of each program, the geographic scope, the stakeholders involved and the communication and knowledge sharing strategies that each program evolved. This serves to reinforce the recommendation that an ICT assessment be a part of project/program design and initial work planning by the selected implementer(s). CARPE is a large and long-established central African project. It is relatively data-intensive and makes extensive use of satellite imagery, GIS and other land use planning and management tools. It has recently developed a communications strategy that may allow it to make more use of social network tools and other communications vehicles, which may be important since it works primarily through a network of NGOs.

STEWARD, which operates in the Guinean forest, a transboundary network of protected areas in West Africa uses a more traditional suite of communications and knowledge sharing tools, relying live interaction, print materials and videos more than other forms of communications. Its main web interface is a low cost partnership with FRAMEweb, a USAID – supported interactive knowledge sharing focused site that was formed to support communities of practice in natural resources management in Africa more than 10 years ago. Hence, STEWARD's ICT footprint is smaller than CARPE's but is evolving as it develops a new communications strategy.

In Section 5, a summary of the ABCG focus group discussion provided useful insights on the roles of ICT in the various conservation organizations involved, all of which view ICTs and the Internet as playing critical roles in achieving their mission as well as helping their activities to be more cost-efficient.

The extensive Reference list is hyperlinked to the source documents, whenever possible. Annex one summarizes the results of an online survey on the use of technology among conservation individuals and their institutions active in Africa.

PRINCIPAL RECOMMENDATIONS

The conservation community has a wealth of experience in harnessing ICTs and communications spread among its many members. The distribution of this expertise, however, is uneven and opportunities exist to learn within the conservation community as well as learning from others operating in different fields but with similar ICT requirements. The recommendations in this report are intended to help build overall capacity for USAID and its implementing and cooperating partners to better manage and benefit from investments in ICTs and communications for conservation. Other more specific recommendations can be found in the body of the rest of this report.

INSTITUTIONALIZING GOOD PRACTICE

This paper recommends that agencies and development practitioners engaged in the design and implementation of Natural Resource Management (NRM) projects systematically incorporate the use of ICTs in projects from the earliest stage of project design through closure. This can be achieved by including an ICT component as a project design requirement, including assessments of existing ICT capabilities and collaboration opportunities , particularly in remote areas, to boost efficacy and build on existing networks. Potential exists for collaboration across networks, platforms, databases and client pools. The private sector, as this report will illustrate, is playing a critical role in transforming the ICT landscape. This presents an unprecedented opportunity in Africa for public private partnerships to increase the conservation and development of interventions. From Google Applications to mobile

companies offering creative and inexpensive access to mobile phones, Africa is ripe with transformational opportunities to use ICT technologies and practices.

The Agency should build on networks of practitioners already recognized by their membership in communities supporting conservation. The Africa Bureau Conservation Group (ABCG) is an example of a community with strong representation of practitioners and a history of information sharing on conservation in Africa. To make a community valuable as both a communications channel for dialogue and a clearinghouse for accessing and applying good practices, the community will need a means to conduct two-way discussions, a means to assess approaches to ICT and communications innovation and a means to develop prototypes and adaptations for broader adoption.

Dialogue on emerging technologies serves both to educate and to develop field requirements. To move from understanding issues to applying that experience, a broader community will benefit from access to subject matter experts and criteria to assess approaches and recommend specific applications for field programs. To encourage adoption of recommendations, one model used in other sectors is to centrally provide technical assistance. One version of this combination of innovation and expansion has been planned for the Famine Early Warning System through a small incubator activity running in parallel to the regular operations of the project. Alternatively, the Technical Assistance Support Contract 4-Information and Communications Technology for Health (TASC 4-ICT Health) Project is an example of a broad vehicle to support a sector with ICT services. By building from the needs of practitioners and connecting to a means to implement prototype efforts, good practice can be more broadly established, problems resolved more efficiently and programming decisions better informed institutionalizing use of ICTs and communications approaches.

Part of better institutionalizing best practices will be the use of a requirements analysis at the outset of activity planning to calibrate human resources and technology investments properly against overall goal achievement. This would also provide an opportunity to explicitly make the case for continued investments and to track results through integration with Project Management Plans (PMPs) and monitoring and evaluation efforts. By integrating ICT and communication activities in USAID strategic and project planning those new efforts would also help support larger Agency goals around data transparency and learning, evidence-based designs and more efficient investments in project tools. A focus on learning and networks, additionally, will help strengthen connections to field-based efforts coordinated with central activities.

Learning support can also take the form of local use of multimedia for training on a wide range of topics. Low-cost technologies to transform classroom-based PowerPoint trainings into multimedia stand-alone digital courses and other self-paced presentations offer an easy means to expand training on tools and methods and potentially reach larger audiences. Regardless of continuous access to the Internet, rich media "e-resources" can be delivered for use on standalone systems and bring together text, video and audio for learning associated with all aspects of program implementation. The intent is not to further spread "death by PowerPoint" but to build from existing products, supplement with context-rich alternate learning channels (built-in exercises, videos and other tools) to communicate and align products with an instructional design focus. The FAO's IMARK program is a good example of an online learning series using multiple delivery modes to reach beyond current connectivity. Online and CD-based products are available.

1. THE SCOPE AND EVOLUTION OF ICT USE IN DEVELOPING COUNTRIES

1.1 ICT DEFINED

The European Information Technology Observatory defines ICT as consisting of the following: **IT equipment** (servers, computers, monitors and other equipment); **software** (applications, system infrastructure software); **IT services** (training and education, planning, support services, operations management), **communications equipment** (mobile phones, smart phones, LAN routers and switches), **wireless access infrastructure** (mobile access infrastructure, transmission equipment) and **carrier services** (fixed voice telephony, internet access and services, mobile voice telephony, mobile data services).[2] To this list, we would add geospatial imagery and geographic information systems since both belong under the subset of information technology.

1.2 SPREAD OF MODERN ICT IN THE DEVELOPING WORLD

The worldwide rise of the Internet in the 1990s catapulted ICTs to the forefront of the development dialogue. Mobile phones may have had a greater social and economic impact on the developing world in the shortest period of time than any other single technological advance. Despite major advances in global access to and use of ICTs, a large technological divide remains between developed and developing countries. Least Developed Countries rank at the bottom of the ICT Development Index, with little movement since 2002.[3] The bottom ten countries of the ICT Development Index are African nations.[4] Statistics indicate that the digital divide between those countries with very high ICT penetration levels and those with the very lowest is closing only slightly. The one exception is mobile phone penetration: by the end of 2008, with over four billion mobile phone subscriptions around the world,[5] mobile phones in the developing world had reached an estimated 49.5% penetration rate. This represents a steep rise since 1998, when the penetration rate was close to zero.[6] Although mobile phone telephony has experienced a massive uptake in Africa, Internet usage and applications are lagging significantly due to a lack of infrastructure and associated high operating costs. This report will examine ICTs in Africa and their impact to date by analyzing trends, highlighting case studies and success stories and making recommendations on how conservation organizations working in Africa might apply lessons learned from other sectors.

1.3 SUMMARY OF EMERGING ICT TRENDS IN AFRICA

1.3.1 DEMOGRAPHIC, ECONOMIC AND INFRASTRUCTURAL FACTORS AFFECTING ICT DEVELOPMENT

In Africa, the steep rise in the use of mobile telephony and other ICTs has been caused not only by the simultaneous rapid increase in functionality and an equally rapid drop in production and operating costs but also by major demographic and socio-economic shifts on the continent. Africa has the fastest rate of urbanization of any region in the world. Urbanization and globalization have combined to integrate much of the continent into both the global economy and the information age. It also has one of the

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[2] http://www.eito.com/definitionsICT.htm
[3] International Telecommunications Union, 21
[4] International Telecommunications Union, 22
[5] International Telecommunications Union, 3
[6] International Telecommunications Union, 1

youngest populations. The large youth bulge tends to be relatively better educated and more ICT-savvy than previous generations and, combined with the other factors described above accounts for the rapid penetration of ICTs in Africa.

Africa's slow development and lagging infrastructure has had, at times, contradictory impacts on the development of ICTs. The lack of infrastructure, on the one hand, has caused Internet usage to remain relatively low and limited primarily to urban areas. On the other hand, this same infrastructure problem meant that the Continent largely leap-frogged over the landline stage of telephony and went straight to mobile, wireless telephony, much more suited to the economic conditions on the continent.

The limited development of public services, finance, extension services provided opportunities for the development of new services, based around mobile phones in microfinance, health services, agriculture and business. South Africa especially but also Kenya, Uganda and Ghana have been pioneers in developing ICT-based services to meet the needs of growing urban and, to a lesser extent, rural populations..

The fields of environment and nature conservation have long embraced some kinds of ICT, e.g. radio collars for tracking animal migrations, satellite imagery and GIS but these organizations also are now rapidly taking up mobile telephony and use of the Internet in Africa and the rest of the developing world. A persistent constraint has been that high conservation value ecosystems and wildlife habitats tend to be in remote areas and so are often poorly serviced by telephone, cable or satellite receivers. This constraint, In recent years, has been partially overcome through the use of clean energy, especially solar power to provide electricity for satphones or mobile telephones.

1.3.2 ICT PROGRAM APPLICATIONS

Development is an inherently high-risk undertaking and the Agency's renewed t emphasis on evaluation and learning are important tools to use when adopting new or improved practices. With the rate of change in the ICT sector and the diversity of capabilities in the sector across Africa , programs undertaking new activities do not have time to wait for formal evaluations to inform investments. Traditional monitoring regimens are best suited to capturing results from more familiar investments.

To support testing and adaptation of ICT investments, an adaptive management approach with a strong learning component can capture and apply experience at the rate of change needed to support current operations. The CARPE Project is an example of adaptive management that integrates diverse organizations across a broad geographic scale. To diversify current practice, *peer assists* offer an opportunity to build in flexibility to start-up efforts with broader inputs to subsequent design efforts. As the name suggests, peer assists are networks (or communities of practice) designed to jointly solve common problems or help a new project learn from the experiences of others with a similar challenge. A*fter action reviews* provide a management tool for decision makers built on the experience of practitioners, mostly internal to a team or organization, providing input on what worked or did not work, why. and how to improve. By building in chances to collaborate on design and ongoing review of implementation, programs create additional channels of learning for management and rapid improvement. For purely IT activities the Agile approach to software design is a good example of this kind of approach to assessment.

The non-profit community has extensive experience using social media, open source software and data sharing. Programs, having identified the need for internal or external ICT resources for management and communications, should actively consider Google, Facebook, LinkedIn and other large-scale freely available technologies to benefit from cloud computing and the broad reach of this new genre of tools. With small investments of staff time, internal systems as well as public outreach can be constructed from existing online resources. The same kinds of value-added that social media offer the general public and private sector - online networks, office automation, communications, data sharing and storage - are also valuable and available to internal project work. Facebook, for example, has private groups offering all the

features of public pages to support networks of practitioners. Google offers office automation for all. Free wikis and blogs are available as platforms for knowledge sharing readily available to any with online access. The ubiquitous nature of online technology for those with access has shifted the dynamic from how to use scarce, expensive technologies to how to best use abundant resources.

1.3.3 APPROACHES TO IMPLEMENTING ICT TECHNOLOGY

IMPROVING COORDINATION AND APPLICATION OF STANDARDS.
With a decentralized organization and a global footprint, large investments in centralized technology solutions are not likely to provide valuable results. That said, there is an opportunity to better coordinate both conservation tools and information. Applications standards building, for example, on the current Automated Directive System's mandates in Sections 540 and 548 could help to trim redundant investments in technology and improve USAID's ability to capture technologies for future re-use.

Data standards could help a federated approach to long term collection and use of data, regardless of specific technology. Efforts like the Geo-spatial Center of Excellence provide a platform to develop program-focused standards for inter-operability of data collection and improved collections management. As a complement to standards, low-cost, widely accessible storage via cloud computing provides a vehicle to use central coordination to support decentralized efforts. Whether it is through more active participation in open government efforts, improved capture of data types beyond documents by the Development Experience Clearinghouse or another effort by a specific portion of the Agency, there is a need for an organized, available repository for more of the Agency's investments in data.

INFORMATION CAPTURE AND MANAGEMENT.
Mobile technologies continue to create opportunities to capture information to supply repositories with new material. The cost of hardware continues to drop, open source operating systems allow for relatively easy creation of applications and the range of ways to capture information, from geo-positioning to audio and video allow for richer capture of qualitative and quantitative data. The growing stream of data, though, can exacerbate the risks of information overload. The relative embarrassment of data riches can make it difficult for decision makers to make sense of their options. Strong analytical capacity and creative mash-ups of data are important adjuncts to increased use of ICTs. Geospatial analysis and data visualization are important investments not only for decision makers but also as tools to generate local change. Continued increases in connectivity and analytical capacity can help push data and analysis back to local stakeholders through the same devices used to collect the information. The mobile data collection and community mapping approaches used by organizations like the Jane Goodall Institute support analysis and policy as well as local learning and action through visualizations accessible to local communities. Investments in mobile technologies should address the full life cycle of information from collection, organization and analysis through storage, dissemination and action.

USAID has an opportunity to capitalize on its Operating Expense budget investments in systems that can also support program efforts.: the Google platform available to Agency staff , for example, enables central document sharing, email group management, web pages, data storage and basic mapping. Many, if not all, of these assets are also valuable for program coordination and management. For programs without dedicated ICT budgets, the Agency's existing investments in Google technologies provide a low-cost option for many needs. Investments in USAID's extranet, AllNet and basic listserves provide cost-effective resources. Building on Agency-standard platforms provides potentially greater consistency across activities and also creates greater incentives for those platforms to better address the needs of field programs. Actively seeking out partnerships within USAID to complement program activities helps operationalize the current Agency reform efforts.

USE OF WIRELESS INTERNET ACCESS AT THE COMMUNITY LEVEL.

Partnerships within African countries to provide wide area wireless internet access and local renewable power generation are important capacity building efforts to support communications and enable use of ICTs. While many mobile applications can be configured to store data until the unit is in range of a signal or network, greater prevalence of Internet access meets many needs for activities in local communities. Access to external resources, internal communications, financial management and operations, and e-learning all are strengthened by improved Internet access. As one of the regular long-term participants operating in remote environments, USAID should adopt a long term view of investments in local infrastructure as these will pay significant development and conservation dividends downstream. An analysis should be undertaken in select conservation hot spots to assess the viability of partnering with the private sector on local power generation and appropriate IT infrastructure. As the cost for solar and other clean energy generation continues to drop and private sector interests move into the off-grid energy sector in Africa, there is a near term opportunity to amplify the rate of change through additional local investments. With the completion of the latest fiber optic cables off the coast of Africa and the fast pace of growth in the mobile market, telecom providers will have more capacity and products to move to market. Building on these trends to keep conservation practices at the forefront of policy discussions and public dialogue can serve as an important counter-balance to pressures on landscapes and biodiversity.

ICT has also recently emerged as a critical factor in the field of climate change adaptation and mitigation and, specifically, in the context of establishing and monitoring Reduced Emissions from Deforestation and Forest Degradation (REDD+) activities. This initiative is based, in part, on developing a market for carbon credits based on carbon sequestered by forests. ICT is important initially in establishing a robust baseline against which to measure improvements in carbon sequestration. This, in turn, requires the development of a very accurate forest and tree inventory, something that usually lacking in developing countries, especially those with large forested areas. The use of sidereal radar, geospatial imagery and the creation of forestry GIS is increasingly recognized in the climate change and allied conservation communities as essential tools in what would otherwise be a far too expensive effort of manual inventory. These same tools can also be used for the monitoring, reporting and verification (MRV) process of REDD+ in which periodic inspections of REDD+ project forests are done to guarantee the integrity of the negotiated carbon price and markets.

Beyond climate change, various ICT tools have become important tools in aiding land use and land tenure activities. These include the use of geospatial imagery and GIS in cadastral surveys, the delineation of protected boundaries and the design of biodiversity corridors. A recent example of this can be seen in Rwanda. Until recently, formal land titles to rural land did not exist. Currently, the Government of Rwanda has begun a large, participatory cadastral survey of agricultural lands near the Volcanoes National park, home of the threatened mountain gorillas. It is expanding the buffer zone around the park to better protect the gorillas. This activity has involved extensive use of geospatial imagery and a GIS with the land parcel and park boundaries as different data layers.

The use of bar codes and bar code readers has become increasingly common in tracking certified timber and non-timber forest products (NTFPs) from point of harvest to final sale. Linked databases and the Internet help to mediate this information tracking and to strengthen the chain of custody in order to provide greater assurance to customers. Certified timber and NTFCs are crucial to slowing or halting illegal logging and forest habitat destruction.

2. EMERGING TECHNOLOGIES FOR CONSERVATION IN AFRICA

2.1 INTRODUCTION

Conservation organizations today are faced with familiar challenges – encroachment on natural resources, financial and reporting pressures, , local human and institutional capital shortages and difficult working conditions to name a few. The emerging situation in Africa presents significant opportunities to benefit from the evolution of technologies and practices with the potential for significant improvements to communications and the use of the Information and Communications Technologies (ICTs). The market for mobile technology continues to grow as does the market for renewable energy. The growing enthusiasm for applications of new ICT technologies in sectors such as agriculture, health and micro-enterprise/finance as well as environment and conservation is leading to the creation of pools of expertise and policy reforms pressure . The shift to greater emphasis on locally managed implementation of aid programs and increased investment in the private sector in Africa is also creating previously untapped markets for capacity building . Opportunities to engage beyond traditional bilateral aid continue to grow as well with new private/public partnerships and other models. In fact, private/public partnerships have become an especially favored model for ICT market development.

The emerging situation in Africa is cause for some optimism that ICT tools help the conservation community create local positive results. Before outlining emerging trends in communications and ICTs relevant for conservation, a brief survey of the broader landscape provides important context.

2.2 BACKGROUND

Sub-Saharan Africa is not insulated from the financial, commodity and other crises affecting global economies yet recent projections give rise to more optimism. As a diverse and multi-faceted region, the aggregate effects of trade, foreign investment and productivity can be summed up as follows from this recent World Bank report:

> *"Despite the turbulent global economic environment in 2011, growth in Sub-Saharan Africa remained robust, inching up from 4.8 percent in 2010 to 4.9 percent in 2011, just shy of its pre-crisis average of 5 percent. Excluding South Africa, which accounts for over a third of the region's GDP, growth in the rest of the region was even stronger at 5.9 percent in 2011, making it one of the fastest growing developing regions in the world. Indeed, a third of countries in the region grew by at least 6 percent, and another 40 percent posted growth rates of 4-6 percent."* [7]

Growth – from a conservation standpoint – can present a challenge to sustainable natural resource management and species diversity, particularly in the context of continued challenges for rural Africans. Rural populations in Sub-Saharan Africa still account for 67% of the total population. UNHABITAT estimates that Africa will be 50% urban by 2030.[8] Addressing rural poverty is challenged by[9]

- Populations with little basic infrastructure;
- Limited economic opportunities and financial services; and those that exist arel largely based on agriculture but there is some diversification with remittances becoming increasingly important;

[7] World Bank, 2012
[8] UNHABITAT, 2010, State of African Cities Report
[9] United Nations, 2010

- Social services such as health and education can be up to 10 times more difficult and costly for rural access compared to urban populations;
- Rural populations are at greater risk of "shocks";
- Transparency and accountability of public service delivery is harder to track.

Broad social, economic and technological trends will continue to be important drivers of change. In addition, climate change will act as a stressor making the impacts of bad policies and economic mismanagement much worse. Climate change will put new stresses and pressures on ecosystems and the people they support. A recent Guardian article put it succinctly:

"From Cairo to the Cape, the impact of man-made climate change is already being felt. Farmers, people in cities, local scientists and governments all tell a remarkably similar story – that there is evidence of more extreme and unseasonal weather taking place outside the natural variability and cycles of African climate, and that the poorest communities are the least able to adapt."[10]

Figure 1- Africa Freedom Index

Source: Freedom House, 2012

Against this backdrop, the trends in communications and ICT present real opportunities evan as many of the persistent challenges of poor connectivity and lack of resources will persist. Fundamental to broad communications for programs is a free press and public access to open information. As Figure 1 illustrates on a broad scale, African countries – particularly where conservation work is focused in regions like the Congo basin – have a long way to go to reach a free and open communications environment.

The mobile market and telecommunications in general present a complicated picture for much of Africa. While some core landline infrastructure continues to be managed as a monopoly in some African countries with the attendant inefficiencies and lack of pressure for innovation, the mobile market is evolving quickly.

> *"In just 10 years—dating from the end of the 1990s—mobile network coverage rose from 16 percent to 90 percent of the urban population; by 2009, rural coverage stood at just under 50 percent of the population. Institutional reform has driven this radical change in telecommunications. Markets have been liberalized, and regulatory bodies have been established. The resulting increase in competition has spurred investment and dramatic reductions in prices."*[11]

In remote areas of high conservation value, connectivity is much less than 50%. Mobile access is poor to non-existent in many of the most ecologically sensitive areas. Africa continues to bypass landlines in favor of wireless communication speeding access. The trend toward a more open and accessible mobile market will continue as infrastructure, institutions and technology evolve to meet the huge market demand. This is not more of the same on a larger scale with relatively few entities controlling the channels of communications but a real broadening of the private sector base to support communications development across Africa (see Figure 2). Mobile connectivity need not be present immediately on-site to be of use to conservation efforts with the use of handheld technologies able to store information and connect at a later time to update internet sites and datasets.

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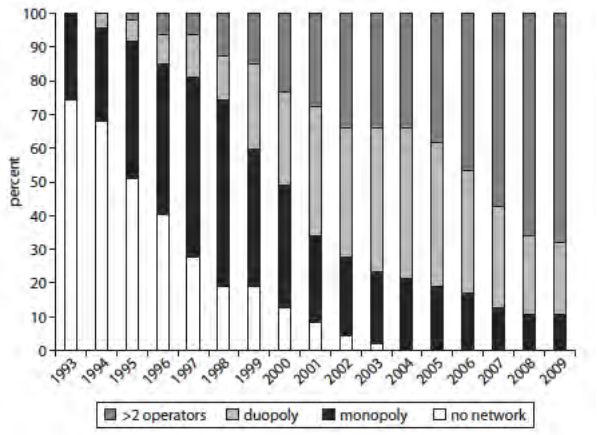
[10] Vidal, 2011
[11] Williams, Mayer, & Minges, 2011

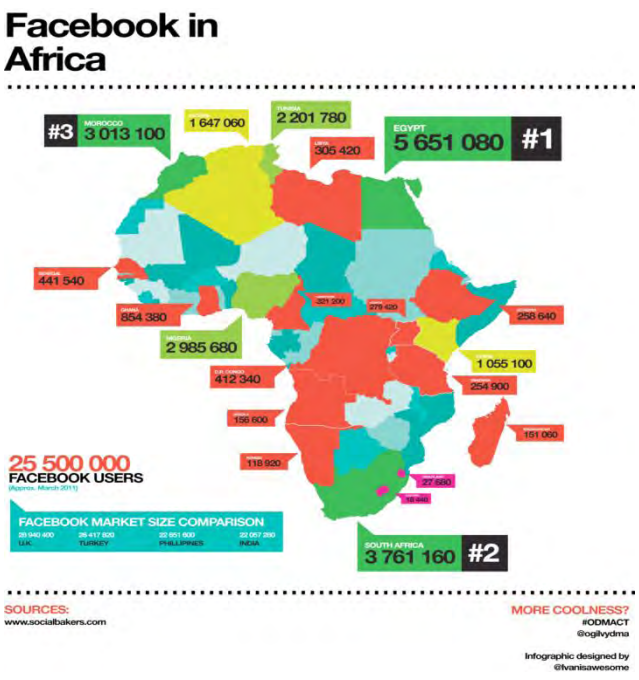
The mobile market is also opening up to to connect onto platforms such as Facebook and Twitter. The growth of Facebook use in Africa has been remarkable and offers potential to reach new audiences with conservation messages, tap new diaspora communities for partnerships beyond the conventional aid models and spur scientific collaboration (see Figure 3). While the growth is impressive, it is building from a smaller base as a percentage of total population compared to many other countries. As with mobile connectivity – the reach of tools like Facebook directly into field-level conservation is likely some ways off but the additional reach within Africa and on a global scale is very promising. In those situations where immediate connectivity is not an option, mobile computing offers options to connect over time for less immediate communications.

Figure 2 - Mobile Voice Market Liberalization in Sub-Saharan Africa, 1993-2009



Source: ITU, 2011

Figure 3 – Distribution of Facebook Users in Africa



ICTs in conservation go beyond mobile telephony and Internet applications. The use of radio collars and other forms of transponders to track animal migration and life cycles is of great importance to both terrestrial and marine conservation. Webcams, closed circuit TV and motion sensing cameras have been highly useful for research, monitoring and public education of elusive, nocturnal or rare species of wildlife. GPS and associated GIS software provide tools for illustrating, mapping and analyzing conservation data against other data sources.

Across the continent, access to reliable energy sources continues to hamper the basic development of all sectors. Power to produce economic benefits, support health services and educational outcomes is all too often in short supply. As with the jump to mobile telephony over landlines, Africa seems poised to make a significant leap forward in use of renewable energy to move beyond the challenges of inadequate energy infrastructure. There are already anecdotes of solar cell towers popping up in remote regions of the Congo basin.[12] The market for renewables can serve both low-resource environments familiar to conservation programs as well as commercial markets for general development and productivity needs. This creates a greater potential to be able to move through some of the near term fiscal and policy/regulatory challenges inherent in developing a new

[12] Flynn, 2012

sector.[13] The renewable energy market has the potential to greatly boost connectivity options for conservation efforts in Africa in the near future with $3.6 billion invested by 2010 and projected by industry analysts to growth to more than $50 billion by 2020.[14] In Rwanda, for example, USAID's Destination Nyungwe project funded the construction of a solar-powered radio communications tower to improve emergency and nature guide communications in the remote Nyungwe Forest National Park. On a smaller scale, solar powered and hand crank chargers free cell phones from the grid.

2.3 EMERGING TRENDS

Costs for hardware continue to drop, the pool of talent grows from related sectors like humanitarian aid and cost-effective software options proliferate. There are active efforts underway to capitalize on these emerging technologies within the conservation community. Vital to any investment in ICTs by conservation groups or any other community of practice is a sound initial requirements-gathering effort. Adequate planning for a tool's optimal use and alignment with the larger goals of an activity greatly help to realize a successful fit of ICT solutions. For a general treatment on requirements analysis – Wikipedia provides http://en.wikipedia.org/wiki/Requirements_analysis and Techsoup's Tips and Tools for Technology Planning provides useful resources geared toward non-profits. Ideally – ICT planning is part of work planning in general at the beginning of an activity and support to content, users and technology is maintained throughout the life of project.

An additional element to consider is the approach a team takes to develop applications and systems. A traditional approach termed the "waterfall" method attempts to plan out an entire development process for whole systems. There are various schools of thought on planning modes, but a more recent and flexible model is known as the "agile" process, which starts with smaller segments of a development process and allows for rapid prototyping and faster testing and resolution of issues. In the following sections we will review a wide array of technologies and their applications as a sampler of options for conservation in Africa.

2.3.1 OPEN DATA

The open data effort in the U.S. began in response to calls for greater transparency and led to the establishment of a central site for U.S. government data access - http://www.data.gov/. The growing realization that the high-risk nature of international development would benefit from greater transparency has led to efforts from major institutions such as the World Bank to provide access to key indicators through their open data website. Open data efforts allow for information sharing that can reduce recurring costs, increase accuracy and create greater transparency. For conservation – the ability to have datasets available in standard formats with associated meta-data helps to achieve increased analytical rigor and can improve data quality. Projects like CARPE have substantial data holdings available to analysts and practitioners.

Biodiversity datasets such as Global Biodiversity Information Facility (GBIF) and the Encyclopedia of Life available to a broader audience help with:

> *"…Fostering of new research, permitting the creation of new data sets when data from multiple sources are combined, reinforcing open scientific inquiry, encouraging diversity of analysis, and making possible the testing of new or alternative hypotheses."*[15]

[13] Hankins, 2011
[14] James, 2011
[15] Global Biodiversity Information Facility

The basic benefits for conservation groups are two-fold – access to additional data beyond the immediate project during implementation, and an opportunity to institutionalize findings from activities for a life beyond the immediate project.

USAID has an additional opportunity – to capture and share government funded research through participation in www.data.gov and its own Development Experience Clearinghouse. The Agency has requirements for reporting – including data – covered in the Automated Directive System Chapter 540 stating:

> *"d. Additional information products*
>
> *Any product produced by the Agency that furthers USAID development assistance activities, including*
>
> - *Reference works*
> - *Bibliographies*
> - *Videos and DVDs*
> - *Electronic information products like databases and CD-ROMs."*

While USAID has the mandate to collect data – the addition of data.gov as a resource available to the Agency may help with formally capturing datasets not readily included in the existing USAID system.

In addition to the benefits of access and archiving – the possibility in "data mash-ups" (see below) as important elements in software applications will be greatly aided.

2.3.2 OPEN SOURCE SOFTWARE

Open Source Software (OSS) is not a new phenomenon yet continued innovation and growing acceptance of OSS solutions is providing a continued stream of valuable resources to the conservation and other communities. By providing the source code itself – communities of programmers are able to advance application development to suit specific needs and feed innovation for the larger community. OSS is used for everything from complete content management systems (CMS) with tools like Apache, Drupal and Plone to open source mobile applications and scientific analytical tools. For example - the Biodiversity Informatics Facility at the American Museum of Natural History's Center for Biodiversity and Conservation hosts several applications that they actively maintain for the conservation community. The Open Data Kit (ODK)[16] is another example of a software platform that helps organizations author, field, and manage mobile data collection solutions based on common data standards.

The flexibility of OSS means greater opportunity for organizations to plan and implement what they need from software tools. When planning for using OSS – the staff costs to maintain and customize are generally either born by the organization itself or outsourced to a third party. Wikipedia maintains a lengthy list of OSS covering the spectrum from individual applications to entire platforms offering multiple platforms. The scientific community also has a long history of programming solutions for specific analytical needs. Sourceforge – a major resource for OSS – has an extensive section for science and engineering solutions.

For conservation – some of the innovations involved with integrating multiple datasets and mapping may be of greatest interest. One recent example from the humanitarian aid community is support to Haiti through the open street map project and the suite of applications used to integrate data and geospatial information. Mapaction.org and their updated "Field Guide to Humanitarian Mapping" provides an excellent primer. The Jane Goodall Institute's use of ODK and Google fusion tables with

[16] University of Washington

mapping tools is another example.[17] WikiMapia is a online map and satellite imaging resource that combines Google Maps with a wiki system, allowing users to add information, in the form of a note, to any location on Earth. CARPE Mapper, Congo Basin Satellite Data Clearinghouse and CARPE Data Explorer all are example of the technology in practice. Geospatial analysis is a longstanding staple of conservation work. The opportunities presented from easy data sharing, crowd sourcing input and new ways to use maps for decision support is a rapidly evolving area.

2.3.3 CLOUD COMPUTING

Cloud computing – software applications, platforms and hardware provided as a service over the internet– is revolutionizing how organizations manage ICT resources. Whole government agencies – including USAID – are moving major portions of their IT systems to the cloud to save costs on hardware, software and staffing. By sharing a common hardware and software platform across large numbers of users – organizations can share expenses and drive down costs. Google and Amazon both offer cloud services to clients and use this approach themselves.

The benefit of free or very cost effective hosting combined with the global reach of service providers with hardware distributed around the world means fast, cheap applications available over internet or mobile connections.

2.3.4 SOCIAL SOFTWARE

The changes and innovations useful to conservation in what can be broadly termed social software are growing exponentially. The organic nature of a wide array of readily available options to work in new ways and connect with individuals and groups presents those with connectivity with a dizzying array of options. The ability to work one-to-many or many-to-many helps to maximize participation in communications and analysis. What follows are brief updates in recent trends in what have now become fairly familiar platforms to many. One of the significant challenges is the time and creative energy to harness the potential and focus it on conservation and resource management goals.

2.3.4.1 NETWORKING – CONNECTING TO LEARN AND IMPROVE CONSERVATION OUTCOMES

Facebook has gone from a college experiment in 2004 to a phenomenon valued at as much as $100 billion early in 2012 for an initial public offering[18] and with:

- More than 800 million active users and 50% of active users logging on any given day
- More than 900 million objects that people interact with (pages, groups, events and communities)
- Average user is connected to 80 community pages, groups and events
- On average, more than 250 million photos are uploaded per day
- More than 70 languages available on the site
- Approximately 80% of users are outside of the United States

Members have their own web pages and profiles and can join groups and individual pages, manage events, participate in surveys and games/simulations and share video, images and text. The ease of access has also been a boon to news providers, many of whom run old fashion clipping services on this new medium with video and images included with breaking stories.

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[17] Gunther, 2009
[18] Maxfield, 2011

Conservation groups have taken notice. Conservation International has more than 47,000 members ("Likes"), an interactive game developed with Disney to help with a virtual avian census, videos, an email list subscription and more. Jane Goodall Institute has more than 12,000 members, World Wildlife Fund has more than a half million members, African Wildlife Foundation has more the 13,500, Wildlife Conservation Society has more than 25,000. These are examples of a few established conservation groups and their corporate reach into Facebook.

Why does this matter? With use in Africa growing fast, and a global audience virtually at your fingertips – the ability to connect and educate new audiences as well as provide network solutions with technical experts should not be overlooked. One of the basic tenets of communications – go where the people are – makes this a very appealing platform.

Beyond communications, networking at this scale can help advance science. Take the example of the first ichthyologic survey on Guyana's Cuyuni River conducted under the auspices of the Smithsonian Institution. The river faces significant degradation from mining and to bolster conservation efforts it was imperative that an accurate census help make the case for better management. The survey team had gathered more than 5,000 fish specimens and had the daunting challenge of identifying them all as quickly as possible. A member of the team suggested posting pictures on Facebook given the number and variety of specimens. Within 24 hours, all the specimens had been identified.[19] The Audubon Christmas Bird Count after 112 years of data collection provides an U.S. example of citizen science.

This is noteworthy for two reasons: first, the strength of the scientific social network was amplified by the use of an accessible tool, and secondly, last minute innovation had an outlet that enabled a response not previously possible at this scale. This story may admitedly be an exception in conservation to date, but the potential to benefit from ever-growing networks should not be overlooked.

There are many other networks and individual platforms available as well where groups can gather in either open or closed fora. LinkedIn, Ning, and Ellgg are examples of the family of complete offerings for groups to coalesce around a subject or cause to share, learn and network. Wikipedia lists an extensive array of social networking sites to help in assessing where to start in building on existing networks. A simple search of LinkedIn for "biodiversity" groups returned 105 search results. When particpating in an open system like LinkedIn or Facebook groups can be more easily discovered by peers and the public.

2.3.4.2 VIDEO AND AUDIO – TELL YOUR STORY IN YOUR OWN VOICE

YouTube is the undisputed king of video sharing sites with:

- 48 hours of video uploaded every minute, resulting in nearly 8 years of content uploaded every day
- Over 3 billion videos viewed each day
- Users upload the equivalent of 240,000 full-length films every week
- More video is uploaded to YouTube in one month than the 3 major US networks created in 60 years
- 70% of YouTube traffic comes from outside the US
- YouTube is localized in 25 countries across 43 languages
- YouTube reached over 700 billion playbacks in 2010

[19] Westol, 2011

- 800 million unique users visit YouTube each month

As with Facebook and alternative social networking sites – there are many other video sharing sites. However, YouTube has the lion's share of the market at the moment and the advantage of integration with the rest of Google's technologies.

As activities like USAID's CARPE and STEWARD projects use more videos for their in-country conservation work, video hosting sites present very low cost opportunities to repurpose existing footage. Video hosted on the web is now easily integrated into a wide array of web applications as well as mobile platforms. In the case of YouTube – the move to extending their professional video production for what is called narrow-casting to compete directly with cable television means even more viewers and additional revenues to strengthen this already extensive resource. With easy uploads, content tagging, comments, on the fly transcription and more – YouTube and similar services provide an excellent springboard for conservation efforts.

Field use of video is already moving beyond simple capture and broadcast models. Teams are creating video for town hall style sessions in local settings to educate stakeholders in participatory resource management efforts. There are new creative efforts underway to use video as a survey tool using local people in their own words. The Ethnocoder project is one such effort using a mobile phone application and video captured on the device. The tool allows one to create multimedia questions and responses, geo-location tagging for all questions and deliver and administer surveys without a web connection. For field enumerators this kind of tool offers a richer yet still rigorous means to capture and analyze data. With modern distribution channels now available on a broad level – the application is readily available for purchase from iTunes.

Along with images and video – the Internet also provides a rich audio resource for spoken word recordings as well as wildlife recordings. As with using video streaming to extend the reach of conservation-related video, podcasts offer the opportunity to extend the reach of local radio broadcasts to diaspora communities. With inexpensive recording and editing technologies audio that is produced for local use can easily be stored and shared for re-use on a global scale. Collections like Apple's iTunes University also offer extensive educational material to train a new generation of conservationists.

In addition to hosting video online – there are now services to stream (broadcast) video in real time over the internet. This effectively allows anyone with an Internet connection and basic video gear to create their own live broadcasts. Many services also allow files to be saved for later use. The opportunity to engage audiences in real time around the issues of the day – on the topic of interest to that specific group – is further democratizing access to media and technology. Sites like USTREAM have entire channels for animals with live critter-cams and more bringing conservation science into the living rooms of millions.

2.3.4.3 PICTURES/SLIDES – A WORLD OF IMAGES AT YOUR FINGERTIPS

Still images are more easily stored, organized and shared than ever. Sites like Picasa and Flickr are creating vast photo archives of content driven entirely by individual interests. Combined with Creative Commons licensing – groups can upload and share photos for education, analysis and advocacy. These photos are also easily integrated into other platforms on the web for entirely web-based systems requiring no fixed storage or systems for individuals. Groups working from cyber cafes or handheld devices can populate and manage sites on the web quickly and easily.

Similar to photo sharing – sites like Slideshare allow the ubiquitous PowerPoint a new life as a web-based multimedia offering. With the ability to include sound along with slideshows, the web offers free access to millions of existing presentations and a platform to re-purpose new material and broadcast to new audiences. CGIAR and their CIFOR page are an example of conservation groups capitalizing on

Slideshare to create a web presence and share – in this case – more than 150 presentations on conservation themes.

2.3.4.4 BLOGS AND WIKIS – DEMOCRATIZING CONSERVATION COMMUNICATIONS

Blogs and wikis have become a staple of Internet use. From major newspapers to local events, ready access to user-generated content through these two tools has greatly democratized communications. For the scientific community, collective efforts like scienceblogs.com offer a constantly updated information resource. There are free platforms like Livejournal, Blogger and WordPress which allow anyone with internet or mobile access to create and maintain a website complete with text, graphics, video and audio. For cash-strapped conservation efforts this has been a boon to communications and education efforts. With the ready access to communications tools, there is now a small industry of non-profit organization consultants with strategic planning information to help realize the full potential of these tools. For example, Beth Kanter offers a wide range of material for the non-profit community of general interest to anyone serious about capitalizing on communications. A recent article on content curation describes the important elements of keeping content fresh and valuable for an audience.

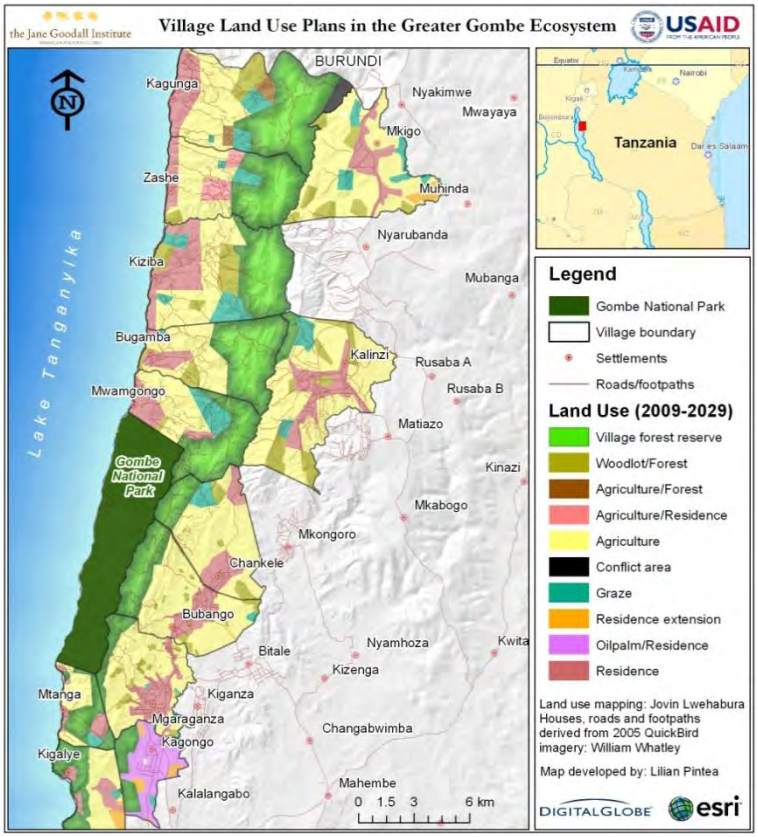
Blog and wiki tools continue to add features that allow you to organize content with tags, manage comments, add video and audio, update from a mobile device, integrate content directly from other web sites and more. Blogs can be individual or group efforts and available in whatever language is required. To help make sense of the options available, there are blogs and wikis about blogs and wikis. All the large blog and wiki hosting sites provide basic help systems and web sites like wikiHow offer the basics for beginners.

Wikis offer the scientific and research community an easy tool to co-author documents with revisions, history and discussions including all in a simple to use package. While Wikipedia is perhaps the best-known instance – there are many other applications relevant to the conservation community, such as fotopedia and photobucket.

2.3.4.5 VISUALIZATION AND MAPPING

To help make sense of complex relationships and large datasets, visualization offers a way to centralize and simplify information and make it more easily interpreted. Beginning with early efforts to make data interpretation more accessible through the work of Edward R. Tufte and continuing now with the work of Hans Rosling and others, there has been a convergence of data and design to support analysis and communications. Advances in software and cloud computing have enabled easy access to systems like Google's Fusion Tables application to visualize, publish, host and combine data. The ability to store and update live data over the Internet is making possible the transparency hoped for by open data advocates and allowing for new ways to combine and interpret data.

Figure 4 - Village Land Use Plans in the Greater Gombe Ecosystem



Source: Jane Goodall Institute

For conservation, using maps and satellite imagery over time has proven to be highly useful in making transparent processes that occur either over time or space that is not readily visible from on the ground observations. The innovative work of the Jane Goodall Institute (JGI) provides excellent examples of flexible integration of remote sensing, participatory mapping and conservation planning. Many of JGI's programs use geography as a common starting point to support their projects. Using a spatial view – JGI provides a construct accessible to local participants to connect their activities and knowledge with conservation science data to develop a shared understanding of landscapes and how they could be better managed.

For the Greater Gombe Ecosystem Project – focused on integrating rural development with chimpanzee conservation, JGI, with support from USAID, worked with local communities to facilitate village-by-village conservation and land use plans using state of the art satellite imaging and conservation science tools (Figure 4). High resolution satellite imagery allowed local groups identify specific features and resources and see the relationships of their immediate surroundings with the larger landscape. This helped inform the development of a network of connected forest reserves between villages designed to restore both watersheds and create travel corridors for chimps to interact with others while strengthening the capacity of Tanzanian National Park Authority to protect Gombe. Using a similar approach and with continuous support from USAID, JGI facilitated participatory village land use plans in more the 45 villages in Gombe-Masito-Ugalla ecosystem in western Tanzania. As part of building community capacity to implement their land use plans and for more evidence-based decision-making JGI set up a simple Village Forest Monitoring system using a combination of low-cost mobile technology, an

open source data-gathering tool and cloud-based data storage. More than 45 Forest Monitors have been identified by their village government and equipped and trained in the use of ODK and Android based smartphones and tablet PCs. Forest Monitors use 5 protocols to collect geo-referenced data and pictures on the monitoring effort, wildlife presence and human threats to forests and wildlife and uploading and storing the data in the cloud.

In Uganda – JGI faced a challenge in its efforts to gather data on private forest owners as part of building capacity of local landholders to collaborate in applying for funding for Reducing Emissions from Deforestation and Forest Degradation (REDD). JGI delivered two Android tablet PCs and trained two of its local staff in Uganda over Skype to use the tool. JGI staff with the help from the local communities was able then to record more than 360 data points on private landowners in three weeks to fulfill the requirements for developing REDD carbon offsets offering economic incentives for local conservation. JGI has also successfully used high-resolution remote sensing data and village-level participatory mapping in the Democratic Republic of the Congo to show extensive illegal mining within protected areas and allow local groups to visualize their roles at a landscape level for improved conservation outcomes. The focus on local solutions using an innovative mix of technologies exemplifies the emerging options available to any conservation or resource management effort. The Google Android platform is open source – allowing software developers a system to build bespoke applications with relative ease. The Open Data Kit used by JGI and others offers (opendatakit.org) is:

> *"A free and open-source set of tools which help organizations author, field, and manage mobile data collection solutions. ODK provides an out-of-the-box solution for users to:*

- *Build a data collection form or survey;*
- *Collect the data on a mobile device and send it to a server; and*
- *Aggregate the collected data on a server and extract it in useful formats.*

In addition to socio-economic and health surveys with GPS locations and images, ODK is being used to create decision support for clinicians and for building multimedia-rich nature mapping tools."

2.3.5 MOBILE COMPUTING

Mobile computing in Africa continues to offer the opportunity to leapfrog over traditional wired systems and connect people and organizations faster and more cheaply. With the arrival of three submarine cables to Africa in the past year, data speeds have quadrupled and cut prices by 90% for core connectivity to the content.[20] Mobile-phone coverage is far better than fixed-line availability beyond the fiber network with the cellphone swiftly becoming Africa's computer of choice. By some counts there are already 84 million mobiles in Africa with at least basic Internet connectivity.

Manufactures are moving fast to capitalize on newly opened markets toward the bottom of the pyramid. Nokia claims a market share of 58% in Africa. Some 90% of mobiles sold in Africa are basic models and combined with growing mobile access many competitors are rushing phones to market to compete. New low-cost models plan to offer a better screen, internet connectivity and some basic access to social-networking sites like Facebook and Twitter, all without sacrificing durability and price.[21]

As the general access grows, low-bandwidth options to communicate are becoming more ubiquitous. Twitter – a micro-blogging and texting service – allows users to send and read text-based posts of up to 140 characters, known as "tweets". Twitter had over 300 million users as of 2011, generating over 300

[20] Economist
[21] Economist

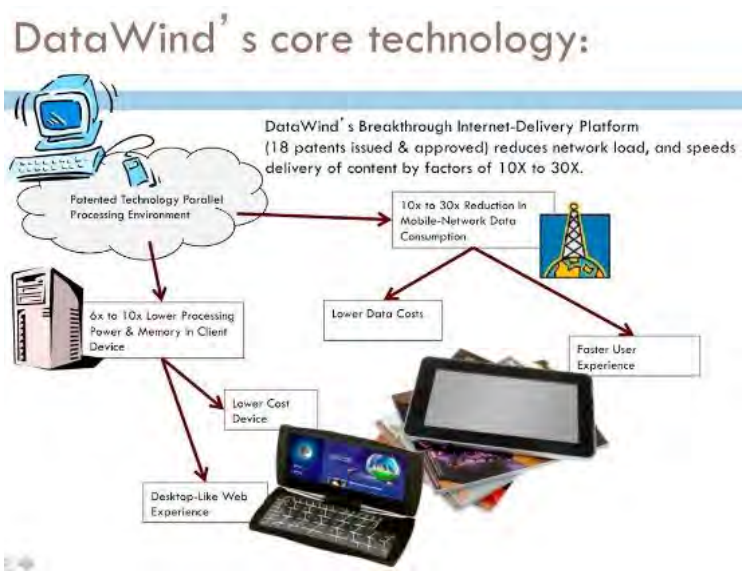
million tweets and handling over 1.6 billion search queries per day.[22] It has been described as the SMS of the Internet.

A recent study claims to have analyzed over 11.5-million geo-located Tweets originating on the African continent during the last three months of 2011.[23] Summary results from the survey include:

- 57% of Tweets from Africa are sent from mobile devices.
- 60% of Africa's most active Tweeters are aged 20-29.
- Twitter in Africa is widely used for social conversation, with 81% of those polled saying that they mainly used it for communicating with friends.
- Twitter is becoming an important source of information in Africa. 68% of those polled said that they use Twitter to monitor news. 22% use it to search for employment opportunities.
- African Twitter users are active across a range of social media, including Facebook, YouTube, Google+ and LinkedIn.
- The majority of those surveyed said that at least half of the Twitter accounts they follow are based on the continent.

As blogs and wikis have opened up the web for new uses and new audiences – so has the social texting and micro-blogging phenomenon Twitter exemplifies. There are other micro-blogging tools available such as Yammer, but Twitter's focus on short text messages, searchable and open to all readers, has created a global pool of information and networking more accessible on even the most basic handheld units. Twitter played a significant role in the Arab Spring and has become a standard means to communicate to groups and individuals. For conservation, the ability to quickly send text updates – also with images depending on hardware and connectivity – to individuals or globally will further shrink the gap between field work and world visibility. The same technology able to rally interest in civil society issues is available to conservation and resource managers and increasingly important for all kinds of communications as global access continues to grow. Twitter also has a built-in potential for metrics the way the system is built for monitoring topics and traffic to better illustrate the interest of key audiences and the reach of messages.

Figure 5 – DataWind's core technology



The continued development of low-cost tablet computers with Wi-Fi and mobile access will also continue to push the reach of mobile into the bush. As previously illustrated with the JGI examples, the

[22] Wikipedia
[23] Thomas

potential for creative uses of distributed computing continues to grow. One innovation to watch in this area is the new launch of a low-cost tablet in India. The Android tablet is already in use successfully but with this new architecture and more connectivity options this could continue to change the mobile market. The system is built to economize on bandwidth and electricity consumption for India's market as illustrated in Figure 5.

According to a recent Wall Street Journal article:

> *"On December 14... the Aakash [went one sale] on sale for the absurd price of 2500 rupees, or around $47, hoping to move 100,000 units over the course of 2012. That figure was seen as staggeringly optimistic, since it represented 40 percent of India's total market for tablet computers. But as soon as the announcement went all, their call center was jammed with calls, and their website started crashing due to excess traffic, to the point where their Internet provider warned them they might be experiencing a malicious hack attack. Their initial inventory of 30,000 units sold out in three days. Within two weeks, they'd built up a backlog of 1.4 million preorders. According to CEO Suneet Tuli, that reservation pool is now over 2 million - and still going strong."*

The rapidly changing communications and ICT landscape at all levels of the technology spectrum mean development practitioners in general and conservation and resource managers in specific cannot afford to be complacent about continued engagement to stay abreast of developments.

2.3.6 MASHUPS, BARCAMPS AND HACKATHONS – FORUMS FOR INNOVATION

The ready availability of data and applications over the Internet has led to a creative move to integrate in ways previously not possible. Software Mashups are a web page or application that combines data, presentation or functionality from two or more sources to create new services. Easy, fast integration are implied and frequently using open Application Programming Interfaces (APIs)s and data sources to produce enriched results not necessarily the original reason for producing the raw source data.[24] Barcamps – or "unconferences" – offer a process to encourage participation around problem solving efforts. The energy and ownership for creating solutions is the responsibility of the participants and is loosely based on the Open Space approach to group process. Hackathons are collaborative computer programming events – generally focused on developing open source solutions or addressing specific needs like the Tech Camp activity at US Department of State and their work with Mapbox – an open source mapping effort. For rapid development of new resources to solve conservation challenges – whether ICT-focused or as a general process management approach – the spirit of collaboration and collective action embodied in mashups, barcamps and hackathons could offer new energy to help address pressing challenges.

2.4 CONCLUSION

Emerging is almost a misnomer to describe the rapid rate of change for options to benefit from advances in ICTs and communications for conservation. Africa will continue to become better connected, driven by huge unrealized private sector interests in commerce, finance and media. At the same time – the explosive growth of tools and talent to help address the current situation in many conservation contexts means there is no reason to wait on a perfect solution before moving ahead. The old web adage "everything is beta" applies. Creating flexible mechanisms and portable data and information means the conservation community can move ahead now in continuing to save the world's endangered habitats and species.

[24] Wikipedia

2.5 SELECT WEBSITES

ICTWorks

ICTworks™ is a premier resource for sharing and expanding knowledge on appropriate information and communication technologies (ICT) and the implementation processes that can make them sustainable in rural and underserved communities across the developing world (ICT4D). Go to ICTWorks

Knowledge for Health – Mobile section

The mHealth Toolkit provides knowledge management to clarify the opportunities and uncertainties of this rapidly evolving field. Selected resources are presented to suggest promising approaches for the high potential of mHealth. Go to Knowledge for Health – Mobile section

ICT for Development section – The Communications Initiative Network Go to ICT for Development section

USAID Global Broadband Initiative

The U.S. Agency for International Development's new Global Broadband and Innovations (GBI) program has been designed to focus the Agency's attention and resources on leveraging the adoption of Information and Communication Technologies (ICTs) across its development portfolio. Go to: USAID Global Broadband Initiative

Nethope

NetHope's mission has a clear focus: to be a catalyst for collaboration among international humanitarian organizations. By working together to solve problems and share knowledge, they help ensure that their members have access to the best information and communication technology and practices when serving people in the developing world. Go to: Nethope

TechSoup Global

TechSoup Global, a 501(c)(3) nonprofit, was founded in 1987 on the belief that technology is a powerful enabler for social change. Since then, they have assembled a worldwide network of individuals and organizations that share this conviction. This network is working to develop and share innovative solutions to the world's most urgent social challenges. Go to: http://www.techsoupglobal.org/Techsoup

MobileActive

MobileActive.org connects people, organizations, and resources using mobile technology for social change. They are committed to increasing the effectiveness of NGOs around the world and recognize that the more than 5 billion mobile phones provide unprecedented opportunities for organizing, communications, and service and information delivery. Go to: MobileActive – Environment section

Nexus for ICTs, Climate Change and Development

This Web site provides online guidance, research knowledge and networking about ICTs' relation to climate change mitigation, monitoring, strategy and adaptation in developing countries. Go to: Nexus for ICTs, Climate Change and Development

oAfrica

oAfrica keeps in mind that no two African nations can implement the same methods to foster sustainable online growth. The reason: a tangled web of political ideologies, economic barriers, and geographic constraints necessitates unique approaches for development. In order to achieve success, consumer adoption, connectivity and technology infrastructure, the business environment, social and cultural environment, government policy and vision, and legal environments must align. "Africa" is often

used to reference the continent and macroscopic trends, but care is given to not group individual nations with the entire continent. (Tulchin). Go to: oAfrica

ICT to Enhance Impact of Agriculture Development

Welcome to the ICT and AG community website. It has been set up for use by anyone interested in the topic, including USAID and other government agency partners, USAID implementing partners, private sector service providers, and other agriculture and ICT practitioners. Go to: ICT to Enhance Impact of Agriculture Development

3 THE USE OF ICTS IN FINANCE, AGRICULTURE, HEALTH AND GOVERNANCE SECTORS IN AFRICA

3.1 MOBILE PHONE REVOLUTION IN AFRICA

Mobile communications have had a particularly pronounced impact in rural areas, which still make up nearly one-half of the world's population and where 75 per cent of the world's poor live (World Bank 2007).[25] The rapid spread of mobile cellular telephony across the developing world has reduced isolation and spurred economic growth.[26] A marked shift has occurred from fixed to mobile cellular telephones since the early 2000s. This is due, in part, to the impact of competition on prices, evident especially in the mobile cellular market in which the cost of a handset and airtime have dropped significantly over the past decade.[27] The introduction of prepaid billing systems like SIM cards greatly reduced the costs of cell phone usage as companies no longer needed to bill clients or collect debts. Liberalization of telecom markets and the issuance of licenses to competitors have also played a significant role in reducing prices.[28] The effects of liberalization on prices and mobile phone penetration become evident if one compares Ethiopia and Somalia. In Ethiopia, mobile telecoms continue to be run by government monopoly. In 2008, the country's "mobile teledensity" was 3.5%. On the other hand, war-torn Somalia, a failed state for more than 20 years necessarily has an unregulated telecoms market. There, mobile teledensity has reached 7.9% - the result of operators moving in to fill demand.[29]

The price drop in mobile telephony has resulted in increased mobile penetration, connecting traditionally isolated populations at an unprecedented rate. In the developing world, Africa has the highest mobile growth rate. Mobile penetration has risen from 1 in 50 in 2000 to approximately 25 per cent of the population today.[30] Another reason for the rapid uptake of mobile services is due to the mobility and ease of use, which allows mobile phones to reach rural populations with low levels of literacy.[31] A number of developing countries are now surpassing OECD countries in SIM card ownership.[32] According to Hamadoun Toure, Secretary-General of the International Telecommunication Union, "It looks highly likely that global mobile cellular teledensity will surpass 100% within the next decade, and probably earlier."[33]

Lacking dense wireless access networks to support high mobile phone usage demands, companies in Africa have devised numerous ways to reduce costs and incentivize usage more evenly over grids by offering customers price incentives to make calls at "off-peak" times. "Dynamic tariffing," developed by MTN, adjusts the cost of calls every hour depending on the level of usage. Customers may check their mobile phone at any given time to determine the rate of discount. During off-peak hours, it may be as high as a 99 per cent discount. This discount drives traffic to network cells when they would otherwise

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[25] Information and Communications for Development 2009, 4.
[26] International Telecommunications Union, 51
[27] International Telecommunications Union, 51
[28] Eureka Moments: How a Luxury Item Became a Tool of Global Development, The economist, Sept. 24, 2009
[29] Eureka Moments: How a Luxury Item Became a Tool of Global Development, The economist, Sep. 24, 2009
[30] International Telecommunications Union, 3.
[31] Information and Communications for Development, 2009, 4.
[32] OECD Report, 15.
[33] Finishing the Job, Economist, Sept. 24th, 2009, p. 1.

be little used. Dynamic tariffing has been employed in a number of countries, including Uganda, South Africa, Swaziland and Kenya. Vodacom has taken notice and has devised a similar offering.[34]

Other measures to cut costs and encourage the seamless use of mobile phones have been introduced. Celtel (rebranded as "Zain") launched "borderless roaming" in 2006, enabling customers in countries such as Kenya, Tanzania and Uganda to cross borders without being charged roaming fees to make or receive calls.[35] Zain now offers borderless roaming across its entire African network and customers can top-up their credit in any country in the network.[36] Competitors, such as MTN, now offer similar plans.[37]

Mobile phones have become a driver of economic growth, particularly for entrepreneurs and small businesses in Africa. Jussi Impio, Research Leader for Nokia Research Center Nairobi, has found that globally, micro-entrepreneurs make up 50-60 per cent of all businesses. In Africa, nearly 90 per cent of all businesses are made up of micro-entrepreneurs.[38] Cell phones have brought great benefits to entrepreneurs who may not have access to an office or desktop. Entrepreneurs may schedule appointments with clients and provide basic services through their mobile phones. As an increasing number of mobile phone applications become available, it is anticipated that demands for functionalities akin to those of a desktop will increase. The Ericsson Division for Sub-Saharan Africa reports that the first 4-G networks for this region will be developed in 2012 focused initially on hot spots with high demand for smartphone services with further development of such networks very likely from African mobile service providers such as Mountain and Vodacom.[39]

3.2 IMPACT OF MOBILE PHONES ON FINANCIAL SERVICES

Aside from the demonstrated impact of mobile telephony on communications, it is contributing to overcoming long-standing constraints to business and finance caused by a lack of financial services outside the main urban areas and typically limited to the middle and upper classes. This transformation has primarily occurred through innovations that facilitate secure financial transactions via mobile phones.

3.2.1 M-PESA CASE STUDY

One of the greatest success stories of enfranchising populations through mobile technology is M-PESA in Kenya. Since its inception in March 2007, it has had a significant impact on transforming financial services for the poor and has become the most widely used mobile money service in the world.[40] M-PESA (M for mobile, PESA Swahili for money) was born out of a partnership between Safaricom, Kenya's largest mobile service provider and Vodaphone. M-PESA allows customers to use an application on their mobile phone to transfer money, check their account balance, pay bills and store money. Customers' funds are housed in an account at the Commercial Bank of Africa.[41] As of

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[34] The Mother of Invention: Network operators in the poor world are cutting costs and increasing access in innovative Ways, The Economist, Sep. 24, 2009

[35] The Mother of Invention: Network operators in the poor world are cutting costs and increasing access in innovative Ways, The Economist, Sep. 24, 2009

[36] http://www.cellular-news.com/story/35211.php, Dec. 2008

[37] The Mother of Invention: Network operators in the poor world are cutting costs and increasing access in innovative Ways, The Economist, Sep. 24, 2009

[38] A Special Report on Telecoms in Emerging Markets Eureka Moments: How a Luxury Item Became a Tool of Global Development, The economist, Sep. 24, 2009

[39] Thomson-Reuters News Agency, "Africa may have first commercial 4G network in 2012"

[40] Olga Morawczynski and Mark Pickens, Poor People Using Mobile Financial Services: Observations on Customer Usage and Impact from M-PESA, CGAP, 2009. http://www.cgap.org/p/site/c/template.rc/1.9.36723/

[41] Ibid

November 2011, M-Pesa has over 14 million subscribers in Kenya and well over 28,000 agents across the countryM-PESA has proven revolutionary. Rapidly obtaining substantial scale, M-PESA allows Kenyans to transfer money across the country, reliably and cheaply – a service heretofore non-existent in Kenya.[42] M-PESA has become a major vehicle for sending remittances, driven by the service's affordability. Using M-PESA to send 1,000 ksh (~US$13) costs ~US$0.39. To transfer the same amount, the post office's Posta Pay costs ~US$0.52, 27 per cent more than M-PESA, while a bus company charges ~US$1.16, a nearly 68 per cent increase. And, unlike traditional methods, the transfer occurs almost instantaneously, is easier to access due to a large network of agents, and is more secure.[43] M-PESA has now expanded to include new financial services such as school fees payment, micro-finance and micro-insurance.[44] It also offers a function similar to a savings account, although no interest is accrued. Having a reliable way to save and access money is a major benefit to those who do not have access to formalized banking services.[45]

However, M-PESA's success has not been matched evenly in other countries. In Tanzania, M-PESA did not take off as in Kenya. This may be due to a number of social, economic and political factors. M-PESA's success in Kenya was due to the unusually high cost of sending money by other methods, Safaricom's 80 per cent share of the market, regulators' decision to allow the proposal to go forward without formal regulatory approval, and the security it gave people to transfer money across the country, especially after the post-election violence in 2008.[46] A similar scheme has gained traction in Uganda, which indicates that M-PESA in Kenya may not be a stand-alone and may be successfully replicated elsewhere. The *Consultative Group to Assist the Poor* (CGAP) predicts that by 2012, approximately 1.7 billion people will have a mobile phone, but no bank account. Twenty per cent of these will be using mobile money.[47] This would result in a staggering 340 million users of mobile banking services.

3.2.2 WIZZIT CASE STUDY

In South Africa, a mobile banking start-up, WIZZIT, is bringing financial services to the poor. In 2005, in South Africa and Botswana, one-third of people who did not use any form of formal banking services had a mobile phone or access to one.[48] By the end of 2008, WIZZIT had an estimated 250,000 customers in South Africa; by 2011, that number had leapt to 2 million customers across Africa and Europe.[49] As has proven successful with mobile telephony around the world, WIZZIT utilizes a pay-as-you-go pricing model to provide virtual banking services. Although WIZZIT has no banking branches of its own, as is the case with M-PESA, customers can use their mobile phone to make payments, transfer money and purchase airtime. WIZZIT allows customers to make cash deposits at any Postbank branch or Absa Bank. Customers also receive a Maestro debit card, which they use to make purchases, withdraw money at any South African ATM, and receive cash back.[50] WIZZIT conducts marketing through a network of more than 2,000 "WIZZ Kids," unemployed youth drawn from the lower income population – this is precisely the demographic that WIZZIT targets as its market base.[51] However, a study conducted by CGAP, UN Foundation and Vodafone Group Foundation found that although users of WIZZIT are low-income, they are not among South Africa's poorest people.[52]

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42 CGAP Brief, Poor People Using Mobile Financial Services: Observations on Customer Usage and Impact from M-PESA, 1.
43 CGAP Brief, Poor People Using Mobile Financial Services: Observations on Customer Usage and Impact from M-PESA, 2.
44 OECD Report, 20.
45 Beyond Voice: New uses for mobile phones could launch another wave in Development, The Economist, Sept. 24, 2009
46 Beyond Voice: New uses for mobile phones could launch another wave in Development, The Economist, Sept. 24, 2009
47 Beyond Voice: New uses for mobile phones could launch another wave in Development, The Economist, Sept. 24, 2009
48 Mobile Phone Banking and Low-Income Customers: Evidence from South Africa, p 1.
49 Dr. Manmohan Rao, 2011, Mobile Africa Report 2011, Regional Hubs of Excellence and Innovation, in Mobile Monday, p. 29.
50 Mobile Phone Banking and Low-Income Customers: Evidence from South Africa, p 2.
51 Mobile Phone Banking and Low-Income Customers: Evidence from South Africa, p 3.
52 Mobile Phone Banking and Low-Income Customers: Evidence from South Africa, p 1.

3.3 IMPACT OF MOBILE PHONES ON AGRICULTURE

Agricultural and market information, critical to farmers' ability to make decisions about markets, crop selection, and planting scheduling, is increasingly provided by mobile phones, rather than by kiosk or other media, with the advantage that information is available on demand.[53] In 2001, Niger had approximately two landlines per 1,000 people.[54] Between 2001 and 2006, mobile phone service networks became available. By 2007, 78 per cent of the country had coverage. In grain markets, this level of telephonic access allowed traders to identify the highest sales price and to greatly reduce transport costs. Traders were able to search across markets as well as sell in numerous markets.[55]

3.3.1 NIGER CASE STUDY

According to a study by the Center for Global Development, the introduction of cell phones in Niger resulted in a 20 per cent reduction in grain price differences across markets.[56] Price variations between one market and another were reduced by at least 6.4 per cent.[57] The impact of mobile telephony was particularly visible between those markets that were farther apart and those linked by poor quality roads. As cell phone coverage extended to more markets, the reduction in prices increased. To traders, mobile phones have reduced search costs, provided more market information and greatly increased efficiency moving products from field to market.[58] During the food price crisis in 2005, grain was 4.5 per cent less expensive in markets with mobile coverage.[59]

3.3.2 KERALA CASE STUDY

Another micro-level example of improved prices for goods at markets as a result of improved information gathering via mobile telephony is evident in Kerala, India. Along the coast of this Indian state, numerous fish markets exist. In the past, fishermen took their catch to the market nearest their home port almost exclusively.[60] Excess fish from the catch was thrown away if there was insufficient demand from their local market.[61] Once fishermen had cell phones, they were able to call multiple fish markets while still at sea and sell their catch to the one offering the best price. As a result, 35 per cent sold their catch at a harbor other than their home harbor. [62] Consumer prices decreased by four per cent, fishermen's' profits increased by eight per cent, and the price variation across markets along the coast was significantly reduced.[63]

5.3.3 GHANA CASE STUDY

In Ghana, TradeNet, a trading platform, enables users to receive instant market alerts and offers to buy or sell commodities. Users can obtain and request prices for more than 80 commodities from 400 markets across West Africa. As a result of this platform, The Ghana Agricultural Producers and Traders Organization concluded trade deals worth $60,000 in 2006, with producer and trader groups in Nigeria, Mali and Burkina Faso. The transactions included the purchase of tomatoes, onions and potatoes without an intermediary. As a result, transaction costs were significantly reduced.[64]

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[53] OECD Report, 79.
[54] CGD, Working Paper No. 154, Does Digital Divide or Provide? The Impact on Cell Phones on Grain Markets in Niger, Overview.
[55] CGD, Working Paper No. 154, Does Digital Divide or Provide? The Impact on Cell Phones on Grain Markets in Niger, Abstract.
[56] CGD, Working Paper No. 154, Does Digital Divide or Provide? The Impact on Cell Phones on Grain Markets in Niger, Abstract.
[57] Eureka Moments: How a Luxury Item Became a Tool of Global Development, The economist, Sep. 24, 2009
[58] CGD, Working Paper No. 154, Does Digital Divide or Provide? The Impact on Cell Phones on Grain Markets in Niger, Abstract.
[59] Eureka Moments: How a Luxury Item Became a Tool of Global Development, The economist, Sep. 24, 2009
[60] OECD Report, 95.
[61] Eureka Moments: How a Luxury Item Became a Tool of Global Development, The economist, Sep. 24, 2009
[62] OECD Report, 95.
[63] Eureka Moments: How a Luxury Item Became a Tool of Global Development, The economist, Sep. 24, 2009
[64] Information and Communications for Development 2009, 4.

A complementary suite of applications comes from Esoko, A Ghanaian NGO turned franchiser for its mobile market price suite of tools. The software's interactive platform allows farmers and other business people in the agricultural sector to use their mobile phones to exchange real-time market information. The SMS platform, called "Esoko" (from the Swahili word "soko" which means market), supplies text-message based price alerts, allowing farmers to monitor crop prices and demand in various locations across the country.

Esoko runs a non-tradable commodity index comprising 12 commodities, including groundnuts, white maize, millet, soya beans, rice, cowpeas, cassava tuber, wheat, tomatoes and yams. According to the Soros Foundation, a major Esoko investor, commodity indices, rare in Africa, are a "powerful tool in helping ensure that farmers are fairly compensated for their crops."

Aside from signing up for a subscription where they receive alerts automatically, farmers can also send an SMS to Esoko with a specific commodity code. In return, they receive a comprehensive list of wholesale and retail prices for different markets. This enables them to deliver products to a market of their choice where they will get a better price deal. It also eliminates the need for middlemen who profit from connecting farmers with buyers.

SMS alerts are but one part of Esoko's growing software products. Groups can also use Esoko to track stock, send out bulk text messages and do sophisticated SMS polling to gather information from the field. The common theme driving these products is a focus on improving the lives of small holder farmers through access to information.

3.3.4 UGANDA CASE STUDY

In Uganda, an SMS application is transforming farmers' access to information. Launched in June 2009 by MTN, Google and the Grameen Foundation, Farmer's Friend is a search engine for agricultural information using an SMS-based database.[65] It offers a highly cost-effective way for farmers to query and receive information. Keywords in the query are transmitted to a database where a rapid search is performed and the farmer receives a reply in moments via SMS. Farmers' Friend provides information on queries ranging from crop and livestock pest and disease control, planting, storage and harvesting tips, and weather forecasts. For example, a user may receive an answer such as "To control tomato blight, spray the crop with milk."[66] More complex questions that the database cannot answer are transferred to a human expert, who typically calls back within 15 minutes.[67] Technical farming information is provided by a local NGO, the Buoga Rural Open Source Development Initiative (BROSDI), which consults with farmers to collect and share best local farming practices. Weather data are provided by the Government of Uganda's Department of Meteorology.[68] The new suite of services also provides information on health and markets.[69]

Google Trader is a similar application, which was developed in concert with Uganda's rural producers and consumers to provide linkages to markets. Small producers typically lack basic infrastructure and efficient transport networks. AppLab, therefore, developed a basic market system allowing buyers and sellers to identify each other by using mobile phones to list their offerings, thereby reducing transaction costs. Similar to a classified ad system or bulletin board, the system increases transparency and enables small producers to fetch higher prices. The service is in English, but has the capacity to respond in three local languages. Pilot projects for Google Trader were performed in Western Uganda with banana

[65] Beyond Voice: New uses for mobile phones could launch another wave in Development, The Economist, Sept. 24, 2009
[66] www.grameenfoundation.applab.org/section/uganda-ag-apps
[67] Beyond Voice: New uses for mobile phones could launch another wave in Development, The Economist, Sept. 24, 2009
[68] www.grameenfoundation.applab.org/section/uganda-ag-apps
[69] Beyond Voice: New uses for mobile phones could launch another wave in Development, The Economist, Sept. 24, 2009

producers. Farmers felt they were able to more efficiently connect with buyers and receive higher prices for their produce.[70]

3.4 IMPACT OF MOBILE PHONES ON HEALTH

The promotion of health-related services through mobile phone applications, what the U.N. has termed "mHealth", is achieving significant development impacts.[71] In many countries, health care outlays are one of the largest budgetary expenditures.[72] In much of the developing world, epidemics are exacerbated by a dearth of health care workers.[73] The proliferation of mobile communications is helping to bridge the gap in health care delivery systems. mHealth is providing increased access to healthcare information, particularly for isolated populations; improving the ability to diagnose and track diseases; disseminating public health information more widely; and expanding access to medical training for health care workers.[74] mHealth provides a suite of applications in developing countries, including remote data collection; remote data monitoring; disease and epidemic outbreak tracking and diagnostic and treatment support.[75]

3.4.1 SMS AND HEALTH DATA COLLECTION

There are a number of mobile phone based applications that enable health service delivery. Short Message Service (SMS) offers a cost-effective and efficient way of reaching a large audience. In a given health campaign, SMS messages are sent to users' phones to provide information about prevention, testing and treatment. Data indicate that SMS alerts have a greater impact on and ability to influence behavior than television and radio campaigns.[76] Remote data collection is one of the most important components of mHealth. Broader-based data collection allows policymakers and health care providers to obtain critical information in order to better inform policy and responses to health care needs as well as respond to epidemics. This provision of service is particularly important to the majority of people in developing countries who lack access to hospitals and health care. Collecting data has proven to be more efficient, reliable, and accurate using mobile applications over paper-based surveys.[77] Mobile technology enables the collection and transmission of data on the incidence of diseases such as malaria, SARS, cholera, and avian influenza, a key factor in controlling outbreaks and spread of infectious disease. It has proven to be an accurate and low-cost health care tool.

3.4.2 MOBILES AND PATIENT MONITORING

The developing world faces an acute shortage of healthcare workers. Enfranchising health workers with information via mobile technology provides a necessary support system, especially for those working in remote locations.[78] Mobile phones enable the remote monitoring of patients, which provides new opportunities for treatment in an outpatient setting. Monitoring consists of one- or two-way

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[70] www.grameenfoundation.applab.org/section/uganda-ag-apps
[71] mHealth for Development, The Opportunity of Mobile Technology for Healthcare in the Developing World, UNF and Vodafone Foundation, 4.
[72] Information and Communications for Development 2009, 4.
[73] mHealth for Development, The Opportunity of Mobile Technology for Healthcare in the Developing World, UNF and Vodafone Foundation, 4.
[74] mHealth for Development, The Opportunity of Mobile Technology for Healthcare in the Developing World, UNF and Vodafone Foundation, 5.
[75] mHealth for Development, The Opportunity of Mobile Technology for Healthcare in the Developing World, UNF and Vodafone Foundation, 9.
[76] mHealth for Development, The Opportunity of Mobile Technology for Healthcare in the Developing World, UNF and Vodafone Foundation, 10.
[77] mHealth for Development, The Opportunity of Mobile Technology for Healthcare in the Developing World, UNF and Vodafone Foundation, 11.
[78] mHealth for Development, The Opportunity of Mobile Technology for Healthcare in the Developing World, UNF and Vodafone Foundation, 13.

communications via mobile phones to monitor conditions and ensure adherence to medication regimens. This is especially valuable for health issues requiring strict and often complex medication regimes, such as AIDS and diabetes.[79]

3.4.3 MOBILES AND THE US PEPFAR PROGRAM

The U.S. President's Emergency Plan for AIDS Relief (PEPFAR), in cooperation with the GSM Association Development Fund, Accenture Development Partners, Motorola, MTN and Voxiva is sponsoring a $10 million public-private partnership to leverage technology for health systems.[80] Working in concert with ministries of health and health organizations in ten countries, "Phones for Health" is providing health workers in local communities a basic handset and an application enabling them to collect and enter health data. Once the data have been transmitted, they are integrated into health information systems and utilized by health care officials. The application also allows health care workers to order medicines, transmit public safety announcements and health alerts, and access treatment guidelines remotely and in real time.[81]

3.4.4 RWANDA'S TRAC CASE STUDY

Often recognized as the first national health system in Africa, the Rwanda system was created through a public private partnership that incorporated ICT tools to manage critical information on HIV/AIDS patients. The Center for Treatment and Research on AIDS, Malaria, Tuberculosis, and Other Epidemics (TRAC Plus) was founded in 2007 to serve as a national center for infectious disease control and prevention under the supervision of the Ministry of Health. The system, originally founded in 2005 as the Treatment and Research AIDS Center (TRAC) employed cell phone applications that monitored anti-retroviral treatment, drug distribution and access to the latest information on HIV/AIDS care and treatment. The vast majority of users of the system accesses the service via mobile phone, as this option is less expensive than computers and has greater coverage than the Internet.[82] Rwanda's Ministry of Health has expanded this service to include malaria, tuberculosis and other epidemics.[83] TRAC Plus provides a bilingual English and French telephone and web interface.

3.4.5 TELEMEDICINE IN AFRICA

Through the collection of health data and dissemination of health information by mobile phone, information technology – both through computer software applications and web-based technologies is rapidly transforming health care management and treatment. "Telemedicine" is increasingly used to transmit vital diagnostic and medical history data, to remotely monitor patients (as described above) and to remotely support treatments. Real-time audio and video tools have been used by surgeons in one country to remotely guide doctors in other countries in carrying out sophisticated surgeries. In West Africa, beginning in 2001, a telemedicine project involving three West African countries and Switzerland was initiated. It enabled various collaboration channels, including North-South, South-South, and South-North distance learning and "tele-consultations". However, it has also revealed a set of potential problems: a) the limited importance of North-South collaborations when there are major differences in available resources or the socio-cultural contexts between the collaborating parties; b) the risk of an induced digital divide if the periphery of the health system is not involved in the development of the

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[79] mHealth for Development, The Opportunity of Mobile Technology for Healthcare in the Developing World, UNF and Vodafone Foundation, 12.

[80] http://www.pepfar.gov/pepfar/press/80384.htm

[81] mHealth for Development, The Opportunity of Mobile Technology for Healthcare in the Developing World, UNF and Vodafone Foundation, 49.

[82] mHealth for Development, The Opportunity of Mobile Technology for Healthcare in the Developing World, UNF and Vodafone Foundation, 49.

[83] RBD, TRAC PLUS www.tracrwanda.org.rw

network, and c) the need for the development of local medical content management skills. Similar projects have been underway in Senegal and Mozambique.[84]

3.5 IMPACT OF MOBILE PHONES ON GOVERNANCE

The "Arab Spring" in 2011 dramatically demonstrated the power of ICT to mobilize and help organize ordinary people to confront authoritarian governments to peacefully demand change. In fact, one of the young leaders of the uprising in Egypt, Wael Ghonim, was an executive of Google Egypt. When the government attempted to turn off mobile phone use, it was confronted by angry international and domestic business users. Mobile phones are a potentially powerful tool to foster democratic processes. They offer a two-way channel that can be used to give poor people a voice, and to help government bodies engage marginalized communities as well as to disseminate public information (thereby increasing transparency).

Mobile telephony and information technologies already have had increasing social and political impacts in sub-Saharan Africa. In countries such as Sierra Leone, Nigeria, Ghana and Kenya, mobile phones have been used in election monitoring.[85] During the 2008 presidential elections in Ghana, a thousand locally trained parallel vote tabulation (PVT) observers transmitted electoral results and violations via SMS to a central system, thereby giving almost instantaneous independent verification of the election results.[86] A novel approach of combining SMS, Twitter and geo-mapping by the general public for monitoring political conflicts has been used in Kenya and Uganda[87]. The downside to this latter methodology is its vulnerability to manipulation and disinformation because there is no quality control over who is sending the SMS messages or tweets. An alternative approach used in Burundi combined known and trusted "experts" in the field with SMS and geo-mapping.

The use of crowd-sourcing via ICT can significantly supplement efforts to collect basic data on infrastructure and populations, often woefully inadequate in Africa. A recent mapping study of 100 health facilities and schools in Kenya found that only 25% of the clinics and 20% of the schools matched official data.[88] The remainder required updating. The World Bank and Google have formed a partnership to facilitate developing country governments and UN agencies to access Google Map Maker's global mapping platform to allow the collection, viewing, search and access to geo-information data in more than 150 countries and in 60 languages.[89] This crowd sourcing approach can serve as a base for citizens not just to map and provide feedback on the extent and quality of services in their communities. This feedback, in turn, can be used to improve service delivery, fight corruption and track the use of government budgets

3.6 IMPACT OF MOBILE PHONES ON SOCIAL MEDIA

Widespread cellular penetration in Africa has led to a greater interest and use of social media (Internet based tools that enable people to interact virtually) and collaterally mobile Internet. Until recently, the African growth rate of mobile Internet usage was the highest in the world. According to several studies, a majority of Africans spends the greatest proportion of their mobile Internet time on social media platforms (e.g. YouTube and Twitter). Recently, Facebook (the most visited website in Africa) reached 17 million users, up from 10 million in 2009. More than 15 per cent of people who are online in Africa

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[84] Cheick Oumar Bagayoko, MD, Henning Müller, PhD, and Antoine Geissbuhler, MD *Telemedicine in Western Africa (RAFT project)*, Geneva University Hospitals, Geneva, Switzerland

[85] Eureka Moments: How a Luxury Item Became a Tool of Global Development, The economist, Sep. 24, 2009

[86] Jenny C. Aker and Isaac M. Mbiti**,** "Africa Calling: Can mobile phones make a miracle?", *Boston Review*, March/April 2010

[87] Mara J. Roberts, Crowdsourcing vs Experts: Assessing Technological Approaches to Conflict Monitoring, in Peacebuilder Journal, Eastern Mennonite University.

[88] Caroline Amstey, "Empowering citizen cartographers" in International Herald Tribune, 14-15 January 2012, p. 8.

[89] Ibid., p.8

use Facebook, as opposed to 11 per cent in Asia. Twitter and YouTube also rank as some of the most viewed websites in the majority of African countries. According to Jon Von Tetzchner, co-founder of Opera, the most widely used Internet browser for mobile phones in the world, "Triple-digit growth rates are routine across the continent, the widespread availability of mobile phones means that the mobile Web can reach tens of millions more than the wired Web." Social media platforms understand Africa's potential. Facebook, which launched versions in several African languages including Swahili, Hausa and Zulu, recently stated that it will provide free access to Facebook to mobile phone users in many African countries. Google has launched a new social platform in Swahili for East and Central Africa. Baraza, or "meeting place" in Swahili, enables users to engage and share information, much of it centered on topics particular to local and regional interest, by asking and answering questions.[90]

The Economist summarized the explosion of Internet-based technologies in the developing world as follows. "The development potential of the wireless platform is enormous. Mobile communications are evolving from simply voice services and text messaging to more intelligent systems, requiring more broadband width, that enable a diverse range of applications in locations where conventional services are not available in developing countries. "Smart" wireless phones now allow users to browse the Internet, download music, and access information services. This opportunity is especially exciting given that the developing world missed out on much of the initial Web revolution because it did not have adequate Internet structure."[91]

3.7 THE INTERNET

The Internet offers the potential of transforming developing countries into information societies.[92] In urban areas in Africa, social networks are beginning to appear through broadband-enabled web-based groups that drive economic development. Blogs and wikis and other sites that allow users to share content encourage the free flow of information.[93]

3.7.1 INTERNET INFRASTRUCTURE CONSTRAINTS TO DEVELOPMENT

In the realm of broadband in Africa, access to sufficient Internet infrastructure, though improving, is still critically lacking in Africa, making the digital divide particularly apparent. Lack of access, including exorbitantly high prices and the lack of networks, has stunted the spread of Internet use and pose a major constraint in promoting the use of ICTs for development.[94] The rate of Internet penetration is not growing at nearly the same rate as mobile telephony. In Africa, less than five per cent of the population uses the Internet.[95] While dial-up is rapidly being replaced by broadband across developed countries, in the developing world this is not yet the case. As of 2007, fixed broadband penetration levels were at less than 0.2 per cent in Africa (compared to 14 per cent in Europe and 11 per cent in the Americas).[96] Not surprisingly, South Africa leads Africa in connectivity rates.[97] Developing countries lack wired access, which is frequently available only in urban centers. Mobile broadband, however, has the potential to greatly increase the availability of high-speed internet due to the proliferation of mobile telephony and cellular networks. This is underpinned by the increasingly popular use of mobile phones for data applications, such as SMS.[98] In some countries, however, broadband is spreading quickly. In Senegal and

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[90] "A social media boom begins in Africa: Using mobile phones, Africans join the global conversation," Andre-Michel Essoungou, Africa Renewal Magazine, December 2010, 3. http://www.un.org/ecosocdev/geninfo/afrec/vol24no4/social-media-boom.html
[91] The Economist 2008b, *Information and Communications for Development 2009*
[92] International Telecommunications Union, 53.
[93] Information and Communications for Development 2009, 5.
[94] OECD Report, 11
[95] International Telecommunications Union, 4.
[96] International Telecommunications Union, 4.
[97] OECD Report, 18
[98] International Telecommunications Union, 5.

Morocco, for example, broadband subscribers represent over 90 per cent of all Internet subscribers.[99] It would be useful to research why broadband access has done so well in these two countries for possible lessons for the rest of the region. Sub-Saharan Africa remains one of the most expensive regions for broadband services.[100] The average broadband price per person in sub-Saharan countries is $692, more than double when compared to the average rate of $332 per person in the U.S.[101] The price of ICT access is inversely related to usage. More than two-thirds of the 30 economies ranked at the bottom of the ICT Price Basket are developing, low-income countries.[102] 18 out of 20 of the lowest countries surveyed (out of 150) are in Africa[103] and the bottom-14 is comprised of Sub-Saharan nations.[104]

The majority of African countries still relies on satellite connectivity and typically paid anywhere from $2,000-$5,000 per Mb per month.[105] However, in recent years, the new availability of additional satellite and undersea fiber optic cable connections have put increased downward pressure on prices in some markets. For example, in Kenya, which now has access to three satellite and cable feeds, subscription costs fell from $5,000 USD per Mb per month to $600.[106] Sub-Saharan Africa consists of low-capacity wireless networks. Only 12 percent of terrestrial infrastructure in the region is fiber-optic cable; the rest consists of microwave.[107] The continent is served by two undersea cables (SAT3 and SAFE), but the service remains out of reach of most of the continent, due to cost. Three new cables serving East Africa have become available (SEACOM, TEAMS and EASSy). It is anticipated that these new cables will have a measurable impact on pricing; however, high operating costs and legal and regulatory barriers may outweigh much of the cost benefits.[108]

Providing broadband in rural areas is confounded by technical and economic constraints.[109] Broadband speeds diminish as distance from a central location increases. Thus, the expansion of the broadband market in developing countries has primarily taken place in urban areas leaving rural populations without connectivity.[110] This inversely means that the cost of capacity decreases as traffic volumes increase.[111]

The majority of backbone infrastructure is owned by a consortium of private sector groups, but financed by development institutions. The Eastern African Submarine Cable System, EASSy, is a 10,000 km submarine fiber-optic cable system deployed along the east and south coast of Africa providing voice, data, video and internet service. It links South Africa with Sudan via landing points in Mozambique, Madagascar, the Comoros, Tanzania, Kenya, Somalia and Djibouti.[112] All countries along its route are granted access. EASSy is significant in that it is owned by a consortium of private sector enterprises, but financed by development agencies with no support or subsidies from any African government.[113] This may, in part, ensure that the cable continues to operate on an open-access basis and encourage

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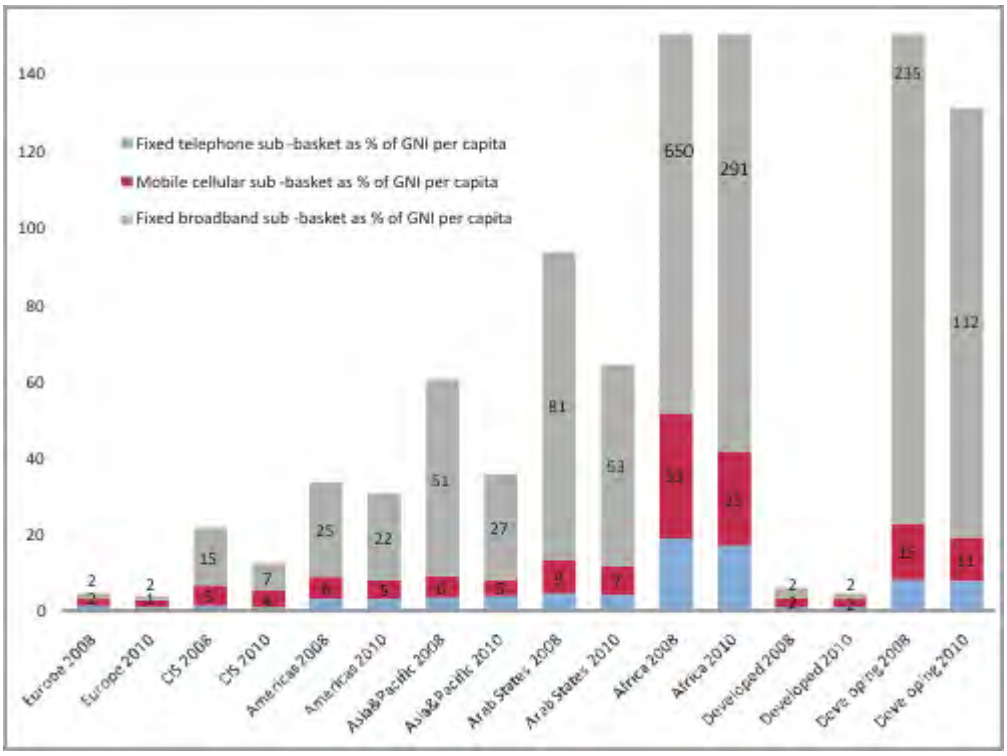
[99] International Telecommunications Union, 53
[100] Ibid, 65.
[101] Ibid, 67.
[102] International Telecommunications Union, 55.
[103] International Telecommunications Union, 57.
[104] International Telecommunications Union, 67
[105] OECD Report, 16.
[106] Moshi and Mitomo, 2012, Achieving Optimum Socio-economic Growth from Broadband Investment and Penetration in Africa, p. 8.
[107] Information and Communications for Development 2009, 53.
[108] OECD Report, 16.
[109] Information and Communications for Development 2009, 53.
[110] OECD Report, 129
[111] Information and Communications for Development 2009, 52.
[112] http://www.eassy.org
[113] Information and Communications for Development 2009, 11.

competition from private service providers in the countries that the cable serves. It is a good example of the possibilities of public private partnerships in broadband networks.[114]

To develop backbone network infrastructure, policy makers face two significant challenges. First, competitive markets in backbone infrastructure must be established and encouraged. Second, it is necessary to provide some form of financial support and incentive to spur the development of high-capacity networks in commercially underserved areas.[115] Due to the increasing use of the Internet to provide public services, there is speculation that once Internet services reach a "critical mass," Internet access will become an indispensable "public good." Universal coverage will be required to prevent discrimination against rural and traditionally more isolated populations.[116] However, despite significant growth over recent years, broadband in Africa remains in the nascent stage of development.[117]

Figure 6: ICT sub-baskets by region and by level of development, 2008 and 2010[118]



Note: The IPB is a composite basket that includes three tariffs sets, referred to as sub-baskets: fixed telephone, mobile cellular and fixed broadband Internet services. The IPB is the value derived from the sum of the price of each sub-basket as a percentage of a country's monthly GNI per capita, divided by three. The cost of each sub-basket as a percentage of monthly GNI per capita is limited to/capped at a maximum value of 100, so that the final price basket value may vary between a theoretical 'zero' (ICT services are for free) and 100 (the price of all three sub-baskets is equal to, or exceeds, the monthly GNI per capita). However, the three sub-baskets , as presented in this chart, are not capped at a maximum of 100 and in the case of fixed broadband, some countries exceed 100 (i.e. the cost of fixed broadband services exceeds the monthly GNI per capita).
Source: ITU

[114] Information and Communications for Development 2009, 11.
[115] Ibid, 56.
[116] OECD, *The Development Dimension, ICTs for Development: Improving Policy Coherence*, 2009, 129.
[117] Ibid, 121.
[118] International Telecommunications Network, http://www.itu.int/ITU-D/ict/ipb/ (accessed February 02, 2012)

The great challenge remains providing universal coverage to all those who want to access the Internet. This will likely occur using low-cost PDAs or notebooks through mobile connections.[119] There is some debate surrounding the cost benefit of providing universal broadband coverage. In a Center for Global Development essay, Charles Kenny argues that the benefits of broadband are being oversold. This is because the evidence of broadband achieving a large positive economic impact is limited. The costs associated with fixed universal broadband rollout are exorbitant in comparison to available resources in developing countries. Kenney suggests making the case for government subsidies of fixed broadband in developing countries is difficult one: the evidence does not yet conclusively support whether this might be deemed a good use of taxpayer (or donor) resources.[120] Christine Zhen-Wei Qiang of the World Bank, however, posits that access to the Internet may do more to leverage economic growth than access to mobile phones. The Internet requires users to have a certain level of education and literacy. Although the Internet may significantly impact development in the longer-term, it will neither be as nimble nor as impactful as mobile telephony has been in just the last decade.[121]

3.8 E-GOVERNMENT IN AFRICA

E-Government allows citizens to access public services and information online. Simultaneously, e-Government promotes economic development, increases government transparency and accountability, reduces costs, improves service delivery and public administration and helps to facilitate an e-Society.[122] E-Government importantly affects the relationship between government and citizen, government and business and government to government. E-Government remains at an early stage in Africa. A number of developing countries are working to utilize e-Government services. E-Government refers to the use of ICT to improve the efficiency, effectiveness, transparency and accountability of government, which has proven a difficult undertaking.

3.8.1 GHANA CASE STUDY

In Ghana, with support from the IDA, the e-Ghana Project features a public-private partnership to improve revenue collection. The project has assisted the government in attracting US$40 million in private sector investment to put in place an electronic tax application to automate revenue agencies and the Registrar General's Department. Upon completion in 2012, it is anticipated that this application will assist the Government of Ghana improve compliance, increase the tax base, reduce the incidence of fraud and increase transparency.[123] Ghana has also launched the e-Customs System (GCNet), which increased customs revenue by 49 per cent in its initial 18 months of operation and shortened the time to gain clearance from three weeks to two days.[124] Although there are a number of success stories related to e-Governance, as illustrated by Ghana, thus far, there has also been a high failure rate in uptake by developing countries generally.[125] E-government is relatively new on the development scene, and, therefore, it will take some time before a comprehensive list of best practices can be realized. So long as Internet connectivity is limited to urban centers and even then prohibitively expensive, it will exclude poorer citizens and especially those living in rural and less developed areas.

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[119] Finishing the Job, Economist, Sept. 24th, 2009, p. 1.
[120] Overselling Broadband: A Critique of the Recommendations of the Broadband Commission for Digital Development, Abstract, p13. http://www.cgdev.org/content/publications/detail/1425798
[121] Finishing the Job, Economist, Sept. 24th, 2009, p. 1.
[122] http://siteresources.worldbank.org/INTEGOVERNMENT/Resources/e-Gov_guideline.pdf
[123] http://siteresources.worldbank.org/NEWS/Resources/Results2011-SDN-SB-update-ICT.pdf, p.2
[124] Information and Communications for Development 2009, 8.
[125] Information and Communications for Development 2009, 9.

3.9 E-LEARNING

E-learning includes all forms of electronically-supported learning and teaching. The supportive information and communication systems, whether they are networked forms of learning or not, serve as specific media to implement the learning process.[126] The term is still mainly used to reference both out-of-classroom and in-classroom educational experiences via technology, even as advances continue in regard to specific tools and curricula. The advent of webinars (Internet-mediated seminars, panel discussions and similar) has rapidly become very popular among development agencies, NGOs and private firms working in the development space. USAID has recently begun using these e-Learning tools quite widely as well as tools for self-paced learning/training courses through Adobe Connect™, which USAID brands as AID/Connect. In an era of declining budgets, "retail" approaches to training and knowledge sharing, i.e. teams going from country-to-country to implement classroom based courses are increasingly giving way to "wholesale" e-Learning based approaches, sometimes with additional online mentoring or "help desk" functions. E-learning tools and approaches span a broad range, including the use of "peer assists" in which professionals (e.g. engineers, health care providers, computer technicians) help solve particular design or operational problems for their professional peers using a variety of ICT tools (emails, video-conferencing, webinars, etc.) and an ever-increasing number of technologies and methods for "knowledge management" and sharing.

While e-learning is slowly increasing in African businesses, NGOs and universities, it is severely constrained at the K-12 level by a widespread lack of ICT infrastructure, computers and even basic ICT familiarity among teachers and administrators. An ever-increasing number of experiments at this level of schooling, e.g. Ethiopia's One Laptop Per Child experiment or the SPED initiative in Nigeria have been tried but with limited impacts to date.[127]

Simple and affordable mobile phones, on the other hand, are also being used as a means to promote adult literacy in Africa. In addition to a regular literacy curriculum, adults in the Nigerien village of Falenko learn where to find letters and numbers on a mobile phone and how to send and receive SMS messages. Within four months, students have been able to practice their newly acquired literacy skills by sending SMS messages to their friends and family. In a country without vernacular newspapers and village libraries, SMS makes literacy functional. Early results suggest that students who use a mobile phone as a learning device make faster progress and achieve greater levels of literacy than those relying solely on traditional classes. Similar mobile-literacy projects are starting in Senegal, and others in India are using smart phones and mobile games as teaching tools for children.[128]

3.9.1 BOTSWANA CASE STUDY

In 2002, the University of Botswana embarked on a program of developing digital courses to supplement live lectures and to reach students who could not attend live lectures. After a slow start, 343 new online courses had been created and by 2006, a steady increase in lecturers interested in using this approach was observed. As of 2008, 145 lecturers were using e-learning at the university or 18% of the total academic staff. The number of students enrolling in e-learning courses has also steadily grown. As of 2008, more than 13,000 students had been added to courses, on average 90 students per course.

However, some problems with the e-learning do exist at the University of Botswana are apparent. An early constraint was unfamiliarity and even technophobia with respect to using online courses by some students and teachers. In addition, the university does not have enough computer terminals – an average

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[126] Tavangarian D., Leypold M., Nölting K., Röser M.,(2004). Is e-learning the Solution for Individual Learning? Journal of e-learning, 2004.

[127] See *e-Learning News Portal*, December 2011 for reports of these initiatives.

[128] Boston Review, op. cit.

of one terminal per 15 students. For those lecturers that have decided to put their exams online, this has sometimes resulted in conflicts over access to the terminals.

3.10 KNOWLEDGE MANAGEMENT AND ICT

Knowledge management is increasingly recognized as an essential component of sustainable development due to its function of distilling and sharing best practices and lessons learned, successful development and governance models and key sources of knowledge and expertise. While knowledge management is not a new concept, its modern application has become highly integrated with the development of ICT, though it should be stressed that knowledge management is not simply the application of ICT for development. One of the leading sources of information and exchange on knowledge management and development is the large online community, Knowledge Management for Development (KM4Dev: www.km4dev.org). The site provides a large and detailed wiki and database of KM tools and methods.

The emergence of ICT-mediated knowledge management coincides with the development of online "communities of practice"(CoPs), i.e. self-identified or sponsored groups with common interests (e.g. protected area managers or value chain specialists) spanning both developing and developed countries. CoPs have been aided by ICT tools including interactive websites. USAID was an early adopter of this approach in Africa in the field of natural resource management, starting with the FRAME Project in the late 1990s. Knowledge management through CoPs can be combined with periodic live meetings where the opportunity for building personal relationships is often very effective to facilitating an ongoing and dynamic online community.

Knowledge management in Africa as a conscious and strategic organizational initiative is still relatively limited in scope. ICT firms, African branches and/or subsidiaries of international firms and NGOs, and some research and university institutions have been the main promoters of knowledge management, especially those approaches making full use of online (or Web 2.0) tools, including some social networking tools. A number of donors, USAID among them, have begun to support and require the use of knowledge management tools and approaches to achieve scale and replicability of successful project approaches, facilitate better monitoring and evaluation and to collect best practices and lessons learned.

3.11 GEOSPATIAL DATA AND GIS

A geographical information system (GIS) is a special category of ICT. GIS is essentially the organization of "data layers", geo-referenced information that, systematically organized, provide a multidimensional view of a given location analogous to the way that old-fashioned transparent overlays were used in early spatial planning exercises. Hence, on top of a digitized topographical base map or satellite image, data layers for physical infrastructure, population, water resources, agriculture and other land uses can be overlaid. GIS software applications can then be used for trends analysis, planning simulations and modeling. GIS has become a necessary and frequently used tool in developed countries for urban and infrastructure planning, crop and weather predictions, disaster management, national security and a host of other important uses.

For many years, geospatial data and their use mainly in GIS technology found little application in developing countries. Partly, this was due to the relatively high cost of geospatial data, especially satellite imagery but also because foreign governments were often reluctant to release satellite imagery for use in development activities, typically citing "national security" concerns. In addition, spatial and land use planning in many developing countries was often informal or ad hoc when it was undertaken at all. The principal GIS software, the Arc suite of products developed by the ESRI Corporation required extensive training to be used effectively presented another barrier to the widespread use of geospatial data. Finally, until 2000, the U.S. military did not permit the use of their geo-stationary satellites for civil geo-

positioning systems (GPS) uses, which would have greatly facilitated the expanded development and use of GIS.

Many of these constraints are now easing. GPS is now freely available and navigation systems and uses for GPS have exploded in number and type, including driving aids, business and social applications, tourism guides and many others. A variety of other forms of GIS software have emerged to compete with ESRI, which have forced the company to offer more accessible and cheaper versions of its software. Finally, a new generation of computer-savvy and better educated professionals in developing countries is more comfortable using GIS. Policy reforms have gradually been enacted requiring more participatory and transparent forms of land use and natural resource decision making, e-government and spatial planning stimulating greatly expanded use of geospatial data and GIS. Assessing the impacts of climate change and planning for adaptation to these impacts are some of the most recent and important uses for geospatial data and GIS.

As noted previously in this paper, increasingly data collected for businesses (e.g. supply and value chains), health (e.g. epidemiology, maternal and child care), agriculture, conflict and disaster management and other development sectors are increasingly being geo-referenced and incorporated as part of new ICT tools (e.g. smart phones and software applications for collecting and analyzing information collected in the field). The demand for and use of geospatial data in ICT is likely to continue to expand rapidly.

3.12 CONCLUDING THOUGHTS

The increasing penetration and affordability of Internet services, particularly through mobile phones, though not broadband, and the advent of targeted ICT applications across sectors continue to reinforce the significant potential impact of ICT on developing countries.[129] In Africa, Internet penetration is steadily increasing. Coupled with the spectacular rise of mobile phone usage, Africa has achieved significant investments in ICTs. ICT networks have the potential to make significant service delivery impacts as well as serve as a platform for civic participation.[130] Key ICT challenges remain, including improving affordability to reach populations who live outside of ICT networks and closing the infrastructure gap; increasing access to more advanced and affordable services, e.g. broadband for high-speed internet; and leveraging ICTs to improve the delivery of services and increase economic growth.[131]

3.13 RECOMMENDATIONS:

The recommendations in this paper are directed mainly to USAID. They are divided between those that are generally applicable to a range of subjects and those that are focused on the conservation and natural resources management topics discussed in this paper.

3.13.1 GENERAL RECOMMENDATIONS

ICT and KM communities of practice have proliferated and provide tremendous resources for more widespread and effective use of knowledge sharing tools and methods. The experience of USAID and other development agencies and networks such as the Consultative Group for International Agricultural Research (CGIAR) strongly suggests that CoPs need to be cultivated and actively managed by a supporting project or project/program component in order to thrive.

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[129] http://siteresources.worldbank.org/NEWS/Resources/Results2011-SDN-SB-update-ICT.pdf, p.4

[130] Information and Communication Technologies in Developing Countries: Connecting People, Transforming Service Delivery, and Fostering Innovation, Brief,

[131] Information and Communication Technologies in Developing Countries: Connecting People, Transforming Service Delivery, and Fostering Innovation, Brief,

Project designers would do well to include an assessment of the ICT landscape and capabilities into project development project designs since such an assessment could inform the degree of effectiveness of ICT to contribute to capacity building, public awareness, communications, governance reform and many other aspects inherent to development projects/programs. For example, assessing bandwidth constraints or the relative advantages of using an Internet/website approach to communications and learning or using mobile phone for data collection could be important to the overall project design. As discussed earlier, much of the African continent lacks broadband infrastructure, which will still pose a long-term constraint. The challenge will be both in understanding what is but also predicting what will be and the speed of change.

Promote policy and institutional governance reforms to remove barriers to private sector participation, increase competition and lower prices. There is an essential role for government in making markets work more efficiently and to ensure equitable access. "Three key barriers prevent the poor from making use of services even when available: affordability, lack of financial literacy, and lack of trusted intermediaries. To address these would, again, require coherence across a set of policy areas including taxation, telecommunications policy, education, and financial regulation."[132]

3.13.2 SPECIFIC RECOMMENDATIONS FOR NON-CONSERVATION RELATED SECTORS

Banking and Finance. Kenya, Uganda and South Africa have all demonstrated the efficacy of mobile banking in reaching the rural poor. Lessons learned and best practices developed by M-Pesa, WIZZIT and others need to be disseminated around the continent. Donors and developing country governments should include extending mobile banking services as part of their poverty reduction strategies. Many countries' telecommunications legal and regulatory structures do not allow for mobile banking and commerce activities. This should be changed. Mobile banking reforms will need to regulate mobile operators, which tend to have a dominant position vis-à-vis the mobile banking providers. This includes a fairer division of fees charged. Fraudulent mobile banking operations and spam also need to be carefully regulated.

Agriculture. African countries need to encourage and promote the creation of applications (based on open source approaches to facilitate sharing) which are i) relevant to subsistence farmers, agricultural processors and other parts of agricultural value chains, ii) available in local languages and iii) work on locally available media (i.e. mobile phones). Harnessing knowledge management by supporting access to information on international best agricultural practices through virtual communities of practice and online forums has the potential to more easily bring international best practices to African agricultural researchers and extension agents as well as enabling a better understanding of the wider challenges African farmers face. One of the most important interventions would be for governments to create forums for dialogue and interaction amongst the key stakeholder groups in critical agricultural value chains. Often communications among value chain segments is poor leading to significant inefficiencies that could be ameliorated through online forums (websites, listserves). Traceability systems for chain of custody of livestock and crops (especially organically-certified) depend on good ICT and should be encouraged through private public partnerships. The use of computer-aided drip irrigation systems in water short areas, which also rely on good ICT, will be increasingly important. The constraint here, of course, is the initial high capital cost of such systems, which may initially limit them to commercial agriculture. ICT should be an integral part of donor food security strategies and project designs.

Health. A large number of mobile phone-based health software applications have emerged over the last decade. A first recommendation would be to bring together African health practitioners to assess which

[132] OECD Report, p. 30

of these has been most useful (accessible, ease of use, low hardware requirements, etc.) for individual and institutional purposes (monitoring, data collection and analysis, tele-medicine, information dissemination). The legal and regulatory reforms need to support the use of ICT for health needs to include privacy concerns. It is critical that women and girls be included in any project/program design involving the use of ICT and health not only because they are the focus of high priority health programs (e.g. maternal and child health, HIV and other infectious disease prevention) but also because they are likely to be information collectors, managers and disseminators. Phase interventions in order to gradually institutionalize the use and maximize the impact of ICT for the health sector. Donors should encourage and reward cross-sector and public-private partnership efforts in mHealth and eHealth systems development.

Governance. It is clear that the use of mobile telephony will have the broadest impact on e-governance and conflict management for a long time to come in Africa owing to the relatively low penetration fixed Internet access, especially outside of capital cities. Developing innovative approaches to using mobiles for this purpose should be a priority. Focus the development of e-governance capabilities at the municipal and local government levels since the impacts of their use are more immediately evident and measurable.

E-Learning and Knowledge Management. The available – but still limited - case studies indicate that the most positive impacts of ICT in the form of e-learning initiatives occurs at the tertiary level of education (college and beyond) and at the lowest level (basic literacy programs) while primary and secondary levels are not cost-effective at least at the individual pupil level. Having some access to computers at the K-12 levels may be useful as an instructional aide but this subject needs to be studied further in individual countries. A key recommendation in this regard is expanded training of teachers at the K-12 levels to become comfortable with the use of ICTs for e-learning and to encourage and support them in the development of their own materials using ICTs so that they are locally appropriate and teachers take ownership of the materials. Support the development of public-private partnerships to promote e-learning. Such partnerships are already an important part of this field and should be further supported.

As noted in this paper, ICT-mediated knowledge management is increasingly recognized as a critical part of donor project design and the sharing of best development practices more generally. While much of the developed world knowledge management interactions increasingly occur through the Internet, this is likely less the case in Africa outside of multinational firms, donors and research institutions. Nevertheless, in the context of individual sector projects, like those described in this paper, support for ICT-mediated knowledge management and sharing practices and development of communities of practice has proven to be a successful approach not only for sustainability of project interventions but also for replication and scaling up.

4. AFRICAN REGIONAL CONSERVATION PROGRAMS REVIEW: CARPE AND STEWARD

4.1 INTRODUCTION

USAID Africa Bureau's Biodiversity Analysis and Technical Support (BATS) program provides analytical and technical assistance to USAID country Missions and other operating units on a range of activities. During planning sessions for the 2010 fiscal year, the four BATS partners: USAID/AFR, US Forest Service, Africa Bureau Conservation Group (ABCG), and International Resources Group (IRG), agreed that the use of information and communications technologies (ICTs) within and among conservation organizations is an important emerging issue. To address the question of how these organizations currently share information within their areas of operations and how to improve those methods, the BATS program commissioned a review of existing large, regional conservation projects. The way in which these activities communicate within their management structure and with partners, beneficiaries and other organizations provides an important benchmark from which to learn and for future planning. The challenges of operating across large natural landscapes as well as national boundaries, across languages often in communities with poor to no connectivity to many communications channels offers an important reality check for an increasingly interconnected world.

The Central African Regional Program for the Environment (CARPE) operates in the Congo Basin, the second largest contiguous moist tropical forest in the world, to promote sustainable natural resource management. The Sustainable and Thriving Environment for West African Regional Development (STEWARD) initiative is a joint effort conceptualized by USAID and the US Forest Service working in the Upper Guinean forest region of West Africa, including forested areas in the countries of Guinea, Sierra Leone, Liberia, Côte d'Ivoire, and Ghana. A review of project documents and key informant interviews provides the core of this analysis to capture the project's current use of ICTs and social networks to collect, collate, analyze and share information and the lesson's learned from information exchange.

4.2 INTRODUCTION TO CARPE

4.2.1 OVERALL OBJECTIVE

The Central African Regional Program for the Environment (CARPE) is a USAID initiative aimed at promoting sustainable natural resource management in the Congo Basin. The Congo Basin forest is the second largest contiguous moist tropical forest in the world and plays a key role in securing the livelihoods of Central African citizens. The forest also provides critical habitat for floral and faunal biodiversity and supplies vital regional and worldwide ecological services. Amidst the increasing pressures facing the Congo Basin forest, CARPE works to reduce the rate of forest degradation and loss of biodiversity by supporting increased local, national, and regional natural resource management capacity. This is achieved by implementing sustainable forest and biodiversity management practices, strengthening environmental governance, and working to monitor forests and other natural resources throughout the region.

4.2.2 STRATEGY

CARPE was designed as a long-term, regional initiative. CARPE is currently in the transition between the second and third phase of the program. Phase II is specifically concerned with intensive implementation and the establishment of improved natural resource management capacity in order to reduce deforestation and conserve biodiversity. This primary objective has been further divided into

three Intermediate Results concerned with (1) sustainably managing natural resources; (2) strengthening natural resource governance; and (3) institutionalizing natural resource monitoring. All of CARPE's intermediate results are tracked through corresponding indicators.

In order to execute effectively a comprehensive program aimed at meeting these results, USAID directly funds multiple partner organizations. These implementing partners include both international conservation organizations and "cross-cutting" service providers.

The majority of CARPE funds are allocated to planning and management activities within the 12 CARPE landscapes. The CARPE landscape programs are currently being administered by multiple international conservation organizations functioning as consortia. These consortia are led by a single member and include other international NGOs, local NGOs, government agencies, international research institutions, and specific individuals to implement the landscape programs. CARPE has shifted its focus in the second phase to take a landscape approach and landscape-level land use planning model, including significant local community participation. This scale and level of local participation is viewed as a major strength of the second phase and will be continued in the third iteration. This focus has presented challenges and opportunities for use of communications and ICTs across the project.

In addition to the landscape programs, CARPE also supports broader cross-cutting activities throughout the Congo Basin. Cross-cutting activities are designed to bring specific expertise to the Congo Basin and are concerned with a wide variety of tasks, including: forestry and natural resources monitoring, improved natural resources governance, policy development, and institutional capacity building.

Finally, to provide additional technical and administrative guidance at the country level, CARPE II supported 9 national-level 'Focal Points,' one for each of the nine Central African countries where CARPE operated. Focal Points work with local non-governmental organizations and community-based organizations to increase their capacity to accomplish CARPE activities while convening a range of stakeholders to support and improved policy environment at the national level.

4.3 COMMUNICATIONS AND ICT IN CARPE

CARPE employs a variety of approaches to communications and ICTs including; a large public web site housing a range of documents, video, map data and remote sensing imagery; community-based video; community mapping and GPS data collection for Geographic Information Systems (GIS); and face to face events supporting project management, learning, policy reform, land use planning and regulation.

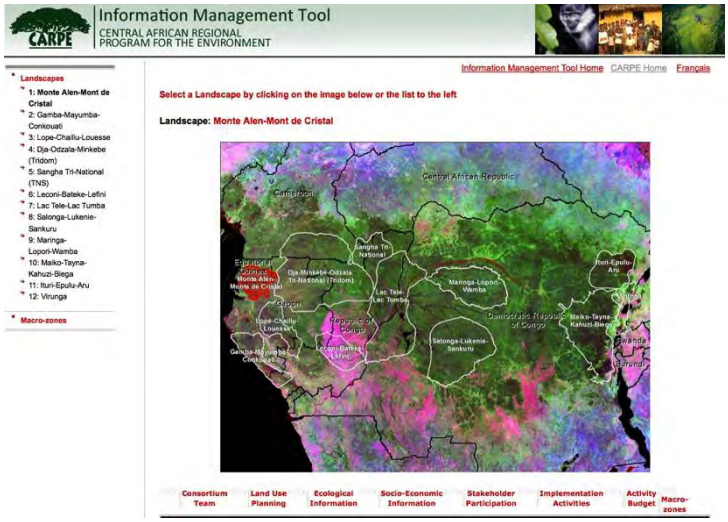
4.3.1 CARPE WEBSITE – DATA, MAPS AND DOCUMENTS

INFORMATION MANAGEMENT TOOL (IMT)

CARPE supports a large-scale forest landscape management planning process as part of its overall objective to slow the rate of tropical forest and biodiversity loss in Central Africa. The Information Management Tool (IMT) organizes information and reports from its 12 CARPE/Congo Basin Forest Partnership (CBFP) landscapes and for macro-zones within each landscape (protected areas, community zones and extractive resources zones). The CARPE IMT is available on the CARPE website to CARPE partners, stakeholders, and members of the general public who may be interested in following the progress of this undertaking. Landscape-level documents can be found on the IMT. Information on the consortium team managing each landscape is also available, along with landscape-wide reports from CARPE partners.

Because landscape-level planning and landscapes themselves are dynamic processes, the IMT will change periodically as new information becomes available. it is updated at least once each year, but changes and updates may be made at any time if warranted.

Figure 7 - CARPE Information Management Tool



The information on the IMT is organized according to each of the 12 CARPE/Congo Basin Forest Partnership (CBFP) landscape programs according to the principal processes that CARPE partners use to develop both landscape management plans and macro-zone management plans.

Each landscape is divided into macro-zones as the planning process matures. There are three different types of macro-zones:

1. Protected Areas (PA) are defined according to a classification system developed by the IUCN, and includes national parks.
2. Community-Based Natural Resource Management (CBNRM) areas are lands in which communities have tenure over natural resources and manage them for communal benefit through a variety of traditional and modern systems.
3. Extractive Resource Zones (ERZ) include forest concessions, large-scale private plantations, mining, sport hunting zones, and energy and transportation infrastructure.

Landscape maps showing existing macro-zones are available on the CARPE IMT as well.

CARPE DATA EXPLORER

The CARPE Data Explorer is a web-based tool, open to the public, which allows users to (1) access spatial data for the Congo Basin; (2) download data and metadata from CARPE partners; and (3) view, download, and utilize available products (posters, maps), satellite imagery and GIS layers.

Figure 8 - CARPE Data Explorer

The CARPE Data Explorer uses GeoNetwork's open source platform. GeoNetwork open source is a catalog application to manage spatially references resources. It provides metadata editing and searching functions as well as an embedded interactive web map viewer. GeoNetwork connects spatial information communities, such as CARPE, and provides these

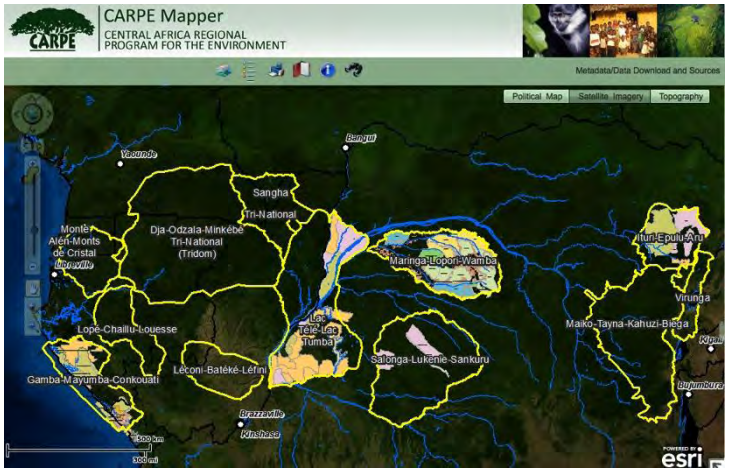
communities with an easy-to-use web interface to search geospatial data across multiple catalogs, combine distributed map services in the embedded map viewer, publish geospatial data using the online metadata editing tools and the embedded GeoServer map server.

Information available on the Data Explorer is divided into seven categories: Documents, GIS Data, Interactive Resources, Maps & Graphics, Other Information Resources, Satellite Data/Derived Products, and WRI Atlas Data. There is also a "Recent Changes" tracker, allowing users to see the most recent changes that have been made to various data.

SATELLITE-DERIVED MAPS[i]

Using satellite images, corroborated by data gathered on the ground, CARPE staff is gaining a comprehensive picture of the Congo Basin. CARPE provides stakeholders, including members of fishing communities and farmers' associations as well as NRM professionals, with training in skills such as the creation and use of geospatial data.

Figure 9 - CARPE Mapper



EXAMPLES OF USE OF SATELLITE-DERIVED MAPS

Elephant telemetry project – This project tracks elephants tagged with Global Position System (GPS) collars via satellite. The project combines spatial data, based on report sensing technology, with statistics on elephant densities and distribution as well as demographic information. Researchers can then generate maps indicating the number and density of elephant herds in relation to their distance from roads and villages.

DOCUMENTS

CARPE also uses the website to capture and share a voluminous library to make available material on the state of the region's forests, lessons learned, governance, technical guidance and general documents. Documents are classified by type for easier access and included in multiple languages whenever possible.

There is an important link between the use of guidance on the website and a programmatic focus on standardization. To counter the tendency toward localization of practices and improve comparability and data capture across the project – forms and templates are used extensively to standardize use of tools, methods and reporting. Currently there is a backlog of 800 to 900 documents to be added to the website as part of the project's Annual Means of Verification exercise to provide evidence of impact.

4.3.2 CARPE VIDEO AND COMMUNITY PARTICIPATION

Much of the most relevant and effective communications by CARPE are focused on field efforts. To reach local populations the project has used video to great effect to share best practices around a range of issues and to create a springboard for policy and resource management discussions. Video allows the project to capture contemporary situations – for example the issue of zoonotic communicable diseases prevalent in local bushmeat and mitigation methods to avoid exposure – in local languages with local participation. By training people on the ground and equipping teams with solar gear, the movies can be readily created close to the actual context they relate to and shared village to village by travelling groups for broader exposure. There are plans to spread the practice beyond the current use in three landscapes and target national television as a distribution channel. By circumventing connectivity and providing an

accessible communications platform the project is capitalizing on more traditional communications methods, augmented by appropriate portable technology.

4.4 CARPE COMMUNICATIONS STRATEGY

The CARPE Communications Strategy addresses the issue of communications for CARPE at both the internal and external levels. The Communications Strategy identifies goals, key audiences, changes, and actions/ expected reactions, the key messages, the channels and products, and the responsibilities of all the parties involved in its implementation. The two main goals of the communications strategy are:

1. Promote, disseminate, and share the information CARPE and its partners in the United States and in the region have gathered or will certainly gather through the course of current and future CARPE phases.
2. Develop, through a series of products and other opportunities, an identity for CARPE as a distinct and recognizable umbrella entity that is working to preserve the integrity of forest resources in Central Africa.

The Communications Strategy identifies the role of the Communications Program to be:

- Promote CARPE's and CARPE partners' products, messages, and activities;
- Provide Central African decision-makers and other stakeholders with information about forest resources in Central Africa;
- Provide researchers and practitioners with information about biodiversity conservation in the Congo Basin; and
- Ensure that information flows at all levels within the CARPE structure and network.

Indicators to that accomplishment will be that:

- Environmentally sound policies are adopted by national governments;
- A network of collaboration is developed and widened among practitioners and researchers in Central Africa;
- Civil society and local communities are more involved and take responsibility for the sustainable use of natural resources;
- Information is willingly and regularly circulated within CARPE; and
- CARPE identity is developed.

Communications is an ongoing, dynamic part of the CARPE project. The main website represents a public view for what is also an active on the ground process to build awareness of the project and its programmatic elements. An intranet site linked to the public site is under-used and is likely to be discontinued.

Internal communications are supported by standard email channels between staff using VSAT connections when cheaper local ISP internet options are not available. The regional offices also receive hand-delivered hard drives with the major data updates for the bandwidth-intensive GIS data required for much of the mapping work carried out on the local level. Cell phones and text messaging supplement email for project communications.

Apart from the public website – housing access to the online data sources and documents described elsewhere using a static html shell – CARPE is not currently using more recent collaboration tools or social media such as Facebook, Twitter, blogs, wikis or listserves.

4.5 CARPE'S APPROACH TO ADAPTIVE MANAGEMENT AND MANAGEMENT COMMUNICATIONS

CARPE III activities will be implemented in 6 countries, 5 of which have no USAID presence, by a consortium of NGO grantees and partners, both international and local, at times working across international boundaries. As the project has evolved, the internal communications and knowledge sharing efforts around program management have improved based in part on more uniform use of an adaptive management approach and more consistent application of the Project Management Plan (PMP) reporting.[133] To integrate these various actors around a relevant unit of analysis – CARPE uses the land use planning model and landscape partners as an approach to make implementation and monitoring more consistent. The CARPE IMT housed on the project's website is used as a transparent public view of the planning process to help ensure greater adherence to implementation and reporting requirements. The recent phase II evaluation covers this range of issues in more detail in section 4.2 and outlines use of innovative tools such as Whole-System-in-the-Room (WSR).[134] These elements of the project – while not formally called out as communications per se – certainly represent an important aspect of management communications for the project and are clearly part of the current successful implementation.

4.6 GENERAL OBSERVATIONS ON CARPE COMMUNICATIONS AND ICT

CARPE is a large, established and complex project. As such, any changes to use of communications approaches or use of ICTs will require a thoughtful approach to planning prior to implementing any content or technology changes. That said, the web platform CARPE is currently using is basic and labor intensive to maintain. The content management opportunities offered by using desktop html editors to manage a growing complex site and all the associated files and applications significantly limit efficient maintenance and the overall usability by an increasingly sophisticated public. The lack of more than basic search tools, the inability to sort columns of document listings and the absence of RSS news feeds, email or Twitter updates limits the accessibility of truly unique and valuable content. Communications and the website are not featured in the recent evaluation or in the strategic planning document. While the project is using the web and generates a substantial amount of material, it does not appear to be updating its approach to public communications on the Internet, at this point.

For internal communications, those with Internet access could take advantage of several recent developments the project could explore depending on its internal capacity. The ready availability of central file sharing tools such as Usendit and DropBox can be a means to avoid large file attachments for emails. For external communications, RARE's impressive integration of blogging into their conservation and communications efforts is a model of a relatively low bandwidth approach to capturing project reporting and results real time. The use of wikis for information sharing and co-authoring is moving more into the mobile market and may be a means for the project to create and share core documents either internally, with local communities or the general public. Several applications offer the ability to download sections of a wiki to a local system while connected for later use when a connection is not available. The project also as the opportunity to use video sharing tools such as Youtube or Vimeo to

[133] (ECODIT, 2010)
[134] (ECODIT, 2010)

create an online archive of films for global access. The market for non-English language video is growing daily. Many of the resources above rely on cloud computing, a distributed storage and delivery approach to data and applications on the Internet, which the project can use to improve local access (faster downloads from closer, local servers) and save costs on IT investments. It is important to work with IT staff aware of the project's requirements for security, archiving and backup to ensure a cloud solution makes sense for the project on a case by case basis.

CARPE has a rich set of information resources to share and a growing range of options to reach new audiences and support their existing fieldwork. To help fit the project to the existing and emerging options there may be a need for a communications and ICT needs assessment to review the project's current needs and to develop an approach suitable to the project's context and resources.

4.7 SUSTAINABLE AND THRIVING ENVIRONMENTS FOR WEST AFRICAN REGIONAL DEVELOPMENT (STEWARD)

4.7.1 INTRODUCTION TO STEWARD

The Sustainable and Thriving Environment for West African Regional Development (STEWARD) is a joint effort conceptualized by USAID and the US Forest Service to increase collaboration, improve regional natural resource management, promote transfer of knowledge among countries at a regional level, and to initiate trans-boundary development projects at select sites within the Upper Guinean forest region of West Africa. The Upper Guinean forest includes the countries of Guinea, Sierra Leone, Liberia, Côte d'Ivoire, and Ghana. This region is a high global priority for biodiversity conservation, and is of strategic importance in terms of peace building, extractive industries, and other key global commodities such as rubber, cocoa, and oil palm[ii] And operates in both French and English in addition to local languages.

The overarching goal of STEWARD is to foster regional strategies for, and approaches to, biodiversity conservation, improved livelihood, and sustainable natural resource management in the Upper Guinean Forest. STEWARD will focus on activities in the countries of Guinea, Sierra Leone, Liberia, and Cote d'Ivoire. The four specific objectives of STEWARD are:

- Build capacity for increased regional collaboration;
- Improve policies for regional conservation and natural resource management;
- Develop and promote 'better management practices' for transboundary natural resource management, conservation of forest biodiversity, sustainable forest-based livelihoods, water-sanitation and hygiene (WASH) and climate change response from actions in priority zones sites; and
- Promote the transfer of knowledge and lessons learned among countries.

4.7.2 COMMUNICATIONS AND ICT IN STEWARD

STEWARD AND COMMUNICATIONS

Phase II of the STEWARD program was implemented from June 2009 to February 2011 and with the support of USAID/Sierra Leone, transitional funding ($500,000) enabled field activities to continue until March 2011. The transition to Phase III is underway at the time of this report and anticipated to begin with additional partners in early 2012. The Final Report for phase II of STEWARD outlines the results

which occurred in the final months, October 1, 2010 to February 28, 2011.[135] The overall Phase II program Intermediate Results managed landscapes, improved communities well-being, and strengthened political commitment to natural resource conservation through activities aimed at fulfilling the 11 program objectives. Much of the relevant reporting for communications and ICTs for the project are summarized in the list below and captured under Objective 10 from the project's overall strategy: "Learning networks enhanced through information technology and media managers/users".

- Newspaper articles: 3
- Radio broadcasts: 15
- Screenings of environmental documentaries: 0
- Establishment of Chimpanzee Theater Outreach Troup: 1
- Film & theater outreach: 12
- Video documentaries: 3
- Database of GIS/Maps of Priority Zone Sustainable Livelihood activities: 8
- Television interviews/reports: 6
- STEWARD quarterly bulletins: 0
- New users of FRAMEweb.org: 5
- Copies of one pager flyers distributed on 5 success stories: 0
- Copies of comic book on chimpanzees and conservation (WCF): 5,000
- Weekly STEWARD FORUM (including Community FORUMs): 12 (Total new participants since Sept. 2010 = 200)
- Murals on NRM: 0

STEWARD used multiple mechanisms to spread best practices and success stories of natural resource management and biodiversity conservation throughout the region including the use of new and old media platforms (quarterly bulletins, one-page flyers), a video on NRM success stories in the region, and reports, maps, databases, announcements, and discussions on FRAMEweb.org. In its initial assessment, STEWARD recognized that "a first step in supporting a regional conservation planning agenda is to promote the flow of knowledge and experiences about best practices."[136] This assessment recommends that STEWARD create a regional best practices network database, including lessons from individual USAID mission programs as well as other African countries through knowledge resources such as FRAME and Nature Wealth and Power (NWP). Rather than create a database in a region with poor connectivity and relatively weak policy and practices – STEWARD has included active development and dissemination of best practices themselves as a core focus of the project's efforts.

Much of the effort above and beyond the communications work described elsewhere is oriented toward data gathering and capacity building on the ground to support the realities of the current local working

[135] STEWARD, 2011
[136] Biodiversity Analysis and Technical Support Team, 2008

environments.[137] Policy and management dialogues and GIS data gathering are examples of on the ground use of ICTs. To support local dialogue – STEWARD has successfully created short films on timely topics then used them as springboards for local town hall-style events to educate about NRM practices. The "Without Borders" film (hosted on Vimeo - http://vimeo.com/29727040) is the most successful example – the film was used initially for high-level outreach and communications at the Embassy level and subsequently translated into three local languages and used for several events to bring a mix of local groups together for dialogue and learning around NRM practices.[138]

STEWARD publishes most media deliverables, forum summaries, and general natural resource management information on the FRAMEweb site on a weekly basis. The Community of Practice for STEWARD has received 58 technical documents on biodiversity conservation from the region, and increased membership by nearly 12% since September 2010.

STEWARD's Objective 11: "Learning networks enhanced through site visits and study tours" prepared and managed the FY11 annual meeting of STEWARD partners to share best practices and lessons learned in workshops in Conakry, Freetown, Monrovia, and Accra involving the USFS, USAID/WA and participants from various organizations, private sector, and government institutions working in conservation, climate change, sustainable livelihood development, and water/sanitation. The learning networks objective also sponsored two representative of the Sierra Leone Forestry Division (Ministry of Agriculture, Forestry, and Food Security) to participate in the USFS International Seminar Series on Protected Area Management, July 12-31, 2010.

For a complete listing of accomplishments, see:

STEWARD II Sustainable and Thriving Environments for West Africa Regional Development Phase II Final Report , October 2010 to February 2011

STEWARD's summer 2011 Stakeholder Workshop listed the following range of priorities related to communications under the category "Information Sharing, Networking, and Technical Assistance" for activities in Sierra Leone, Guinea, Liberia, and Cote d'Ivoire[139] for the third iteration of the project:

- Exchange Forums on NRM between implementers
- Coordination among government/donors
- Reporting / informing / collection (tour of region to collect & disseminate information)
- Increase media outreach on NRM issues
- Website use
- Sector-tailored media approach
- Capacity building in education and outreach
- Literacy training and Information sharing
- Study tours and exchange visits
- Support trans-boundary technical committees

[137] Massaquoi, 2012
[138] Massaquoi, 2012
[139] US Forest Service International Programs, 2011

- Knowledge sharing in and out of region
- Research
- Awareness programs
- Information exchange/partnerships (networking)

These general methods will be applied in the context of the STEWARD III approach to forest protection, conservation, and management. The specific recommendations from the core STEWARD team include:[140]

1. Focus work in Three STEWARD Priority Zones (PZs)
    a. PZ-1) The Outamba-°©-Kilimi National Park (Sierra Leone) and Madina-°©-Woula and Ouré-ˇ-Kaba areas (Republic of Guinea)
    b. PZ-2) Mount Nimba (Guinea and Ivory Coast) and Nimba Nature Reserve (Liberia)
    c. PZ-3) Grebo National Forest (Liberia)and Tai National Park (Cote D'Ivoire)
2. Develop Concrete Examples of Natural Resource Management Best Management Practices
    a. Agroforesty systems integrating trees within orchards (e.g. palm oil, citrus & mango) and gardens (e.g., bananas) and N^2 fixing species with staple crops (i.e. rice) for soil fertility and conservation
    b. Beekeeping with Kenyan top-bar hive
    c. Fire management outreach
    d. Co-management of Community forests
    e. Sustainable silviculture for timber and fuelwood
    f. WASH component added for Phase III
    g. GIS and cartography for community forests and landscape-level management
3. Harmonization of Policies and Laws Based on Priority Zone (PZ) Experience
    a. Seek input from communities and natural resource professionals on-the-ground
    b. Use natural resource management (NRM) experience as a template to guide policy
    c. Bring together experts to develop policy recommendations (e.g. results from the Saniquellie Conference on harmonization.[141])
    d. Bring together policy makers (e.g. Minsters of the Environment) from MRU countries to ratify recommendations and pass legislation
1. Information Exchange and Media Coverage at All Levels
    a. Participatory approach in PZs
    b. Village outreach including drama and film presentations
    c. Forums aimed at NRM professionals
    d. Publications, newsletter, and FrameWeb: http://www.frameweb.org/steward.htm
    e. Networking to promote sustainable natural resource training and practice at all levels

Future communications activities are expected to be aided by the addition of a new partner organization to help with media, the addition of webinars for online collaboration and communication, a

[140] Tucker & Massaquoi, 2011
[141] US Forest Service International Programs, 2011

reinvigorated print newsletter to reach local audiences and an email newsletter to reach the larger online public.[142]

4.7.3 STEWARD AND ICTS

STEWARD's focus on use of ICTs is oriented toward appropriate uses for the local context and the capacity of the current staff. Local STEWARD offices do not have consistent access to the Internet nor consistent cell phone coverage. When possible, project teams do use SMS messaging and Skype to augment communications for daily operations but fall back to USB drives for file transfer at times. While the project uses FRAMEWeb (described in the following section) for its online presence – many on the project cannot access the site reliably due to bandwidth constraints. Efforts to use Facebook for outreach have been stymied by similar access problems.

STEWARD WEB SITE - FRAMEWEB

FRAME's Natural Resource Management Communities, located at http://frameweb.org, is an online community set up to share resources, ask questions, and discuss topics relating to biodiversity and conservation. FRAMEWeb has capabilities for participants to upload News, Tools & Resources, Discussion, and Blogs, all of which are open to the public.

The STEWARD site is hosted as a sub-set of the FRAMEWeb site through an agreement with the Capitalizing Knowledge, Connecting Communities (CK2C) Program on their NewsGator platform and currently only employs the "Tools & Resources" and "Discussions" sections of FRAME. The "News" and "Blogs" sections do not contain any information and attempts to host video and capitalize on the CK2C GeoExplorer application have not been successful.[143] In the "Tools and Resources" section of FRAME, STEWARD has uploaded a number of documents to be shared, most of which show best practices and project reports for various programs in the area.

4.7.4 GENERAL OBSERVATIONS ON STEWARD COMMUNICATIONS AND ICT

The STEWARD program is transitioning between phases II and III and has invested in overall planning, including communications as described above. As with CARPE, the project's appropriate emphasis on field work in often hard to access local areas makes broad use of communications tools problematic without devoted resources. The plan to build a more robust print presence seems fitting given the local conditions and dependence on hard copy materials. The continued use of video is building on its successful use as a communications, education and advocacy tool.

The FRAMEWeb site is geared specifically for communities and collaboration. It is not clear if the difficulty in customizing the site for video and mapping applications is an artifact of the site itself or the time and access STEWARD staff have to work on solutions. The STEWARD team is not currently using social media such as Facebook, Twitter, blogs or wikis – all potentially important tools to engage a wider audience and build support for the project's work. One option for the project is to work with implementing partners – like the CK2C project and others – to more fully use social media. Given the field-focus of the project, these efforts should only be considered if the time and resources required are available to successfully support the project's core mission. The consistent labor to make social media valuable to the project and the intended audience can be considerable. Simply because the emerging online tools themselves are easily accessible (assuming adequate bandwidth) should not be confused with the effort to translate project work into appropriate material. The earlier observations on the CARPE project's internal and external communications options and use of ICTs pertain here as well. The range of opportunities to improve internal and external communications continues to grow and without a

[142] Massaquoi, 2012
[143] Tucker, 2012

dedicated focus through some sort of needs assessment the project may be challenged to move forward with new initiatives in these areas.

Another important area for the project to consider that could show more local impact is the use of mobile technology for data gathering, communications and outreach. The advances made in Health, microfinance and Agriculture offer examples of areas where the project could capitalize on the ICT sector's growth. Support to best practices including coordination of agroforestry and beekeeping, fire management, monitoring silviculture and GIS data gathering are all potential areas for future development. With the growth of interest in ICT4D mobile applications elsewhere – STEWARD may be able to use a challenge or competition-style event to generate pilot applications for testing in field settings with relatively little up-front investment. Any new investments in communications or ICTs, of course have to be weighed against the returns to the project's core mission.

4.8 CONCLUSIONS FROM THE CARPE AND STEWARD EXPERIENCE

For CARPE, the value of standard methods for project planning and management and the fit with adaptive management will continue to be considerable for the project. While couched in management terms, much of this work results in improved communications within the project and with stakeholders and warrants continued focus for that reason as well as the returns to improved management. Under the new phase of the project, there is a planned expansion of radio to build awareness and action around several themes. Given the success of pilot efforts and the use of video in the field, efforts to use a call-in radio format for issues like REDD, biodiversity conservation, bushmeat and trafficking will help extend the project's reach. The additional opportunity to capture the radio shows for later broadcast via the Internet as podcasts (for local distribution) would further extend the project's influence.

CARPE also plans to build on the success of its existing data resources with the addition of an improved satellite imagery reference section and further development of a basic carbon and REDD data area on the website.

For a large, established project such as CARPE, the challenge of refreshing the use of communications tools can be considerable. With the advent of broad access to communications materials, the project would benefit from using a wider range of platforms to drive audiences to their core resources on the CARPE website. The website itself would be more accessible and cost effective to manage over time with the switch to a more data-driven content management model.

One of the single biggest game changers for both CARPE and STEWARD will be the anticipated growth of solar power use in remote areas. This likely development, combined with the potential for stand-alone cell towers and wide area wireless access means the infrastructure for improved communications and information management is likely to be in place during this phase of the project. The broader economic drivers of fields such as commerce and health will complement the project's need for improved connectivity. Exploring options to partner with microfinance or mHealth efforts may provide the means to move into greater connectivity for the project and its beneficiaries.

STEWARD faces many of the same challenges that confront CARPE. With the growth of the project and increases in funding, the lessons from CARPE's use of adaptive management and standardized templates could be valuable to help streamline internal communications and management. Because STEWARD is less data-driven in its approach, the use of a more basic web presence makes sense for communications and information distribution. The low cost partnership with CK2C also has the benefit of exposure to related communities on the FRAMEWeb site. That said, where STEWARD needs more than the online community tools available through CK2C, exploring the greater use of social media and ICTs for internal and external communications could greatly benefit the project. With the planned

addition of a communications partner in the upcoming phase of the project there will be an opportunity to explore these options. The expectation to move into wider use of newspapers, radio and theater for local communications is a logical extension of the successful work carried out under the earlier phase of the project. Part of that exploration of ICTS or existing channels should be a consideration of the level of effort required by project staff outside the immediate communications unit to contribute. Historically this has been a significant issue for both internal and external communications. The benefits to new modes of communications should be relatively obvious and immediate for staff to engage.

5. SUMMARY OF FOCUS GROUP DISCUSSION ON THE USE OF ICTS IN CONSERVATION IN AFRICA

5.1 BACKGROUND

USAID Africa Bureau's Biodiversity Analysis and Technical Support (BATS) program provides analytical and technical assistance to USAID country Missions and other operating units on a range of activities. During planning sessions for the 2010 fiscal year, the four BATS partners – USAID/AFR, US Forest Service, Africa biodiversity Collaborative Group (ABCG), and International Resources Group (IRG) – agreed that the use of information and communications technologies (ICTs) within and among conservation organizations is an important emerging issue. On January 10, 2012, BATS hosted a focus group to discuss the current information-sharing challenges and opportunities facing conservation organizations in Africa. Representatives from several member organizations of ABCG participated to share their observations on the current state of affairs and to discuss future challenges and opportunities.

ABCG began in 1999 at the closure of the Biodiversity Support Program (BSP), as a response to growing threats to African biodiversity against the backdrop of shrinking financial resources and inadequate human capital on the ground. Representatives from the African Wildlife Foundation (AWF), Conservation International (CI), Jane Goodall Institute (JGI), The World Conservation Union (IUCN), Wildlife Conservation Society (WCS), World Resources Institute (WRI), and World Wildlife Fund (WWF) have been meeting regularly to review opportunities for collaboration in recognition of the fact that cooperation offered real potential for positive changes in conservation outcomes.

The focus group was conducted as a guided discussion following the broad agenda below to allow members to share their recent experiences from fieldwork. The guiding principle throughout the discussion was to view information sharing as two-way communications – a reciprocal exchange to not only inform decisions in the field but also educate implementers about realities and local cultures on the ground. In this context – ICTs serve as a means to an end and may take many forms to work effectively in a conservation context in Africa. The role of communications as a management tool within conservation groups was also highlighted for consideration. This BATS-sponsored study of technology and communications for conservation in Africa was also conducting an online survey and participants were encouraged to share their experiences through the survey as well.

5.2 AGENDA:

Introductions and ground rules

Current use of communications and ICTs

- Tools and methods
- Organizational/capacity issues
- Fit with larger project goals
- Scope, scale and ability to replicate

Lessons from other sectors

- Awareness of activities in health, agriculture, micro-enterprise etc.

- Opportunities to collaborate across sectors
- Approaches to adaptation

Challenges

- Technical
- Financial
- Staffing/skills/time
- Organizational/structural
- Cultural
- Local context

Opportunities

- Mobile
- Social media
- Face to face
- Media (radio, video, print)
- Organizational change/business models

5.3 FOCUS GROUP SUMMARY

The focus group began with introductions and directions to the group for the session and followed with the opening questions:

- What different forms of communication exist in Africa (e.g radio, dramas, newspaper, posters Internet.) and how are they used?
- How has the concept of "Mobile Money" been realized in various projects in various countries? Has it been effective?
- How are we using emerging tools and how can we better plan for soon-to-be emerging tools in communication?
- Do solutions like low-bandwidth versions of websites offer useful options?

From the discussions it was clear communications and ICT use went well beyond email and websites. Representatives of RARE http://rareconservation.org reviewed experiences with local radio call-in shows and video production for advocacy and education in the unwired world of the African forests. While initial up front costs for gear may appear to be expensive, the return of reaching remote areas and effecting change was felt to be a more than adequate return. RARE staff also described their mentor program and use of blogging and websites to build a knowledge base for conservation and engage audiences through intentional links to training curricula.

The example of Jolu Technical College in the Democratic Republic of the Congo with 50 students, intermittent electricity and a single grant-funded Internet connection pointed up the real challenges faced

by conservation efforts. The situation in areas of Equatorial Guinea was even direr for use of Internet resources with complete outages running more than two months at a time and a very closed situation for communications beyond the country. Both examples pointed up the disparities in access to even hard copy material but the importance to local conservation training and forest stewardship by local groups.

The group discussed the unique aspects of conservation and how future solutions to communications and ICTs might be able to help. Conservation efforts face fiscal and human capital shortages that are not entirely unique in contemporary development situations. Part of what confounds conservation work at times is the geographic location and scale of the efforts as well as the long time frames needed to balance local human needs with sustainable conservation. An additional challenge to conservation efforts is access to reliable power sources – for basic illumination as well as powering IT and communications hardware. Options for connectivity such as the Israeli from Gilat and their $250 per month VSAT offering were discussed as creative ways to connect.

Asked how central IT staff within organizations support field operations there was a range of responses. Some organizations rely on project-funded individual solutions and others tailor their support from a central office to specific local conditions. The African Wildlife Foundation customizes solutions to individual conditions on the ground and the USAID Last Mile Initiative used a separate firm for IT maintenance.

How well are conservation efforts staying ahead of technological change? The focus group itself was an important first step to catalyze increased focus on building capacity within the conservation community. The SERVIR project was felt to be part of the solution as well – providing a rich source of data for analysis and action as well as analytical tools. As part of building the network to interact with ABCG on follow-up, it was suggested a comprehensive list of communities of practice would help USAID become more proactive in developing new ICT approaches. Learning from other sectors such as disaster response, health and micro-enterprise were also referenced as important sources to learn from and adapt.

5.4 TAKEAWAYS AND NEXT STEPS

5.4.1 TAKEAWAYS

- Conservation as a discipline was said to be fundamentally different than other development practices. The scale of the efforts – often encompassing natural and man-made landscapes – and the scope sometimes spanning generations – makes for a different operating environment. Conservation is also about more than human development and the challenge of balancing people and natural environments is distinct to the discipline. While ICT tools and communications can be adapted to support those situations, they do not change the fundamental nature of conservation work.

- It is important in this fast-evolving ICT environment to identify how best to connect partners with appropriate ICT tools. How they fit conservation work and support the relationships between partner organizations is important for continued success.

- The focus on ICT and communications to support conservation has to also be considered against the backdrop of the emerging energy situation in Africa. Cheap solar panels and alternative energy sources have the potential to revolutionize working conditions in Africa. This should be considered when looking at near and medium-term investments in ICTs.

- It is vital to have a comprehensive understanding of the reality that each effort is facing on the ground. Improved ability to conduct effective needs assessments by USAID and implementing

partners and in a timely fashion is essential to match those needs with the appropriate technology.

- Marketing of results is important, as well as improving the use of cell and smart phones to help generate demand for conservation. In many areas of Africa there is not even the awareness of how much tourism and other industries could benefit from more effective and creative ICT usage. The idea of shared resources creates opportunities for immediate mutual gain and more fully integrates conservation into the larger economic opportunities in-country.

5.4.2 NEXT STEPS

- The focus group participants agreed that the brief time of the session was insufficient to develop capacity and concrete solutions. USAID suggested creating an email list and online community using the FRAMEWeb site to carry on the conversation. ABCG staff pointed out the need for broad engagement from partners and potentially assistance with moderating the group to ensure a fruitful discussion. Ideas to create engagement and build practical solutions included and innovation contest for apps for the environment

- An important part of making ideas generated in central Agency settings more real is the need to focus on effective communication in-country. Field-based activities can be an excellent source of ideas and initiatives to apply different methods and learn how to more effectively engage host country governments, multinational organizations and private firms.

- Getting the product mix right is important and should be an early focus of the new community's discussions. An emphasis on learning solutions for capacity building, management support for improved internal information management and communications, GIS applications to place work on the map and in a landscape context, and improved external knowledge sharing through innovative use of tools and methods were all felt to be important subjects for early investigation.

5.5 BIOGRAPHICAL SKETCHES

Ingrid Schultze – has worked with Jolu Technical College and with Bonobo Conservation Society in Equateur Province in Democratic Republic of the Congo. Jolu Technical College has very poor resources and Internet access: for the small local university of 50 students can accommodate only one user at a time Internet connection and that is thanks to a grant by the Internet Society. There is little access to books; Internet use is very expensive ($6/MB of data), and is not a really viable option for the college. Graduates are doing conservation and community development on the ground with very few resources.

William Wright - Gorongosa Park Restoration Project in Mozambique. Previously with the DotCom Alliance, he started a "Last Mile" program with a USAID grant reaching out to remote areas. The grant used Wi-Fi "on steroids" – CDMA (Code Division Multiple Access) that reached out to schools and other centers up to 50 miles away.

Anton Seimon works with WCS – specifically on Climate Change & Adaptation initiatives in relation to Biodiversity and Conservation.

Heidi Ruffler –with Conservation International is currently managing graduate students doing conservation work in Equatorial Guinea. Guinea is very closed; recently there was no Internet in her office for 2 months. The University has very little access to online journals, the Internet, books, etc. No awareness of plagiarism or other academic standards (e.g. students often lift information straight from Wikipedia). Communication will be her main focus for the next six months, as well as producing a documentary for television. She is also pushing for the government to invest in conservation. Equatorial

Guinea had the fastest-growing per capita GDP in Africa from 2001-2010. Radio and TV are government controlled; if positive messages are used, repeat coverage is more likely. She is primarily interested in the potential of various methods beside radio and TV to disseminate information.

Kate Mannle – RARE – working in Madagascar and West Indian Ocean. Interested in ICTs (1) from an organizational aspect, (2) as a tool for mentoring their in-country partners, and (3) for understanding how communities communicate and for more effectively encouraging communication with these communities. A lot of experience from communications campaigns in-country to share. Mentoring is part of an integrated online and in class training effort – use of online mentoring formally part of training.

Patrick Mehlman– RARE – key interests include remote learning and training, community linkages (via Skype, or other). When with Conservation International, he worked with a local university and saw community radio drive community conservation in the DRC. They established VSAT (Very Small Aperture Terminal) to enable social networking, lobby, fundraise, and communicate with other universities. RARE finished Solution Search (innovation tournament that was conducted online on the cusp of using ICT to encourage innovation from the communities. He would like to know about new ways to involve new groups on the fringe of USAID's reach in ICT innovation and use. How do we bring them in and use in a local context? The International Conservation and Education Fund (INCEF) in DRC is another interesting model of sustainable use of video for communications and advocacy.

Amy Gambrill – works with faith leaders to further conservation goals. She has recognized that so many have such influence and power within their communities but are reluctant to use that influence beyond the reach of their congregations. She is also working on World Bank Water effort to develop ICT solutions (hack-a-thon hosted in October 2011) – intending to harness what's already there to improve project effectiveness and wider use of ICT.

Jimmiel Mandima – AWF – Aquatic Ecologist. two decades in Zambezi; formerly at University of Zimbabwe; working on transboundary regional issues. He is interested in the "digital divide" in conservation. He is interested in understanding how others are addressing the disparity of levels of development within different countries and regions when implementing ICT tools. His projects are trying to improve cell phone and Internet access and have set up VSATs, these are marginally effective. VSAT has helped to link field teams to regional and US offices. AWF works through partners to fund the VSAT access and is not using a fee-for-service model.

Since much of the work is in marginal but attractive tourist destinations – what are the options to link this to the private sector? What are the opportunities to create symbiotic relationships between ICT growth and private sector?

Jimmiel is currently using:

- GPS-based spatial analysis on a limited basis.
- Boxnet for file transfer http://www.box.com.
- GIS teams in Nairobi and satellite sites to collect data.
- An ICT team for systems support.
- A marketing and communications team handles social media for public outreach

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ANNEX I

SUMMARY OF THE ONLINE SURVEY – TECHNOLOGY AND CONSERVATION IN AFRICA

As part of the series of activities supporting research into information and communications technology use in Africa requested by USAID Africa Bureau's Biodiversity Analysis and Technical Support project an online survey was conducted during December and January 2012. The survey used a series of questions on IT technologies, access and use of social media to provide context for the other more specific studies and to help define the current landscape for the issue in the conservation community. The survey was distributed to members of the global conservation community with participation from the U.S as well as eight countries in Africa and Australia. The complete survey, including open-ended questions – is included in Annex 2. Selected charts illustrating the main questions from the survey are included below.

The survey's respondents are well educated overall with greater than 87% of respondents reporting an education level at or above the Masters level. The majority of respondents reported working either for NGOs (35.9%) or donor governments (25.6%). 53.8% reported working in management and 30.8% were subject matter experts. All had some affiliation with conservation networks as well.

Not surprisingly, the most extensively used technologies were computers, email and websites. Flash drives and email lists were also highly ranked with mobile phones and digital cameras just below. For social media, the most often-used technology is Voice Over IP (e.g. Skype) and professional networking sites (e.g. LinkedIn, etc.). Wikis, photo sharing and social networking sites (e.g. Facebook, etc.) are also highly ranked.

While 79.5% of respondents reported that their organizations use social media, the majority reported using the tools themselves for communications comparatively less with just more than half reporting having used social media for more than three years. Considerably more (63.4%) reported that they had the expertise to use social media. 70% reported that social media is moderately or extremely important for external information sharing and 87.8% felt social media would be moderately to extremely important in the next two years.

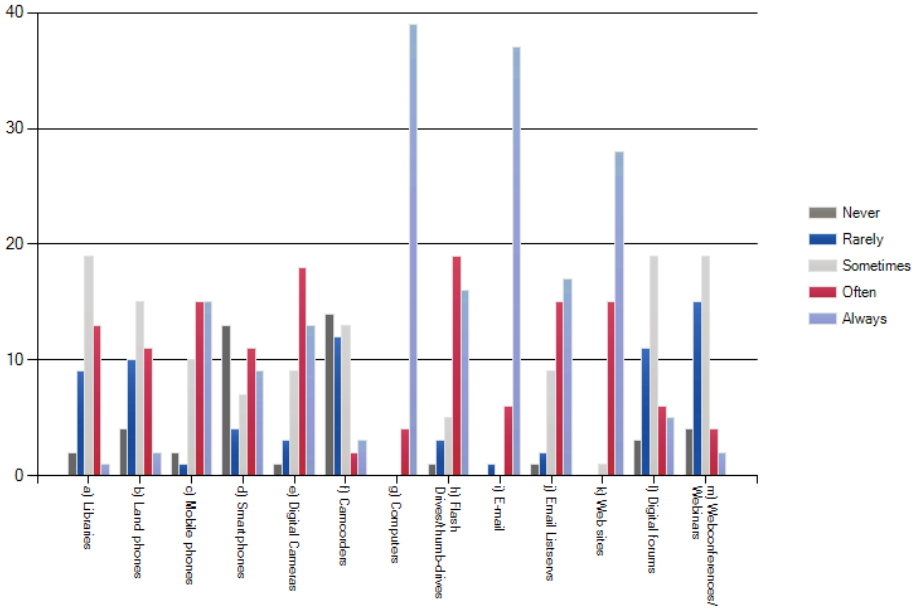
The greatest challenges to the use of social media are felt to be employee's lack of expertise, management's delay in researching and approving use of the tools and doubts about social media's effectiveness for work objectives.

A consistent thread throughout the survey is basic access. Many conservation field activities take place at the edge of connectivity or beyond and these tools are simply not available for use absent an Internet or wireless mobile connection. The prevalent use of thumb drives and cameras may point to the potential to expand a mix of online and offline approaches to bridge the connectivity and content divide between field and home office. It would appear there is building interest and demand for improved use of communications technology within organizations and for public dissemination. Given the high response rate from managers and subject matter experts presumably in positions of some influence within their organizations, one potential response to capitalize on the survey and the overall interest could be a series of needs assessments. These could be part of internal exercises or a shared exploration as a community could help to inform policy-level decisions with valid technical input from the ICT and communications practices.

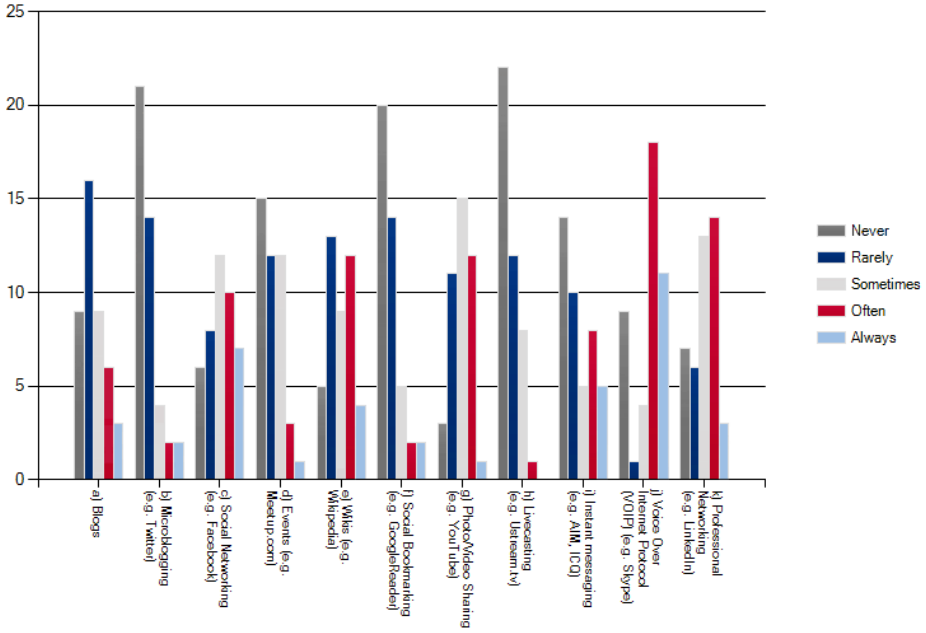
A series of graphic representations of the data capture the full report follow. The complete survey is included in Annex 2.

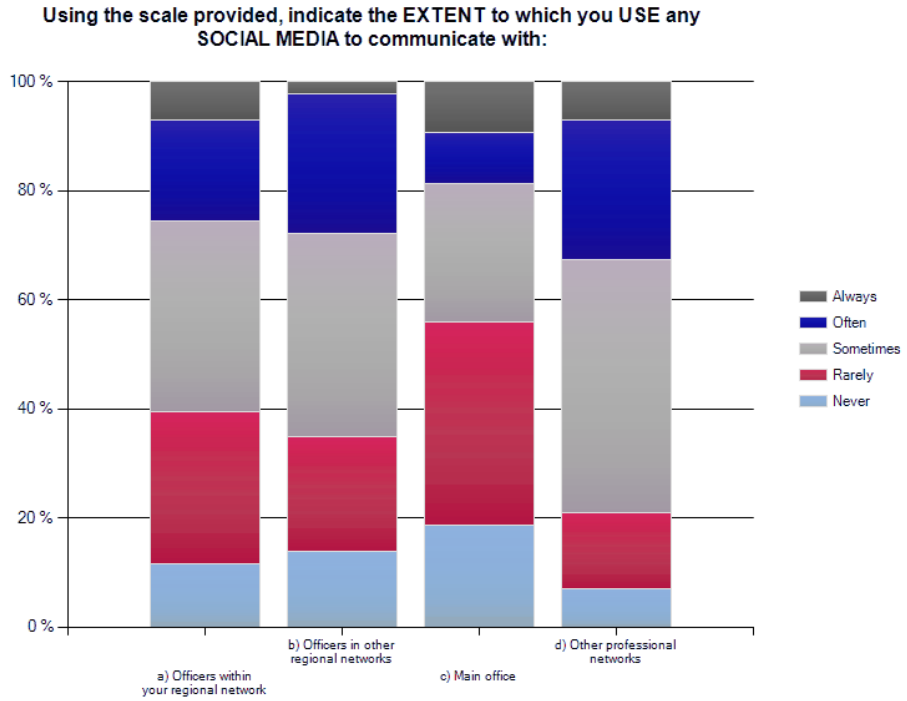
SELECTED GRAPHS ILLUSTRATING THE ONLINE SURVEY - TECHNOLOGY AND CONSERVATION IN AFRICA

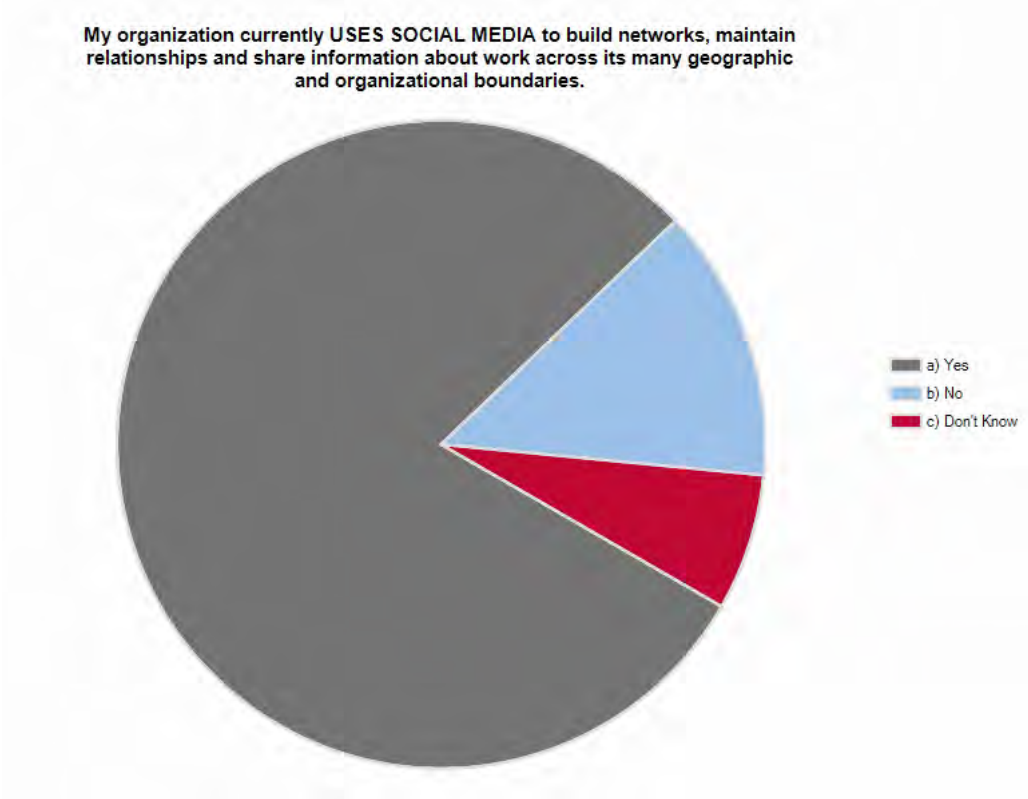
Please indicate the EXTENT to which you USE the following INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) (a range of electronic technologies) for your environmental conservation work.

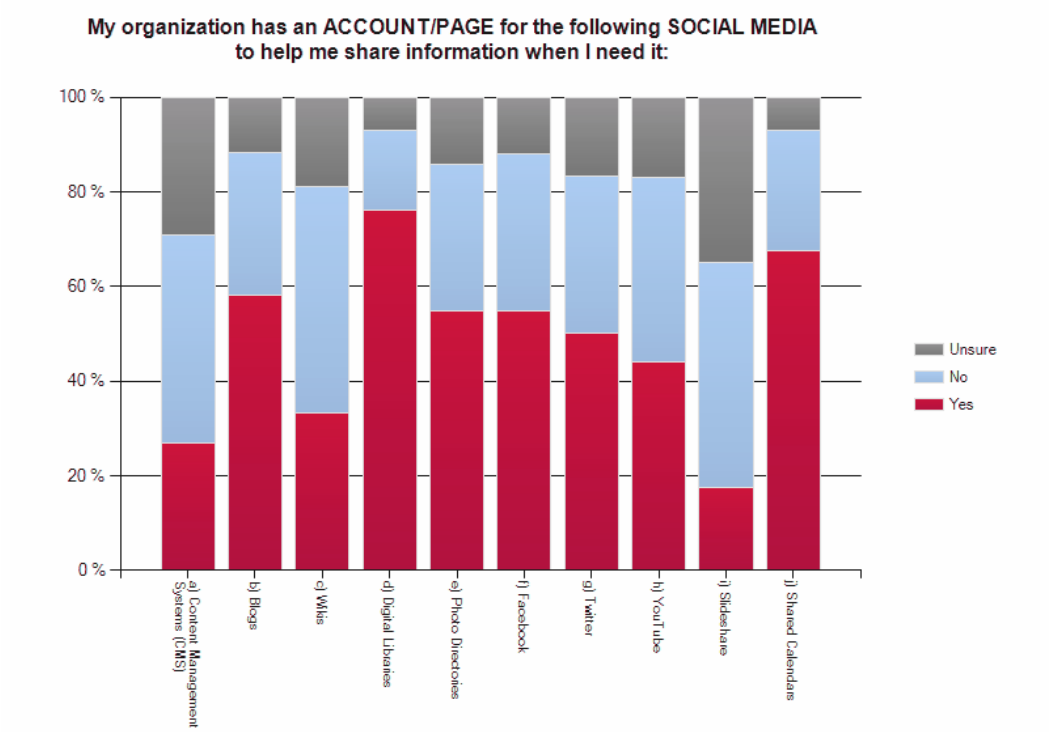


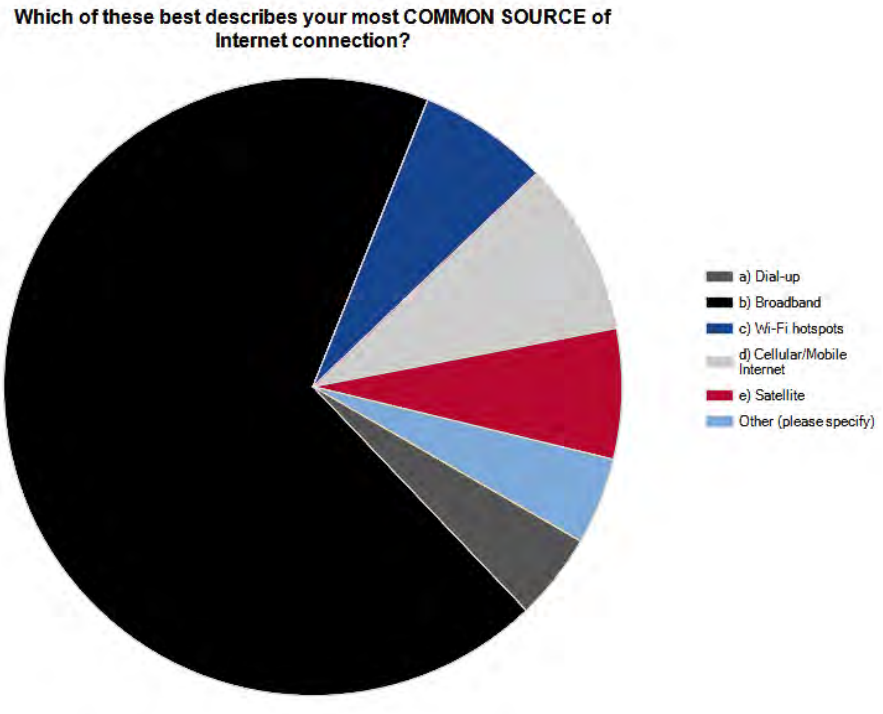
Please indicate the EXTENT to which you USE the following SOCIAL MEDIA tools for your work.

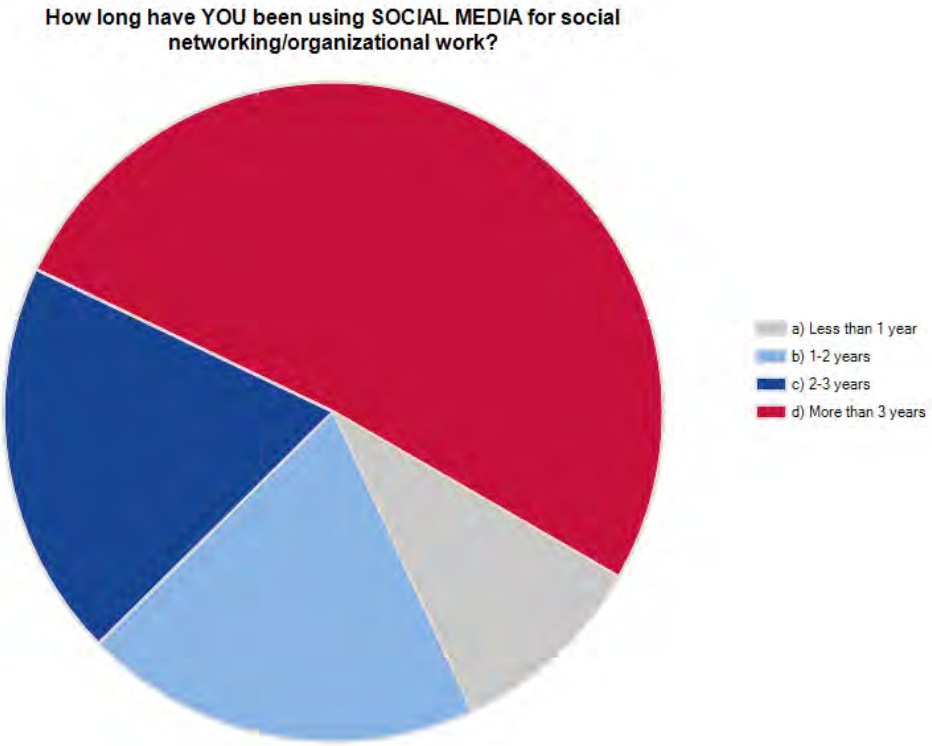


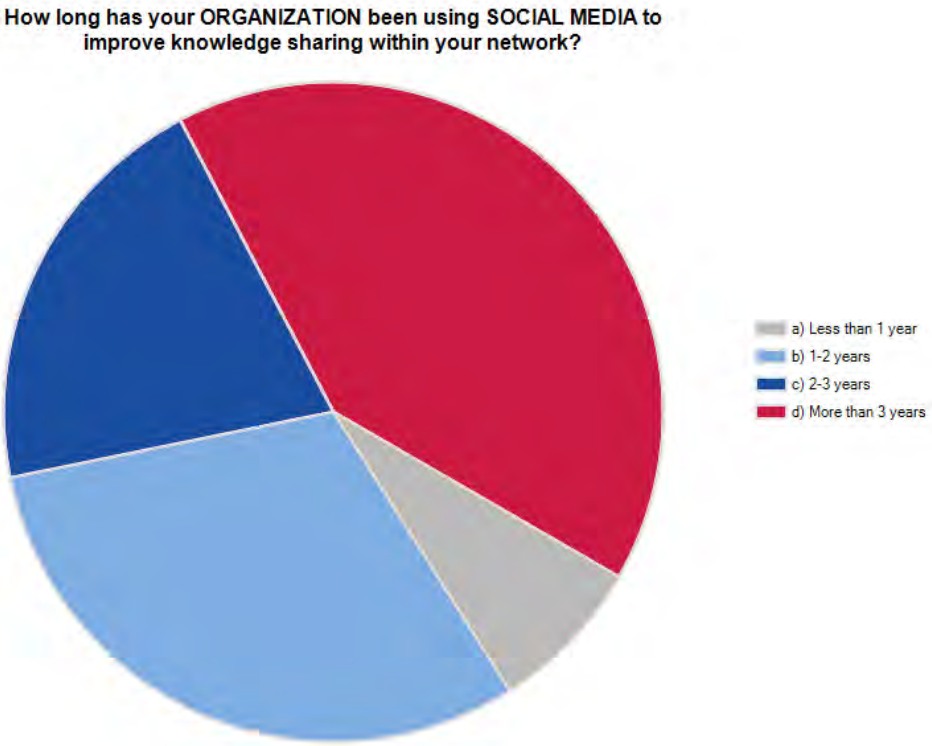

Using the scale provided, indicate the EXTENT to which you USE any SOCIAL MEDIA to communicate with:
100 %
80 %
60 %
40 %
20 %
0 %
a) Officers within your regional network
b) Officers in other regional networks
c) Main office
d) Other professional networks
Always
Often
Sometimes
Rarely
Never


My organization currently USES SOCIAL MEDIA to build networks, maintain relationships and share information about work across its many geographic and organizational boundaries.
a) Yes
b) No
c) Don't Know

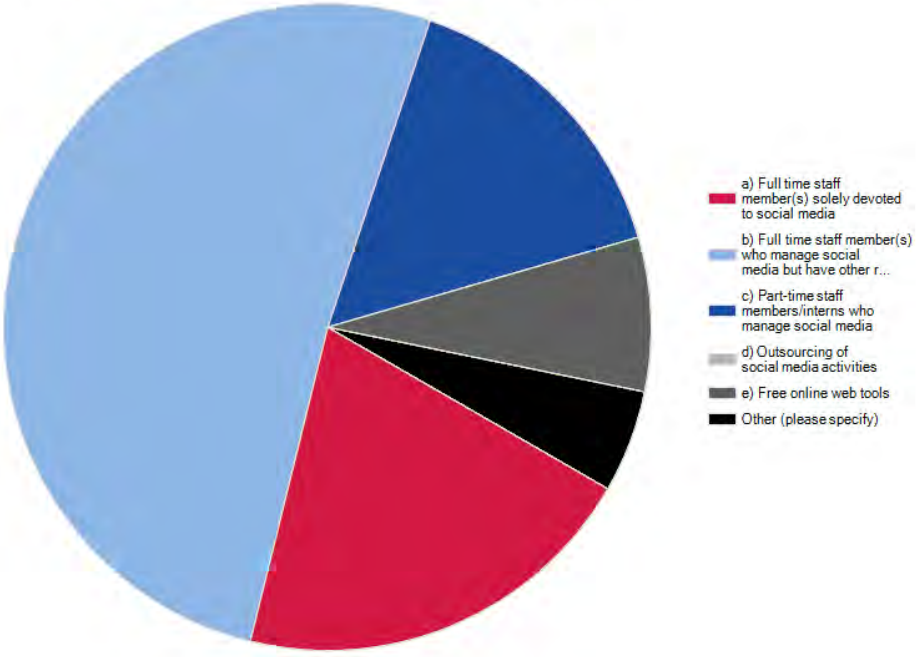

My organization has an ACCOUNT/PAGE for the following SOCIAL MEDIA to help me share information when I need it:
100 %
80 %
60 %
40 %
20 %
0 %
a) Content Management Systems (CMS)
b) Blogs
c) Wikis
d) Digital Libraries
e) Photo Directories
f) Facebook
g) Twitter
h) YouTube
i) Slideshare
j) Shared Calendars
Unsure
No
Yes


Which of these best describes your most COMMON SOURCE of Internet connection?
a) Dial-up
b) Broadband
c) Wi-Fi hotspots
d) Cellular/Mobile Internet
e) Satellite
Other (please specify)

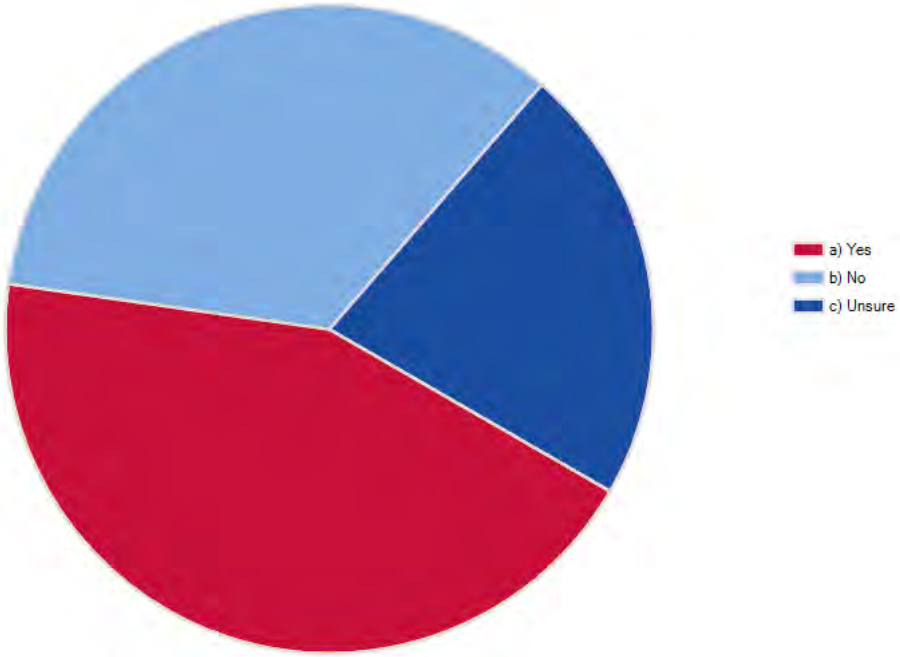

How long have YOU been using SOCIAL MEDIA for social networking/organizational work?
a) Less than 1 year
b) 1-2 years
c) 2-3 years
d) More than 3 years

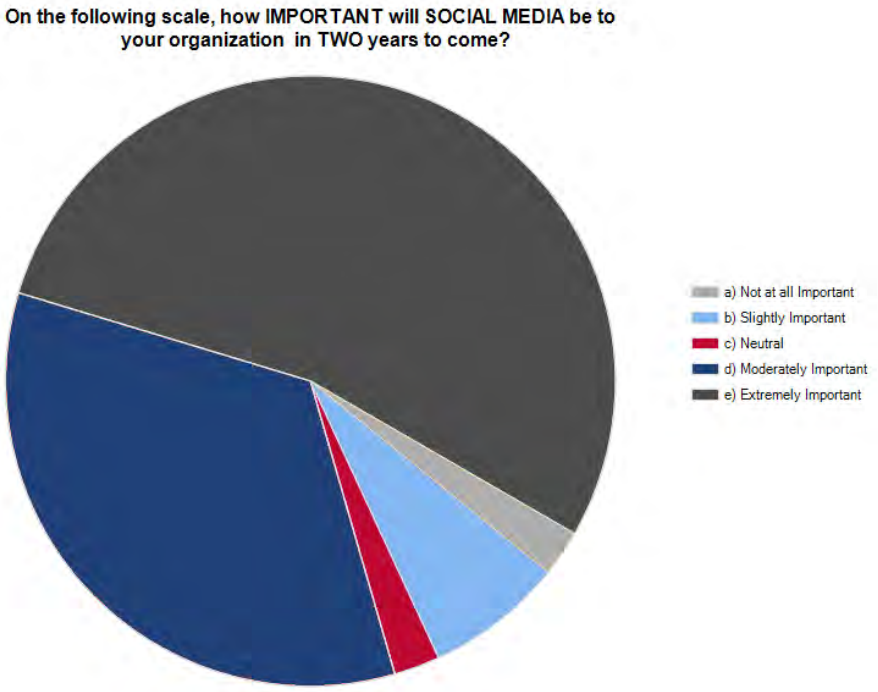

How long has your ORGANIZATION been using SOCIAL MEDIA to improve knowledge sharing within your network?
a) Less than 1 year
b) 1-2 years
c) 2-3 years
d) More than 3 years

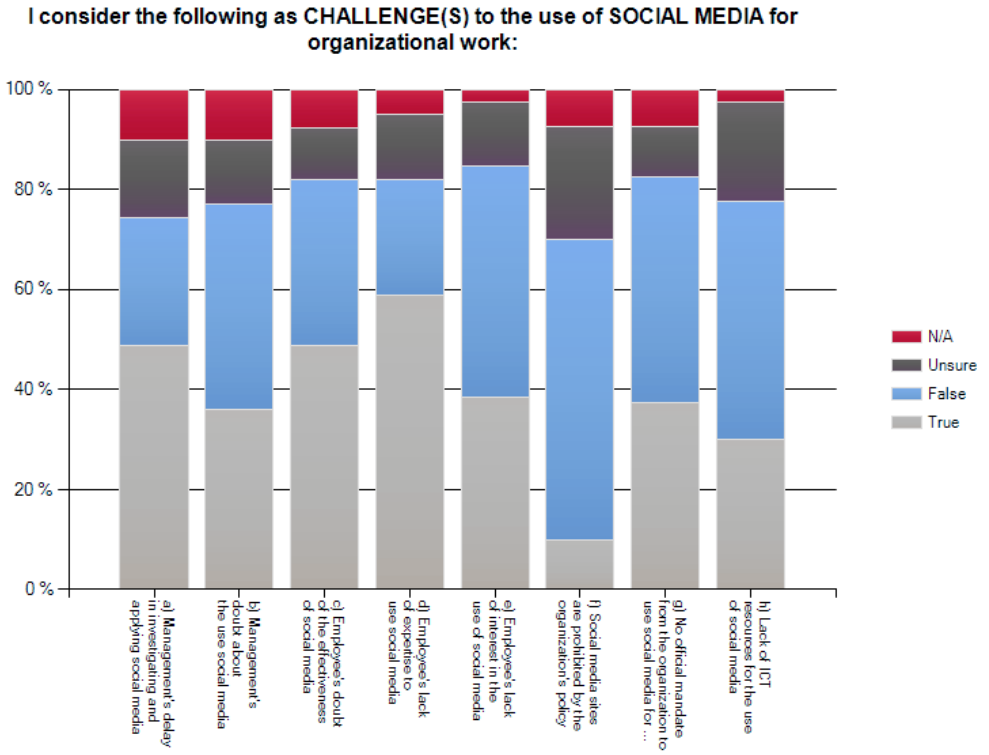
My organization MANAGES SOCIAL MEDIA activities through:



In general, I believe my organization has all the necessary ICTs and SOCIAL MEDIA resources for collecting, collating, analyzing and sharing information for my work.



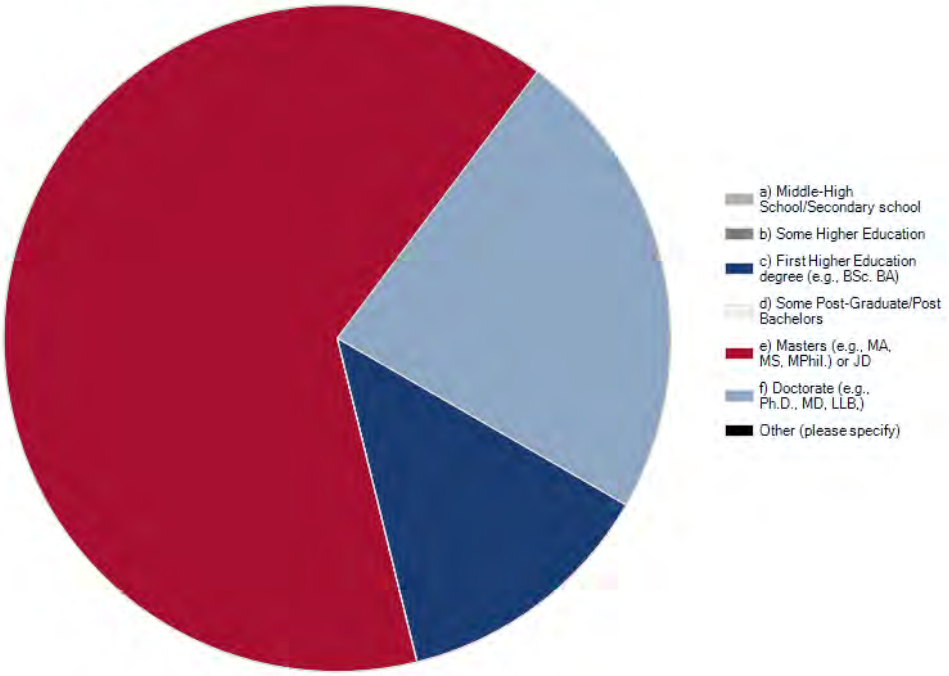

On the following scale, how IMPORTANT will SOCIAL MEDIA be to your organization in TWO years to come?
a) Not at all Important
b) Slightly Important
c) Neutral
d) Moderately Important
e) Extremely Important


I consider the following as CHALLENGE(S) to the use of SOCIAL MEDIA for organizational work:
100 %
80 %
60 %
40 %
20 %
0 %
N/A
Unsure
False
True
a) Management's delay in investigating and applying social media
b) Management's doubt about the use social media
c) Employee's doubt of the effectiveness of social media
d) Employee's lack of expertise to use social media
e) Employee's lack of interest in the use of social media
f) Social media sites are prohibited by the organization's policy
g) No official mandate from the organization to use social media for ...
h) Lack of ICT resources for the use of social media

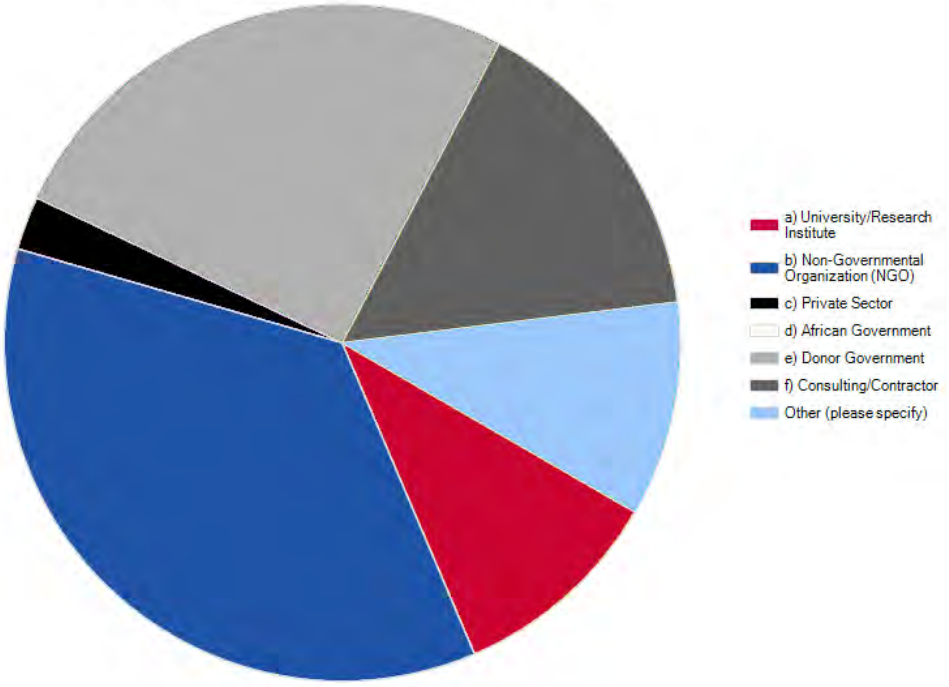
Which of these environmental conservation themes have you worked on in the past months (select as many as apply)?

Environmental conservation themes	Percentage of respondents
Capacity Building for Conservation	86.5%
Global Climate Change, Biodiversity Impacts and Conservation in Africa	81.1%
Community-Based Natural Resources Management (CBNRM)	75.7%
Collaboration for Conservation	73.0%
Transboundary Natural Resource Management	70.3%
The Future of Biodiversity in Africa	62.2%
Conservation and Conflict	59.5%
Bushmeat Crisis	54.1%
Communications for Conservation	54.1%
Food Security and Wildlife Conservation in Africa	48.6%
Training for Africa Protected Area and Wildlife Personnel	48.6%
Future Trends and Interventions for Biodiversity Conservation in Africa	43.2%
All Other Responses (See Annex 2 for a list)	25.5%

What is your highest level of education completed?



What type of organization do you primarily work with?



QUESTION 32. SAMPLE OF PARTICIPATING ORGANIZATIONS

African Wildlife Foundation
Conservation International - Africa and Madagascar Field Division
USAID/ East Africa
Rural Access to New Opportunities for a better water, hygiene and sanitation access and better natural resources management
Jane Goodall Institute
Action for Cheetahs in Kenya
BirdLife International
Wildlife Conservation Society
Solar Household Energy
School of Public Policy
Conservation International
Virginia Tech
International Resources Group
Rare
US Agency for International Development
WILD Foundation
World Wildlife Fund
Semaphore Inc.
Smithsonian Institution
Art of Conservation
USAID/ Central Africa Regional Program for the Environment (CARPE)
USAID/Natural Resource Management
International Union for the Conservation of Nature, Regional Forest Programme
USAID Bureau for Africa, Office of Sustainable Development
Ecole Pour La Formation Des Specialistes De La Faune

ANNEX 2: ONLINE SURVEY INSTRUMENT

INVITATION TO TAKE ENCAP'S ICTs FOR NRM SURVEY

Dear Survey Participant,

The USAID Africa Bureau's Biodiversity Analysis and Technical Support (BATS) Program has identified the use of Information and Communication Technologies (ICTs) and social media within and among conservation organizations in Africa as important to improved conservation practices and effectiveness. BATS recognizes that better understanding the current and potential uses of ICTs for knowledge sharing and collaboration could directly contribute to improved impact of conservation activities.

As a result, a four-member team from the International Resources Group (IRG) working through the Environmentally Sound Design and Management Capacity Building Support for Africa (ENCAP) program, is tasked with researching the role of ICT's in knowledge sharing and application for African conservation. As part of a larger set of studies - we have assembled this online survey to allow for easy participation by stakeholders and practitioners to support our analysis and help inform USAID on future options to include ICTs in conservation programing.

We invite your participation in this brief survey to help us better understand the role of ICTs and social media in knowledge sharing, collaboration and improved conservation practices.

The survey should take between 20-30 minutes. If you have any questions about the survey or anything else related to information sharing within BATS, please do not hesitate to contact us.

Thank you for your time.

Kindest regards,

Benjamin K Addom
Social Media for Environmental Advocacy in Africa
Analyst/Consultant
International Resources Group (IRG)
Email: bkaddom@gmail.com; Skype: tordeben

Peter Hobby
Senior Manager
International Resources Group (IRG)
1211 Connecticut Avenue, NW Suite 700
Washington, DC 20036
P: 202-465-3418 / F: 202-289-7601
Email: phobby@irgltd.com; Skype: prhobby

Please click "Next" to indicate your consent and then begin the survey.

INFORMED CONSENT

Should you choose to participate in this survey, your participation will remain completely voluntary. You may withdraw from the survey at any time. If any question makes you feel uncomfortable, you may skip that question. Further, all of the information collected during this study will be kept strictly confidential. Only the 4-member team may have access to the individually collected data, which will be made anonymous before any analysis is started. We will not mention any participant by name in our report, unless requested and/or approved in advance.

***1. If you agree to participate in this survey, please indicate so below, and then begin with the questions on the next page.**

- a) Yes
- b) No

SECTION I: BACKGROUND TO INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) ...

In this first section, we are interested in both your professional and personal use of the new and emerging technologies, systems and applications (ICTs and SOCIAL MEDIA) for environmental conservation work.

INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) are a range of electronic technologies capable of transforming organizations through handling of information, and facilitating different forms of communication among human actors, between human beings and electronic systems, and among electronic systems. ICTs include tools such as telephone, electronic mail (email), Internet, fax, World Wide Web, fiber optics, and satellites.

SOCIAL MEDIA (SM) embodies the emerging online relational tools, methodologies, and applications that allow groups of people to interact with one another by exchanging content, opinions and insight. Underlying this is the desire to build social and professional networks, maintain these networks and use them to share resources.

I) PIPES: ICT pipes include the overall telecommunications environment, the state of infrastructure, equipment, products/services such as Internet service provision, mobile/cellular telephone provision, information technology equipment and services, media and broadcasting, libraries and documentation centers, commercial information providers, network-based information services, and other related information and communication activities.

II) PEOPLE: ICTs and Social media are knowledge-based tools which requires that users be continuously updated with new and emerging features, tools and applications to keep pace with progress in technologies along with increasing complexity. Organizations, therefore, have the task of developing the ICTs human resource base and build ICTs human capacities of their staff and new recruits through training and other incentives to be able to use the technologies for their work.

III) POLICIES: Sound ICT policies for the use of the new media is key for environmental conservation work. The absence of incentives for the use of social media within organizations could limit knowledge exchange and environmental conservation work. Lack of control over social media could lead to over-exposure, abuse, loss of privacy, and unsocial behavior.

Questions for this section are in three parts dealing with ICT pipes, policies and people. Your response to these sets of questions will greatly enhance our efforts to understand the status of your organization with respect to the ICTs and SOCIAL MEDIA.

A: ICTs/SOCIAL MEDIA PIPES

2. Please indicate the EXTENT to which you USE the following INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) (a range of electronic technologies) for your environmental conservation work.

	Never	Rarely	Sometimes	Often	Always
a) Libraries	○	○	○	○	○
b) Land phones	○	○	○	○	○
c) Mobile phones	○	○	○	○	○
d) Smartphones	○	○	○	○	○
e) Digital Cameras	○	○	○	○	○
f) Camcorders	○	○	○	○	○
g) Computers	○	○	○	○	○
h) Flash Drives/thumb-drives	○	○	○	○	○
i) E-mail	○	○	○	○	○
j) Email Listservs	○	○	○	○	○
k) Web sites	○	○	○	○	○
l) Digital forums	○	○	○	○	○
m) Webconferences/ Webinars	○	○	○	○	○

Other (please specify)

3. Please indicate the EXTENT to which you USE the following INFORMATION SYSTEMS and APPLICATIONS for your work.

	Never	Rarely	Sometimes	Often	Always
a) Geographical Information Systems (GIS)	○	○	○	○	○
b) Decision Support Systems	○	○	○	○	○
c) Environmental Monitoring Systems	○	○	○	○	○
d) Management Information System (MIS)	○	○	○	○	○
e) Environmental Databases	○	○	○	○	○
f) Community Information Centers	○	○	○	○	○
g) Mobile Environmental Management Systems	○	○	○	○	○

Other (please specify)

4. Please indicate the EXTENT to which you USE the following SOCIAL MEDIA tools for your work.

	Never	Rarely	Sometimes	Often	Always
a) Blogs	○	○	○	○	○
b) Microblogging (e.g. Twitter)	○	○	○	○	○
c) Social Networking (e.g. Facebook)	○	○	○	○	○
d) Events (e.g. Meetup.com)	○	○	○	○	○
e) Wikis (e.g. Wikipedia)	○	○	○	○	○
f) Social Bookmarking (e.g. GoogleReader)	○	○	○	○	○
g) Social News (e.g. Digg)	○	○	○	○	○
h) Photo Sharing (e.g. Flickr)	○	○	○	○	○
i) Video Sharing (e.g. YouTube)	○	○	○	○	○
j) Livecasting (e.g. Ustream.tv)	○	○	○	○	○
k) Crowd Sourcing (e.g. ushahidi)	○	○	○	○	○
l) Instant messaging (e.g. AIM, ICQ)	○	○	○	○	○
m) Voice Over Internet Protocol (VOIP) (e.g. Skype)	○	○	○	○	○
n) Professional Networking (e.g. LinkedIn)	○	○	○	○	○

Other (please specify)

5. Using the scale provided, indicate the EXTENT to which you USE any SOCIAL MEDIA to communicate with:

	Never	Rarely	Sometimes	Often	Always
a) Officers within your regional network	○	○	○	○	○
b) Officers in other regional networks	○	○	○	○	○
c) Main office	○	○	○	○	○
d) Professionals within your discipline	○	○	○	○	○
e) Other professional networks	○	○	○	○	○

6. My organization currently USES INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) to collect, collate, and analyze information about work across its many geographic and organizational boundaries.

- a) Yes
- b) No
- c) Don't Know

7. My organization currently USES SOCIAL MEDIA to build networks, maintain relationships and share information about work across its many geographic and organizational boundaries.

- a) Yes
- b) No
- c) Don't Know

8. My organization has an ACCOUNT/PAGE for the following SOCIAL MEDIA to help me share information when I need it:

	Yes	No	Unsure
a) Content Management Systems (CMS)			
b) Blogs			
c) Wikis			
d) Digital Libraries			
e) Photo Directories			
f) Facebook			
g) Twitter			
h) YouTube			
i) Slideshare			
j) Shared Calendars			

Other (please specify)

9. Which of these best describes your most COMMON SOURCE of Internet connection?

- a) Dial-up
- b) Broadband
- c) Wi-Fi hotspots
- d) Cellular/Mobile Internet
- e) Satellite
- Other (please specify)

10. The QUALITY of your Internet connection determines the speed at which you can download content from the Internet and use other applications. In general, how SATISFIED are you with the speed of the Internet in your organization with the use of social media?

- a) Very Dissatisfied
- b) Dissatisfied
- c) Unsure
- d) Satisfied
- e) Very Satisfied

11. Sometimes there are problems with electricity and phone lines which can affect your use of computers or social media. According to your own experience, how OFTEN do these kinds of problems affect your ability to use social media at your organization?

- a) Never
- b) Rarely
- c) Sometimes
- d) Often
- e) Always

B: ICTs/SOCIAL MEDIA HUMAN RESOURCE DEVELOPMENT

12. How would you describe your level of SKILL with ICTs/SOCIAL MEDIA?

- a) Very Poor
- b) Poor
- c) Good
- d) Very Good
- e) Excellent

13. How long have YOU been using SOCIAL MEDIA for social networking/organizational work?

- a) Less than 1 year
- b) 1-2 years
- c) 2-3 years
- d) More than 3 years

14. How long has your ORGANIZATION been using SOCIAL MEDIA to improve knowledge sharing within your network?

- a) Less than 1 year
- b) 1-2 years
- c) 2-3 years
- d) More than 3 years

15. My organization MANAGES SOCIAL MEDIA activities through:

- a) Full time staff member(s) solely devoted to social media
- b) Full time staff member(s) who manage social media but have other responsibilities as well
- c) Part-time staff members/interns who manage social media
- d) Outsourcing of social media activities
- e) Free online web tools
- Other (please specify) _____

16. In general, I believe I have the necessary EXPERTISE to use SOCIAL MEDIA for my work.

- a) Yes
- b) No
- c) Unsure

17. In general, I believe my organization has all the necessary ICTs and SOCIAL MEDIA resources for collecting, collating, analyzing and sharing information for my work.

- a) Yes
- b) No
- c) Unsure

C: SOCIAL MEDIA POLICIES

18. My organization has an official GUIDELINES/POLICY for the use of SOCIAL MEDIA by the employees.

- a) Yes
- b) No
- c) Don't Know

19. My organization ENCOURAGES the use of SOCIAL MEDIA by employees for their work.

- a) Yes
- b) No
- c) Don't Know

20. My organization provides INCENTIVES to employees for the use of SOCIAL MEDIA.

- a) Yes
- b) No
- c) Don't Know

21. On the following scale, how IMPORTANT is SOCIAL MEDIA to you in sharing information with colleagues WITHIN your organization?

- a) Not at all Important
- b) Slightly Important
- c) Neutral
- d) Moderately Important
- e) Extremely Important

22. On the following scale, how IMPORTANT is SOCIAL MEDIA to you in sharing information with other environmental conservation colleagues OUTSIDE your organization?

- a) Not at all Important
- b) Slightly Important
- c) Neutral
- d) Moderately Important
- e) Extremely Important

23. On the following scale, how IMPORTANT will SOCIAL MEDIA be to your organizational in TWO years to come?

- a) Not at all Important
- b) Slightly Important
- c) Neutral
- d) Moderately Important
- e) Extremely Important

24. I consider the following as CHALLENGE(S) to the use of SOCIAL MEDIA for organizational work:

	True	False	Unsure	N/A
a) Management's delay in investigating and applying social media				
b) Management's doubt about the use social media				
c) Employee's doubt of the effectiveness of social media				
d) Employee's lack of expertise to use social media				
e) Employee's lack of interest in the use of social media				
f) Social media sites are prohibited by the organization's policy				
g) No official mandate from the organization to use social media for work related activities				
h) Lack of ICT resources for the use of social media				

Other (please specify)

CONTENT QUESTIONS

25. Which of these environmental conservation THEMES have you worked on in the past months (select as many as apply).

- ☐ The Future of Biodiversity in Africa
- ☐ Bushmeat Crisis
- ☐ Capacity Building for Conservation
- ☐ Collaboration for Conservation
- ☐ Transboundary Natural Resource Management
- ☐ Communications for Conservation
- ☐ Community-Based Natural Resource Management (CBNRM)
- ☐ Compensation for Land Lost for Protected Areas
- ☐ Conservation and Conflict
- ☐ Conservation and Corruption
- ☐ Emerging Infectious Diseases in Africa and Conservation
- ☐ Environmental Impacts of Avian Influenza in Africa
- ☐ Faith and Conservation in Africa
- ☐ Financing Conservation in Africa
- ☐ Food Security and Wildlife Conservation in Africa
- ☐ Global Climate Change, Biodiversity Impacts and Conservation in Africa
- ☐ HIV/AIDS and Natural Resource Management Linkages
- ☐ Human Migration and Conservation
- ☐ Land Use Management Tools for Conservation in East Africa
- ☐ Future Trends and Interventions for Biodiversity Conservation in Africa
- ☐ Marine Tourism
- ☐ Opportunities and Threats in the Congo Basin
- ☐ Parks and People
- ☐ Parks and Poverty
- ☐ Payments for Environmental Services (PES) and Poverty Reduction
- ☐ Poverty and Conservation
- ☐ Private Sector Partnerships and Conservation
- ☐ Protected Area Downgrading, Downsizing, and Degazettement
- ☐ Rapid Environmental Impact Assessment in Disasters
- ☐ Sustainable Financing and Business Planning for Protected Areas

- [ ] Training for African Protected Area and Wildlife Personnel
- [ ] Wildlife Management Issues and User Rights in Africa
- [ ] Other (please specify)

26. What are some of the challenges that you face while sharing conservation information/knowledge with colleagues?

27. We would like you to share with us any other ICT or Social Media that you currently use for your work that has not been mentioned. Please be specific and if possible point us to where we can get more information on this tool.

28. We would also like you to share with us any other ICT or Social Media that you wish you have access to in the future for your work that you do not currently have. Please be specific and if possible point us to where we can get more information on this tool.

SECTION II: DEMOGRAPHY

In this second section, we ask some demographic questions about you and your organization that will help us understand your use of ICTs (a range of electronic technologies) and SOCIAL MEDIA (the emerging online relational tools, methodologies, and applications).

29. In the following range, what is your age?

- a) 18-21 years
- b) 21-30 years
- c) 31-40 years
- d) 41-50 years
- e) 51-60 years
- f) 60+

30. What is your gender?

- a) Female
- b) Male

31. What is your highest level of education completed?

- a) Middle-High School/Secondary school
- b) Some Higher Education
- c) First Higher Education degree (e.g., BSc. BA)
- d) Some Post-Graduate/Post Bachelors
- e) Masters (e.g., MA, MS, MPhil.) or JD
- f) Doctorate (e.g., Ph.D., MD, LLB.)
- Other (please specify)

_____

32. In which country and city/town are you located (please spell the name out in full)?

a) Country

b) City/Town

33. What type of organization do you primarily work with?

- a) University/Research Institute
- b) Non-Governmental Organization (NGO)
- c) Private Sector
- d) African Government
- e) US Government
- f) Consulting/Contractor
- Other (please specify)

34. What is your working experience with this organization?

- a) Less than 6 months
- b) 7 months - 2 years
- c) 2 - 5 years
- d) More than 5 years

35. What is the name of your organization/department (please spell the name out in full)?

36. Which of the following best describes your current working position with this organization?

- a) Administrative Staff
- b) Information Technology (IT) Technical Staff
- c) Subject Matter Specialist (SMS) Technical Staff
- d) Middle Manager
- e) Senior Manager
- Other (please specify)

37. What is the sector focus of your organization?

38. List at most FIVE environmental conservation networks that you belong to.

a)

b)

c)

d)

e)

CONCLUSION

39. Finally, if you have any comment, contribution or question that has not been addressed already please feel free to mention it here.

THANK YOU FOR YOUR PARTICIPATION

Please contact us if you have any questions.

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