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Review

Challenges of environmental threats and increased use of science and technology

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The 21st century is faced with the challenges of environmental conservation, population explosion, desertification, soil erosion, pollution, other environmental threats and increased use of science and technology. It would therefore, be vital to strengthen research and education in forest and environmental protection to equip the public and the rural inhabitants adequately for survival. This review up established that forestry extension has great implications for forest protection and conservation as the importance of the environment and forest ecosystem to human survival can never be underestimated. It is emphasized that existing and emerging scientific information about biodiversity need to be communicated and new concepts and technologies in conservation need to be conveyed if sustainable forest management and development is achievable and if the present heightened loss of genetic diversity must be curtailed. The challenges of forest extension workers as identified by this paper include lack of professional and managerial capacity, serious financial crisis due to overdependence on federal government, lack of public understanding and support and non inclusion of the women folk as most extension services are directed to men who are the heads of households. The paper concluded that the ways forward among other things are reinforcement of forestry extension services, restructuring of existing forestry professional levels and strengthening of missing linkages across institutions needed for forestry extension among others.

Key words: Forest depletion, forestry extension, implications, forest protection, environmental conservation.

INTRODUCTION

The importance of the environment and forest ecosystem to human survival can never be over stressed. Humans depend on the relationship with the environment for safety, health and survival (Foskett and Foskett, 2004). The present situation, where the environment is recklessly assaulted and degraded by individuals and corporate bodies, portrays serious danger to all life forms and it unveils man's ignorance in terms of environmental education and consciousness (Pickering and Owen, 1994; Welford, 1996).

Forests play an important role in the water cycle, carbon sequestering, as a genetic bank and source of food; they stimulate rainfall, protect soils from erosion and regulate the flow of water (Agbogidi and Eshegbeyi, 2008). Tropical forests are disappearing fast while the number of people depending on them grows steadily. It is worthy of note that as environmental services are degraded and users become affected, people become more environ-mentally conscious and will want to protect the environment (Pepper, 1996). Agbamu (2006) posited that knowledge and skills have always played an important role in economic growth. With education, labour productivity is greatly enhanced, resulting in increased physical capital and it is universally acknowledged that technology is produced at a cost by investment in research and development. In order to do this effectively, there is the need for a substantial investment in education and research by governmental, policy makers, non governmental bodies as well as the private sector participation including extension for forest conservation and protection. This review is an attempt to provide information on the roles of forestry extension in forest protection and conservation.

Forestry extension: What it entails

Extension is the dissemination of relevant information and advice to farmers and a mechanism for delivering information and advice as an input in modern farming. According to Onumadu et al. (2001), extension education is regarded as one of such wide educational inputs designed for farmers to help themselves. Williams et al. (1984) as cited by Onumadu et al. (2001) maintained that extension education is a voluntary out- of-school educational programme for adults comprising relevant content derived from researches in the physical, biological and social sciences and synthesized into a body of concepts, principles and procedures. Forestry extension programmes are designed to meet the needs of small- scale farmers through agro-forestry technology, conservation of small-size log and wood processing technology, scientific information about biodiversity and new concepts in conservation. This can only be achieved with aggressive forestry extension.

Improved information, analysis and research are required to enable forest managers to meet the current challenge. This is because; there are inadequate forest data as well as the incompatibility of definitions and measurements employed by those agencies involved in forest data gathering and analysis. Even official forest data are suspected by those knowledgeable about the field and the manner in which data are collected or submitted is debatable (Salim and Ullsten, 1999; Agbogidi and Ofuoku, 2005).For example, the forestry department of the ministry of environment gave unreliable data to the students of forestry who were doning a survey study. This happens in a situation where the number of trees harvested can not be accounted for as a result of illegal felling by forest raiders. The implications of forestry research and extension include to; foster clear awareness of and concern about economic, social, political and ecological interdependence in urban and rural areas. It also provides every person with oppor-tunities to acquire the knowledge, values attitudes, commitment and skills needed to protect and improve the environment and create new patterns of behaviour in individuals, groups and society as a whole towards the environment.

Improved research and training are necessary to support the process towards sustainability. To this end, there should be establishment by existing institutions and programme of an international network within which, research for sustainable forest management can be enhanced and training can be accelerated. Support has to be given by corporations of such a network as a means of enabling them to satisfy sustainable forest management requirements, standards and certification systems. Currently, research into forest management is scattered across many disciplines, with little systemic attempt to combine data and integrate analysis (Agbogidi and Ofuoku, 2005). More so, there is still much uncer-tainty about the functioning of the forest ecosystems, as well as the understanding of forest and climate change relationships is in its infancy (Salim and Ullsten, 1999). Forestry extension programme involve training activities for communities through short–term courses, field visits and practical demonstration in specific areas and disciplines including tree tending techniques, mainte-nance of hand tools, sustainable harvesting practices, interrelationships of the forest components etc (Roger, 1971; Oladele, 1996; FAO, 1997; Eke, 2001). All groups of forestry personnel need one form of training or another to enable them face the challenges for sustainability of the resources they manage and keep abreast of developmental approaches in the new millennium. They require training in extension practices, data gathering and storage techniques and sustainable forest management practices (Ogunwale et al., 2006). Apart from the earth summit, which took place in Rio de Janero in June, 1992, other bodies including?

(a) Non-governmental organizations (NGOs) such as the Nigerian environment study (Action) team (NEST), Nigerian conservation foundation for environmental development and education in Nigeria (FEDEN),

(b) Governmental agencies such as federal environ-mental protection agency (FEPA) now a full fledge ministry of environment are actively involved in forest conservation and protection.

In-service training for professionals and managerial staff are necessary to keep pace with technical and methodological developments. Refresher training is also advocated because of its inherent benefits. In the area of technical and vocational education, existing facilities in forestry schools, forestry institutes etc, need to be improved to keep up with developmental and techno-logical changes. The acceptance of information by farmers to a larger extent depends on the use of appropriate links for messages relevant to their needs. There is a growing need for more social science research into the interactions between demands from society, policy development and implementation and forest functions and management. Education in forestry has to shift from forests in isolation to the relationship between forests and society, with attention to other land users and diverse user groups as obtainable in the Netherlands (Bartelink et al., 1996). Training could be regarded as an extension tip, which could be greatly explored as a communication method where agricultural development project (ADP) collaborates with other institutes to organise such training. The role of an extension agent is very crucial to the farmers. They serve as link between research and farmers bringing information of new improved technologies from researchers (Oladele, 1991). Research and extension efforts should be devoted to be complex, diverse and risk proved areas where many of the poor live. Effective and detailed forestry research and extension are required for technical communications for forest technology.

Role of forestry extension in forest protection

Our forests cannot be protected and conserved unless extensionists can demonstrate to the local people that they can make a reasonable livelihood from the forests on a sustainable basis. The best way to protect the forest and its vast diversity is to create awareness among local inhabitants of their value and involve the people in protective measures through extension aggressive forestry extension is a must if sustainable forest management (SFM), which has always been the goal of foresters, is achievable (Agbogidi et al., 2005). Agbogidi et al. (2005) further maintained that now that forestry as a profession has many more concerns including biodiversity conservation, community participation etc and the need for forestry extension at all levels cannot be over emphasized. In the same vein, given the changing nature of the challenges facing SFM in the tropics including Nigeria, forestry education at all levels is recommended.

Forestry extension will enable the populace to know that forests will be better enjoyed by sharing their benefits if sustainably managed (Ogunwale et al., 2006). Loss of genetic diversity and tropical deforestation according to Kola-Olusanya (2000) and Agbogidi and Dolor (2002) can better be solved through aggressive environmental extension. Kola-Olusanya (2000) posited that earth habitat destruction and poaching have become major threats to the continued existence of many plant and animal species. Climatic changes are fall outs by our environmental mismanagement by man (Onumadu et al., 2001). Onumadu et al. (2001) and Adeodun et al. (2005) stressed that environmental forestry coupled with an aggressive extension education stands out as the best option for combating environmental degradation. This is because, loss of genetic diversity is a problem not just because once extinct, a species is lost forever, but because of the cumulative consequences these losses have for our ability to develop new sources of food and pharmaceuticals and to understand the world we live in (Agbogidi and Dolor, 2002). Forestry extension is necessary for forest protection as it will enable the public, especially the rural dwellers, to understand that the wide spread harvesting of trees for fuel burning and the clearing of land for agriculture and cattle raising has resulted in the destruction of our tropical rainforests. About 60% of the earth's remaining forest is found in the developing world where the rate of deforestation is alarming in that 0.2 million trees are felled daily in Delta state, but replacement is not done (Agbogidi and Dolor, 2002; Agbogidi and Ofuoku, 2007). Deforestation has also been reported as a contributing factor to the high rate of loss of genetic diversity (Agbogidi et al., 2005). The emphasis on sustainable development is not only on production without lowering the environmental quality and the productive capacity of the ecosystem, but also on maintaining and improving the well-being of people, as well as enhancing their capacity to utilise available resources effectively and efficiently to meet the needs of present and future generations. Sustainable agriculture and forestry are founded on ecological principles and which are more harmonious for people, our societies and culture (Taylor, 2002).

Madumere (2003) noted that effective utilisation of information and communication technology such as television, giggles, radio, internet, etc could help in the teaching of environmental education. With environmental education, people are influenced towards a better interaction and sustainable use of natural and man-made resources. Field foresters need to be equipped with new tools of rapid rural appraisal and techniques for conflict resolution as well as market research. These skills will make them better able to support the range of activities involved in developing all forest resources including the non - wood products. To this end, field foresters need to understand disciplines that earlier generations of foresters may not have emphasized including forest ecology, anthropology, forest economics, forest pathology, etc. This can only be achieved by forest extensionists who will also help to improve the relationship between forest services and rural communities. Owolabi and Dansu (2005) noted that capacity building in the sciences including forestry is imperative if forestry must remain a recognized profession, forestry extension and research must be given a priority. If we are concerned with education for development, then we must consider the specific ways in which educational programme and institutions and systems contribute to the goal of environmental integrity and sustainability (Taylor, 2002). This is because, without environmental education there will be no biodiversity conservation, a goal of sustainable development (Agbogidi and Ofuoku, 2007).

Conservation education programme aims at increasing public awareness of biological diversity issues and stimulate pride in and enjoyment of Nigeria's unique biota. Extension can assist farmers by increasing their awareness of improved forestry technology and by improving their decision making skills with respect to their consciousness about environmental issues. Forestry extension improves forestry by enhancing the knowledge, attitudes and skills of the forest population. It will aid rural development by the application of technological innovations to the agricultural production process (Rogers, 1971) because forestry extension helps to communicate the results of experimental research to farmers. By so doing, forestry extension contributes to social development, home making and youth develop-ment and subsequently, poverty reduction (Ekpere and Durant, 1999; Eke, 2001; Reid et al., 2006). Agbogidi and Ofuoku (2005) maintained that forestry research is a veritable instrument for food security and environmental protection and conservation because, according to them, investment in forestry research has a multiplier effect and can improve the lives of the people by providing job opportunities and other services. With forestry extension,

the public could be made to know that planting and conservation of natural trees provide valuable crops and timber, soil conservation, crop shade, wind breaks, and wildlife habitats. In the same way, forests extension will enable the rural populace to recognise that the economic viability of the forest sector is a prerequisite to safe-guarding the environmental, social and cultural functions of the resources. Over exploitation impacts negatively on biodiversity and sustainable use of tropical rainforest ecosystems. With forestry extension, rural communities could learn that forest resources should be used sustainably by using and re-using the forests as against the current unsustainable practice indulged in by most rural inhabitants.

Challenges of forest extension workers

One of the main reasons for poor management of forest resources is the lack of professional and managerial capacity, which could be updated with relevant curricula. The numbers of forestry extensionists are grossly inadequate when compared with the large number of the people who require their services. Even the few trained personnel are not given enough incentives to boost capacity building in Nigeria. In 1998, the international institute of rural reconstruction (IIRR) noted that many extension workers are without a clear idea of their role hence it is not possible to impact what they do not have.

Currently, Nigerian education and research sectors are facing serious financial crisis. As a result important developmental and expansion plans have been curtailed and the quality of work impaired. There is over depen-dence on the federal government for financial assistance which releases inadequate funds irregularly and epileptically. In addition, the instability of governments and their policies affect fund release. Hundreds of thousands of extension workers are without salaries, incentives and support (IIRR, 1998). Forestry extension programme needs adequate funding to ensure successful extension service delivery. Extension programme are expensive considering the recurrent budget (Adegeye and Azeez, 2006) . Due to inadequate foreign exchange earning and poor gross domestic product of developing countries, they are unable to adequately provide the funds needed to operate efficient extension systems (Agbamu, 2005). Poor financing of extension programme has been a long standing problem facing the services as echoed by Adams (1984) and Williams (1989) as cited by Agbamu (2005). This problem of inadequate funding still persists today. Funds are required to purchase audio - visual aids and other communication facilitates for training the forest orientated populace; office equipment and secretarial materials; to provide transport facilities for field staff and to pay salaries and allowances of staff in the extension service. There is also the challenge posed by poor logistic support for field staff. This is very much related to the problem of planning and organization required exe-cuting large and difficult operation in extension service. It also concerns the skill of moving personnel and supplying them with work materials. The main problem as far as logistics are concerned is mobility of extension agents to the various locations where they have to render their services to the forest communities on a daily basis. Transportation of field staff is very important in operating an efficient forestry extension service. In many developing countries, and in Nigeria in particular, extension workers in the block, district, or cell / village levels who have the responsibility of training and visiting farmers in various communities lack dependable official means of transportation to fulfill their weekly itinerary as suggested by Agbamu (2005) . Where vehicles and motor cycles are available, they are few and as a result, leave a large number of extension practitioners without means of transport. The poor arrangement of public financed extension system in the provision of transport for field staff has exacerbated their inability to achieve some of the goals of extension programme. This is also known to affect proper supervision of the field level staff because extension supervisors are not adequately encouraged with vehicles for their mobility through the areas of operation to over see the work of the field officers at intervals.

Disproportionate extension agent to forest family ratio is another factor is a very critical problem facing forestry extension in Nigeria. The number of forestry extension workers that provide service to the enormous population of forest related population is insufficient. The population of extension workers in relation to the number of farm families has been a perennial problem in Nigeria and other developing countries. According to Agbamu (2005), in 1995, Nigerian agricultural development programmes (ADPs) were able to cover 7,809,500 farm families, and operated at the rate of 1:1,189 farm families, in April 1997, Nigeria had 6,563 extension agents with an extension agent, farm family ratio of 1:1,615. On the other hand, Agbamu (2005) further posited that the ratios for Indonesia, Mexico and Tanzania are 1:1,200; 1:800 and 1:1000 respectively. These are in sharp contrast to 1:252 and 1:500 found in Japan and South Korea respectively (Agbamu, 1998). In 2003, the ratio of agricultural extension agents to farm families in Nigeria is about 1:1,722. This meant over stretching the workforce and calls for the need, to recruit more extension agents in Nigeria so that they can cope with the population of farmers who also happen to constitute the forest communities.The disproportionate ratio of extension agent to forest / farm family that is prevalent in the developing countries had led to a situation in which many rural dwellers or farmers do not benefit from the available services. Davidson et al. (2001) reported that 3 out of 4 Asian farmers have no contact with extension agents or services. Agricultural extension services are often direc-ted to the heads of households with the assumption that once the information reaches the head; it will automatically be shared with the rest of the household.

This is however, not always true and women often have little technical information necessary to improve their forestry activities (Eke, 2001; Larinde, 2003).

The forestry sector is administered at the federal, state and local government levels according to the Nigerian constitution. However, there is a lack of clarity in the mandates of the 3 levels. As such, forest production has fallen, creating an imbalance between supply and demand. From its previous status as a significant exporter of forest products, Nigeria has become a net importer. Besides, the wood- processing industry is characterised by outdated technology, poor recovery and inefficiency. In addition, data are generally weak and the federal government cannot confirm the accuracy of the data presented herein. For example, out of inefficiency, our foresters do not know the population of each tree species in our forests (Eke, 2001)

Forestry extension will not succeed without strong public understanding and support. These in turn, can only be fostered by communicating information about values, status and conservation of biological diversity in Nigeria in the public school curriculum, in professional training and development and in various public fora (including museums, zoos, national parks, information and visitors centers as well as mass media).

Democratic short–sightedness: What a particular government administration may consider important may not be included in the programme of another government. In addition, various governments are more driven by immediate economic projects compared to long time ones. In another development, each regime had its own development scheme with various extension programme tied to the different development schemes. The led to the occurrence of policy instabilities such that extension personnel had to adjust to the various policy shifts, modifications and reversal in extension policy thrust. With changes in policy, there come changes in extension programme and strategies. The frequent changes in policy and institutional arrangements in extension in Nigeria led to extension programme instabilities. The lack of clientele participation in programme development is also a challenge to forestry extension. The management of agricultural extension systems in developing countries is such that agricultural programme for clientele are planned by experts in an extension agency and decisions are taken by senior staff at the headquarters: who are not in touch with local problems facing the rural populace. Those changes with the responsibility of programme development hardly identify with beneficiaries and the beneficiaries anxieties and fears. A good extension programme planning and implementation will use village or forest level approach and it would concern itself with the understanding of what the forest users consider as an optimal farming system and how this varies with individual forest users circumstances; the constraint facing the farming or occupational system from the forest beneficiaries perspective; ways of reducing the constraints and inducing desirable changes in forest communities behaviour and implications of various communication approaches for infusing new techniques into the forest community. The lack of involvement of stakeholders in the planning and implementation of extension programme has been responsible for programme failures.

There is an over- emphasis on commercial products and under emphasis on sustainable production systems. Forestry research tends to focus almost only on increasing production while other important uses including best management of forest resources for multiple uses are neglected. Forests have not had the extensive research and management bestowed on other cultivated tree crops such as rubber, coffee and citrus. The long generation times of most trees (5 - 20 years) when compared to herbaceous crop plants can well explain the lack of comprehension of their life cycles.

The way forward

Forestry extension services need to be reinforced or strengthened to obtain maximum co-operation from rural communities towards sustainable forest management. Such services should be aimed at helping rural communities to articulate their needs, environmental problems and their perceptions of possible solutions to identified problems. The system of extension and information dissemination including materials and methods relating to conservation and sustainable development, cultivation and management, harvesting and processing of forest products need to be strengthened. Research agenda should not skew research away from sustainable systems for local subsistence and local markets. Research should not be duplicated and research finings through linkages between institutions should be adequately utilised. Because Africa and Nigeria in particular has a proportionately larger rural population than other regions, relying more on subsistence uses of the non-wood forest products (NWFPs) than on marketing the products, research studies should recognise this in assigning priority. For example, research and extension efforts can show greater impact if they consider the effect of gender on activities related to NWFPs (Welford, 1996). For example, women often notice pest and insect damage earlier than men, who are sometimes, involved only in harvesting and planting. In the same way, a programme, which aims to improve monitoring of plant health would show best results if it identifies women as a target group (Ogbodu, 1992; FAO, 1995).

Forest valuation studies should be carried out and the development of mechanisms that will allow the values of forest to be appropriated in a manner that will support both the conservation of the forest ecosystem and sustainable forest based development should be given a top priority (Sene, 1995).

There is the need for the restructuring of existing forestry programme at both technical and professional levels such as including community/social forestry, environmental education and assessment and rural development using forestry principles (FAO, 1997). Similarly, there is the need to review and upgrade the schemes, curricula and syllabi to correspond with modern techniques of resource management and sustainability. Local language abstracts and manuals are essential to reach rural audiences (FAO, 1995) . For research findings to be more applicable, they need to be available to the communities that need them. Missing linkages across institutions needed for forestry extension need to be strengthened (Onumadu et al., 2001) as there is a missing link between research-extension-forest community linkage. The formation of strong independent farmers' multi- purpose organisations to represent their interests and to have some influence on extension activities is needed. Forestry extension should not be a government service alone but should be privatised. In this way, the government can then help in the provision of agricultural adversary services. Position future scenarios require significant investments in environmentally protec-tive technologies, public goods (particularly education and health) and poverty reduction. Research and extension efforts should be devoted to the complex, diverse and risk prone areas where many of the poor live. In the same way, research and extension should tilt towards non-commercial tree species grown by the poor farmers and adapting relevant technologies.

Regarding funding, governments need to demonstrate the political will to perceive forestry extension service as a priority area in their development agenda and commit reliable flow of funds to it (Agbamu, 2006). The government need to ensure a more sustainable funding arrangement that is not dependant on temporary assistance from donors. To solve the problem of logistic support, incentives should be given and should be such that staff that is good in field work should be encouraged to remain in the field, in rural areas by providing them accommodation, permanent vehicles and rural allowance. Such logistic support will be a source of encouragement to field staff in rural communities who are cut from basic social facilities, to help extension organisations to achieve the broad goal of forest protection and conserva-tion or development. Beynon et al. (1998) argued that adequate material provision and better service back-up in the field will depend on improvement in management of forestry extension organisations and incentives for field staff.

To take care of the problem of planning and implementation of extension programmes, administrators must ensure that at all stages of planning and implementation, the forest community for whom the programme is designed should be given opportunity to participate in its planning and implementation process. More time and energy need to be devoted to environmental education at all levels. A national strategy for environmental education should be developed by the extension agencies and an advisory group of scientists, educators and conserva-tionists be appointed to provide guidance and advise in the design of curricula involving biological diversity and its conservation, development of teacher training programmes, organisation of extension services to disseminate information about biological diversity to new landholder and to communicate landholder concerns back to the scientists and policy makers.

The proposal for a global forest information service (GFIS) which was agreed upon at an international meeting in Austria in September, 1998 could be a useful start to addressing this problem. For activities in which women are the key actors, information is a must if they are to participate (Agbogidi and Okonta, 2003). The extension system should also acknowledge the importance of local knowledge. Agro tourism and agricultural diversity should as well as ecotourism be integrated or partnerships between stake holder (including farmers, extension workers, researchers, farmers' co-operatives unions, political administrations, exporters and foreign buyers) at every state of the research process should be advocated.

Conclusion

The extension services have a vital role to play in increasing forest protection and conservation through their linkage role between researchers and end users. Without extension, most research endeavours will be futile. The protection of forests depends on how effective extension services are. For the forestry extension service to be effective, the challenges facing the service must be seriously considered and the way forward fathomed. Researchers should not be skewed away from sustainable systems of local subsistence way of life of the local communities. Research and extension should increase focus on women who are often more connected to forests than the men. Forest valuation should be carried out and mechanisms that will support conservation of the forest ecosystems and sustainable forest based development given a top priority. The missing linkages between research and extension organisatons need to be retraced and strengthened; the institutional frame work and infrastructure for expanded, relevant and up to date training need to be given urgent attention. There is also the need to invest in environmental protection technologies, public education and poverty reduction. Funding of forestry extension programme should be such that has political will to perceive forestry extension as a priority area; better materials and service back up should be provided for extension agents; adequate participation of clientele should be given top priority and consistent extension policy should be enacted. More resources should be devoted to environ-

mental education at all levels and women who are the major end users of forest products must be reached by extension services in any of the forest protection/ development programme. Governmental and non–governmental bodies participation is highly required as the adage goes that 'a finger can not remove lice from the head, it requires the assistance of other fingers.'

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