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DIRECTOR'S MESSAGE

In 2015, we commenced the implementation of our new four-year strategic plan for 2015-2018, which aims to:

- Empower researchers at African Universities and other research Institutions to undertake research and dissemination to inform policies on the sustainable, efficient and equitable management of natural resources in Africa;
- Support member states and other UN agencies in generating knowledge on emerging natural resources management issues;
- Strengthen UNU-INRA's Organisational Structure.



In 2015, we pursued a number of on-going projects and initiated two new ones. The first is on “*Expanding Private-Public Partnership in Agriculture and the Environment*”, supported by the International Development Research Centre (IDRC), Canada. It is implemented in six Sub-Saharan African countries, namely Burundi, Cameroon, Ghana, Mozambique, Senegal and South Africa. The second project, funded by Embrapa, Brazil is on “*Integrating food and feed crops to improve livelihoods and resilience to climate change*”, in the Upper East Region of Ghana.

Under our visiting scholars and PhD internship programmes, we hosted a good number of fellows at our Accra office and at the operating units. We also initiated a home-based scholarship programme with 25 researchers, who are conducting a wide range of research on natural resources management issues in different African countries, to help inform policies.

A substantial number of activities were undertaken under our capacity development programme. We organized training programmes, seminars, workshops and fora to help improve capacities for the efficient management of Africa's rich resources. Some of these activities include the Regional Forum on Green Economy, organised in collaboration with the International Training Centre of the International Labour Organisation (ILO) and the ILO's Green Jobs Programme. This event was held in Accra, Ghana, and brought together 80 participants from 30 African countries. We also held 12 different national validation workshops in various West African countries to validate country

assessment reports on climate change, agricultural trade and food security in ECOWAS.

In terms of dissemination, which is a core activity of the Institute aside research, policy advice and capacity development, we published two policy briefs, three working papers and four journal articles. Several research reports are under preparations for publication. Our visibility activities have also improved, as we continued to make progress to reach out to all stakeholders through media releases, feature articles, and media coverage so as to help disseminate findings of our research widely to impact lives.

The Institute also pursued its resource mobilization endeavours. UNU-INRA signed a cooperation agreement with the Government of Cameroon, which has pledged to contribute to the Institute's Endowment Fund. Cameroon will become the fourth African country, after Ghana, Cote d'Ivoire and Zambia, to honour a resolution taken by the Assembly of Heads of State and Government of the Organisation of African Unity (OAU), establishing cooperation between UNU-INRA, the OAU and the Economic Commission for Africa (ECA). We appreciate the Government of Cameroon for taking a step to honour this resolution.

UNU-INRA seizes this opportunity to thank the Governments of Ghana and Zambia for their continued contributions to its endowment fund. We are equally grateful to IDRC, Embrapa, the United Nations Environment Programme (UNEP) and the United Nations Economic Commission for Africa - African Climate Policy Centre (UNECA-ACPC) for funding support to carry out specific projects.

As member states of the United Nations begin implementation of the Sustainable Development Goals (SDGs) in 2016, we hope to continue pursuing our mandate. This mandate is directly in tune with SDGs # 2, 6, 7, 8, 13, 14 and 15, all of which aim at promoting the efficient use of natural resources for sustainable growth.

Elias T. Ayuk (PhD)
Director, UNU-INRA

ABOUT US



The United Nations University Institute for Natural Resources in Africa (UNU-INRA) was established in 1985 to bridge the gap between science and natural resources management policies in Africa. A year after the establishment of the Institute, the Assembly of Heads of State and Government of the then Organisation of African Unity (OAU), at their 21st ordinary session in Addis Ababa, approved a draft resolution establishing cooperation between UNU-INRA, OAU and the Economic Commission for Africa (ECA). The statutes of UNU-INRA were then approved at the 28th session of UNU Council in 1986. Following a preparatory period, the Institute commenced its activities in 1990.

The mandate of the Institute is to contribute to the sustainable management of Africa's natural resources in a way that maintains the quality of the natural

environment and transforms lives. UNU-INRA's main goal is to be a catalyst for knowledge creation and delivery to enhance the efficient use of the continent's natural resources so as to improve livelihoods. The Institute is currently one of the 15 Research and Training Centres /Programmes (RTC/Ps) that constitute the United Nations University's (UNU) worldwide network.

Vision

To be the leading institution in Africa in capacity building for research in natural resources management (NRM).

Mission

To empower African universities and research institutions through capacity strengthening.

Our Operational Framework
 UNU-INRA operates from its main office in Accra, Ghana and carries out some of its programme activities through a network of Operational Units (OUs) and a College of Research Associates (CRA). The OUs consist of multi-disciplinary groups of researchers located at selected institutions. The OUs are currently situated in five African countries: Cameroon, Ivory Coast, Namibia, Senegal, and Zambia. Each of these focuses on specific areas of natural resources management.

The CRA is a continent-wide network of senior African research scientists who assist UNU-INRA to address the critical challenges facing natural resources management in Africa.

The members, who are based at various universities and research institutions, complement UNU-INRA's work by undertaking training and research on natural resources management issues in Africa. The Institute also runs a competitive Visiting Scholars, Home-Based Scholars and PhD Internship programmes that provide opportunities for researchers from the continent to undertake high quality research.

UNU-INRA collaborates with other UN agencies, multilaterals and bilateral institutions to deal with natural resources management challenges facing Africa.

Programme Areas (PAs) and Core Activities



2015 ACTIVITIES

Research



In the area of research, the Institute's projects fall under its three main programme areas (PAs), as stated in the previous section. These are:

PA 1: Harnessing Renewable Natural Resources for Efficient and Sustainable Use

Projects carried out under this programme area include:

Integrating food and feed crops to improve livelihoods and resilience to climate change

This project aims to evaluate integrated systems that would increase and sustain food and feeds crop production; improve climate resilience; water and nutrient use efficiency. UNU-INRA researchers are working with cassava, cereal

and legumes farmers to integrate feed crops into their traditional farming systems. The practice of integrated system is expected to increase crop yields, provide feeds for animals as well as help reduce greenhouse gas emissions. The project is being carried out in five villages in the Upper East Region of Ghana.

In 2015, a stakeholder forum was held at the Ministry of Food and Agriculture (MOFA) office in Talensi District in Upper East Region of Ghana. In addition, community entry and introduction of the project to the farming communities were also undertaken. Thirty farmers were taken through Farmer Field Schools (FFS), where the cropping technologies were introduced to them.

As part of the project, land was ploughed for fifteen women farmers. All farmers selected their preferred crop combinations and were supported with agro-inputs for planting. They planted their crops with *Cajanus cajan* feeds and harvested the crops and feeds. The feeds are being used to feed their animals and some farmers have enough feeds to sell for income.

Climate Change, Agricultural Trade and Food Security in ECOWAS



The United Nations University Institute for Natural Resources in Africa (UNU-INRA), in collaboration with the African Climate Policy Centre (ACPC) of the United Nations Economic Commission for Africa (UNECA), commenced a two-year project in 2014 on Climate Change, Agricultural Trade and Food Security in countries of the Economic Community of West Africa States (ECOWAS). The main objective of the project is to assess whether agricultural production systems and trade policies in ECOWAS can be

adjusted to alleviate the impact of climate change on food security to promote sustainable development.

As part of the project implementation plan, UNU-INRA in 2015 worked on phase 2, which involved data collection and development of empirical models, and also started work on the final stage, phase 3. This stage involves model simulations and policy assessments. In collaboration with the West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL), UNU-INRA has finalised the development of climate baseline and scenarios for ECOWAS. One Hundred and Thirty (130) years of simulations were undertaken using the most recent International Centre for Theoretical Physics (ICTP) Regional Climate Model (RegCM4), driven by three Earth System Models, being the National Centre for Atmospheric Research (NCAR; Boulder, Colorado, USA) GFDL-ESM-2M, the Max-Planck Institute (MPI; Hamburg, Germany) MPI-ESM-MR and the United Kingdom Met Office (Reading, UK) HadGEM2-ES.

These experiments considered two Greenhouse Gases (GHG) forcing scenarios: the Representative Concentration Pathways 4.5 (RCP4.5), which is a mid-level GHG forcing and 8.5 (RCP8.5), which is a high level GHG forcing scenario often categorised as

“business as usual”. For each experiment, three simulations have been performed: a present-day one (historical: 1970- 2005) and two future (RCP4.5 and RCP8.5: 2006-2100).

Similarly, the Institute has partnered with the International Crop Research Institute for the Semi-arid Tropics programme on Climate Change, Agriculture and Food Security (ICRISAT-CCAFS), to finalize the development of socio-economic baseline and scenarios for ECOWAS. Based on feedback received from stakeholder consultation sessions held in West Africa, four socio-economic scenarios (2015-2100) were developed taking into account the following:

- i. Policy driver (short and long term priorities) and;
- ii. Dominant force (state and non-state actors).

The four socio-economic scenarios are:

- a) Cash, Control & Calories (CCC): a scenario on short-term priorities with state actors as the dominant force in West Africa up to 2100;
- b) Civil Society to the Rescue (CSR): a scenario where non-state actors are dominant and long-term issues have priorities;
- c) Self-determination(S):a scenario where state actors are

dominant and long-term priorities prevail in West Africa up to 2050;

- d) Save Yourself (Y): a scenario where non-state actors are the driving force and short-term priorities dominate in West Africa by 2100.

UNU-INRA has also finalised the development of empirical models to study climate change, agricultural trade and food security in ECOWAS. Three models were developed to capture the social, economic and environmental systems of ECOWAS. These are combined with other models such as AquaCrop, crop simulation model, to form four Integrated Climate-Economic Models (ICEMs) for ECOWAS. The first ICEM combines a crop simulation model (ACRACROP) and a Hydro-economic model (ECOWAT) to simulate water availability, land allocation and food production in ECOWAS up to 2100 under different climate, socio-economic and environmental scenarios.

The second ICEM combines a crop simulation model (ACRACROP), a land allocation model (ECOLAND), and a Hydro-economic model (ECOWAT) to simulate land allocation and food production in ECOWAS up to 2100 under different climate, socio-economic and environmental scenarios. The third ICEM

combines a crop simulation model (ACRACROP), a land allocation model (ECOLAND), an agricultural trade model (ECOTRADE) to simulate trade flows and food security in ECOWAS up to 2100 under different climate, socio-economic and environmental scenarios. The final ICEM combines a crop simulation model (ACRACROP), a land allocation model (ECOLAND), a Hydro-economic model (ECOWAT) and an agricultural trade model (ECOTRADE) to simulate trade flows and food security in ECOWAS up to 2100 under different climate, socio-economic and environmental scenarios.

The Institute is currently calibrating and simulating the Integrated Climate-Economic Models (ICEMs) for ECOWAS. The first evaluation shows that our ICEMs are able to predict about 95% of the observed crop yields and about 87% of observed land allocation in ECOWAS. Using the ICEMs to simulate yields and land allocation in 2050 for 7 groups of crops under RCP 4.5, we found that crop production will shift between Agro-Climatic and Soil Zones (ACSZs) in ECOWAS as a result of climate change. Some crops like cocoa will no longer be profitable in 2050 for all countries in ECOWAS.

Mushroom Research

UNU-INRA's Operating Units (OU) in Namibia and Senegal worked on mushroom projects to document indigenous knowledge and utilization of wild edible mushrooms by local communities. The projects aimed at promoting the production and consumption of wild edible mushroom species in the two countries.



As part of the project activities, training in mushroom production was conducted for rural and peri-urban communities. The OUs also provided technical advice and extension services to mushroom farmers.

Coastal and Desert Agriculture



The OU in Namibia also worked on the production of organic manure for vegetable cultivation under hydroponic conditions in arid Namibia. The project involved the engagement of the youth in the use

of goat and chicken manures to produce vegetables under hydroponic systems. The aim was to help offer employment to unemployed youth in vegetable production and sale.

PA 2: Promoting a Green Economy



Photo: Food Ethics Council

Impact of the Transition towards a Green Economy on Employment and Growth in Côte d'Ivoire

This project is addressing the issue of unemployment in Côte d'Ivoire and constraints related to the transition process to green economy. The preliminary results indicated that promoting investment in natural resources management (land and water) provides a sustained agricultural growth in the long term.

However, reducing agriculture land for forestry will decrease contribution of the agricultural sector to GDP. At the same time, the green scenarios in the energy sector and waste recycling showed an increase in production and employment in the industrial

sector. Investments in social sphere particularly in health and education, which will increase the labour force and the efficiency of labour, would improve labour productivity as well as production in agricultural and services sectors.

Unleashing the potential of African rural economies through green growth

This project, which started in 2013, is being supported by the International Development Research Centre (IDRC). In 2015, UNU-INRA received three visiting scholars and six PhD Interns, who carried out research under the project. The research included the following:

Estimating the opportunity costs of Conservation Tillage as Climate Change Mitigation Option in Tandjoare-Togo

Conservation tillage (CT) has been considered as a win-win strategy because it mitigates climate change, improves productivity and enhances ecosystem services. The purpose of this study was to determine the costs and explanatory factors of conservation tillage adoption in Nano-Tandjoare, Togo. The study used a contingent valuation approach and econometrics tools such as tobit model to analyse primary data obtained from a survey conducted on 450 farmers in Nano-Tandjoare, in Togo.

The findings revealed that a farmer will be willing to accept a payment of 14,832.24F CFA (about 25USD) on average to renounce conventional tillage and adopt conservation tillage. Farmers who were aware of the benefits of conservation tillage were less willing to receive payment before adopting the practice. These results suggest that dissemination of information on the benefits of conservation tillage and appropriate financial support from stakeholders in the agricultural value chain could be appropriate incentives for the transition towards green agricultural farming in Nano-Tandjoare in Togo.

Green Strategy for Maize Varietal Selection and Identification of Suitable Sites in Drought-Prone Ecologies of Southern Guinea Savanna Zone of Nigeria.



Drought stress is the most important environmental constraint contributing to instability of maize (*Zea mays L.*) yield. This study extracted multi-environment trial data sets from regional maize trials using Additive Main Effects and Multiplicative Interaction (AMMI) and Genotype and Genotype-

Environment (GGE) biplot models to assess the performance of drought tolerant (DT) maize genotypes and identify the best genotypes for suitable sites. The impact of climate change and economic implications of producing DT maize was estimated. The test environments contributed about 75-100% of the total variation in grain yield. Four ideal locations for 10 promising genotypes were identified. Rainfall, soil temperature and sunshine hours are significant in explaining changes in DT maize production as a result of climate change. The findings suggested that investment in DT maize production will generate a profit of US\$ 571 for open pollinated maize and US\$ 1,426 for hybrids per hectare with a production efficiency of 52% and 30%, respectively.

Climate Change Induced Migration and its Implications for the Development of SMEs and the Protection of Rural Livelihoods in Nigeria.

Rural households adopt several adaptation measures in order to deal with climate variations and related environmental damage. The study set out to examine migration as an adaptation to climate change. Using the Farming and Rural Systems Approach and a multistage random sampling technique, 120 households were selected from the rural areas of

Bende Local Government Area of Abia state in Nigeria. Clustering procedure yielded 3 farming systems: The Resource Poor Labour Intensive system (RPLI), the Resource Rich Labour Intensive system (RRLI) and the Resource Poor Non-Labour Intensive system (RPNLI).

The results showed that the Resource Rich Labour Intensive system (RRLI) was the most economically viable of the three systems and had a relatively better standard of living although it was dependent on other resource owners in the community for land. Several households in each system have Climate Change-Induced Migrants (CC-IM) but the Resource Poor Non-Labour Intensive system (RPNLI) had the largest proportion, thus, 52 per cent. The system was also the least food secured, had the largest proportion of female headed households and was the most vulnerable of the 3 systems.

The climate shocks that induced migration include floods, erosion, crop loss and increase pest and disease invasion as an aftermath of climate variability. Most of the migrants were economically viable and were able to send food, clothing and money back home.

Resources Efficiency and Economic efficiency in fish farming in the South-East of Côte d'Ivoire

Fish farming is considered as a complement to fish production in Côte d'Ivoire. However, the level of production remains low. This study analysed the efficiency of resource use and the economic efficiency of fish farmers in the South-East of Côte d'Ivoire. Using a non-parametric frontier approach, the results showed that productive and economic potential can be realized in fish farming if resources are managed efficiently. In addition, farmers' access to training and education and control of the production cycles were identified as key factors for improving the fishery sector's efficiency.

The Potential of Sustainable Fishery in Mitigating Unemployment and Poverty in Africa



This research examined the potential of the fishery sector to mitigate the growing unemployment rate and poverty in Africa. Egypt, Morocco, Madagascar, Namibia, Ethiopia, Seychelles, Niger, Mauritania, São Tomé and Príncipe and Chad were

considered as the target sample areas from the five African sub-regions. The findings revealed that almost all countries considered in the study, failed to achieve sustainable fish production, failed to reduce unemployment rate and poverty. This was mainly due to overexploitation of the fishery stock, underutilization of fishery resource, high employment pressure on the sector, and increased in export boarder rejections of exported fish.

Options for Greening the Concessionary Forestry Business Model in Rural Africa



Dwelling on the “Green Business Model Innovations” by the Danish Business Authority, this study proposed a “Green Business model” for the dominant business practice in Africa’s high forests - concessionary forestry business. Africa’s forestry sector faces numerous challenges which are posing a threat to its sustainability. Introducing the concepts of both sustainability and green innovation into the “business as usual” forestry practices, the study found that there are many opportunities to

make the concessionary forestry business greener and inclusive.

For example, there is a need to integrate the local communities and indigenous people as service providers to support the forestry business operations. In addition, it will be critical to modify the wood product value chain by integrating concessionaires i.e. the producers of wood, into the product value chain in other sectors. However, the operationalization of these green strategies will require strong enforcement measures by the State, which is a key business partner.

Linking climate resilient green growth and forest management for rural wellbeing in South Africa

This study assessed current mode of forest use and management at the rural community level in South Africa with the view of locating space for forest-based green growth initiatives development and determining factors that might facilitate or hinder uptake of such initiatives. This was done with the aim of decoupling rural livelihood activities from forest degradation in response to government’s climate change adaptation and mitigation target at the rural community level. Vegetation type was used as criteria to select three municipalities (Makhado, Mutale and Thulamela) out of the four municipalities in Vhembe district. Seven rural communities in each

municipality were selected making a total of 21 rural communities. In all, 366 households were selected and interviewed.

Findings showed that the formal forest sector e.g. tree plantations and sawmill operations, on the average made less than 42% contribution to households income and livelihood. The formal forest sectors were thus less positioned for immediate delivery of green growth benefit to the rural communities. However, it was observed that there was widespread participation in the informal forest sector, reaching up to 90% in Mutale municipality. By inference, the informal forest sector is best positioned for immediate delivery of green growth benefits to the communities. Firewood and wild edible insects were identified as the priority products for forest green growth initiative uptake.

However, issues related to skill and technical capacity remain a barrier to social inclusiveness in the uptake of green growth initiatives in the community. The study thus recommended capacity building initiatives and forest resource base expansion initiatives via afforestation and reforestation as a means of delivery of green growth benefits to the communities.

An assessment of the impact of grazing livestock on cereal and tuber crops production in Abuja, Nigeria

This research assessed how small-scale crop farmers perceived the impact of grazing livestock on cereal and tuber crops production in Abuja. A multi-stage technique was adopted for sampling in five Area Councils (Kwali, Kuje, Gwagwalada, Abaji, Bwari) while semi-structured questionnaires were used for data collection. The results indicated that there were significant locational differences in the impact of grazing livestock on cereal and tuber crops production. For cereal crops, the mean responses showed that Kwali Area Council was the most affected while Kuje and Abaji Area Councils had the highest impact of grazing livestock on tuber crops.

The results also indicated that the level of destruction depended on the type of livestock and type of crop cultivated. For cereal crops, cattle and goat/sheep were rated as the most destructive animals while for tuber crops, it was cattle. The least destructive livestock was domestic fowl. Again, among the crops, maize and cassava were the most affected cereal and tuber crops. The least affected were rice and potato. In terms of cost estimate of damaged crops by grazing livestock, cassava farmers were the most affected. They lost

an average of N11, 745 (about 59 USD) while potato farmers lost at least N3, 679 (about 18 USD). Based on the findings, the study concluded that grazing livestock are some of the factors limiting the production of cereal and tuber crops but the magnitude of impact depends on location, the livestock and crop cultivated. It was recommended that efforts should be geared towards developing grazing routes at community level to minimize the impact of grazing livestock on crop yields.

PA 3: Facilitating Good Governance and Management of Non-Renewable Natural Resources

Zambia Tax Regime 2015

This project aimed at facilitating a technical and social debate on the impact of recent changes in Zambia's mining taxation policy; at determining its impact on the various stakeholders; and at proposing the ideal tax regime (model) for Zambia. Under the existing fiscal tax regime, Zambia currently has one of the highest Effective Tax Rates and environmental costs in the world. The government has made significant changes to the mining tax regime creating fiscal instability. The Mineral Royalty Tax (MRT) has been adjusted 4

times in 7 years. Findings indicated that:

- The existing regime represents one of the highest effective tax rates in the world. At a 9% MRT, Effective Tax Rate (ETR) is now well over 50%.
- Fiscal environment is already challenging.
- Proposed MRT changes will move Zambia into unchartered fiscal territory.

Based on the findings and looking at the current tax collection mechanism, Floating Mineral Royalty Tax is proposed. This will require the need for deliberate focus on MRT at point of extraction before injection into the black-box process. Based on tested sample of ore content, value of this content against prevailing London Metal Exchange (LME) grade Copper price must be assigned. This is to allow the country to do away with the Variable Profit Tax (VPT) of 15% and further reduce the Corporate Income Tax (CIT) by an additional 10% from 30 to 20% as the floating aspect will cater for any gains in commodity price increase.

It is also envisaged that by focusing on MRT, the mines will:

- Have an incentive to improve efficiencies in the black-box to ensure that they get LME grade Cu.

- Build internal capacity at Zambia Revenue Authority (ZRA) to fully understand the process.
- Establish a multi-disciplinary Tax Task force that will be able to verify and correctly capture MRT figures on the tested ore content.
- Utilize the Mineral Monitoring Tool that is in the pipeline to fully understand the Unit Cost Structure of Mining Operations to ensure the CIT component is equally maximized.

In summary, based on the perception of the mining sector, with regard to revenue collection and whether Zambia is fully benefiting from the sector, the following are therefore recommended:

- Transparency in agreements with mining sector investors;
- Standardised Tax concession tenures;
- Complete disclosure of operational cost structures by mining companies.



Capacity Development



Regional Forum Held on Green Economy

UNU-INRA, in collaboration with the International Training Centre of the International Labour Organisation (ILO) and the ILO's Green Jobs Programme, organised a five-day regional forum and training workshop on Green Economy in Accra, Ghana. The workshop, held from 9th -13th November, 2015, was on the theme "*Greening Industries and Green Entrepreneurship Promotion as a Driver of Sustainable and Inclusive Growth in Rural Africa*". It brought together 80 participants from 30 African countries.

The aim was to enhance and build the capacity of policy makers and researchers in Africa to understand the role of business in the transition to a green economy in rural Africa

and to promote the creation, development and growth of green and resource efficient enterprises in the African region. The event offered participants two parallel learning tracks to customize their learning experience according to their individual interests. The topics discussed were:

- i. *Greening industries and enterprises*. This addressed resource input optimisation and minimisation of environmental risk and pollution in the production process and supply chain through the review of well-established approaches and workplace practices, and;
- ii. *Green entrepreneurship and eco-innovation*, which addressed how to unleash the potential of new business opportunities in environmental goods and services in rural Africa.

The forum followed a participatory learning approach notably through a knowledge fair that gave the opportunity for extensive experience sharing. It concluded with a forward-thinking discussion on how to create an enabling environment for green enterprise and green industry development, for instance, through effective policy frameworks and research-based advocacy, revisiting traditional African practices and taking into account gender dimensions in rural Africa.

The event was organised within the framework of the UNU-INRA green economy project “*Unleashing the potential of African Rural Economies through Green Growth*”, funded by the International Development Research Centre (IDRC). Other partners of the forum were UNECA and UNIDO.

Green Business Training Workshop



UNU-INRA organised a one-week Green Business training workshop for African researchers, entrepreneurs, environmentalists and economists from 9th – 13th

February, 2015, in Accra, Ghana. The training workshop, which was under the theme “*Greening Business through Biodiversity and Ecosystem Services*” aimed to equip the participants with the necessary tools to be able to identify potential risks of their business activities on the environment and develop effective management strategies to mitigate them.

This was organised for Francophones following a similar workshop organised for Anglophones in 2014. There were 20 participants including 4 females from Benin, Burkina Faso, Cameroun, Central African Republic, Côte d’Ivoire, Niger, and Rwanda.

Inception and Methodology Workshop on PPP Project



UNU-INRA organised a workshop in Accra, Ghana from 2nd -3rd October, 2015, which brought together researchers and key national and regional stakeholders involved in Private-Public-Partnerships (PPPs) for agricultural development in Africa. The aim of the workshop was to review a draft research toolbox

developed for the Institute's project on ***“Improving the Development Outcomes of Private-Public-Partnerships in Agriculture and the Environment”***. The workshop brought together 25 participants, including three females, from Burundi, Cameroon, Ghana, Mozambique, Senegal and South Africa.

The PPP project is a one year research project being supported by the International Development Research Centre (IDRC). Its aim is to review and assess the state of PPPs in agriculture and the environment in a representative number of Sub-Saharan African (SSA) countries so as to guide further research, policy development and targeting of private and public funds for partnership development. Six SSA countries (**Cameroon, Burundi, Ghana, Mozambique, Senegal and South Africa**) have been selected for the project implementation.

National Validation Workshops in West Africa



UNU-INRA held national validation workshops in 12 West African countries from 29th January – 26th March 2015 to discuss preliminary findings of country assessment studies undertaken within the Institute's project on ***“Climate Change,***

Agricultural Trade and Food Security in ECOWAS”.

Held in Benin, Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Mali, Niger, Nigeria, Senegal, and Togo, the workshops brought together key national stakeholders involved in climate change, agricultural production and trade, and food security issues to review draft country assessment reports on the studies and make input to improve the data quality.

The validation workshops drew on average, about 30 experts in each of the participating countries. These included climate experts, meteorologists, hydrologists, ecologists, agricultural and trade experts, soil scientists, researchers from relevant institutions, government officials from key ministries, non-governmental organisations (NGOs) as well as local and international development partners.

2nd African Research Discovery Camp Held in Namibia

UNU-INRA's Operating Unit in Namibia hosted the 2nd African Research Discovery Camp under the Regional Graduate Network in Oceanography (RGNO) programme. The camp is a research-based training event on the sustainable use and management of marine ecosystems. The 2015 Camp, which was held from 3rd May to 4th June, had 14 selected students coming from eight different countries, researchers from Sam

Nujoma Marine and Coastal Resources Research Centre, Namibia, as well as instructors and lecturers from Namibia, South Africa, Switzerland, Chile, Germany and the USA.



The participants exchanged research ideas and carried out actual oceanographic research at sea using RV *Mirabilis*. The RV *Mirabilis* is a deep-sea fisheries and multidisciplinary research vessel that belongs to the Ministry of Fisheries and Marine Resources of the Republic of Namibia.

The RGNO African Research Discovery Camp series is part of the Scientific Committee on Oceanic Research's cross-national capacity building initiative, and it is supported by a grant from the Agouron Institute and an equipment grant from the Swiss|i-research & training institute. Additional contributions in kind came from the University of Namibia as the host institution, ETH Zurich, University of Minnesota and the Namibian Ministry of Fisheries and Marine Resources.

SMEs Mentored on Business Growth



InfoDev and SNV in partnership with Ashesi University, Ernst & Young and the United Nations University Institute for Natural Resources in Africa (UNU-INRA) trained and mentored selected potential green businesses on business planning and marketing strategies, at a two-day session dubbed “Green Innovators Bootcamp” in Accra. The event held from 27th to 28th February, 2015 at the Ashesi University College campus, aimed to equip entrepreneurs and small and medium scale enterprises (SMEs) with business training, mentorship, expert guidance and practical suggestions to refine and shape their business plans and marketing strategies.

The bootcamp formed part of the Ghana Climate Innovation Center project, which when operational, will provide financing, mentoring, training and business advisory services to support emerging entrepreneurs and new ventures involved in developing locally appropriate solutions to climate change mitigation and adaptation.

The Center will be hosted and managed by a world-class consortium led by Ashesi University in partnership with SNV, Ernst & Young, and UNU-INRA. It is being supported by the World Bank, Danish International Development Agency (DANIDA) and the Netherlands Government.

Training on Computer Applications to the Analysis & Management of Natural Resources: Geomatics, held in Cameroon



UNU-INRA operating unit (OU) in Cameroon organised “train the trainers” course on computer applications for the management of natural resources, from 12th – 24th October, 2015. The training course, which was held in partnership with the University of Yaoundé I, Cameroon, aimed at building the capacity of researchers and other individuals in digital technology to facilitate the analysis and management of natural, human and environmental resources data.

The participants were taken through basic tools module, GIS and Remote Sensing module, Digital Map making and Spatial Analysis, and Practical work. There were 18 participants including 3 females, coming from Cameroon, Chad, Democratic Republic of Congo, and Republic of Congo.

Seminars



Sixteen public seminars have been organised in Ghana, Côte d'Ivoire, Senegal and Zambia in 2015 to disseminate findings of the Institute's research to relevant stakeholders. The seminars brought on average 40 relevant stakeholders from the public and private sectors as well as from academia.

Below are topics discussed at these seminars:

In Ghana

- *Future Challenges to Environmental Risk Management (presentation by Prof. Jakob Rhyner)*
- *The Potential of Sustainable Fishery in Mitigating Unemployment and Poverty in Africa (presentation by Mr. Shiferaw Mitiku Tebeka)*
- *Green Strategy for Maize Varietal Selection and Identification of Suitable Sites in Drought-Prone Ecologies of Southern Guinea Savanna Zone of Nigeria (presentation by Dr. Felix O. Takim)*
- *Addressing Wastewater Challenges with an African Bio-Resource (presentation by Dr. Effiom E. Oku)*
- *Climate Change Induced Migration and its Implication for the Development of SMEs and the Protection of Rural Livelihoods in Nigeria (presentation by Dr. Oluwafunmiso Adeola Olajide)*
- *Estimating the Opportunity Cost of Conservation Tillage Adoption as Climate Change Mitigation Option in Tandjoare, Togo (presentation by Ms. AFO-LOKO Owodon)*

- *Assessing the Impact of Climate Shocks on Farm Performance and Adaptation Responses in the Niger Basin of Benin* (presentation by Dr. Boris Odilon Kounagbè Lokonon)
- *Use of Multi-Criteria Evaluation, GIS and Optimization Problems in Water Resources Management, Planning and Modeling: Case of Bâoulé - North West of Côte d'Ivoire* (presentation by Coulibaly Naga)
- *Options for Greening the Concessionary Forestry Business Model in Rural Africa* (presentation by Ms. Mavis Boimah)
- *Bioenergy Supply and Environmental Impact on Cropland: Insights from Multi-Market Forecasts in Great Lakes Sub-regional Bio-economic Model* (presentation by Dr Aklesso Egbendewe-Mondzozo)
- *Implementation of Green Agriculture in Africa: The Role of Agricultural Institutions* (presentation by Ms. Melissa McCullough)

In Côte d'Ivoire

- *Resources Efficiency and Economic efficiency in fish farming in the South-East of Côte d'Ivoire* (presentation by Christian Aboua)
- *Rationality of rural households in RDC: Choice between peasant logic and entrepreneurial logic* (presentation by Fabrice Lukeba Nfuamba)

In Senegal

- *The potential use of Pseudomonas sp. in the fight against Phytophthora colocasiae, causative agent of Taro leaf blight (Colocasia esculenta)* (presentation by Mr NTYAM MENDO Samuel Arsene)

In Zambia

- *An assessment of the impact of grazing livestock on cereal and tuber crops production in Abuja, Nigeria* (presentation by Julius Ajah)
- *Linking climate resilient green growth and forest management for rural wellbeing in South Africa* (presentation by Chidibiye Ofoegbu)

Book Launch



UNU-INRA launched two books in 2015. The books are entitled “*Economic and Financial Analyses of Small and Medium Food Crop Agro-Processing Firms in Ghana*” and “*Harnessing Land and Water Resources for Improved Food Security and Ecosystem Services in Africa*”.

The first book “*Economic and Financial Analyses of Small and Medium Food Crop Agro-Processing Firms in Ghana*” reports on a research project that analysed agro-processing firms’ economic situations in Ghana. Findings from the study revealed that the agro-processing subsector in Ghana is characterised by high informality with lack of business planning, poor financial records keeping and financial analysis, and absence of risks and performance monitoring. High interest rate of loans is also identified as one of the factors limiting the profitability of agro-processing firms.

Among policy options explored in the book is the need to develop customised innovative and inclusive financial products and services to meet the specific needs of micro, small and medium food crops processing enterprises to improve their profitability. The book also proposes increased awareness on quality control and standardization as well as capacity development as potential strategies to promote the growth of the agro-processing sub-sector.

The second book “*Harnessing Land and Water Resources for Improved Food Security and*

Ecosystem Services in Africa” is a compilation of research papers that draw attention to the impact of human activities on land and water resources. Issues such as wastewater management, water pollution, land degradation, massive land acquisition, and climate change impact on food

security were discussed in the book. The book calls for the provision of alternative livelihoods such as the promotion of aquaculture, recycling of agro-wastes for biofuel and soil amendment measures among others, to halt land degradation and water pollution in Africa.



Cross-section of participants at the book launch

Other Events

UNU-INRA staff participated in a number of meetings/events in 2015. The table below summarises some of these.

Event	Date	Place	Role of UNU-INRA	Papers Presented / Responsibility
Office of the Special Advisor on Africa (OSAA)-UN Experts Group Meeting	24 th February, 2015	New York, USA	Contributor	Dr. Elias T. Ayuk, Director, UNU-INRA
Inclusive Green Economies (IGE) for Poverty Reduction and Sustainable Development in Africa: From Inspiration to Action	28 th February - 1 st March, 2015	Cairo, Egypt	Participant	Dr. Calvin Atewamba, Green Economy Fellow, UNU-INRA
Workshop on Contribution of Sustainable Bioenergy in Food and Energy Security in Côte d'Ivoire	11 th – 12 th March, 2015	Abidjan, Côte d'Ivoire	Contributor	Dr. Namizata BINATE FOFANA, OU Coordinator, UNU-INRA
39 th Annual Conference of Soil Science Society of Nigeria	9 th – 13 th March, 2015	Omu-Aran, Kwara State, Nigeria	Contributor	<i>Presentation on "Enhancing Wastewater Quality for Irrigation and Soil Pollution Prevention: A Climate Smart Solution in an</i>

				<i>African Grass Species”</i> , by Dr. Effiom E. Oku, Land & Water Resources Fellow, UNU-INRA
Green Jobs Assessment Institutions Network (GAINS)- 2 nd International Conference	4 th -16 th April, 2015	Geneva, Switzerland	Panellist and Contributor	Dr. Elias T. Ayuk, Director, UNU-INRA and Dr. Calvin Atewamba, Green Economy Fellow, UNU-INRA
National Workshop on Blue Economy.	13 th – 15 th July, 2015	Abidjan, Côte d’Ivoire	Participant	Dr. Namizata BINATE FOFANA, OU Coordinator, UNU-INRA
2nd Africa Ecosystem-Based Adaptation for Food Security Conference	30 th – 31 st July, 2015	Nairobi, Kenya	Moderator	Presentation on “ <i>Building scalable and inclusive business models for Ecosystem-Based Adaptation (EBA)</i> ”, by Dr. Elias T. Ayuk, Director, UNU-INRA
6 th Annual Ibadan Sustainable Development Summit (ISDS)	23 rd - 28 th August, 2015	Ibadan, Nigeria	Keynote Speaker	Presentation on “ <i>Economic growth and decent jobs within planetary boundaries</i> ” by Dr. Elias. T. Ayuk, Director, UNU-INRA

High Level Forum on “ <i>Mobilising Domestic Resources to Finance Africa’s Transformation</i> ”	2 nd -4 th September, 2015	Addis Ababa, Ethiopia	Panellist	Dr. Elias. T. Ayuk, Director, UNU-INRA
XIV World Forestry Congress: Pre-congress Workshop	4 th – 5 th September, 2015	Durban, South Africa.	Contributor	Presentation on “ <i>Harnessing Tree - Soil Nexus to Foster Green Growth, Soil Carbon Stocks and Ecosystem Services</i> ”, by Dr. Effiom E. Oku, Land and Water Resources Fellow, UNU-INRA
Training on the Concept of Gender and Gender Mainstreaming Tools	9 th – 10 th September, 2015	Abidjan, Côte d’Ivoire	Facilitator	Dr. Namizata BINATE FOFANA, OU Coordinator, UNU-INRA
Workshop on Introduction to the Threshold 21 Model- Côte d’Ivoire	12 th – 16 th October, 2015	Abidjan, Côte d’Ivoire	Participant	Dr. Namizata BINATE FOFANA, OU Coordinator, UNU-INRA

COMMUNICATIONS AND DISSEMINATION

One of UNU-INRA's main priorities is to make its research findings readily available to various stakeholders including policy makers. This, the Institute does, by producing various communication products on its research and other activities. UNU-INRA's publications in 2015 include policy briefs, working papers, articles in peer-reviewed journals, feature articles and press releases in newspapers and on online media platforms, as well as news coverages by print, broadcast and electronic media. Below are selected key publications:

Policy Briefs and Working Papers

Oku, E.E, Aiyelari, E.A, and Asubonteng, K.O. (2015). ***Controlling Erosion and Increasing Crop Yields in Slope Farming: A Vetiver Technology***, Accra, UNU-INRA.

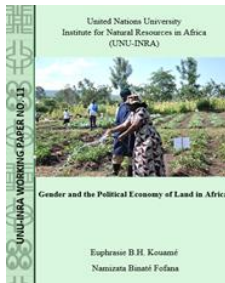


This policy brief reports on research that revealed that Vetiver Buffer Strip spacing at 5m reduced rainfall, soil and carbon losses on slope lands. The brief calls for the adoption of vetiver technology, awareness creation and capacity building of extension officers to improve knowledge on the use of vetiver technology on slope farms to mitigate greenhouse gas and climate change impact on crops.



The policy brief is available at <http://collections.unu.edu/view/UNU:3141#viewAttachments>. The full paper can be downloaded at <http://collections.unu.edu/view/UNU:3167#viewAttachments>

Kouamé, E.B.H, and Fofana, N.B. (2015). *Gender and the Political Economy of Land in Africa*, Accra, UNU-INRA.

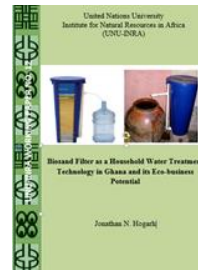


This paper draws attention to the political systems within which land tenure and property rights operate, especially for women. It also points out the main challenges in securing women's land rights in Africa and highlights the economic, social and environmental benefits of increasing women's access to land. Available at <http://collections.unu.edu/view/UNU:3302#viewAttachments>

Hogarh, J.N. (2015). *Biosand Filter: An Eco-efficient Household Water Treatment Technology and a Viable Eco-business Option*, Accra, UNU-INRA



This research investigated factors that may influence the acceptability of biosand filter at the household level in rural communities in Ghana. The study further applied lifecycle environmental and cost assessment methods to analyse the eco-efficiency potential of biosand filter and examined prospects of leveraging this potential for green business development.



The key demographic and socio-economic indicators of biosand filter acceptability were gender, age, education and wealth. Compared to local sachet water production, which was considered as an alternative to household application of the biosand filter, it was established that the latter had superior eco-efficiency, provided quite comparable profitability and was potentially viable for eco-business development.

The Policy brief is available at <http://collections.unu.edu/view/UNU:3349#viewAttachments> and the working paper is at <http://collections.unu.edu/view/UNU:3348#viewAttachments>.

Journal Articles

Oku, E.E, Asubonteng, K.O, and Blege, P.K. (2015). “**Role of Soil Properties and Precipitation Concentration in Enhancing Floods in Northern Ghana**”, *European Journal of Sustainable Development*, 4(2), 339-346.



The study assessed water infiltration rates and storage capacities of soils in the Northern and Upper East Regions of Ghana and their contributions to floods. A field infiltration test was carried out and precipitation concentration index (PCI) was estimated for over a 30 year period. Based on the findings, it was recommended that introduction of trees in combination with vetiver grass as an ecological tool could break and open-up the soil profile to allow more water intake and mitigate flood damage. The article is available at <http://ojs.ecsdev.org/index.php/ejsd/article/view/268>

Atewamba, C. and Nkuiya, B. (2015). “**Testing the Assumptions and Predictions of the Hotelling Model**”, *Environmental and Resource Economics*, 1-35.



The authors empirically examined whether the assumptions and predictions of the Hotelling model are consistent with patterns observed in data. They considered non-linear functional forms for the extraction cost and resource demand to develop an empirical Hotelling model with technological progress and stock dependent extraction costs. Using panel data on fourteen non-renewable natural resources to estimate this empirical Hotelling model, different qualitative results were obtained as compared to the related literature. Evidence of stock-dependent extraction costs for most resources was found. There was no evidence against the linearity of the optimal extraction rate in the resource stock for almost all resources studied.

This is available at <http://link.springer.com/article/10.1007/s10640-015-9922-0?wtmc=email.event.1.SEM.ArticleAuthorOnlineFirst#>

Oku, E.E., Ojikpong, T., Yakubu A., and Ezeaku. P. (2015). “**Soil Carbon Dynamics and Soil Properties Influenced by different Types of Agronomic Land Use in the Forest Zone of Nigeria**”, *Journal of Environment and Agricultural Science*, 2 (5).



The study was conducted from 2013 to 2014 on Alfisols of the humid forest zone of Nigeria to assess soil characteristics under different agronomic land use, namely; cocoa plantation, cassava farming, natural fallow land and mixed cropping. Coefficient of variability (CV %) of the soil properties explained the influence of the land uses on soil properties. Soil characteristics such as bulk density, WSA, pH, Na and base saturation were not influenced by different types of agronomic land use. Based on the saturated hydraulic conductivity, the studied soil was categorized in very slow to slow conductivity class. Carbon accumulation in the soil varied among the different plantation types with an increasing order: Cocoa plantation > grassland > mixed cropping field > natural fallow > cassava farming. The SOC C values revealed unstable soil structure in cocoa plantation, grassland and mixed cropping farm land and indicated the risk of soil degradation (SOC C = 5–7 %) while cassava farmland was more prone to degradation as the soil suffer from loss of soil structure and is highly susceptible to erosion (SOC C = < 5 %).

Available at http://agropub.com/Journals/index.php/JEAS/article/view/JEAS_2.5

Ezeaku, P.I., Eze, F.U, and Oku, E. (2015). “**Profile Distribution and Degradation of Soil Properties of an Ultisol in Nusska Semi-Humid Area of Nigeria**”, *African Journal of Agricultural Research*, 10 (11), 1306-1311.



The study investigated the relative changes in properties of ultisol under conventional tillage for arable crops and compared with fallowed plot (greater than 10 years of continuous no-till fallow) in the semi-humid Nsukka of southeastern Nigeria. Soil samples were collected from designated profile horizons for determination of soil properties. In cultivated plot relative to fallowed plot, soil erodibility increased by 2.5% ($E_i + 0.11$), total porosity decreased by 1.1%, whereas macro and micro-porosity increased by 3.4 and 7.1%, respectively. Soil saturated hydraulic conductivity increased by 4.9%. The degree of topsoil saturation with water was similar in both the cultivated and the fallowed plots. Soil pH increased (7%) when exchangeable acidity increased (21.3%, $+0.46 \text{ cmol (+) kg}^{-1}$). Losses of organic carbon (28%, -2.58 gkg^{-1}), total N (26%, -0.17 gkg^{-1}), available P (47%, -2.63 mgkg^{-1}), Ca (55%, $-1.75 \text{ cmol (+) kg}^{-1}$), CEC (17%, $-1.11 \text{ cmol (+) kg}^{-1}$), and base saturation (11.3 %) due to cultivation were observed. Since the fallowed plot that was previously under cultivation was able to show more favourable values of the measured soil properties than the cultivated plot without human activity, the study deduces that an ultisol can be resilient.

Available at <http://www.academicjournals.org/journal/AJAR/article-abstract/54AB3A051459>

Media Coverage

As part of efforts towards the achievement of the Institute’s communication goal, which aims at promoting UNU-INRA as a leading natural resources management think-tank in Africa, a number of news worthy articles and stories have been generated. In the year under review, two feature articles and four news releases were developed and published in Africa and international media. Similarly, four web stories were developed and published on the Institute’s website. The Institute has also received forty-six news coverage reports from TV, Radio, Newspapers and Online media across Africa. Social media reports on Twitter and Facebook were also more than fifty. Below are details of key media publications in 2015:

Details on Media Coverage

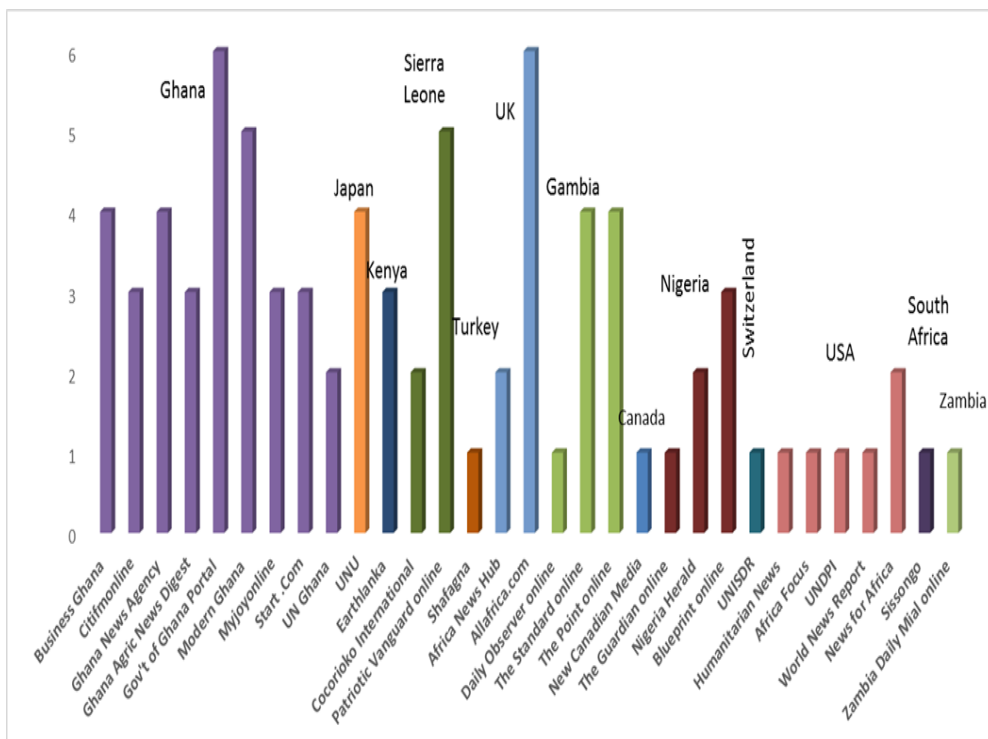
News Categories	Headlines	No. of Publications
Media Releases	Education is Key to Disaster Risk Reduction – UNU Vice Rector	23
	Climate Change Mitigation in Africa must be a Priority - UNU-INRA Director	21
	Policy Implementation is Key for Africa’s Development	6
	UNU-INRA Engages Stakeholders on Wastewater Management	15
Feature Articles	Freshwater: A Lacking Resource	22
	Natural Resources Can Drive Sustainable Growth	3

News Coverage	Book Launch	9
	National Validation Workshops on Climate Change Country Assessment Reports	20
	Regional Green Economy Forum	14
	Signing of Agreement of Cooperation between UNU-INRA and the Cameroon Government	3
Website Stories	Regional Forum on Green Economy Underway in Accra-Ghana	
	UNU-INRA Calls on African High Commissioners in Accra	
	New Resident Coordinator for UN Ghana Visits UNU-INRA	
	UNU-INRA Signs Agreement of Cooperation with the Government of Cameroon	

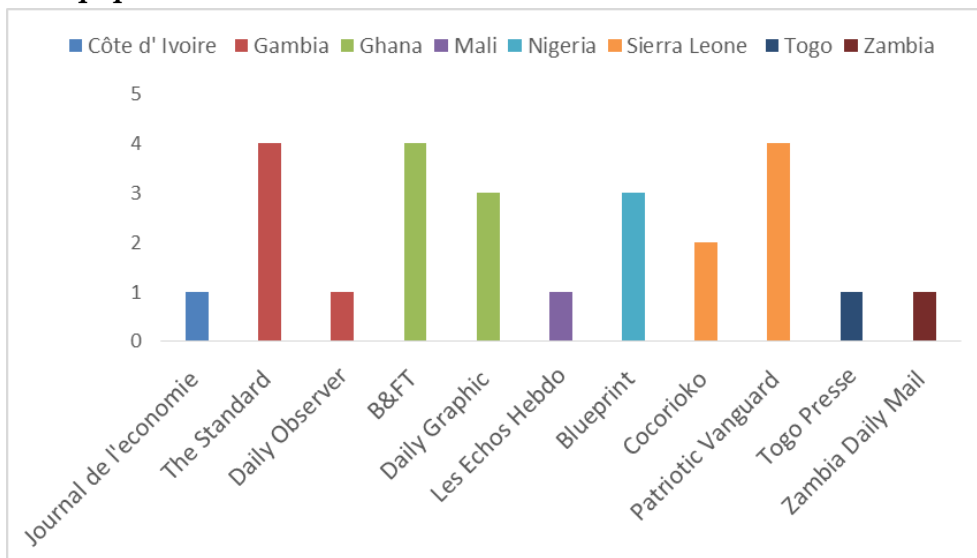
Major Media that Covered UNU-INRA Stories

Major media networks in Africa and beyond have covered UNU-INRA news in 2015. These media include online, print and broadcast media. Key Africa media that dedicated much space and airtime to UNU-INRA stories include Ghana Government official portal, myjoyonline.com, Daily Graphic, TV3, Joy News, Business & Financial Times (BFT), Daily Graphic, all in Ghana, The Patriotic Vanguard, and Cocorioko (Sierra Leone), The Standard Newspaper and The Point Newspaper (Gambia), and Blueprint Newspaper (Nigeria). Other international media include UNISDR (Switzerland), UNDP and News for Africa (USA), and AllAfrica.com (UK). Below are details on major media that covered UNU-INRA activities in 2015:

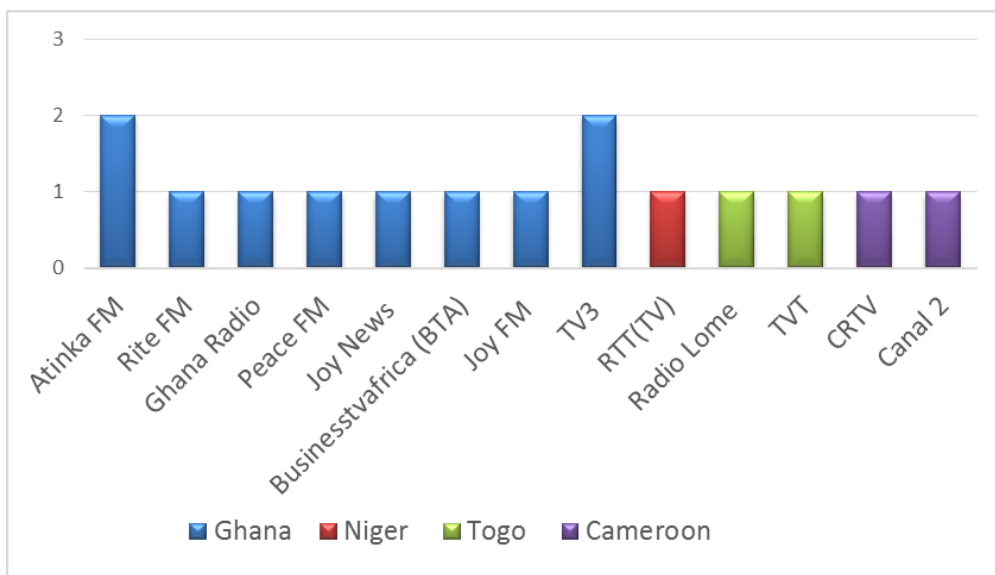
Online Media



Newspapers



TV and Radio



Website

UNU-INRA website received 25,110 page views from 5,739 users in 2015. The top ten countries for visitors to the website were:

No.	Countries	Sessions	% Sessions
1.	Ghana	2,316	20.43%
2.	Uganda	566	4.99%
3.	Kenya	558	4.92%
4.	Nigeria	516	4.55%
5.	United States	461	4.07%
6.	Ethiopia	434	3.83%
7.	Japan	431	3.80%
8.	Cameroon	426	3.76%
9.	Germany	398	3.51%
10.	South Africa	286	2.52%

Stakeholder Relations



H.E Timothy Mwaba Walamba, Zambia High Commissioner (middle), on his left is Dr. Elias T. Ayuk, UNU-INRA Director and Mrs Praise Nutakor, Communications and PR Associate, UNU-INRA, on his right.

UNU-INRA continued to deepen its working relationship with various stakeholders to share information on its research and other activities with them. In 2015, the Institute paid courtesy calls on a number of government representatives. For instance, high commissioners in the following missions were visited:

- South African High Commission
- Norwegian High Commission
- Zambian High Commission

The Institute seized the opportunity to present key policy briefs on its research findings to the High Commissioners.

UNU-INRA also concluded discussions with the Cameroon Government, leading to the signing of cooperation agreement and a commitment to contribute two million US Dollars (\$2million) to its endowment fund per year, over a period of three (3) years.

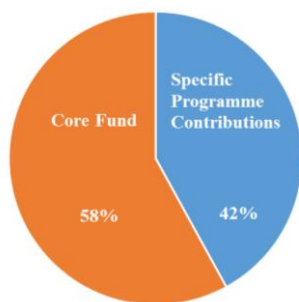


H.E Adoum Gargoum, Minister Delegate in-charge of Islamic Affairs and Prof. Jakob Rhyner; Vice Rector of the UN University signing the cooperation agreement.

FINANCE

Income

UNU-INRA's income comes from two sources: specific programme contributions and core income. The specific programme contributions are from project funds, supported by donor partners, while the core income is generated from interest on contributions received from African governments to UNU-INRA's endowment fund and support from the UN University headquarters in Tokyo, Japan. For 2014-2015 biennium, core fund was about 58% of the Institute's budget, and specific programme contributions was 42%.



Projected budget for the Institute's activities for its head office in Accra and operating units (OUs) was \$3,074,000.00 for the 2014-2015 biennium.

Endowment Fund Contributors

UNU-INRA appreciates the continued contributions from the Governments of Ghana and Zambia to its endowment fund. The Institute is also grateful to the Government of Cameroon for signing a cooperation agreement to provide a funding support to the Institute.

Specific Programme Contributors

UNU-INRA is grateful to the following organisations for the funding support to carry out specific projects:



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