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The impact of Bioversity International's African Leafy Vegetables Programme in Kenya

IMPACT ASSESSMENT DISCUSSION PAPER 1

Bioversity International's Impact Assessment Discussion Papers aims to stimulate discussion and critical comments. All discussion papers are peer reviewed and are or will eventually be published in some other form.

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Abstract

One of the objectives of Bioversity International is to promote income and food security by ensuring that agricultural biodiversity is conserved, characterized and used to improve productivity. The African Leafy Vegetables (ALVs) programme was initiated and implemented to meet this objective. Since the programme was concluded almost five years ago, no impact evaluation has been carried out. Thus the purpose of this study is twofold: to evaluate the role played by Bioversity and its partners in the programme, and to assess the impact of the ALVs programme on the livelihoods of farmers in Kisii, Tharaka, Kilifi and peri-urban Nairobi. The study utilized both secondary and primary data. Primary data was generated between June and July 2007, using 211 randomly selected households stratified into participant and control households. Information from the survey was complemented by focus group discussions. To assess the role of Bioversity and its partners, all the partners, both directly and indirectly related to the project, were identified and interviewed. Bioversity was found to have ably acted as catalyst, facilitator and coordinator of the programme. Results further showed that production, consumption and marketing of ALVs had increased since 1997, women still dominated most of the ALVs activities, and those households that marketed ALVs were relatively well off than those that did not.

Keywords: Agro-biodiversity, ALVs, In-situ Conservation, Kenya, Poverty Alleviation, Impact Assessment.

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Introduction

Bioversity International's (hereafter referred to as Bioversity) global mandate is to conserve and use the world's plant genetic resources for the development and welfare of present and future generations[1]. Thus the purpose of Bioversity's work is to ensure that individuals and institutions are able to make optimal use of agricultural biodiversity to meet the current and development needs of people and society. In this regard, Bioversity carries out a range of activities to meet several broad objectives, all geared towards agricultural biodiversity, and works through partnerships with other institutions ranging from large international organisations to small community-based organisations (CBOs), with host of others in between that include national institutions, nongovernmental organisations (NGOs), universities, and private entrepreneurs (IPGRI, 2004).

One of the objectives of Bioversity is to promote biodiversity for income and food security by ensuring that agricultural biodiversity, is conserved, characterised and used to improve productivity. The African Leafy Vegetables (ALVs) programme is one of the programmes carried out by Bioversity to meet this objective and it fells within the overall Bioversity's strategy on neglected and under-utilised species[2].

Since the programme was implemented, starting 1996, no comprehensive assessment of its impact on nutrition and income generation has been carried out. In Kenya, seemingly significant milestones have been realised. Once relegated to poor man's crop, ALVs are now found in the country's most modern supermarkets, is a major constituent of many dishes of the people living in Nairobi, and it seems to have attracted a significant number of research institutions, universities, NGOs, CBOs and even private companies. Past studies on ALVs have tended to be more explorative, and ex ante analysis. Since the programme was implemented almost ten years ago, and since it was concluded over five years ago, it is important to conduct an evaluation of its impact and sustainability. Secondly, many partners have been involved in this programme and it is important to identify the role that Bioversity actually played, and the role played by its other partners.

The aim of this study is therefore geared towards assessing the impact of the project on household budgets and nutrition of target communities' households; and to identify the role of Bioversity and partners in the whole project.

[1] *For convenience, we use 'Bioversity International' in the text even though the activities to which we refer may have occurred during the time of one of its predecessor organizations, respectively, 'The International Board for Plant Genetic Resources' (IBPGR), from 1974 to 1991; and 'The International Plant Genetic Resources Institute' (IPGRI), from 1991 to 2006. With effect from December 2006, IPGRI and INIBAP have operated under the name 'Bioversity International,' Bioversity for short. This new name echoes the strategy of Bioversity International, namely improving people's lives through biodiversity research. For further details on Bioversity work visit: www.bioversityinternational.org.*

[2] *For a definition of neglected and underutilized species see IPGRI, 2002:P12.*

Assessing the impact of agricultural biodiversity research: methodological challenges

At Bioversity impact assessment has a prominent and critical role to demonstrate the link between programme results and human welfare. The impact assessment system put in place over the last several years focuses on assessing the consequences of research-based interventions that build on and/or foster the use and conservation of agricultural biodiversity to improve people's lives.

Assessing Bioversity's impact is thus very challenging precisely because this relationship requires multi-faceted interventions. The complexity is due to the fact that agricultural biodiversity generates different types of benefits, which have different "social and economic" properties that affect their use and management and occur at different scales, from the local to the global. Another layer of complexity has to do with the way that Bioversity operates, working with a multitude of partners to develop and implement its projects. The links between Bioversity's roles, actions and outputs contribute to wider processes and thus expected impacts follow intricate pathways. Outputs coming from Bioversity's research are diverse; so too are the pathways that connect these outputs to disseminated outcomes that subsequently generate a change. Overall, the changes brought about through Bioversity's research activities manifest themselves in the different ways that agricultural biodiversity can be used to improve human well-being in general, and livelihoods in particular.

The goods and services that humans derive from agricultural biodiversity are varied and intricate. For example, a diversity of foods needed for a balanced diet; both foods and agricultural practices with a wide array of cultural significance; genetic diversity for adaptation to heterogeneous and variable environments; the ability to manage agricultural pests and diseases. This complexity and diversity are reflected in the fact that agricultural biodiversity generates many different types of benefits, and hence types of value, for humankind. These goods and services, as well as their associated benefits, have different economic properties that affect how they are used and managed. These have to do with the extent to which their use by one agent reduces (or not) their availability to another (known as rivalry) and the extent to which one agent can (or cannot) exclude others from using or benefiting from the good or service (excludability). The combination of these two properties, rivalry and excludability, creates four categories of goods and services that define how their benefits are accessed and managed by society (figure 1).

In principle, private goods and benefits can usually be allocated efficiently by markets. However, due to transaction costs and information asymmetries, this is not always the case. Public goods and services (either common or collective) are usually misallocated by markets, creating major externalities, i.e. uncompensated impacts of one agent's actions over the welfare of another. Externalities can be positive or negative depending on whether the impact of the actions of the former increases or decreases the welfare of the latter. An example of a negative externality associated

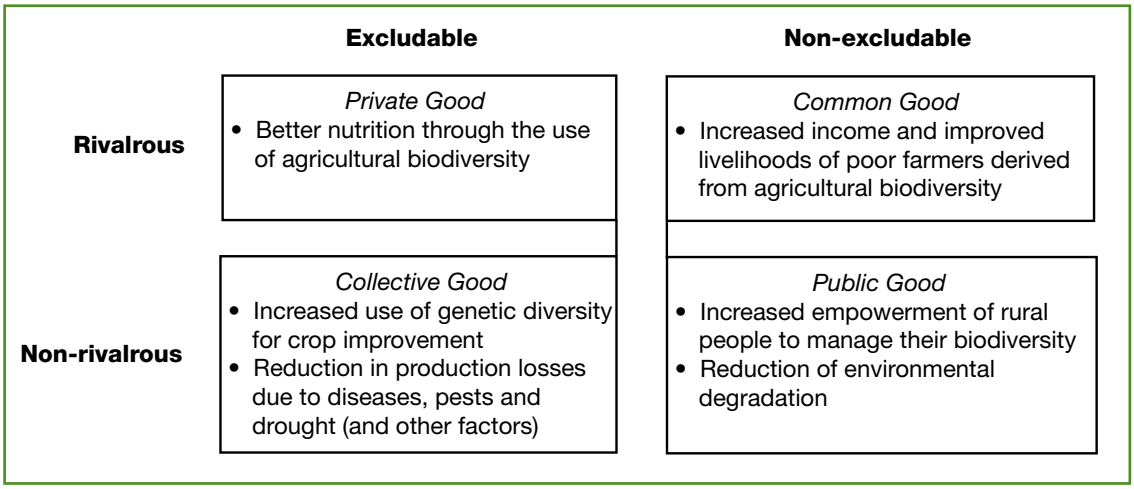

***Figure 1**. Biodiversity public and private goods.*

with agricultural biodiversity is the fact that highly developed markets tend to create strong incentives to specialize in the most profitable crop or variety. This in turn creates extremely uniform crop stands in space and time that translate into high vulnerability to pest and disease outbreaks, which affect those who profit from the uniformity, but also affects consumers who, through no fault of their own, will have a less reliable food supply.

Many of the goods and services provided by agricultural biodiversity are public and in numerous cases even those that are private may not be allocated efficiently by markets, creating very strong negative externalities for society. Since markets are poor at valuing many of the benefits of agricultural biodiversity, market prices tend to underestimate their worth, leading to poor allocation decisions, which can result in a lower current or future supply of these benefits than is socially optimal. Through research and interventions, an important role of Bioversity and its partners is to contribute to documenting and correcting these negative externalities.

A further complication is that the benefits of agricultural biodiversity occur at different scales, from the local to the global, and these scales are linked, but sometimes in complex ways. For example, the costs and benefits of using and conserving agricultural biodiversity may be distributed differently across scales. There tends to be a spatial mismatch between conservation costs and benefits. Economic benefits tend to be limited on a local scale, increase somewhat on a national scale and can be substantial on a global scale. On the other hand, costs, in terms of foregone development opportunities, tend to be locally significant and nationally and globally moderate. Tracing impact from one scale to another presents particular problems that require rethinking or adapting existing methodologies or creating new ways of approaching the assessment of impact across scales. This is one of the main thrusts of the impact assessment system Bioversity is developing (figure 2).

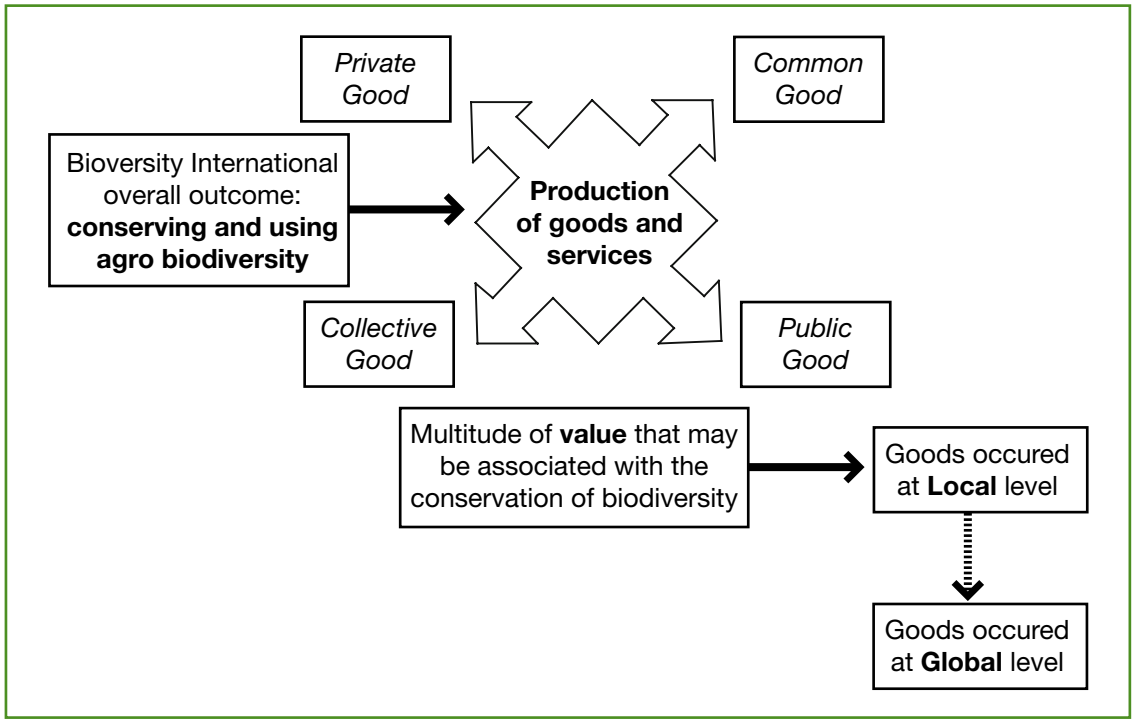

***Figure 2.** Bioversity International Impact assessment structure.*

Cost-benefit analyses, which are traditionally used to analyze allocation decisions and evaluate alternative investments, also present problems for Bioversity because many of the benefits generated by the organization, such as the conservation of biodiversity or the development of methods to empower communities to manage their genetic resources more effectively, cannot be as easily measured and monetized as increases in yield or efficiency in input use. The application of both cost-benefit and cost effectiveness analyses to Bioversity's work hence presents important methodological challenges that require further research, particularly on economic valuation of the benefits of agricultural biodiversity, an area of research currently being developed.

The African Leafy vegetables programme in Kenya

Since 1992, discussions on the fate and future of ALVs were going on amongst the African scientists some of whom had been working on these vegetables for a long time. In 1995, Bioversity's Sub-Saharan Africa office convened a workshop in Nairobi on traditional vegetables (Guarino eds, 1997). The following year (1996), the ALVs programme commenced, with research activities in collaboration with partners in Botswana, Cameroon, Kenya, Senegal and Zimbabwe to increase the understanding and knowledge about the plant genetic resources of traditional vegetables, their distribution and local use by rural communities. The programme was implemented in two phases. The major focus of phase 1 (1996- 1999) was conservation through use, since collecting and storing these vegetables was not an option as they were too many, too localized and still not much was known about their genetic diversity. The specific objectives included:

- To document the indigenous knowledge on diversity and use of leafy vegetables
- Identification of species based on use and availability
- Identification of priority species for further work
- Germplasm sampling and characterization
- Chemical analyses to document variation in nutritional composition
- Effects of storage and processing techniques on nutritional quality

The project (phase 1) identified a number of constraints in terms of seed quality, availability and supply, identification of varieties that were easier to prepare and transport. Genetic diversity was found to be a key factor in improving the competitiveness of ALVs. As a result it was found necessary to launch the second phase of the project to follow up on the findings of the first phase. The second phase officially ran from 2001 to 2003, though work continued through much of 2004. The main goal of phase two was to exploit the potential contribution of ALVs towards improving the nutrition and food security of vulnerable groups, namely women and children, in sub Saharan Africa.

The specific objectives of phase two (2001 to 2004) included:

- To collect, describe, map and conserve germplasm of priority species of ALVs
- To enhance genetic material of priority ALVs
- To improve horticultural practices for ALVs
- To improve seed systems and on farm management of ALs
- To improve handling, marketing and processing of ALVs
- To disseminate information about ALVs to target groups
- To increase capacity increase the capacity with the national agricultural research programme to evaluate, conserve and promote the use of ALVs (IPGRI, 2001).

As a research outputs over 37 research papers were presented in national, regional and international conferences, over 17 were published in referred journals while some results led to academic degree awards[3]. In the latter, a total of 13 MSc and MA Students and two PhDs were supported during this phase in Kenya alone. An MSc course on traditional vegetables was also launched at Maseno University during the period. In addition several staff of the universities and research institutes receiving technical training in germplasm characterization, description and mapping. Other scientists gained technical experience as they carried out various projects. Networking among national and international scientists in ALVs was also fostered through the planning meetings, regional workshops and international conferences attended.

Many organizations reported some work on ALVs before Bioversity programme. However Table 1 below shows that most of the organization started after 1996, with the mode being 2003, towards the end programme.

Bioversity involved many partners in the implementation of the ALVs programme. A number of questions which call for detailed empirical investigation arise from these partnerships: what role did Bioversity actually play? What is the role played by these other partners? How did these partnerships contribute to the achievement of the objectives of the programme? Over the years, and since the end of the programme, answers to these questions have remained

Table 1. Onset of Collaboration within Various Organizations Working in ALVs.

Year	Frequency	Percent
1980s	2	2.3
1990s (all before 1996)	4	4.5
1997	5	5.7
2000	4	4.5
2001	20	22.7
2002	10	11.4
2003	19	21.6
2004	12	13.6
2005	7	8.0
2006	2	2.3
2007	3	3.4
Total	88	100.0

[3] *Titles of mentioned publications are available upon request.*

undocumented. Understanding the way such a partnership or a delegated approach worked would be helpful to future implementation of research and development activities, not only by Bioversity but also by other international research institutes of the Consultative Group on International Agricultural Research (CGIAR).

Moreover exploring the impact of the programme on ALVs conserved and consumed would also give useful insights to successful promotion of other crops in order to improve living standards in Kenya and other developing countries.

The attribution analysis

To assess the role played by Bioversity, this study adapts the Ego, Alter, and the Researcher's (EAR) instrument (Arts and Verschoen 1999). The concept implies triangulation of findings from three different perspectives: the EAR's perspectives. Accordingly, the ego perspective consists of views of Bioversity' staff that were involved in the programme. Staff interviewed included the team leader, the project coordinator, and other three members involved in the programme. The external partners (alter perspective) are those individuals and their organizations who worked with the ALVs programme in various capacities. A list of main partners was obtained from Bioversity and the contacts visited for a detailed interview. On three different occasions, members of staff were interviewed about their role in the programme. During each interview session, there was more than one person, for validation sake. In some organisations particularly those with several centres, more than one individual was interviewed. Most of the collaborators were either in management, in research or in both (83.9%). A few respondents were in administration or in private enterprises. In terms of geographical distribution, the country was well represented: Western Kenya (19.3%), Eastern Kenya (12.9%), Coast (12.9%), Central Kenya (6.5%) and Nairobi (45.2%). Nairobi had the highest representation as this is where most of the organizations' headquarters are located. The collaborating organizations ranged from CBOs to National Research Institutions. Table 2: shows the main collaborating organizations in the ALVs programme and the key areas of responsibility they assumed during the programme.

Data were then validated either throughout the analysis of secondary data collected such as project report, peer review journals or documents issued or by confronting the interview's outcome with the researchers point of view which in this case is the one of external partners who participated in the promotion of ALVs without establishing a formal partnership with Bioversity. These include international organizations such as: the World Vegetable Center (AVRDC), International Potato Centre (CIP), International Centre for Research in Agro-Forestry (ICRAF), Farm Africa, The International Development Research Centre (IDRC), and Plant Resources of

Table 2. Main Collaborators in the ALVs programme.

Name of Institution	Type of ALV work
Farm Concern	Marketing
FORMAT	Community development
Nairobi Friends Club International (NFCI)	Community conservation
Rural Outreach Program (ROP)	Rural development/seed banks/recipe development
KARI (Thika, Kisii, GBK, Head office)	- Agronomic research, selection - on farm trial - collection, mapping, characterization and conservation
Jomo Kenyatta University of Agriculture and Technology	Nutrition value analysis
University of Nairobi	- Agronomic research - Nutritional value analysis - Nutraceutical analysis
Kenyatta University	Nutrition and promotion awareness
Maseno University	- Agronomic research - Standardization of recipes - Community seed banks
Kenya Medical Research Institute	Medicinal value research
Kenyatta National Hospital	Nutrition promotion awareness
Ministry of Agriculture (MOA)	Extension, nutrition awareness creation
CBOs	- Production and Marketing - Awareness creation - Research / documentation
Private Individuals	- Awareness creation - Production and marketing - Msc research

Tropical Africa (PROTA). Other local organizations included Kenya Industrial Research Development Institute (KIRDI), Sacred Africa and Kenya Seed Company.

Reasons given for starting to work on ALVs are summarised in Table 3. These range from academic research (either financial support or through supervision) to community and rural development. About 34.5% were influenced directly by Bioversity programme or its primary researcher then, the late Prof. Chweya.

Even those who were not directly influenced to start work on ALVs like Rural Outreach Program (ROP), Kenya Agricultural Research Institute (KARI), Ministries of Agriculture and Health, and Universities, their programme activities were directly influenced later by Bioversity through partnerships in funding and information sharing. Thus Bioversity played a key role in influencing the work on ALVs; it played both a catalytic and enabler role. About (93.3%) of the partners reported that ALVs work has been on the increase since they started. Only two respondents answered otherwise, one had researched on ALVs as a student of Prof. Chweya and thereafter took different line while the other reported that the work had not changed significantly.

Bioversity staff was the most single avenue of partners learning for the first time of its involvement with ALVs. About 80% collaborators said they learnt about ALVs from Bioversity staff, while the rest learnt from secondary sources (i.e. publications or from other collaborators). Of these partners, 64% rated the collaboration with Bioversity as very beneficial, 16% as fairly beneficial and 8% as beneficial. Only 12% felt that they had not benefitted from the collaboration. Those who responded negatively felt that Bioversity had instead benefitted immensely from their efforts without reciprocating the same. Others perceived the role of Bioversity to be that of a donor and felt it had failed to fund them to adequate levels.

To evaluate the rating of the role of Bioversity by partners, the following procedure was used: all responses were valued, i.e. a value of one (1) for least important and five (5) for most important, with the others falling in between. Since not all the interviewed responded to all categories (some could not place a value on some of the categories) a separate analysis was done for each as shown in Table 4.

These results show that Bioversity was rated highly in all of these roles. The highest rating however was mobilizing collective action followed by facilitator. Most partners felt Bioversity's role in providing technical knowledge and in doing primary research was roughly average. On the technical knowledge aspect, many partners felt that Bioversity should have done more in the area of impacting technical knowledge to the partner organizations through short–term training, workshops or even long-term training through sponsorship for further education.

Respondents were also asked to name the two most important organizations in performing various tasks with respect to ALVs promotion. Using multiple sets analysis, the results presented in Table 5 were obtained. For brevity sake, only the first three organizations are reported. According to these results, partners seem to give credit to the fact that Bioversity was the single most important organization with respect to many of the ALVs activities. It was ranked the highest in identification and evaluation. This was attributed mainly to the first phase of the programme, and in a lesser magnitude to phase two in which it also facilitated National

Table 3. Reason for Involvement with ALVs.

Rank	Activity	Frequency	Percent
1	**Encouraged/introduced/ funded by Bioversity**	**8**	**27.6**
2	Part of organizations' mandate	5	17.2
3	Academic research	4	13.8
3	Dietary diversification concerns	4	13.8
4	**Association with Prof Chweya-Project coordinator**	**2**	**6.9**
4	Income generation	2	6.9
4	Association with others (not Bioversity)	2	6.9
4	Poverty alleviation and food security concerns	2	6.9
	Total	29	100.0

Table 4. Partners perception of Bioversity's role.

Role Evaluated	N	Maximum Possible Points	Lowest Possible Points	Maximum Points Given	Rating	
Technical knowledge	25	125	25	80	3.2	Average
Research	22	110	22	77	3.5	Somewhat important
Mobilizing collective action	24	120	24	98	4.08	Somewhat important
Advocacy	21	105	21	76	3.61	Somewhat important
Catalyst	23	115	23	89	3.87	Somewhat important
Facilitator	23	115	23	90	3.91	Somewhat important
Enabler	23	115	23	81	3.52	Somewhat important
Exposure	21	105	23	84	3.65	Somewhat important

Table 5. Ranking of Partners according to Roles they are perceived to have played in the ALVs Programme.

Activity	n	Rank 1	%	Rank 2	%	Rank 3	%
Identification/ Evaluation	34	Bioversity	32.4	NMK	26.5	Universities	11.8
Promotion of production	41	Bioversity	24.4	KARI stations	14.6	MOA	14.6
Promotion of usage	44	Bioversity	31.8	ROP	15.9	NMK	13.6
Awareness creation	45	Bioversity	44.4	NMK	20.0	MOA	8.9
Capacity building at the organizational level	16	Bioversity	43.8	MOA	18.8	several	
Capacity building at the grassroots level	26	ROP	26.9	MOA	19.2	Farm Concern	15.4
Genetic conservation	29	KARI GBK	34.5	Bioversity	20.7	NMK	17.2
Marketing/market development	24	Farm Concern	37.5	ROP	16.7	MOA	16.7

a) N is the number of responses. For every category, each respondent was supposed to name two of the most important organizations in performing that role. In some case no organizations were mentioned as the respondents said they are not aware/are unsure/ or simply do not know any organization in involved in a particular activity.

b) The ratings for the Ministry of Agriculture (MOA) seem relatively high. This could be partly attributed to the large number of respondents from the Ministry who believed their organization had done a lot.

Museum of Kenya (NMK) and Genebank of Kenya to continue with the work. Bioversity also topped in promotion of production and usage, though the highest rating was given in awareness creation.

Awareness creation was attributed largely to the Dietary Diversity project which followed immediately the ALVs programme. This would explain why the follow up position went to NMK, which was very much involved in this project. Ministry of Agriculture extension staff reported that in their day-to-day activities they were involved in creating awareness of the value of traditional foods including ALVs. The Home Economics division was reported to have held cookery demonstrations whenever farmers' field days were taking place.

Only a few partners rated the capacity building role at the organizational level, but out of the few that did, Bioversity topped the list. This involved short trainings, workshops, exhibitions and any learning fora for the staff of the partners. At the grassroots level, Bioversity was conspicuously missing from the list, in which ROP was leading, followed by MOA and Farm Concern respectively. With actual conservation and especially ex-situ, NBK was the leading organization, followed by Bioversity and NMK. Farm Concern was considered the force behind the development of markets for ALVs. As other studies have shown, Farm Concern was instrumental, even after the cessation of funding from Bioversity, in linking up the urban and peri-urban farmers to formal and informal markets (Irungu, et al, 2007, Mwangi and Mumbi, 2006). ROP was instrumental in market development in Western Kenya directly, and in other areas indirectly through the provision of seeds. Farm Concern greatly collaborated with ROP in provision of seeds to the farmers within Nairobi, before they later started acquiring the same from AVRDC. Thus without access to seeds, farmers would not have increased their production for marketing and hence the indirect role of ROP.

A very important issue in the research was to find the counter-factual, that is, what would the situation be if Bioversity was not involved in ALVs at all. To assess this, all respondents were asked what, in their opinion would be the situation in as far as ALVs work is concerned, if Bioversity never got involved. The responses were analysed and shown in Table 6 below. These results indicate that most of the partners (78.2%), acknowledge the positive and important role played by Bioversity in the promotion and utilization of ALVs in Kenya. As Table 4.4 shows, there were some scattered ALVs activity going on but it was not until Bioversity came in, that a momentum was built and sustained for greater impact. Before then, scientists continued to work in an uncoordinated manner, each not knowing what the others were doing. This often resulted in duplication of activities and resources with little impact.

Bioversity demonstrated a keen ability in keeping several ALVs researchers working together delivering dif-

Table 6. Alter perception of ALVs work without Bioversity's involvement.

Response category	n	%	Valid %
Bioversity was able to mobilise resources, (financial and human) to speed up and upscale the work, and give it an international image	11	36.7	47.8
ALVs work would have continued but at a much slower pace	7	23.3	30.4
ALVs work would have continued with or without Bioversity	5	16.7	21.8
No response	7	23.3	-
Total	30	100.0	100.0

ferent outputs belonging to a same bigger framework. One of the key informants metaphorically pointed out that as an orchestra needs a capable conductor to produce an harmonic sounds, partners involved in the ALVs work, all in different capacities needed a conductor in order to achieve tangible results that would otherwise been scattered.

It was in this recognition that an attempt was made by the late Prof. Chweya and colleagues to document scientists and practitioners that were involved in ALVs during the first phase in the late 90s[4]. Once it was established who was in the field of ALVs and what they were doing, then it was easy to convene a meeting and discuss how these scattered efforts could be strengthened and hence the increased number of partners in the second phase of the programme.

The impact analysis

The impact of the programme is measured using an analysis conducted in four regions, namely the former Kisii district in Nyanza Province (now Masimba and Kisii districts), the former Tharaka-Nithi district in Eastern Province (currently Tharaka and Meru South districts), the former Kilifi district in Coast Province (presently Kilifi and Kaloleni districts) and Peri-Nairobi on conservation and consumption of ALVs. The first three areas were purposely chosen based on their perceived richness in ALVs biodiversity and diverse cultural backgrounds based on the knowledge of the researchers involved in the study. In phase two, the programme concentrated a lot of efforts around the city of Nairobi and so it was considered necessary to include it as the fourth region.

Specifically the study covered two sites in each of the four research areas:

- Kisii region: Suneka and Keroka, as high and low potential areas, respectively
- Tharaka region: Chuka and Ciakariga, as high and low potential respectively
- Kilifi region: Kaloleni and Maiakani, as high and low potential respectively
- Peri-urban Nairobi region: Kiambu and Thika districts as high and low potential respectively.

Each site represents a low potential and a high potential area. In each site 13 households directly involved to the programme and 13 households not involved in the programme were randomly sampled. In peri-urban Nairobi, the criteria used involved randomly selecting households from villages where Bioversity and/or its partners had worked and households from villages with similar characteristics but where no work on ALVs had been done by Bioversity and /or its partners.

A total of 211 households were selected, with Kisii, Tharaka and Kilifi having 52 households each. Peri-urban Nairobi had 55 sample households. To randomly sample households in selected villages, the research team acquired a list of all households from the village administrator and used it as the sampling frame. Where such an existing frame was lacking, the research assistants had to draw up one with the village heads. However, there were also cases where it was completely impossible to come up with a sampling frame due to the limited knowledge of the village head on the households in their areas. In such a case, a random walk through the village was used to randomly sample the required households.

The household survey instruments were pre-tested and adjusted several times before administration. The research assistants were then trained on sampling and questionnaire administration. They were encouraged to use direct observation and informal interviews to complement the questionnaire. They were encouraged to note extra information on their notebooks and later submit a written field report alongside the questionnaires. The field report explained in-depth some of the issues that were not well captured in the questionnaire and those issues that were not specific to particular households but whole communities or villages which were considered important in the interpretation of data. Communities in different regions have peculiar languages and this meant that the enumerators had to be native-speakers of the respective regions.

Focus Group Discussions (FGDs) were also conducted by the research team comprising the authors, assisted by each of the three research assistants in Kisii, Tharaka and Kilifi when the team was in their respective research areas. No FGDs was held within the peri-urban Nairobi as it was felt that there was already a wealth of information concerning the area given that a number of studies had been done. These include studies done by Hutchinson (2002), Family Concern (2004), and Irungu et al, (2007).

In total, three FGDs were conducted in Kisii, two in Tharaka and four in Kilifi. The FGDs were intended to provide qualitative data on some of the cross-cutting issues in the communities as well for cross-checking the quantitative data collected through the semi-structured interviews. The topics included types of ALVs known in the community, those that have disappeared, reasons for disappearance, gender issues in production, consumption and marketing, preparation methods, and stakeholders involved.

In each FGDs gender, age, cultural knowledge and socio-economic class representation was considered, however due to the cultural context and other household issues in some cases one gender outnumbered the other in different areas. For example, in Tharaka, men were generally fewer than women while in Kilifi women were underrepresented. This, however, was not a big problem since for each community more than one FGD was conducted as stated earlier. In Kisii, FGDs groups were generally well balanced.

The household poverty level was used as a proxy for welfare. A poverty index was created using the Principal Component Analysis (PCA) statistical procedure. A set of seven simple reliable, verifiable and quantifiable poverty indicators from the study regions were used following Irungu, (2002) and Zeller, et al (2006). One principal com-

[4] *Mnzava, J., (1997): Bibliography of Scientists, researchers and institutions working on Indigenous leafy vegetables. IPGRI, Rome.*

Table 7. Communalities and component matrix of the poverty index model.

Variable	Communalities		Component 1
	Initial	Extraction	
Structural condition of the main house	1.000	0.599	0.774
Type of roof of main house	1.000	0.454	0.674
Main source of lighting for main house	1.000	0.546	0.739
Type of floor for main house	1.000	0.566	0.752
Assets: Whether household owns TV or not	1.000	0.553	0.744
Mean education level of adults	1.000	0.490	0.700
Subjective ranking of the household within the village	1.000	0.417	0.646

a) Extraction Method: Principal Component Analysis

b) The model had a Kaiser-Meyer-Olkin (KMO) value of 0.881 and the Bartlett test of specificity was significant at less than 1% level[5].

ponent was extracted, which explained over 52% of the total variance in the seven variables and was interpreted as measuring poverty. The lower the score the poorer the household was. Table 7 summarises the variables selected in the final model alongside their respective communalities and component loadings.

To assess the impact of the ALVs Bioversity program, we first specified a probit model for the household's decision to grow and market ALVs using the maximum likelihood method. The model for the household's decision to produce and market ALVs is specified as:

$$Y^* = \sigma + \beta_i \chi_i + \varepsilon_i$$

Where: $Y = 1$ if $Y^* > 0$ and $Y = 0$ otherwise.

The β_i is the set of parameters to be estimated that reflect the impact of change on the explanatory variables χi and ε_i is standard normally distributed error term (Greene, 2000).

Since we assume that there are unobservable characteristics that drive the decision process of whether or not to grow and market ALVs, we constructed a selectivity term, the inverse mills ratio (IMR) to capture that aspect. This variable is added to the second stage model where it confirms or otherwise rejects the hypothesis that the process is governed by unobservable characteristics.

The second stage OLS model involves adding the IMR to the welfare performance equation and estimating the equation as follows:

$$C_i = \beta_o + \beta_1 W_i + \beta_2 Y_i + \beta_3 \lambda_i + \varepsilon_i$$

Where the error term $\varepsilon_i = 0$, and C_i is the performance indicator (poverty index); W_i is the vector for households characteristics; and Y_i is the participation (Bioversity program) variable.

The variables and their descriptive characteristics are presented in Table 8.

The dependent variable in the first equation (ALVSOLD) is a proxy for participation in ALVs production and marketing. This model estimates the parameters that influence households to participate in ALVs production and marketing. Due to the small size of sample, only a few variables could be used. Since the households self-select themselves to do this, the equation includes estimations of IMR that is used in the second equation. The second equation estimates the variables determining the poverty level of households. The dependent variable in this equation is the poverty index derived in the previous section which is a proxy for welfare performance. The model incorporates IMR obtained from the first equation alongside other response variables. A negative IMR shows that those who chose to grow and sell ALVs are more predisposed to poverty than the general population; while a positive one shows the opposite. From the results the effect of various factors, among them the role of the ALVs programme are estimated.

Results

Different regions were found to have different priority ALVs species. A total of 27, 31 and 33 different species of ALVs are known in Kisii, Tharaka and Kilifi. Of these seven and two species are no longer available in Kisii and Kilifi respectively. This is because such were gathered in the wild, near river banks and such ecosystems are rare due to population increase and climate change. Between 1997 and 2007, the number of ALVs utilised in the community had increased by three and four in Kisii and Tharaka through new introductions from other areas. This shows that agro-biodiversity with regards to ALVs in regions had been increasing with time. In the Tharaka area most ALVs with an exception of cowpeas and pumpkin leaves, are gathered from the wild. With decreasing idle land coupled with the drying effect of climate change on watershed areas where some ALVs were prevalent, the availability is severely affected.

[5] *KMO statistics represent the ratio of the observed correlation between variables to the squared partial correlation between variables. The closer is the value to one the better since it indicates that patterns of correlations are relatively compact and should yield distinct and reliable components.*

Table 8. Descriptive statistics of variables used in the model.

Variable name	Variable label	Kisii n=52 Mean(std dev)	Tharaka n=52 Mean(std dev)	Kilifi n=52 Mean(std dev)	Peri-urban N n=55 Mean(std dev)
ALVSOLD	Whether household sells ALVs or not: 1= yes, 0=otherwise	0.87(0.35)	0.33(0.47)	0.17(0.39)	0.44(0.50)
POVINDEX	Poverty Index (continuous)	0.725(0.87)	-0.016(0.68)	-1.20(0.56)	0.393(0.65)
AGE	Age of household head in years	46(9.99)	50.6(14.6)	49.9(14.89)	47.5(14.6)
EDUC	Education of household head in years	10.6(3.0)	7.0(4.4)	3.04(3.95)	8.4(4.2)
HHSIZE	No. of members in a household	6.25(1.68)	4.48(1.7)	6.73(2.44)	4.96(2.0)
OCCUP_F	Whether main occupation if farming or not: 1= yes, 0=otherwise	0.19(0.40)	0.51(0.51)	0.56(0.50)	0.51(0.50)
PERCEPTI	Change in perception of ALVs since 1997: 1= yes, 0=otherwise	0.49(0.51)	0.51(0.51)	0.19(0.4)	0.35(0.48)
SOCCAP	Whether involved in groups or not: 1= yes, 0=otherwise	0.83(0.382)	0.73(0.45)	0.33(0.48)	0.78(0.4)
EXPERIEN	No of years ALVs grown	22.9(9,8)	19.96(14.5)	22.38(17.7)	8.92(9.7)
PARTICIP	Whether household is from treatment or not: 1= yes, 0=otherwise	0.48(0.51)	0.50(0.51)	0.75(0.44)	0.47(0.50)
ALVINFO	Whether received any information on ALV: 1= yes, 0=otherwise	0.49(0.51)	0.69(0.47)	0.08(2.69)	0.81(0.4)
FARMSIZE	No. of acres	3.67(2.16)	3.14(2.47)	3.91(2.69)	1.95(1.53)

An increase in production of ALVs was reported in all the research areas. In most cases they are intercropped with other crops, along the fences but in cases where they are grown purely for commercial purposes they are increasingly being grown in small pure stand plots. The plot sizes are small usually less than an acre. Results showed that majority of households grow ALVs (87%) with the figure going to as high as 98% and 96% in Kisii and Tharaka.

Many older households reported to have grown ALVs for along time. The younger generation had however abandoned them for exotic vegetables and only started growing them in the last ten years. Results showed that on average 27% of households growing ALVs have been doing so for more than 20 years, 27% have grown them for between 20 and 10 years, while over 25% started growing them in the last ten years. The results are more pronounced in areas where traditionally ALVs were not a delicacy, particularly in peri-urban areas of Nairobi where only 4.1% were growing ALVs 20 years ago, in comparison to about 51% having started within the last 10 years. This clearly shows that the culture of growing ALVs is spreading to even the areas where growing had stopped or where they were not being grown in the past. The main reason given for this trend was increased knowledge of the nutritional value that led to demand in the urban markets and increased home consumption.

In rural Kenya, there is virtually no refrigeration facilities as lack of electricity and high poverty levels would not permit it. Despite this about 15% of the households do store ALVs for future use. The most common preservation measure across the regions was sun-drying. The results further indicated that for those who do store, 45% had increased their storage amounts relative to their 1997 levels while about 42% had retained the 1997 levels. Only priority ALVs such as spider plant and cowpeas are stored. The reasons for storage included: increased knowledge of the nutritive value of ALVs and thus they did not want to miss them when out of season; increased yields; and need to satisfy relatives in distant areas who do not have access to them. Those who had decreased storage attributed it to increased availability and access in the markets, and availability of substitutes.

Of those growing ALVs, only slightly over half of them (52%) participated in marketing. This differed from region to region with Kilifi and Tharaka having lower figures compared to Kisii and Nairobi. In Kisii almost all households grow ALVs (98%) and an equally high percentage also do market (86%) compared to the survey mean of 87% and 45% for growing and marketing respectively. Kilifi and Tharaka regions were relatively poor in terms of marketing of ALVs. Lack of awareness, problems in transportation and distance from Nairobi (the epicenter of ALVs promotion campaigns – 1997 to 2007) were the main reasons for the low market involvement of the farmers. Farmers usually sold their product to direct consumers in the markets (39%), middlemen in the market (22%), middlemen in the farm (20%), direct consumers in the farm (17%) and the rest sold to institutions. Compared to 1997, the results showed that only 2.5% of the respondents felt

that their monthly net income from ALVs had declined. The rest 62.5% and 35% reported that their monthly net income from ALVs had increased and remained constant respectively relative to their 1997 levels. The two main uses of the income were to supplement kitchen budget and for school expenses in that order.

Over 40 different species are consumed in the regions. The priority ones in order of importance are amaranth, African night shade, cowpeas, pumpkins, spider plant, bitter lettuce and vine spinach. As much as 10% of the consumed ALVs are gathered from the wild. About 45.2% of the households were found to have increased their consumption of ALVs relative to 1997 while 44.3% had retained their consumption at the 1997 level. The main reason for increased consumption was reported to be increased awareness of their nutritive value. When available ALVs are consumed in the two main meals per day (midday and evening) and are always cooked. In the past, most communities would cook the ALVs for long periods but over the last years these traditional methods have been abandoned for those that preserve most of the vitamins and other nutrients. To this effect consumers now derive more nutrients from ALVs than previously.

In addition, about 38.6% of the households had changed their perception of ALVs to a more positive one while 37.5% reported positive health aspects with regards to household members who consumed ALVs regularly. Positive changes are associated with increased awareness of the nutritional value of these otherwise relegated to 'food for the poor' vegetables. Information on the nutritive value of ALVs was attributed to various sources. In order of importance, these included Ministry of Health, social networks, NGOs, Ministry of Agriculture, KARI .Almost all these organisations were operating under Bioversity International programme on ALVs.

ALVs have remained predominantly a preserve of the women. These results are similar to those obtained ten years earlier (Maundu, et al, (1999)) where work on ALVs was found to be dominated by women. A few men were reported to be growing ALVs for market but the trend has not gained enough momentum to equalise with women or reverse the situation. Further, decision-making on how cash from the ALVs was being used was mainly a women prerogative.

Using the poverty index values, all households were ranked and then categorised into three terciles; poorest, poor and not so poor. Table 9 represents the distribution of households into the three groups according to regions. According to these results, Kilifi region is rated the poorest region, followed by Tharaka, peri-urban Nairobi and Kisii in that order. These results reflect the national statistics of the integrated household budget survey conducted by the government (GoK, 2007).

Using the three variables related to ALVs production, marketing and access to information, a cross-tabulation analysis showed that there were significant differences at 5% confidence level or less between the three poverty categories. These results also showed that, although most households grew ALVs, it is the poorest category that had the highest presentation of the non-growers. In terms of marketing, the differences were even more pronounced as the poorest group failed to market what they produced (Table 10).

The results of the econometric models (with dependent variables ALVSOLD (Probit) and POVINDEX (OLS with IMR)) are presented in Annex 1. The statistical validity of the probit models is supported by the log likelihood results which indicate that the null hypothesis that all response variables are jointly zero can be rejected at 10% probability level or less. The OLS models, with the exception of peri-urban Nairobi have a very low adjusted R^2, which shows the variance of the dependent variable explained by the response variables. This is expected since the sample size is quite small.

The results for Kisii identify the number of year's farmers were engaged in growing ALVs (EXPERIEN) as a determinant of the decision to grow and market ALVs. The longer the household has been growing ALVs, the higher the likelihood for getting involved in marketing. Other variables that had positive but weak effect were the number of household's members (HHSIZE variable) and the level of awareness on ALVs (ALVINFO variable). The

Table 9. Survey regions versus relative poverty groups cross-tabulation.

Survey Regions		Relative Poverty Groups			Total
		Poorest	Poor	Not so Poor	
Kisii	Count	4.0	15.0	32.0	51.0
	% within Survey regions	7.8	29.4	62.7	100.0
Tharaka	Count	12.0	26.0	13.0	51.0
	% within Survey regions	23.5	51.0	25.5	100.0
Kilifi	Count	44.0	2.0	1.0	47.0
	% within Survey regions	93.6	4.3	2.1	100.0
Peri-urban Nairobi	Count	7.0	24.0	21.0	52.0
	% within Survey regions	13.5	46.2	40.4	100.0
Total	Count	67.0	67.0	67.0	201

Table 10. A comparison between households that produced and marketed ALVs and those who did not with respect to relative poverty groups.

Relative poverty groups	Grow (n=170)	Do not Grow (n=30)	Market (n=92)	Do not Market (n=105)	Have Information (n=99)	No Information (n=90)
Poorest	51	16	13	54	18	48
Poor	58	8	33	32	40	21
Not so poor	61	6	46	19	41	21
Chi square value		6.493**		35.618***		25.636***
Cramer's V value		0.180**		0.425***		0.368***

*** means significant at 1%level*

** means significant at 5% level*

participation or not it the programme (PARTCIP variable) had a positive coefficient that was not significant, thus the effect of the ALVs programme cannot be deduced in Kisii. This is because the number of years farmers were engaged in the programme was so high that the treatment and control group could not be clearly differentiated hence the binomial variable on the programme participation was not significant. In the second equation, the results show that IMR was negative but insignificant. Only the number of household's members (HHSIZE) which has a negative coefficient, is significant. This shows that the larger the households, the more likely it was to be poor. These results are not unexpected as a larger households means resources are usually over-stretched. The participation or not at the programme (PARTICIP variable) has a negative coefficient but not much meaning can be attached to it since it is not significant. The programme does not seem to have a significant influence both in deciding to grow and sell ALVs and in improving poverty level of households in Kisii. Other factors not studied are probably more important. Only one group had indicated that they had worked with Kenya Agricultural Research Institute (KARI), Kisii in some trials, and that someone had been sent to them from Kenya Resource Centre for Indigenous Knowledge of the National Museums of Kenya (KENRIK-NMK).

Results for Tharaka identify participation or not in the programme (PARTICIP variable), the education level of the household head (EDUC variable) and the occupation of the household head in the farm or not (OCCUPA_F variable) as determinants of a household's decision to grow and market ALVs. The positive and significant variable related to the participation or not at the programme implies that those households from the areas designated as treatment areas were more likely to grow and market ALVs than otherwise. Most households in this region, including those in the treatment areas, said they had not gotten any information on ALVs from any other source except through the KAMEME FM Radio station. The radio broadcast through Kameme Fm was being done by Farm Concern International which was a partner with Bioversity. The education level of the household head (EDUC variable) was positive and significant, depicting that those households who had more educated heads were more likely to grow ALVs than lowly educated ones. This shows human capital is important in enabling people to appreciate, grow and market ALVs. The Variable on the occupation of the household head in the farm or not (OCCUPA_F) also showed a positive and significant coefficient meaning those farmers whose main occupation is farming were more likely to grow and sell ALVs. This is expected since farming being the main source of livelihood respondents are likely to try and market whatever is at their disposal to earn some income.

The second model showed that the participation or not at the programme (PARTICIP variable) and the marketing of ALVs (ALVSOLD variable) were determinants of the level of poverty, however in different directions. The participation or not at the programme (PARTICIP) variable had a negative coefficient meaning that those households from areas taken as treatment were more likely to be poorer. This however is not surprising given the significant negative sign of IMR, which indicates that those households who grow and market ALVs in Tharaka are more likely to be poorer. The marketing of ALVs is however positive and significant at 5% showing that production and sale of ALVs has a positive effect on their livelihoods or increases the likelihood of improving the poverty levels.

For the Kilifi results, the probit model showed that the level of awareness on ALVs (ALVINFO variable) and the number of household's members (HHSIZE variable) were among the determinants of a household's decision to grow and market ALVs. The level of awareness on ALVs had a positive and significant coefficient, meaning those who had gotten some information on ALVs were more likely to grow and market them. The number of household's members variable had a negative and significant coefficient, which is a rather unexpected result. A probable explanation would be that large households are less likely to grow enough ALVs to consume and at same time market. In the second model, only one variable, the education level of the household head (EDUC) was negative and significant at 5% level. This expected result shows that those households whose household head had less education were more likely to be poorer.

The results of the first equation in peri-urban Nairobi model show the education level of the household head (EDUC), the numbers of year's farmers were engaged in

growing ALVs (EXPERIEN) and the occupation of the household head in the farm or not (OCCUPA_F) as major determinants of the likelihood to produce and market ALVs in this region. The longer the household had been growing ALVs, the higher the likelihood for getting involved in marketing, and also the more the education the household heads had, the more they were likely to grow and market ALVs. Farming as the main source of income, experience in growing ALVs and education also increase the likelihood of producing and marketing ALVs. In the second model there were no significant response variables. However the IMR was positive and significant implying that households which grow and market ALVs in peri urban Nairobi are more likely to be wealthier than those who do not.

Discussion

In general, results point to the fact that between 1997 and 2007, there have been notable positive changes in growing, consumption, marketing, and nutritional awareness of ALVs in the study areas. There has also been a noted increase rather than decrease in ALVs biodiversity through more awareness of the nutritive value of ALVs.

Women have continued to be the main actors in ALVs production and marketing. This is a positive aspect in women economic empowerment that can be capitalised on. The threats posed by the ensuing commercialisation need to considered and this could be through capacity building for the women to take up production and marketing of ALVs even more seriously given that they are more and more becoming marketable.

The poorest section of the community was found be the lagging behind in growing and marketing ALVs. This could be as a result of low resource endowment (land, labour and other inputs) but could also be due to lack of exposure as they were also found to have the highest number who had no access to information on ALVs. These results show the poorest group is still disadvantaged in as far as ALVs issues are concerned. They also do not support the proposition that ALVS is a poor man's crop.

From the econometric analysis, the main factors influencing the growing and marketing of ALVs were the numbers of year's farmers were engaged in growing ALVs, the education level of the household head, and the occupation of the household head in the farm or not. This shows that experience in growing ALVs, farming as the main occupation of the household and the education level of the household head all had a positive influence on a household to market ALVs. Others factors included the level of awareness on ALVs (ALVINFO variable) and the number of household's members (HHSIZE variable), the latter one having a negative influence. Those households that had received information on ALVs were more likely to grow and market than otherwise while those with large household sizes were less likely. By creating awareness of the nutritional value of ALVs, the programme may have influenced many people to grow, market and consume ALVs.

Factors determining the likelihood of households being poor included low education level of the household head (EDUC), large number of household's members (HHSIZE) and whether or not one sold ALVs (ALVSOLD) which was positive in Tharaka indicating that those who sold ALVs were more likely to have a higher welfare status than otherwise. Coming from either the treatment area or not did not seem to have much effect in all other areas except Tharaka where it was significant showing that those households from treatment area were more likely to grow and market ALVs than from the control areas.

Conclusions

This study has provided a detailed analysis of the role of Bioversity and its partners in the promotion of ALVs in Kenya. Further the study analyzed the impact of ALVs into rural budgets, nutrition and culture. It was found that although research and promotion of consumption of ALVs has been going on for long time, Bioversity's entry into the scene boosted these scattered efforts. Bioversity was found to have played its roles as a catalyst, enabler, advocate, and facilitator very ably and as a result five local universities, one NARI, several national organizations, NGOs and CBOs are presently active in ALVs activities. In Kenya, the programme invigorated an otherwise slow and disorganized process that had began long time. Currently ALVs are priced delicacies in Nairobi and many other parts of the country.

Bioversity was able to perform its catalytic role effectively given its international status which it delicately balanced by putting on a local face. It effectively employed local human resource as much as possible and this led to wide acceptability of the project as well as building local capacities for the sustainability of the research work. As a consequence, a number of organizations including Farm Concern International, Kenyatta University and KARI have continued to mobilise resources for ALVs' work independent of Bioversity. Farm Concern International was very instrumental in the increased demand of ALVs in Nairobi markets, having started off with a simple funding from ALVs programme.

Production, consumption and marketing of ALVs were found to have increased over the ten year period. The number of cultivated and consumed species also increase in Kilifi and Kisii but had decreased in Tharaka. Market demand for these ALVs also developed over the last ten years. This is as a result of many factors including more awareness creation by the project and other players. The hither to negative perception, even in rural areas has positively changed. Access to information on ALVs was however found to decrease as the distance from Nairobi increased. This shows that awareness creation was concentrated in urban areas as planned, and by default to higher socio-economic groups that have access to mass media channels of communication.

Further qualitative impact assessment results show that households growing and marketing ALVs were largely

better off in terms of welfare than otherwise. Further it showed that women still dominate the ALVs production activities, and are responsible for appropriating funds that come from ALVs sales. It would be important for those promoting ALVs to recognise the role of women, work with them and continuously build their capacity as they are the ones driving the production process especially in the rural areas.

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Annex

Note: Similar variables could not be used in all models as some did not have enough variance due to the smallness of the sample.

Results for Kisii Region

Variable	Probit analysis		OLS analysis with IMR	
	Coeff.	**t-ratio**	**Coeff.**	**t-ratio**
ONE	-0.3041	-0.2337	117.303	1.0514
PARTICIP	0.0945	0.1845	-29.3081	-0.7690
ALVINFO	0.0008	1.3686	58.213	0.3971
HHSIZE	0.2928	1.3269	-27.5343	-2.0648**
EXPERIEN	0.0012	1.7188*		
ALVSOLD			58.213	0.397
IMR			-32.4909	-0.3760
Number of cases	52			
Log Likelihood	-16.3122			
Chi-squared	8.462*			
Cases correctly predicted	86.5%			
Adjusted R^2	0.04			
Durbin Watson	2.0307			

****, **, * means significant at 1%, 5% and 10% levels respectively*

Results for Tharaka Region

Variable	Probit analysis		OLS analysis with IMR	
	Coeff	**t-ratio**	**Coeff.**	**t-ratio**
ONE	-5.2370	-2.9118***	39.6936	0.7885
PARTICIP	0.7696	1.7942*	-81.6939	-1.8206*
SOCCAP	0.7028	1.4244	-58.1029	-1.2635
PERCEPTI	-0.004	-0.4749		
EDUC	0.1351	2.3963**	-7.2558	-1.3818
OCCUPA_F	1.63811	1.9016*		
EXPERIEN	-0. 0001	0.0484		
AGE	0.0275	1.5569		
ALVSOLD			229.36	2.16357**
IMR			-123.848	-1.8162*
Number of cases	52			
Log Likelihood	-24.3549			
Chi-squared	17.016**			
Cases correctly predicted	75%			
Adjusted R^2	0.02			
Durbin Watson	2.174			

****, **, * means significant at 1%, 5% and 10% levels respectively*

Results for Kilifi Region

Variable	Probit analysis		OLS analysis with IMR	
	Coeff.	t-ratio	Coeff.	t-ratio
ONE	0.3487	0.504696	-23.9613	-0.2203
PARTICIP	-0.1262	-0.25131	73.8648	0.7817
ALVINFO	1.12561	1.65635*		
EDUC	-0.0715	-0.987637	-26.7497	-2.4606**
HHSIZE	-0.1757	-1.6894*		
FARMSIZE	0.00322	0.179434		
ALVSOLD			-273.324	-1.0563
IMR			156.797	0.9708
Number of cases	52			
Log Likelihood	-18.8862			
Chi-squared	10.1437*			
Cases correctly predicted	78.2%			
Adjusted R^2	0.05			
Durbin Watson	1.898			

****, **, * means significant at 1%, 5% and 10% levels respectively*

Results for peri-urban Nairobi Region

Variable	Probit analysis		OLS analysis with IMR	
	Coeff.	t-ratio	Coeff.	t-ratio
ONE	-2.64546	-2.4873**	-16.2111	-0.1173
PARTICIP	-0.0518616	-0.126655	15.6955	0.2599
SOCCAP	0.585952	1.11134	-30.7306	-0.3844
EDUC	0.149581	2.4571**		
OCCUPA_F	1.44852	2.8455***	-76.9863	-1.0016
EXPERIEN	0.0015	2.9852***		
AGE	0.0091	0.62631	1.8468	0.8558
ALVSOLD			-166.488	-1.2918
IMR			217.2	2.4505**
Number of cases	55			
Log Likelihood	-26.96592			
Chi-squared	21.421***			
Cases correctly predicted	72.7%			
Adjusted R^2	0.09			
Durbin Watson	1.886			

****, **, * means significant at 1%, 5% and 10% levels respectively*

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