REVITALIZING RESEARCH FOR DEVELOPMENT EFFORTS IN PASTORAL AND EMERGING REGIONS

PROCEEDINGS OF THE 1ST NATIONAL STAKEHOLDERS CONFERENCE DEDICATED TO PASTORAL AND EMERGING REGIONS

11 – 12 NOVEMBER 2010,
EIAR, ADDIS ABABA

EDITED BY
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scaling up and capacity building programs undertaken in pastoral emerging regions since September 2008, and the publication of this ɔceeding was financed by the Rural Capacity Building Project.

FOREWORD

Pastoral and emerging regions are endowed with immense, untapped natural resource potential but this potential has remained elusive and largely unrealized to break the rampant food insecurity and poverty trap gripping the rural communities in these areas. There were many reasons for this sad scenario to prevail for far too long, but the good thing is because of favorable policies and increased government attention we are seeing tangible changes in the positive direction.

The Ethiopian Institute of Agricultural Research on its part is refocusing its attention and making all necessary efforts to strengthen and capacitate the regional research and development endeavors. The institute is doing this not only to redress past injustices which left the regions with poor access to advanced technologies, but also because of its firm belief in the simple fact that national agricultural transformatic will not succeed without bringing about drastic improvements of the technology base in these regions, where there is far greater potential fo knowledge intensive commercial agriculture. This is why, after going into implementation of the institutional reforms in 2008, EIAP embarked on the multi-stakeholder initiative aimed at bringing toge diverse stakeholders in pastoral and emerging regions R & D synergy and complementarity that is dearly needed to overcome th complex agricultural and pastoral development challenges.

In the past two plus years, as part of this initiative and in collabo with respective regional research institutes, we have implementing intensive technology pre-scaling up and cap building programs. During this period we have managed to promo 134 food, animal health and feed technologies in 71 weredas of Afar,

Somali, Gambella and Benshangul Gumuz regions involving and benefitting over 100000 pastoralists, agro-pastoralists and farmers. During the off-seasons of those years, over 300 aspiring young researchers from the RARIs have received need based, hands-on, skill upgrading trainings in various disciplines including livestock and range management, crops, seed technology, veterinary, mechanization, biometrics and science communication in our federal research centers. These are laudable achievements accomplished in such a short period of time and yet we are very much aware that this is not much considering the huge gaps and challenges that have to be addressed, and that we are only taking the first steps of the long and difficult journey awaiting us.

To create national consensus on the R & D challenges of emerging regions and carefully chart the direction to be followed based on the periences of the multi-stakeholder initiative and the lessons learned ring the process, a two day workshop of stakeholders was organized n November 2010. There was very high turnout and active participation of all attendees, and the presentations by invited scientists and experts were superb. One of the successes of the workshop was the sense of ership created from top policy makers down to regional and zonal inistrators and experts which culminated in the issuance of joint tement and conference recommendations with high sense of esponsibility amongst partners. All these and more, dear readers, you find in this well organized proceedings gratefully produced by our al and emerging regions research and capacity building nation office.

Solomon Assefa (PhD),
Director General, EIAR

PREFACE

After the reforms in 2008, EIAR has taken bold steps to increase its level of engagement and ensure expedited flow of agricultural technologies and information to pastoral and emerging regions. However, from the outset it became clear that this is huge task for one institute to go it alone, and this realization led to the launching of a multi-stakeholder initiative which aimed at bringing all concerned federal and regional stakeholders and their competencies on board. This approach has paid dividends. In just over two years, over 100 technological packages were widely promoted involving a multitude of pastoralists, agro-pastoralists and farmers in about 80 weredas of Afar, Somali, Gambella and Benshangul Gumuz. More importantly, the initiative has led to improved sense of awareness of non participating members of the farming and pastoral communities deep in the rural areas, and consequently, to sharp rise in demand for technologies. For R & D partners who participated in running the process, it has helped to strengthen the "can do attitude" and boost their confidence at the same time clearly revealed the indispensability of joint efforts to overcome the highly complex agricultural, pastoral and institutional challenges prevailing in these regions.

The past two plus years of our collaborative engagement has taught us useful lessons. To share those lessons with our stakeholders; review the status, progress and challenges in emerging regions' R & D; appraise the development challenges and come to a national consensus on way forward, a stakeholders conference was organized at the EIAR HQ in November 2010. Senior officials, scientists and experts have shared their highly valuable insights, thoughts and experiences through formal presentations and during the lively discussions. From the agricultural bureaus' and regional institutes' presentations, it has become apparent

that despite the visible strives, there is still a lot of ground remaining to be covered in research and development. The Ministry of Agriculture's persistent efforts to revamp agricultural and pastoral extension delivery system was highlighted. Haramaya University provided expert analysis of the challenges and prospects of agricultural research in the institutes of higher education. Pastoral Community Development Project's multi-faceted approach to improve pastoral livelihoods was described at length and this has left participants better informed about the project's current and future dealings.

Considering the immense value of documenting and sharing the experiences of stakeholder institutions this proceeding is published. The publication consists of four parts. In sequential order, status, progress and challenges in research and pre-scaling up; extension; experiences of stakeholder institutions in emerging regions R & D, and finally conference synthesis and recommendations comprise the different parts of the manuscript. In the annexes poster and pictorial display of the multi-stakeholder initiative are depicted for visual illustration of the momentous undertaking.

Fasil Reda (PhD)
Editor

Conference Synthesis and Recommendations

The national workshop was a huge success. Over 100 participants from a very diverse background, representing federal and regional government agencies, research, institutes of higher education, NGOs, the private sector including senior federal and regional policy makers have taken part. The event has enabled to create national consensus on emerging regions' R & D challenges, and it has also helped to put the importance of synergy and complementarity among stakeholders to solve the complex problems of these regions in firm focus.

During the plenary meeting of the first day, invited speakers made presentations on the status of agricultural and pastoral R & D in the regions, including the EIAR led multi-stakeholder initiative being implemented to promote proven technologies; the experiences of the ministry of agriculture, institutes of higher education and Pastoral Community Development Project (PCDP). The presentations were well received and thoroughly discussed by participants. During the breakout sessions, two groups, one each for the mainly livestock based system of Afar and Somali regions, and the mainly crop based system of Gambella and Benshangul Gumuz regions deliberated at length on the research and development challenges being faced and proposed issues and ideas that served to stimulate discussions aimed at arriving at conference recommendations back at the plenary in the presence of senior officials.

Following the group presentations, a panel of six senior officials comprising the Regional Administrator of Benshangul Gumuz, His Excellency Ato Ahmed Nasir; the Director General of EIAR, Dr. Solomon Assefa; and representatives of regional administration of Somali, Afar and Gambella regions led by the State Minister of the Ministry of Federal Affairs, His Excellency Ato Mulugetta Wuletaw conducted lively discussions and free flow of comments and

constructive suggestions which culminated with the following conference recommendations:

- Appreciating the laudable achievements of the EIAR led multi-stakeholder initiative, the meeting underscored the critical signific -ance of ensuring ownership of the program by the regional political leadership at various different levels (region, zone, wereda) for its sustainability. Without serious commitment of the political leadership this noble initiative will never become fully successful. Regions need to make the program an integral part of their development plans. EIAR should initiate continuous dialogue of stakeholders to enhance awareness of the administration, and other key federal and regional partners;
- Linkages and networking between federal and regional R & D stakeholder institutions i.e. federal and regional research institutes, institutes of higher education, bureaus of agriculture and pastoral development, NGOs and other partners must be strengthened; and to this effect high profile conferences dedicated to emerging regions must be regularly organized, at least once a year. Organizers must make sure that those meetings are attended by senior political leaders of the regions. Furthermore, all stakeholders are obliged to make concerted efforts to strengthen federal and regional agricultural extension and farmer linkage councils;
- Biotic and abiotic constraints such as livestock diseases, invasive plant species including Prosopis and striga, termites, soil acidity and poor marketing structure are very serious challenges that are often beyond the capacity of the regions, and urgent assistance is needed in terms of finding solutions;
- High attrition rate of agricultural professionals is contributing to lack of continuity seriously compromising effectiveness, and the regional administration in collaboration with stakeholders institutions must strive to create a better working environment; Emerging regions are endowed with unique and high value resources e.g. the Borena breed cattle, gum and incense, bamboo, high value trees such as Vitellaria (Shea Butter) in Gambella and Cordoxia edulis (Yeheb Tree) in Somali regions but very little is being done in terms of their conservation and preservation, therefore, greater attention must be given to this matter in the future.

Multi-Stakeholder Initiative for Revitalizing Research for Development in Emerging Regions: An overview

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Introduction

To many, it is a paradox that in spite of the vast riches of land, water and livestock resources pervasive poverty, food insecurity, and malnutrition are still prevalent in the pastoral and emerging regions of Ethiopia. Of course climatic variability, drought and natural resource degradation are problems to be reckoned with in these areas but arguably among the factors exacerbating the existing situation are poor access to improved technologies and weak institutional capacity. Pastoral and agricultural productivity is therefore very low because of the above indicated and a host of other biotic and abiotic constraints and significant part of the population in these regions has remained permanently aid dependent.

If the country is to register rapid growth, alleviate poverty and meet its development goals, it has to enable those regions use their untapped natural resources and boost their agricultural production. Current government policy is geared in this direction, and as a government agency, EIAR has also reorganized itself to be in a better position to play its frontline role by creating multi-stakeholder partnerships and capacitating the newly found regional research institutes and centers. This paper describes the paradigm shift being followed in research for development to foster access of pastoralists and farmers to improved, and market oriented technologies in the pastoral and emerging regions and the strives to strengthen the implementation and institutional capacity of the regional research set up.

BPR Reforms and EIAR's Renewed Focus on Emerging Regions

After the reforms introduced through BPR in 2008, EIAR has established a special office charged with the responsibility of coordinating efforts aimed at strengthening agricultural research and development in emerging regions. The pastoral and emerging regions research process and capacity building coordination office was bestowed with the responsibility to lead promotion and scaling up of proven technologies, work actively in collaboration with the main research processes in the introduction and adaptation of new technologies and implement measures to build capacity of the young regional agricultural research institutes and centers.

To realize its mandates, the coordination office initially set up two focal groups comprising multi-disciplinary team of senior scientists, one each for the mainly livestock-based system of the eastern Ethiopian pastoral regions of Afar and Somali; and the mainly crop-based system of the western Ethiopian regions of Benshangul Gumuz and Gambella. The dominant production system in these regions has dictated the composition of the focal groups, hence livestock and crop scientists make up the majority of Afar and Somali, and Benshangul Gumuz and Gambella focal groups, respectively.

Once the structural set up was in place, the coordination office developed a comprehensive technical support plan project, a 7.3 million Birr budget project which was subsequently approved for RCBP funding. The main objectives of this project were: to provide guidance and advisory services and training; and organize various forums to enhance dissemination of knowledge and technologies by fostering multi-stakeholder partnerships, linkages and networking. The project has five components vis. provision of technical support by focal groups; consultative meetings, field days, research and development forums, and capacity building. Further, separately but as part of the overall comprehensive support plan, projects on crop and animal feeds scaling up (the two priority areas for scaling up) were developed. The comprehensive technical support program commenced with a

2858021.00 Birr budget outlay, and the remaining out of the 7.3. total budget was allotted for the scaling up program.

Having secured a fully funded comprehensive project, the coordination office embarked on creating a multi-stakeholder initiative on the ground. in the regions themselves, for wide scale promotion and scaling up of proven technologies in selected crop and livestock commodities, provision of technical backstopping, advisory services and capacity building as summarized below.

Pre-scaling up of Agricultural Technologies

Consultative Workshops

The pastoralists and farmers in the emerging regions have never had adequate access to improved technologies. Hence, the technology base of agriculture and the pastoral system has remained weak, contributing to the incessant poverty and aid dependency that is common in those regions. To promote wide scale dissemination of proven technologies and bring about expedited change in the livelihood of the people, it is imperative that multi-stakeholder alliance is created on the ground to facilitate participatory planning and sense of ownership at grassroots level in the regions.

The fragmented and poorly coordinated efforts of research and development agencies and NGOs in the past had to change to create synergy and overcome the many and diverse institutional and capacity related problems faced during implementation of development programs. Therefore, scaling up projects were separately developed, thoroughly discussed and endorsed by stakeholders in consultative workshops held separately in the four regions. The forum helped to build consensus among partners on the type of technological packages appropriate for each particular region, agree on the outline of activities to be shared and executed and, ultimately, create team spirit and set the ground for team action, each partner being responsible for tasks implemented individually or collectively.This is exactly what was accomplished ,and during the workshops priority commodities for

scaling up were selected, activity plans were developed, and agreement reached on task sharing (See Table 1 below). An organizational structure (Fig. 3), from region down to wereda level, involving the administration, bureaus of agriculture, research, pastoralists/farmers and NGOs was put in place to coordinate and lead the program.

Table 1. Task/role sharing, responsibility and time frame (Gambella, 2009)

Activity*	Date	Responsible	Remark
Formation of steering committee at wereda level(administration-chairperson, WARDO-C/Chairperson NGO, Research-Secretary	Yekatit 5	Wereda administration	
Selection of farmers	Yekatit 3o	WARDO, GARI	
Formulating technological package	Yekatit 30	EIAR & GARI,WARDO	
Seed increase plan	Megabit 15	Farmers & DAs	
Training of participating farmers and DAs(Grain and seed production, post harvest)	Megabit 15	EIAR,GARI, WARDO	
Sharing of knowledge at kebele level	Megabit 21	Administration, GARI, WARDO, EIAR	
Purchase of input	Yekatit 30	Farmers, WARDO,GARI	
Supply and distribution of inputs - Seed and fertilizer - Financial loan	Megabit 21	Farmers, WARDO,GARI, Administration	- Seed as revolving input - Fertilizer to be supplied on pay (with down payment) - Pesticides to be kept in stock at GARI for emergencies
Field operations	As of end of Yekatit	WARDO,GARI	
Field supervision/monitoring	Beginning end of Yekatit (Land preparation, planting, weeding & post-harvest)	Farmers, WARDO, GARI, Administration	
Exchange visit	Mid Senie (Depending on the crop)	Farmers, WARDO,GARI Cooperatives	
Field days	Starting early September	Taskforce	
Harvesting and pos harvest handling	September onwards		
Marketing arrangement	End of Tahsas		
Agricultural research for development forum			

All activities are both for seed and grain production

In 2009, about 300 participants representing concerned governmental non-governmental agencies, pastoral and farming community took pa in the consultative workshops and came up to an agreement an reaffirmed their commitment by signing the scaling up program documents on 41 food and feed crop technologies in 24 weredas of the four regions (Somali - 8 weredas, Gambella - 3 weredas, Afar - 3 weredas and Benshangul Gumuz - 11 weredas) involving over 12000 pastoralists, agro-pastoralists and farmers (Table 2).

Table 2. Technologies, participating weredas and number of participants in the scaling up program in 2009

Region	Wereda	Type of technology	No of participants
Somali	Jijiga, Dolo Ado, Jareti, Gode, Kebri Beyah, Shinile, Kelafo & Gursum	Rice, sesame, sorghum, maize, sudan grass, Rhodes grass, cowpea & lablab	910
Afar	Asaita, Amibara & Afambo	Rice, maize, baffle grass, panicum, elephant grass, stylo, desmodium & pigeon pea	740
Gambella	Larie, Abobo & Gambella	Maize, sorghum, rice, groundnut, sesame & tomato	1750
Benshangul Gumuz	Bambasi, Assosa, Maokomo, Homosha, Mandura, Dbatie, Dangur, Wenbera, Bulen, Pawie & Guba	Maize, sorghum, rice, groundnut, sesame, millet, soybean, haricot bean, banana & bamboo	9500
Total			12900

In 2010, the consultative workshops were again held in each respective region involving 110 participants representing stakeholder institutions, pastoralists and farmers to review challenges and achievements of the past year, and agree on activities and task sharing for the next season. This year, 52 food and feed crop and livestock technologies are promoted in 33 weredas of the four regions (Somali - 7 weredas, Gambella - 3 weredas, Afar - 5 weredas and Benshangul Gumuz - 18 weredas) involving over 46840 pastoralists, agro-pastoralists and farmers (Table 3).

Table 3. Technologies, participating weredas and number of participants in the scaling up program in 2010

Region	Wereda	Type of technology	No of participants
Somali	Irrigated: 3 weredas (Gode, Kelafo Dolo Ado) Rain-fed: 4 weredas (Jijiga, Awbare, K/Beyah, and Gursum)	Irrigated: • Food crops: Rice (Paddy rice and NERICA-1), Maize (Melkasa-1) & sesame (Kelafo 74 & Serkamo) • Feed crops: sudan and elephant grasses Rain-fed: • Food crops: Early maturing maize (M 1) & Wheat , Feed crops: panicum and buffel grass	1250
Afar	Afambo, Asaysta, Dubti, Awash-Fentale, and Amibara	Food crops: Maize (BH-140 and Bh-540), rice (NERICA-4), wheat (Pica flor), onion (Bombay Red and Adama Red) and sesame (Adi) Livestock technologies: Forages (Panicum grass, Buffle grass, Rhodes grass, Elephant grass, Cowpea, Pigeon pea, Desmodium, alfalfa, Leucaena and Sesbania); livestock (improve local and exotic small ruminant breeds and feeding systems)	4430
Gambella	Larie, Abobo & Gambella Zuria	Maize (Abo bako, Gussaw), sorghum (Gambella 1107), rice (Nerica 3, Nerica 4), ground nut, sesame (Abasena), and tomato (Melkashola)	1660
Benshangul Gumuz	Metekel zone: 7 weredas (Pawe, Dangur, Debate, Mandura, Bullen, Wonbera, and Guba)	Crops: Soybean, sesame, haricot bean, sorghum, finger millet and Banana Livestock: Community based participatory tsetse fly and trypanosomosis control	35000*
	Assosa and Kamashi zones: 11 weredas (Assosa, Mao-komo Bambasi, Menge, Kamashe, Kurmuk, Sherkole, Agalo Mite, Oda, Homosha, and Sirba Abay)	Food crops: Maize, ground nut, soybean, finger millet, teff and potato Forages: Sinar, Rhodes grass and *Susbania macaranta*	4500
Total			**46840**

*About 50 – 60% of the 35000 participants are engaged in control of tse tse fly.

Fig.1., 2 & 2a. Consultative workshop at Semera and Gambella

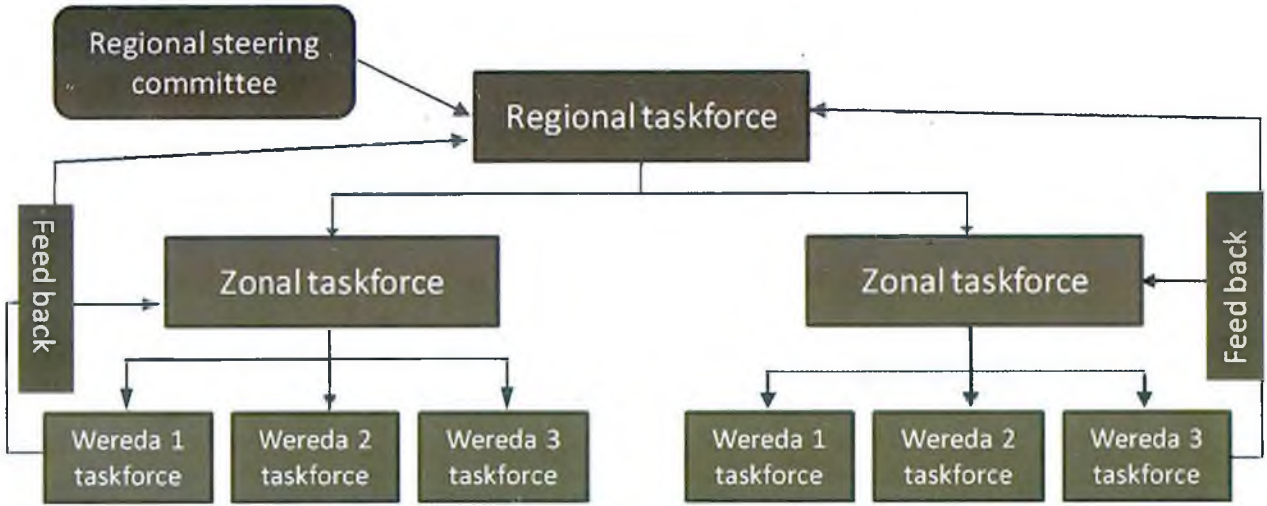

Fig. 3. Organizational structure of the pre-scaling up program

Training of Trainers

Upon launching the first of its kind multi-stakeholder initiative in it was felt that success depends how well the technological packag properly understood and implemented. Therefore, a total c innovative and motivated pastoralists, agro-pastoralists, far development agents and experts received training-manual suppo orientation and hands on training on the selected technologies in each respective region. As this was training of trainers (TOT), the practical knowledge gained was subsequently passed on to all participating pastoralists and farmers through a relay system, the first batch of farmers passing on the information to the next and the next and so on. Before the second year program went into implementation, the TOT was again organized for 473 participants.

Fig.4 & 5. Training of trainers at Assosa

HASE AND DISTRIBUTION OF INPUTS

)9, 1608 quintals of seed was purchased from suppliers and uted at a cost of 134615 Birr. This of course does not include the ds of quintals of own seed retained and used by the regional h institutes and centers. To ensure continuity, particularly in l feeds technology promotion, 19 Q seed of different forage species 4000 m2 elephant grass cuttings was multiplied in five federal esearch centers.

In 2010, quite significant part of the seed demand was met with revolving seed recovered from participating farmers and agro-pastoralists. Nevertheless, 555.8 q of seed and 60 q fertilizer (for rain-fed part of Somali region) was purchased and distributed to make up for the shortfall.

TECHNICAL BACKSTOPPING, MONITORING AND EVALUATION

The emerging regions experience a host of complicated institutional and human resource related problems and the focal groups are helping to fill some of those gaps by rendering their assistance through setting up priorities, identifying future research directions, providing technical backstopping and advising the agricultural development partner institutions in general and the newly established regional research institutes/centers in particular. Furthermore, the focal groups are actively involved in leading the scaling up programs. On assignment from the coordination unit, five teams comprising senior scientists have spent an extended period of time (up to two months) in Somali, Afar, Benshangul Gumuz and Gambella over the two years period, articipating in actual implementation of the programs, and in coaching d training researchers and development workers.

t monitoring and evaluation missions involving stakeholders were 'arly held during the course of implementation of the scaling up m and corrective actions were taken as need arises. For example, it caused by sudden outbreak of insect pest problem in Afar 1 2009 cropping season was averted by the prompt measure

taken by the technical team assigned to the region and the regional taskforce overseeing the whole program implementation.

Fig.6 & 7. Researchers helping out farmers in Afar and Somali regions

Fig.8. Focal group members in Afar against a background of a harvested vigorous sesame crop

Field Days and Exchange Visits for Farmers and Development Agents

The farming and pastoral community in emerging regions had no or, at best, very little access to improved technologies. The low level of use of advanced technologies coupled with environmental problems such drought led to dismal agricultural production and productivity commonly observed in those regions. Extensive programs need to be planned and implemented to change the status quo, and ensure that awareness and demand for improved technologies grows amongst pastoralists and farmers.

The wide scale promotion and scaling up of proven agricultural technological packages and approaches has involved thousands of beneficiaries but this is still a program run at a pilot scale, considering the width and breadth of the emerging regions. Those best practices need to reach and stimulate as many farmers/pastoralists as possible if the regions are to register significant stride in agricultural development. Therefore, field days and exchange visits were organized to facilitate exchange of knowledge and experiences, and ultimately rapid dissemination of technologies. Farmers/pastoralists are pragmatist by

nature and trust more what they see and experience, therefore field days and exchange visits need to be organized to allow farmers travel within and between regions and freely share their experiences and learn from others.

Field days were organized between November 2009 and January 2010 in Benshangul Gumuz, Afar and Somali regions, and despite the distance and remoteness of some of the places the turnout was impressive; and senior government officials, parliamentarians, representatives of pastoral and farming community, and diverse other stakeholders were on hand to witness the best practices, and exchange ideas and experiences. Similarly the exchange visits that followed the field days were well attended by invited pastoralists, agro-pastoralists, farmers and development agents from deep in the rural areas.

Fig.9. Very good looking maize displayed at a field day in Jijiga, Somali Region

Fig.10. Senior government officials attending a field day in Metekel, Benshangul Gumuz Region

Achievements of the Pre-scaling up Program

The multi-stakeholder initiative launched in emerging regions has turned out to be a resounding success. In its humble beginning, spanning only two years, 57900 pastoralists, agro-pastoralists and farmers in the remote corners of the country have actively participated to reap the benefits accrued from adoption of advanced technologies. Most importantly the initiative has significantly contributed to change of attitude of the pastoralist and farming community residing in the vicinity of the pre-scaling up intervention areas and beyond, leading to dramatic increases in demand for technologies.

Taking a cursory look of the outcomes one can see quite an encouraging trend. The promoted technological packages involving sesame and hybrid maize varieties and improved management methods have increased yield by 2 to 3 fold in Afar region. Similarly, up to 80 q/ha yield was registered from BH 540, 30–45 q/ha from rice (Nerica 3 & 4, Superica 1), 45 q/ha from sorghum (Emahoy), 30 q/ha from finger millet (Baruda), up to 12 q/ha from sesame (Abasena), and 17 q/ha from groundnut (Manipeter) under farmers conditions in Benshangul Gumuz. In the dry land, frequently drought affected districts of Jijiga and Gursum in Somali region, up to 12 q/ha of sorghum (Var. Teshale) and 20 q/ha of maize (Var. Melkassa 1) grain yield was obtained whereas the local varieties have totally failed in the exceptionally dry season of 2009.

One of the significant achievements of the whole process was the team spirit and sense of ownership that was created amongst stakeholders who showed collective responsibility all along. Although the strength of the collective effort varied within and among regions and weredas, it nevertheless was a milestone of a kind, especially notable in this regard was the level of determination of researchers, agricultural experts and DAs in Somali and Benshangul Gumuz regions. The sacrifices paid by teams of senior researchers who have spent weeks and at times months under sub-optimal conditions to see the field programs through also deserves a lot of credit.

The other noteworthy effort is the parallel program implemented on seed multiplication in federal research centers, regional research institutes and community based seed multiplication, especially farmer to farmer seed exchange through revolving seed schemes to insure continuity of the initiative. This has allowed seed demand in 2010 program to be largely met locally, leading to significant reduction in transport and handling costs.

CAPACITY BUILDING

TRAINING

EIAR, with World Bank assistance, has conducted substantial infrastructure and capacity building activities in the last ten years. Well furnished office and laboratory facilities are constructed and made operational in Somali, Afar, Gambella and Benshangul Gumuz regional states. Large number of young professionals received short and long term training for advanced degrees. As a result, the regional institutes are now better off and much more capable of playing a greater role in the agricultural development affairs of their respective regions.

EIAR is showing its continued commitment to strengthen research in developing regions. Capacity building is still a major component of the EIAR's new initiative to strengthen agricultural research and development in developing regions. Efforts will still be made to solicit external support for more infrastructure building (laboratories, offices etc.) and long term degree training which require quite substantial financial resources. While the quest for additional resources continues, however, there is an urgent need now to organize short, on job training for young, junior researchers and technicians; exchange educational visits for farmers and pastoralists; and procurement of minor supplies and equipment.

Young graduates joining the regional institutes often lack the necessary practical skills to run field research with some level of confidence, and this, not rarely, leads to wastage of scarce resources and frustration of

the aspiring researchers. Therefore, apart from the constant coaching and mentoring by senior researchers, who often are in these regions on extended visits, those researchers and management staff have benefitted from the formal training organized at federal level on a number of topics including crop improvement, plant protection and livestock research; science communication; and biometrics, including field plot techniques, data collection, analysis and interpretation. This has helped the 165 young researchers so far trained not only gain practical knowledge and experience but also establish contact and collaborative engagement with senior researchers working in federal centers. The other area, the coordination office is focusing on is training of laboratory technicians in emerging regions. In collaboration with the soil and water research process, two senior technicians were sent to Jijiga for over a month at the end of 2009 where they helped train technicians, and helped maintain and calibrate new apparatus and equipment to make the lab functional.

The scaling up programs are in no way limited to junior researchers and technicians, special management skill upgrading training and experience exchange programs were organized for Somali and Gambella region research managers and administration staff. Such programs are of immense value in terms of contributing towards improved implementation and institutional capacity of the young research establishments in emerging regions.

Fig.11. Livestock research training at Melkassa

Fig. 12. Training on science communication at Jijiga

PROCUREMENT

Rice is an increasingly important food and cash crop in emerging regions. Responding to the growing demand, wide scale promotion of new and productive varieties is underway as part of the scaling up program. However, lack of rice shellers is proving to be a limiting factor for further expansion of the technology. To partially alleviate the problem, EIAR, with RCBP support, has procured three shellers at Birr 205795.95 and distributed to Somali, Afar and Gambella regions to be shared and used by participating farmers and agro-pastoralists.

CHALLENGES AND LESSONS LEARNED

The multi-stakeholder initiative was quite rewarding experience for those involved. The sense of fulfillment gained from helping out the disadvantaged communities was visible even among those enduring the hardships deep in the rural areas, nonetheless, there still exist some challenges and lessons worth noting in future endeavors.

- The participatory planning was helpful in creating sense of ownership; but sustained, close follow up needed to make sure the system operates properly was often lacking;
- The expectation was a little too ambitious at times. For a variety of reasons some stakeholders failed to provide support and leadership in

a sustained manner, simply because the targets set were beyond their reach;

- The planning was too optimistic in some cases. It was done with little or no regard to the existing reality e. g. the people, their culture, peculiarities of the farming systems and socio-economic conditions;
- The persistent problem, with regard to staff turnover and low motivation, has clearly left its dent in the whole process. Future plans should have builtin provisions to overcome some of these problems.

CONCLUSION

The growing sense of purpose and sense of responsibility of key stakeholders in emerging regions is a huge source of inspiration. Furthermore, the clearly observed change of attitude of and increased demand for improved technologies by farmers, pastoralists and agro-pastoralists is a sign of great optimism. However, the following points need to be taken into consideration to keep up the momentum and register more laudable impacts in the future.

- Conduct awareness raising functions not only at regional level but also in implementing weredas, involving as diverse stakeholders as possible, with the aim of introducing the program to the wider public and creating sense of ownership at the grassroots level;
- Binding memoranda of understanding with clearly spelled out and agreed up on tasks should be developed and duly signed in the presence of regional presidents or their designates;
- Detailed and transparent budgeting is essential. A thorough enough budget should be worked out, outlining cost sharing arrangements, and debated upon and approved by all stakeholders right at the outset.

The two-year initiative has left us with enthusiasm and great anticipation for the future. Previously un-imaginable changes are taking place e.g. the attitude shift on the part of the native Gumuz, the Somali and Afar pastoralists and agro-pastoralists, the Anguaks and Nuers of Gambella; their willingness to break long held traditional taboos and embrace technologies is an opportunity not to be missed, and we need to seize the opportunity and capitalize on it. On the other hand and ironically, the only source of concern is, in some regions and

weredas, the educated few manning government institutions seem to be unwilling to live up to the expectation. To overcome such and a host of other institutional hurdles currently observed, it is absolutely important that the multi-stakeholder, pre-scaling up and capacity building initiative is owned and led by the political leadership. The administration entity from kebele all the way up to the region must assume its irreplaceable frontline role and lead the way in this noble cause, which has already begun to impart a flicker of hope to a multitude of pastoralist, agro-pastoralists and farmers.

AFAR PASTORAL AND AGRO-PASTORAL RESEARCH INSTITUTE (APARI): ACHIVEMENTS IN RESEARCH, TECHNOLOGY TRANSFER AND SCALING UP

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BACKGROUNDS

GENERAL INTRODUCTION

The nature of farming is changing in Ethiopia because of demographic changes: the pastoral communities are moving towards agro-pastoralism, the farm working group population is aging, while the young rural working male groups are migrating to urban areas, and many rural areas are becoming urbanized. These changes imply an increasingly diverse clientele for agricultural research and the need to give much more attention in addressing special features of a given area. As a result in the current scenario, many pastoralists may give lower priority to livestock farming than agro-pastoral activities mainly due to the absence of new technology options that give promising return in such complex climate. At the same time, resources are being degraded, reducing productivity and the provision of quality environmental services. Thus in this context, agricultural research must focus on activities that enhance resource productivity and on natural resource management practices to reverse degradation, especially in the pastoral areas of the country.

Global and regional climate change could have several important consequences in the pastoral and agro-pastoral areas of Ethiopia. To this effect, crop growing conditions are deteriorating in rain fed areas and the occurrence of recurrent and severe droughts is the year to year phenomena in many of the arid and semi-arid areas. These events are threatening the livelihood of the pastoral system, reducing average productivity and resilience, and thus increasing the vulnerability of

poor people who make living on livestock production. Given the long lead times inherent in much agricultural research, these changes need to be anticipated in setting research priorities for the future.

Although many pastoral development projects have been launched, they appear to have failed to come to grips with the intricate problems posed by the mode of production. The end results of such efforts have been frustrating and the final returns of input have been usually low or negative. The reasons behind the failure of the pastoral development projects have been analyzed and published (Ferguson, 1976; Horowitch, 1979; Goldschmidt, 1980). However, mentioning some positive thinking off-setting the negative sheet balance of ex post pastoral project appraisal may be worthwhile. More effective institutions in pastoral and agro-pastoral areas are required to improve pastoral and agro-pastoral productivity in general and attainment of food security in particular. Concomitantly, the development strategy aspired is to be placed and sustained largely in a place where research and training are extensively carried out, often in collaboration with other centers, institutions, and individuals. Hence the key role of research institutions in technology generation and promotion cannot be underestimated. Moreover, there should be in general collaborative efforts within NARS to evaluate the various trends in agricultural research evolution and to diagnose the challenges they face. One of the greatest challenges of NARS is to address client oriented and/or demand driven technologies through the participation of all stakeholders vis-a-vis its agro-ecological representation

This paper presents a summary of the efforts undertaken in reaching the Afar communities through provision of appropriate technologies. However, it should be realized that these achievements are registered with the commitment of very few number of research staff, using three temporary office rooms and very little budget allocated from the regional government.

Population, Location and Administrative Structure

The region is situated between 80 49′ to 140 30′ north latitude and 39o 34′ to 420 28′ east longitude. It covers an estimated area of 100,860 km2 (ARBoFED, 2009). The topography of the region varies from hilly escarpment in the western and southern edges with an altitude of 1,000-1,500 m.a.s.l to lowland plains that fall in the altitude of 0-100 m.a.s.l (APARDB, 2006). Around 95% of the Region, has a flat landscape with altitude decreasing towards northeastern parts and the total rangeland area is about 91,172 km2 (MCE, 2000). The Region is divided into 5 Zones, 32 Weredas and 401 Kebeles.

The population of the region is more than 1,411,092 out of which 86.60% and 13.40% reside in rural and in urban areas respectively (CSA, 2007). The population density varies from zone to zone based on the suitability of the area, Hari zone has relatively higher population density (64 persons/km2) and Kibileti zone has the lowest (9 persons/km2).

Climate

The most important factors determining the climate of the region can be categorized into altitude, air temperature and precipitation. There is also high association of the climate with altitude and vegetation cover of the area. The temperature is very high in areas of low altitude and bare land cover. The arid area covers 99.33% of the region and the altitude of the zone ranges from 114 m below sea level to 1300 m above sea level. The temperature of this zone is higher than 27oC in most part of the year. The areas lying between 1300 and 2200 m above sea level have semi arid climate with average temperature range of 15 to 20 oC (ARBoFED, 2009).

The amount of rainfall depends on a strong air flow from the south west to the north east caused by a deep low pressure zone over the Arabian Sea and the northern Indian Ocean. The rainfall of the region is highly associated with altitude and vegetation cover in which the high altitude areas around the western escarpment receiving more than 900 mm annual rainfall. Generally, mean annual rainfall of the region varies

from 160 mm in the north to 1500 mm in the south, most of which falls in the two- to three-months of the long rainy season, between July to September. Inter-annual variation in total amount, distribution and length of the growing season is high. The annual temperature varies from 15oC to 45oC in high and low elevations respectively (MCE, 2000). The average annual Potential Evapo-Transpiration (PET) ranges from 1600 mm in the western escarpment to 2800 mm at the eastern portion of the region. The average annual relative humidity, sunshine hours and wind speed are 58%, 8.5 hours and 1.7m/sec. respectively.

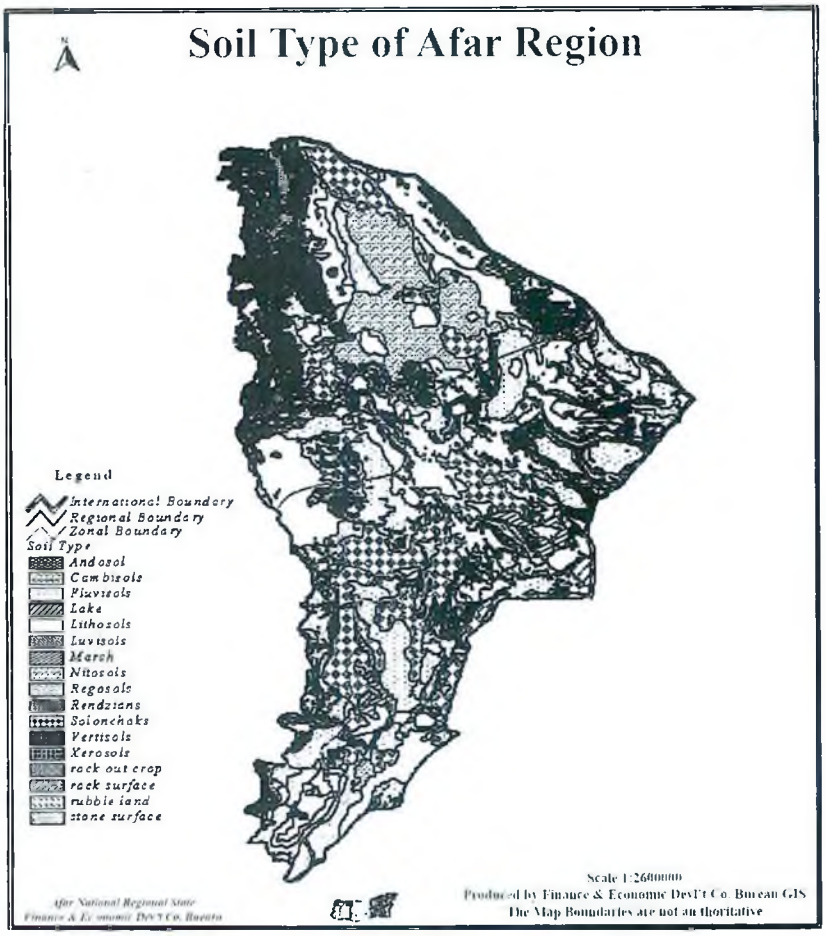
Geographic and Edaphic Features

The development of landforms and landscapes change over time resulted from various dynamic factors. These factors include tectonic movement, weather, erosion, and gravity. The present landscape of the region is very much a product of the tectonic processes, continuing episodes of rifting and volcanism.

The region is a lowland area with an irregular drainage system and depression recording 114 m below sea level as well as some of the exposed rocks. Proportionally, 35.47 % of the region has an elevation less than 400 m above sea level where 51.44% has an elevation between 400 to 900 m. The high elevation which is more than 900 m above sea level is constitutes 13.09% of the region.

The Afar Region is mostly composed of very young geological formations and their pedological development is very much restricted. This can be confirmed by the wide spread occurrence of Leptosols and Regosols. The temperature and rainfall zones of the area are the major determinant factor for the development of different types of soil in the region. The organic matter and nitrogen contents the soil increases with a fall in temperature and an increase in rainfall. Based on TECSULT-Woody Biomass Inventory and strategic planning project map (WBISPP, 2003), 6 major distinct soil types, which accounts for 88.12 % of the area cover of the region and other 10 minor soil types, with area cover of 11.88 % are identified in the Region. The major soils are: Lithosols (20.60%), Regosols (18.88%), Solonchaks (18.72%), Fluvisols (12.57%), Rock surface (9.29%) and Cambisols (8.06%). The Regosols

have depth mostly ranging from 25 to 50 cm and the surface areas are very stony. The regosols of the region are classified as Eutric and Regosols. Cambisols usually occur along valleys, on side slopes and alluvial Colluvial slopes.



Resource Potential

The region has enormous natural resource potential. There are numerous permanent and seasonal rivers which have huge potentials for crop/fodder production on the fertile land of the region. In spite of the resource potential endowment of the region, the pastoral and agro-pastoral production is threatened by resource shrinkage, rangeland

degradation, encroachment of unwanted plant species, climatic variation and conflict over key resources.

Rangeland Potentials

The land cover of Afar Region is majorly classified as rangeland, which is the principal source of feed for livestock. The classification of the rangelands is based upon climatic conditions. They are categorized into semi arid (500mm isohyets and are considered as high potential rangelands), upper-arid (300-500mm rainfall and wet season grazing source) and lower arid (below the 300mm isohyets).

There is a marked seasonal variation in availability and quality of feed resources due to marked seasonal variation in rainfall distribution. The availability of feed resources (grasses and browses) is adequate during the rainy season. However, the grasses become depleted during the dry season, apart to nutritive value limitation caused by over maturity. The situation is further aggravated when the dry season is prolonged inflicting productivity loss of animals, loss of body condition and market value and eventual death due to inadequate feed and water supply and the very low nutritive value of the available feed.

Traditionally the grazing areas were divided into wet and dry season grazing areas and drought reserves. During extended drought the pastoralists migrate to distant places in search of feed and water. However, the scope and possibility for migration is becoming limited as the dry season grazing and drought reserve areas gradually shrink due to expansion of cropping in the water source areas. Moreover, the situation is aggravated these days because of restriction of animal movement from one region to another. The plant composition and range productivity decreases from west to east due to decrease in precipitation and increase in temperature. The major vegetation types of the rangelands are riparian woodland, bush land/shrub land, grassland, wetland and bare land.

Livestock

Livestock production in Afar Regional State is dominated by pastoralism. It is mainly characterized by small holder production system. The pastoralists keep livestock for milk, meat, transportation, and means of saving and strategy of survival. The large majority of afar pastoralists are not market oriented but supply the market either as response to food insecurity or fulfillment of economic, social and legal obligations.

The region is endowed with about 2,336,486 cattle, 852,018 camels, 2,463,632 sheep and 4,267,969 goats and over 90% of the afar population depends largely on cattle, sheep, goats and camels as source of food and cash income. Given the nature of the environment, the available feed types and the prevailing involvement of Afar pastoralists in market, there is. little opportunity at hand to promote output based livestock production system. However, with better integration to market, and the demand for various livestock products, there will be a strong justifiable ground to improve primarily the productivity of the local breeds and also systemically devise ways where potential introduction of other breeds could fit.

Crop Production

The Afar Region has an enormous fertile agricultural land with adequate water resource that could be exploited. According to ARPARDB (2009) assessment report, 409, 678 ha of land in nine weredas of the region are identified to be potential areas for agricultural investment. Similarly, open wood land and swampy areas could be utilized for large scale agricultural investment purposes. Nevertheless, most of the potential agricultural areas are encroached by invasive alien species like Prosopis juliflora and other weeds.

There is huge potential land covered with grass and scattered scant shrubs where part of it could also be utilized for food and fodder crop development. The potential irrigable land along Awash River is estimated to be about 165,545 hectares. Most of the potential irrigated land is found within lower and middle Awash valley which is suitable and ideal for producing different types of crops. The majority of the

developed irrigated land was handed over to the pastoralists after change of government in the country while some of it is owned by private investment. The crop types that are successfully produced in the selected investment areas are rice, cotton, maize, sorghum, sesame, groundnut, tomato, onion, pepper, mango, banana, papaya, sugarcane and date palm. In addition, though they are not yet well adopted by the local people, research trials approved that rice, wheat and chick pea can also be produced under irrigation with attractive yield potential.

Water Resources

The region has a number of perennial rivers namely, Awash, Mille, Kesem Kebena, Awra, Gulina, Dewe, Borkena, Telalak, Jara, Weama and others. Similarly, there are numerous seasonal rivers that flow to different basins. The region also has many lakes such as Afdera, Asahle, Dalol, Abe, Gemeri. The south and central parts of the region fall within the drainage basin of the Awash river whereas Awra, Telalak and Gulina rivers join the Denakil basin. There is very little effort undertaken to study the potential in hydro power and irrigation use of the rivers.

Mineral Resources

The Afar Depression i.e. a plate tectonic tripe junction that forms the red sea and the Gulf of Aden and that joins the east African Rift valley is found in Afar National Regional State. It is one of earth's great active volcanoes. Due to this volcanic activity the floor of the depression is composed of lava, mostly of basalt type. The continuous process of volcanism resulted the existence of major minerals like potash, sulpher, salt, bentonite, gypsum; and other different construction materials are available in most part of the region. Higher concentration of these minerals are found in Dallol, Berahile and Afdera wereda of Kibileti Zone; Elidar, Dubti and Millie woredas of Awsi Zone and Gewane woreda of Gebi Zone. In addition to these minerals, there are also promising geothermal energy sources and hot springs in different parts of the region.

Major Research Focus Areas

APARI is mandated to provide appropriate technologies to pastoral and agro-pastoral communities in the areas of livestock, rangeland, crop, natural resources and socio-economic research through multi and inter-disciplinary approaches. Encompasses broadly agricultural research on livestock, and other natural resources. The main objectives are to generate, develop, and adopt technologies that cater for the needs of pastoral and agro-pastoral communities; and to coordinate pastoral and agro-pastoral research activities in the region, and establish an efficient and effective system of addressing development needs; and to disseminate and publicize research results.

Achievements in Research

APARI is making unreserved efforts to address researchable issues on livestock, crop, soil and forestry programs to bring sustainable development in the region since 2008. The research activities were executed on Participatory Research Approach in order to improve technology development, verification, transfer and adoption through Agro-Pastoral Research Extension Group.

Rangelands

The quality of grass is poor and the major part of the rangeland is considered poor with respect to vegetation cover and productivity. The major feed sources available for the entire livestock in the region are grass land and shrub land. APARI has carriedout rangeland resource inventory. But, most parts of the rangeland vegetation cover was identified to be very low in biomass yield. It was also studied that the major part of the rangeland with area coverage estimate of 1.524 million ha is invaded by undesirable plant species, such as Prosopis juliflora, Acacia melifera, Acacia nubica, etc. Similarly, the degradation of the rangeland vegetation cover has contributed to the increase of unpalatable and poisonous plant species.

Plant species composition and biomass production vary among range sites due to differences in soil, water and topographic features. In conjunction with this, the institute along with pastoral and agro-

pastoral communities has made an initial characterization study on the potential rangelands taking collection and identification of key native species. Mature seed heads of a number of species were systematically collected throughout the region in order to gather enough diversity within and among the species found in the region. A site description form was prepared for each species collected. Accordingly 16 native grass species with high feed value were identified and collected. Evaluation of the nutrient content was carried out for both wet and dry seasons. More importantly, plant growth and development traits such as plant vigor, winter hardiness, phenology and seed production were recorded. Plants of the same species with similar characteristics were bulked to form plant lines. Populations with different performances were grown separately and the bulked seeds were used to establish a progeny trial either for more comparison or for cultural study. The plant lines are also evaluated to ensure that plant performances are in fact hereditary and stable. Currently, native grass species multiplication is undertaken at research stations. On the other hand, the result obtained from use of native plant species for rehabilitation of degraded areas is encouraging and there are huge initiatives among development partners and policy makers to incorporate the activities in the five years pastoral development plan of the region. This project integrates several proposals to increase native plant production and use within the Afar region utilizing an applied science approach in a collaborative project. Ecological approached seeding will be applied to revegetate the rangeland based on knowledge and understanding of the ecology of the site.

In order to know plant covers dynamics of the rangeland, plant species composition of the herbaceous layer of Duba grazing areas was determined using a wheel point apparatus based on the frequency of occurrence of the species. The herbaceous species were classified into groups using the desirability groups, they were divided into four groups, i.e., highly desirable, desirable, less desirable and undesirable. A total of 13 species of grasses, 2 species of legumes, and 4 species of other herbaceous plants were identified in the area. Of the grass species, 15.3, 30.8, 38.6 and 15.3% were highly desirable, desirable, less desirable and undesirable respectively. The grass species dominant in

the area were Chrysopogon plumolosus (22.1%) and Tragus beteronianus (20.6%) whereas Cenchrus ciliaris (21.2%) was dominant in the enclosure area (Mohammed, 2009). The communal grazing areas have deteriorated in terms of species composition and biomass production which indicates the need of an immediate intervention, while the enclosure areas need a sustainable conservation of their present condition by considering alternative management that allows selective, careful and time utilization. Therefore, rehabilitation of highly denuded communal grazing areas through establishment of community based enclosure is paramount important to improve the rangeland.

It is believed by many pastoralists that the rangeland vegetation composition has dramatically changed from time to time within the past 20 years. According to the pastoralist response the most important perennial grasses like *Cenchrus ciliaris, Cynodon dactylon, Digitaria milanjana, Panicum coloratum, Bothriochloa insculpta, Andropogon canaliculatus* and *Chrysopogon plumolosus* are more preferred for livestock feed and most of them are declining in terms of population. According to the respondents, these grass species were very important for milk and meat production but now some of them are endangered and some of them are extinct due to overgrazing and inappropriate range management practices. The important grass species i.e., Digitaria milanjana and Cenchrus ciliaris are totally wiped out from most part of the rangeland. The other grass species like Tragus beteronianus, Sporobolus pyramidallis and Chrysopogon plumolosus have been endangered and are only found in enclosure and hilly escarpment areas.

The pastoralists also compared the present and the past species in terms of livestock products and body condition. They described that the grass species had a high yield and nutritive quality that increases milk production and live weight in the past. Due to this fact, milk, butter and meat availability was very high and the livestock sell was also good. The pastoralists underlined that the existing plant species of the rangeland have less influence on the milk and meat production as well

as on animal body performance. Most of the grass species in grazing areas are light in weight and easily die off after establishment.

The finding of our survey indicated that there is severe soil erosion in the rangeland of the region, in almost all types of the land-use system. Gullies and small rills are formed here and there in most parts of the rangeland. The severity of soil erosion varied along the rangeland depending on human and livestock population, water availability and soil types. In most areas, the respondents described that the grasslands were highly degraded and almost recovery would be very difficult, meanwhile, loss of grassland productivity and occurrence of invader species like *Tribulis terrestris* and *Calotropis procera* is a good indicator of the current rangeland degradation of the study district.

A total of 14 woody species were identified in upper and lower altitudes of Chifra valley and the percentage abundance of each species was studied. According to the perceptions of the pastoralists, of the identified woody species, 42.9, 28.6, 21.4 and 7.1% were highly palatable, palatable, less palatable and unpalatable, respectively. From the highly palatable species, the largest was contributed by different species of *Acacia, Cordia* and *Grewia* which are very important for browsing animals like camels and goats. Among the highly palatable category (5) identified in lower altitude (>550-850m), 4 woody species (80%) were found in enclosure areas and 2 woody species (40%) were found in communal grazing areas. In upper altitude (>850-1100m), 6 woody species (100%) were recorded from enclosure areas, 4 woody species (66.7%) in communal and 2 woody species (33.3%) in riverside grazing areas. The study revealed that the height classes >1-1.5 m and >1.5-2 m constituted a higher percentage than the other height classes. Moreover it was revealed that the rangelands of the study areas were largely invaded by small bushes and shrubs. This abundance of small bushes and shrubs is to be associated on to the exposure of the rangelands to increased anthropogenic disturbances.

The chemical composition of major browse species of Chifra plain was studied for CP, NDF, ADF, ADL and ash content. The highest CP content was found in *Grewia tembensis* and the lowest in *B. aegyptica* in

both seasons. The highest ash content during wet season was found in *Balanite aegyptica,* while the lowest ash content was found in Acacia *nilotica* in the dry season. The lowest and highest NDF content were found in G. *tembensis* and *B. aegyptica* during the wet and dry seasons, respectively. The lowest ADF content was found in A. *nilotica* during wet season, while *G. tembensis* had the lowest ADF content during the dry season. It was found that the ADL content of the browse species of the areas ranged from 5.1% in A. *nilotica* to 5.66% in B. *aegyptica* during the wet season while in the dry season ADL content varied from 4.7% in G. *tembensis* to 8.62% in B. *aegyptica.* The result also showed that the CP content of woody plants was negatively correlated with NDF, ADF and ADL whereas NDF, ADF and ADL were strongly and positively correlated with each other. Among the identified browse species in the study area, G. *tembensis* had high feed quality followed by A.nilotica. Similarly, the composition of the herbaceous species was examined for crude protein and fiber content of grass and non-grass species in communal, enclosure and riverside grazing areas across different altitude ranges.

Invasive Plant Management

The invasion of *Prosopis* in the rangelands in southern and centeral parts of Afar region is threatening the livelihoods of pastoral and agro-pastoral communities. This has led the pastoralists reach consensus on the need for its complete eradication from the region. APARI is trying to synthesize efficient and cost effective methods of eradication. Eradication by hand clearaning was the first method used with *Prosopis.* Pastoral and agro-pastoral communities in Amibara and Gewane woredas were mobilized to cut the trees, seedlings and uproot the stumps in the invaded pasture area. Efforts are made to introduce different clearance methods to control *Prosopis.* While harvesting for firewood and use as fence post and poles are effective methods, the operations are too labor intensive and expensive for the land owner to consider on anything but a small scale.

Mechanical grubbing has been carried out with tractor operated machines, but effectiveness is limited by tree size, and grubbing is more

cost effective in lighter infestations. Mechanical method involves tractor operations of severing roots below ground level to ensure tree kill. These include root chaining, which are often the most effective mechanical means. This treatment was identified as an effective method to remove stumps up to 50 cm in diameter without difficulty. The soil should be neither too wet nor too dry for effective uprooting. This method is, however, one of the most expensive control treatments and is recommended only on deep soils which have a high potential for subsequent increased forage production. Some herbicides and herbicide mixtures have been tested against P. *juliflora*. Some of the chemicals provided excellent suppression of top growth, and some trees were also killed. There was a need to apply the chemical treatments periodically to ensure that forage yields were maintained. Mixed mechanical and chemical methods have proved to be more effective than individual use of each treatment in several of the cases. Several integrated programs that mix mechanical, chemical and fire have had reasonable success but are costly and require a high level of management input. Total tree kill may be possible with some treatments, but adequate techniques for preventing re-introduction of seeds and re-establishment of trees have yet to be developed. The potential environmental damage from widespread use of herbicides must also be taken into consideration.

Improved Forage Development

Due to poor grazing system and quality, native pasture cannot satisfy the nutrient requirement of animals and weight loss of up to 20% have been commonly reported for cattle kept entirely on such pasture (EARO, 1998). To this effect, testing and evaluation of the suitability and productivity of introduced improved grasses and leguminous forage plants were conducted. Pilot interventions were carried out to know the level of the total production unit and were comprised into two categories. The single major constraint to which all producers are affected within the region is that of a uni-modal range resource base, which means the productivity of the system hinges on a two- to four-month rainy season during which nutrient supply is sufficient for maintenance and production in terms of incremental herd growth (live weight gain plus reproduction). Once the growing season is over, the

range resource may remain adequate in quantity but deteriorates gradually in quality over the nine-month long dry season. This situation is in contrast to fodder grower areas that are capable of breaking the deteriorating fodder situation through short or long-distance movement to perennial floodplain grasslands, to crop residue resources or to areas who are engaged in improved forage production. Evaluations were made about the costs and benefits, feasibility, sustainability, social acceptability and environmental impact of improved forage development. None of these options are available to most pastoralists who are far from river banks in all zones, at least not for those with cattle herds, while for small flocks and camels, the options are somewhat greater through the exploitation of browse.

Percentage/ proportion of plant germination, nodulation, nodulation intensity, effectiveness of nodulation in fixing nitrogen of 27 grass and legume species have been identified at different locations in the region. Dry matter accumulation, crude protein, digestibility of respective plant parts of the above species have been evaluated at different sites. In addition inflorescence evaluation and seed production of different grass and legumes species were studied under agro-pastoralists management system. Observations were made for any insect found to feed on different parts of forage species and disease incidence (percentage of plots infested).

Livestock Husbandry

Livestock is the mainstay of pastoral production systems, and efforts geared towards improving the production and productivity of the animals can help save the livelihoods as well as lives of pastoral communities in Afar. The introduction and testing of improved breeds helps to identify suitable breeds for the region and the need for alternative options of breed improvement. Despite the efforts by the Federal Government in supporting national programs aimed at improving livestock production through the regions own resources or with continuous assistance from external donors including ADB (NLDP), success has not been registered in Afar yet. Therefore, there is a need for introducing local and exotic cattle breeds to improve the

production and productivity of livestock in Afar region. Traditional selection based on genetic merit calculated from phenotypic and pedigree information has been tremendously effective to improve dairy cattle production. Hypothetically, genetic improvement could be accelerated even further for yield and other economically important traits by directly selecting upon the genetic differences underlined in the phenotypic character. To this effect, APARI has started activities of evaluating local livestock breeds performance in order to select based on the genetic potentials. The activities of evaluating different local (Begait, Boran and Afar) breeds of cattle under agro-pastoralists management system has been undertaken since 2007 with the participation of all stakeholders (pastoralists, agro-pastoralists, development agents, NGOs, investors and others). There are also efforts to introduce other local goat and sheep breeds from Borena and Abergelle areas of Oromiya and Tigray regions.

The water source limitation in Afar region is major constraint cotributing to feed shortage in most parts of the year. The livestock rearing in the region is pastoral and agro-pastoral production system that mainly depends on rangeland vegetation. Under pastoral condition, animals graze or browse the poor range vegetation early in the day and there is no any supplementation provided to them. There is little supplementation from tree branch, grasses, grains, crop residue and house leftovers in the agro-pastoral system. On the other hand, the pastoralists do not have the capacity to supplement any type of feed which hinders to promoted finishing farm is not yet effective in the region. Therefore, replacing concentrate feed or creating a means to provide supplementation from available and cheaper material in ruminant diets would reduce feeding cost and maximize economic returns for livestock farmers. APARI's work on the use of Prosopis juliflora pods in livestock diets has produced encouraging results with various animal species in the region. This study showed that Prosopis juliflora pod flour could replace other expensive concentrate feed in rations of sheep, goat, cattle and camel. As a result increased dry matter (DM) intake, weight gain and milk production were recorded with increased proportion of pod flour. In goat, it was possible to totally replace wheat flour by ground Prosopis pods. The substitution of the

commercial concentrate with half of the local concentrate significantly improved the apparent DM digestibility, CP and digestible energy. These results suggested that *Prosopis Juliflora* Pod may be used as a mixture with the commercial concentrate without impeding goat performance. The animals fed with ground *Prosopis juliflora* pods were in excellent condition throughout the trial as evidenced by no signs of ill health condition. There was no negative effect of ground *Prosopis juliflora* on body weight gain, carcass weight or dressing percentage. There were also no diet effects on proportions of body organs or fat deposits of shoats. Similarly, there were no significant effects on cut weight, muscle weight or carcass linear measurements of Afar sheep and goat. These findings indicate that feeding Afar sheep and goat with *Prosopis juliflora* pods has no effect on carcass conformation and composition.

Crop Research

Food crops research aims at developing, validating and releasing technologies (improved crop varieties and management practices) to agro-pastoralists. The strategy adopted in this regard was the generation of high yielding and stable varieties of crops with desirable agronomic traits, including value addition at post-harvest and alternative uses which integrate crop and livestock farming thus to reduce cost of production. For practically all crops, appropriate post-harvest technologies (storage, processing, and utilization packages) are required to add value and increase the shelf life of the products. In order to scale up these technologies, deliberate efforts are being made to make link with other stakeholders, such as seed traders, extension agents and agro-pastoralists to disseminate the technologies to the end-users.

Recent achievements in APARI's crop research programs include verification of a number of improved varieties in the region. The varieties released by NARS are already verified and demonstrated to the agro-pastoral communities. Crop management recommendation manuals were also produced by APARI for use by the extension agents. APARI is also conducting adaptation trials on nationally released

varieties. Priority is given to screening maize varieties for those areas that began crop farming recently. Conducting adaptation trials on vegetable and oil crop varieties have been carried out in those areas which have long experience in crop farming.

Different vegetables (mainly onion, pepper and tomato) have been selected in all Weredas of Afar region as a priority to support the market oriented development activities. Introduction and adaptation of new varieties, crop husbandry practices and water management trials are undertaken. Here below are some of the findings:

- Five onion varieties (Nasik red, Melkam, Bombey red, Adama red and Red croyl) were introduced and tested for adaptability. From the adaptstion trial it was identified that Adama red was with high pungency, deep red color and medium sized bulbs and high yielding. But reaches maturity late than Bombey red. Among the characters considered early maturity was preferred by the agro-pastoralists which led to the selection of Bombey red to take advantage of the existing market situation of the region.
- Five tomato varieties (Melkashola, Melkasalsa, RomaVF, Fetane and Marglobe) were introduced and tested for adaptability in the area. Roma VF was found to be high yielder and also preferred by the agro-pastoralists mainly due to its longer shelf life.
- Five hot pepper varieties (Mareko Fana, PBC 600, Melka Zala, Melka Dima and Melka Eshet) were introduced and tested for adaptability at Awra Pastoral and Agro-pastoral Research Center. The highest total and marketable fruit yield were recorded from Mareko Fana and was preferred by the agro-pastoralists in the area.

APARI has multiplied Bombey red and Adama red onion seeds in collaboration with Were Agricultural Research Center and distributed to agro-pastoralists in the region. Similarly, APARI has begun multiplying hot pepper, var. Mareko Fana, seed at Awra Pastoral and Agro-pastoral Research Center. The distribution of seed to the agro-pastoralists was made by Fenti Zone and other neighboring woredas..

Fruit development has been considered as priority area especially where irrigation possibilities exist like Amibara, Gewane, Dubti,

Ayssaita, Afambo and Dalifage Weredas. The tropical fruits namely date palm, banana, citrus, mango, papaya, avocado, pineapple, cashew nut were found to be suitable. To improve fruit production in the region, APARI has tried to facilitate the capacity of private service providers and agro-pastoralists. There are efforts to establish nursery sites to demonstrate fruit trees for extension workers, agro-pastoralists and other stakeholders. Improved varieties of mango (grafted seedling), hermaphrodite papaya variety (solo) and five banana varieties were introduced and demonstrated in Afambo, Dalifaghie and Ayssaita. Ten banana varieties (Ducusa, Williams-1, Williams-2, Poyo, Grand Naine, Pisang Raja, Giant Cavendish, Dwarf Cavendish, Rubusta, and Butuza) were introduced and tested by Dalifage Pastoral and Agro-pastoral Research Center with the participation of Agro-pastoral Research Group /ARG/. Similarly, these 10 banana varieties were maintained in Awra Pastoral and Agro-pastoral Research Center.

In roots and tuber crops, five sweet potato varieties (Koka-6, Fallaha, Koka-12, Dubo and Kudadie) were introduced and tested at Dalifage Pastoral and Agro-pastoral Research Center. Koka-6 and Dubo were most productive in root and above ground biomass yield. The promising varieties, Koka-6 and Falaha were multiplied and distributed to the irrigable areas of the region. A survey has been conducted to assess the indigenous sweet potato production system in Middle Awash Valley of Afar region, around Amibara and Gewane districts and the adjacent district of Meiso in Oromia region. Further, the objective was to identify the indigenous seedbed preparation methods, cultivation system and agronomic practices. Agro-pastoralists in the Middle Awash Valley clip the sweet potato vine at some stages of its development for planting material and animal feed use. Besides, they clip the vines to suppress storage root bulking so as to reduce over sized and unmarketable storage roots. Similarly, agro-pastoralists in the region have been practicing poor land preparation and planting systems, improper irrigation and cultivation technologies which lead to poor quality root bulking storage, over-sized storage roots that are cooked with difficulty. To generate data on impact of vine clipping and type of seedbed on growth and yield of sweet potato production, a field experiment consisting of four treatments (clipping at 45, 75, 105 days

after planting and no clipping) and three seedbed types (ridge, flat, and sunken) was executed. Analysis of the result on average storage root number per plant, the number of branches per plant, vine length, physiological maturity, shoot fresh weight, specific gravity of sweet potato storage roots and percent root dry matter yield showed that total and marketable storage root yields of the plant were significantly influenced by the main effect of clipping stage and also by the main effect of seedbed type. Clipping significantly reduced both yields. Thus, the total storage root yields of plants clipped 45 days after planting, 75 days after planting, and 105 days after planting decreased significantly by 26.4%, 17.9% and 9.7%, respectively compared to the total storage root yields of plants that were not clipped at all. Similarly, the marketable storage root yields of the plants also significantly reduced by 25.0%, 20.1%, and 13.3% in that order.

In maize, eight open pollinated and five hybrid varieties were ntroduced byt Awra Pastoral and Agro-pastoral Research Center and Chifra Wereda and adaptation trial has begun. The same research projects have been implemented in Ayssaita, Afambo and Dubti woredas. High yielding verities have been identified with the participation agro-pastoral communities of the different woredas.

Yield and yield related attributes of 15 rice genotypes were assessed under saline conditions. This study was carried out to investigate the effect of four different salinity levels (0, 4, 8 and 12 dSm-1). The interaction of genotype and salinity was significant for all traits except for plant height during heading, panicle length, number of panicle, number of grains per panicle and number of tillers per plant, indicating the inconsistency of the performance of genotypes and the need for selection of rice genotypes specifically adapted to a particular salinity level.

A survey was carried in date palm plantation areas in Assayita and Afambo Weredas.. The owners indicated the superior trees (trees having high yield and quality fruit). The tree vigor, presence/absence of the offshoot, sex and age of the trees were examined. A list of all

cultivars of the farmers was registered and superior genotypes were selected and marked.

Many pests and diseases present serious threat to major crops in the region. In maize stem and ear borers, armyworms, cutworms, grain moths, beetles (weevils, grain borers, rootworms, and white grubs) and virus vectors (aphids and leafhoppers) are the main constraints. Major fungal diseases are also identified such as ear rot, caused by Fusarium verticillioides that can produce mycotoxins that threaten human and animal health. Combined attacks of pests and weeds cause severe damage and as high as 90 percent loss on cowpea. The institute is undertaking different botanical control trials using available plant material such as neem tree.

Natural Resource

Evaluation of different soil and water conservation techniques and the development of sustainable intensification strategies have been carried out at APARI. There are efforts made to incorporate drought-tolerant tree varieties and choosing species with higher water use efficiencies. Considerable achievements have been registered in introducing technologies that are useful to capture rainfall through improved soil surface management practices, small water harvesting systems and small-scale irrigation systems that enable intensification of farming and fodder/food crop diversification in potential areas.

Characterization and classification of the soils of the irrigated area into different categories of salt affected soils was undertaken in Lower Awash Valley. Similar attempt was done to classify the irrigation water into different categories of quality classes based on the salinity and sodicity content. The results of laboratory analysis indicate that soils of the area are highly base saturated with PBS values exceeding 100 percent. The result of this study indicated that the soil exchange sites were highly saturated by Ca at all sites except for the lower soil profile. Even if Ca was highly dominant in the area, Na concentration of the soil exchange site was found to be high in site 1, 2 and 4 and hence high values of ESP (>15 %) for Profiles 1, 2 and 4 were recorded. In the case

of surface soils, high ESP values were recorded in some sites. It is also indicated as CEC values varied from 39.26 to 63.60 cmolC kg-1 of soil in profile samples, and 53.60 to 64.63 cmolC kg-1 of soil in surface soil samples. The extent of salinity (salt content) was found to be high (ECe > 4 dS m-1) in soils of the study sites except few sites. Based on the criteria for classification of surface soils, both profiles and surface soils of some sites were considered to be saline and saline sodic. Few sites were found to be non-saline and non-sodic at the surface soils. However, beneath the depth of 25 cm, Profile 1 was found to be sodic soil.

The analytical results of irrigation water sampled from Awash River (the source of water for irrigation in the area) indicated that the water was low in electrolytic composition of both total salts (EC) and sodium status (SAR). This tells us the Awash River water in the area is safe for agricultural purposes.

Agricultural Mechanization

Afar Region has established Samara Rural Technology Research and Promotion Center in order to develop appropriate implements and equipment that can improve the livelihood of pastoral and agro-pastoral communities. The Center is contributing its share by generating, modifying, adoption and multiplying of appropriate pre and post-harvest technologies such as milk processing, storage, cooking stoves, solar energy utilization, mechanical water pump, transport equipments, feed chopper, thresher and others. Most of these technologies have been demonstrated to pastoral and agro-pastoral communities in the region.

Gender Mainstreaming

Given the extensive participation of women in all sector of pastoral production, the mainstreaming of gender into the pastoral and agro-pastoral research is a key strategy not only for the promotion of equality between men and women, but also for sustainable pastoral and agro-pastoral development. The gender mainstreaming activities of

APARI focus on three major areas i.e. awareness creation, designing income generating activities and conducting gender related survey.

Technology Transfer and Scaling up

In the rangelands, the institute established enclosure sites for demonstration using traditional management practices. The capability of the enclosure areas to produce large volumes of palatable, nutritious and diversified livestock feeds was demonstrated. Enclosure and water harvesting techniques were introduced in line with demonstration of the ability of managed rangelands to survive without significant input. Based on Afar pastoral and agro-pastoral communities' experience, it very quickly became apparent that the introduction of native plant material would provide a long-lived, easily managed alternative. APARI has also learned that it is no more difficult to establish stands of native species provided certain techniques regarding site preparation, weed control, seed quality and soil and water conservation techniques are properly employed.

Agro-pastoralists have participated in improved forage scaling up program and they have acquired excellent experiences in regard to the use and management practices of improved forages. The number of agro-pastoralists involved in scaling up of improved forage development has reached 340. The agro-pastoralists in the region became successful seed growers and became model forage seed growers nationally too. The seed growers are supplying different improved forage seed to governmental and non-governmental organization at a rate of 50 ETB per kg. The capacity of the agro-pastoralists has improved from time to time and they are now able to supply panicum seed at national level.

In livestock the technical and economic feasibility; and the social acceptability of limited concentrated feeds (cottonseed, grounded *prosopis juliflora* pod, maize grain, forage legumes, grass, groundnut etc.) to goats, sheep and lactating cows both in dry and wet season were demonstrated. APARI has extended those proved technologies to pastoral and agro-pastoral communities through the pastoral research

groups (PRG/ARG). Proven technologies in feed and nutrition, livestock breed, supplementation (improved forage, Prosopis juliflora pod, cotton seed, food grain and crop residue) and other management practices were scaled out to agro-pastoralists in 16 woredas of the region. Similarly, potential local breeds such as Boran and Begait heifers and bulls were distributed to agro-pastoralists who are engaged in improve forage development. The purpose of distributing these breeding stocks was to promote improved dairy husbandry practices among agro-pastoralists in the region. The agro-pastoralists engaged in improved forage production are requesting to keep improved cattle breeds, especially cross breeds of Holstein, Jersey or other available exotic blood. But due to the unavailability of proven technology APARI is concentrating on introducing local Boran and Begait breeds to potential woredas of the region (Ayssaita, Afambo, Dubti, Chifra, Abala, Kuneba and Berahile).

Oilseeds have been identified as a priority commodity in Ayssaita, Amibara and Afambo Weredas and APARI has participated in scaling up of these and other technologies in collaboration with EIAR. The acitivites included:

- Introduction of improved sesame and ground nut (from Werer) varieties,
- Scaling up/out of improved sesame (Adi and Tate varieties) technologies (180 agro-pastoralists in Ayssaita, Afambo and Amibara woredas have participated),
- Scaling up/out of improved ground nut technologies in Afar region involving 85 agro-pastoralists in Ayssaita, Afambo and Amibara woredas),
- Scaling/up out lowland NERICA rice varieties,
- Scaling up/out of improved maize technologies (BH-140 and BH-540) at Ayssaita, Amibara and Afambo Weredas involving 750 agro-pastoralists.

APARI has also intervened to improve the supply of seed in collaboration with different stakeholders. Multiplying and distribution of improved seeds has been carried out in the past three years. APARI has established Agro-pastoral Research Group (ARG) and has promoted participatory improved sesame and ground nut seed

multiplication on the farms of agro-pastoral communities in Ayssaita, Afambo and Dalifage Weredas. This intervention has improved the supply of oil crops and other seeds in the region.

Over three years period, selected sites in three categories of rangeland – good, moderate and poor – were subjected to varying levels of soil and water conservation strategies (terraces, soil bund and micro basin). The effects of soil conservation were evaluated in terms of the production of above-ground biomass. For all treatments, rangeland in good condition produced significantly more biomass than those in moderate and poor condition. Generally, it is indicated that rangeland condition in interaction with the soil water content is the main determinants of optimal production and water use efficiency.

In agricultural mechanization, 50 camel ploughs, 70 tie ridgers, 15 milk churners, 1524 maize shellers (1000 more are being manufactured), 50 tomato handling boxes, 60 beehives, 30 animal feed choppers, 30 each treadle and rope and washer pumps, 9 hand carts, 5 camel drawn carts, 5 donkey drawn carts and 30 box type solar cookers were produced and disseminated in various weredas.

Gaps and challenges

- Intensive work needs to be done to generate more technologies to meet the rising demand however the current budget allocation is not sufficient to do so, and this is leading to increased frustration of researchers.
- There is 271.6 ha of land in Dubti suitable for irrigation, but the irrigation facility is not constructed and there is no experimental station to multiply improved seeds for popularization..
- Pastoral and agro-pastoral areas of the country have limited infrastructure and are not suitable for living due to harsh climatic condition. Currently, there are efforts to establish research centers in these remote areas but there is no encouraging investment being carried to equip and make them operational. It is also difficult to get skilled human power in such areas and there is no any special arrangements made so far in promoting technology generation, multiplication and dissemination to bring equity in nation's development.

- Greater regional and sub-regional co-operation would enhance the efficiency and effectiveness of agricultural research, however there is no that much support to improve the efficiency of newly established pastoral and agro-pastoral research institutions. The linkage in the research system is weak. There are no mechanisms \ designed to assign senior researchers to work in those remote areas permanently. There is no a strong linkages that encourage and equip those researchers who are working in pastoral areas.
- Lack of seed multiplication schemes in the region. APARI has tried to get crop parental lines and breeder seeds in order to multiply and distribute to agro-pastoralists but because of limited capacity the contribution of such effort is grossly inadequate.
- There is no any specialized institution mandated to select, improve and multiply livestock breeds in the country.
- The extension services have often failed to provide technologies that benefit pastoral and agro-pastoral communities. This is because of the limitation of available pastoral technologies and communication strategies. The most affected are the women pastoralists and agro-pastoralists that are responsible for the great majority of agricultural outputs. Absence of effective extension system in pastoral and agro-pastoral areas again has a negative effect on promotion of technology generation and dissemination. This in turn will affect the vision of having research institutions in these areas and there will not be strong support in putting pastoral and agro-pastoral research among top development agendas.
- Lack of incentives that encourage pastoralists and agro-pastoralists to fill the existing yield gaps and become more income secure in the process. This in general requires the establishment of effective system that allow pastoral and agro-pastoral communities respond effectively to price signals that result in more productive systems. Strengthening the competitive ability of pastoralists and agro-pastoralists is not done using information and communications technology to provide speedy and timely market and price information, identification of new niche market opportunities, quality literacy, and encouraging and promoting pastoralists organizations, including co-operatives. Little efforts have been exerted to organize pastoralists and agro-pastoralists strengthen their market orientation and in that process to encourage partnerships with the private agro-service sector, firstly for local and regional markets. Opportunities to improve post-harvest handling and

processing are not fully utilized along with improved grading, packaging, cooling and storage in order to promote exports.

- Agro-pastoralists do recognize the advantage of new technologies to raise productivity, but are often reluctant to balance the payment for the input delivery received. Despite the approaches needed to encourage the pastoral and agro-pastoral communities take the advantage of new technologies, special attention should be considered to increase their access to sound rural financial services, including savings, credit, and insurance.
- There is inadequate effort made to invest in pastoral science and technology at all levels of education, so as to create an attractive environment and demand for further science and technology education. There are no incentives and reward systems that encourage innovation and entrepreneurship in the pastoral and agro-pastoral sector.

Future Direction

- Pastoral and agro-pastoral research and extension services will not sustain without strong political support of policy makers and the broad stakeholders that are committed to bring livelihood change in the pastoral production system. Without the support of stakeholders, adequate funding will not be forthcoming, institutional reforms will not be undertaken, and the efficiency and effectiveness of pastoral and agro-pastoral technology generation and adoption will not increase.
- Research capacity building must be a major component of the regional development strategy.
- Effective incentive and reward systems need to be introduced to motivate employees to work effectively under the very challenging conditions.
- Fostering strong linkages and effective networking between federal and regional institutes and other major R & D partners (universities, CG systems etc.) within and outside the country is of paramount importance to avoid fragmented efforts and create synergy.
- High priority should be accorded to developing a well functioning market structure in pastoral regions.
- Adequate resources need to be allocated for technology shopping and experience sharing for researchers.

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Somali Region Pastoral and Agro-Pastoral Research Institute: Achievements and Challenges

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Introduction

Somali region is one of the nine regional states of the Federal Democratic Republic of Ethiopia located in the south eastern parts of the country, between 40 to 110 north latitude and 400 to 480 east longitude. The region approximately covers a total area of 285,000 km2 . It shares boundaries with Afar Regional State and Djibouti Republic in the north, Kenya and Somali Democratic Republic in the South and East, and Oromia Regional State in the west. The region consists of 9 administrative zones and 53 woredas. It is the second largest regional state in the country in its total area coverage with a total land mass of 32 million hectares. Of this total area, 6 million hectares is arable land. According to the 2007 Population Census results of Ethiopia, the total population of the region is over 4.4 million, of which 86% live in the rural areas and the rest reside in the urban areas

Agro-ecologically, the region has two generalized zones, namely, hot arid and hot semi-arid with altitude ranging between 500 and 1600 meters above sea level. It is characterized by strong winds, high temperature, low relative humidity and little cloud cover. Evapotranspiration is in excess of rainfall in some parts of the zone. On the other hand, the hot semi-arid zone occupies those areas that are adjacent to high grounds of the eastern plateau with mean annual temperature about 18-270C and rainfall of 400-800 mm. The rainfall is highly variable and usually less than evaporation. In general, the region has an average estimated annual rain fall of 200-500 mm, and bi-modal rainy seasons, spring (April-June) and autumn (October-December), but erratic in distribution. The region is also endowed with immense natural resources such as fertile soils and water sources.

The economy of the region is dominated by traditional livestock husbandry and subsistence-mixed farming system, which is characterized by a pastoralist and agro-pastoralist production system. The main characteristics of the pastoralist livelihood system are the predominance of rearing sheep, goats, cattle and camels, while production of crops and rearing livestock represents main features for most households of the agro-pastoralists. The rural populations are mainly pastoralist and agro-pastoralists whose livelihoods are strictly dependent on livestock, crop and other natural resources.

Major crops grown in the region include cereals, pulses, oil crops, spices, vegetables and fruits. Even though there is no well developed crop production system in the region, agro-pastoralists grow these crops both under rain-fed and irrigated areas for food and livestock feed. Crop and livestock production are becoming the priority agenda for the federal and regional governments, but the production and productivity is low as compared to the expectations. Crop and livestock production are constrained by frequent occurrence of drought, pests, flooding, low supply of agricultural technologies, absence of appropriate extension system for pastoralists and agro-pastoralists, shortage of inputs supply, shortages of skilled man power, weak monitoring and evaluation systems, poor market based production system and marketing infrastructure.

Livestock is a vital for substance and economic development in the pastoral and agropastoral areas in the region. The region's livestock population is currently estimated at 20,378,000 heads of cattle, sheep, goats and camel (SRS BOA, 2002). This enormous resource can attract investors and contribute a lot of foreign currency. However, due to poor management and production techniques, drought, shortage of feeds both in quality and quantity, lack of marketing facilities, the region at the moment does not benefit adequately from this sub-sector. There is also abundant arable land which is suitable for mechanized farming and production of high value crops. The use of primitive production practices and technologies, frequent draughts and long dry season, lack of improved technologies and extension services have been

negatively affecting crop production contributing to the prevailing food insecurity in the region.

Historical Background

The host of pastoral and agricultural problems afflicting the rural population led to the establishment of the Somali Region Pastoral and Agro-pastoral research institute (SoRPARI) in August 28/2002.

SoRPARI initially formulated research strategies consisting of various research thematic areas to achieve its targets. The research system comprises five core processes i.e. crop, livestock, natural resource, range ecology and management and mechanization, four research centers and three research sub-centers. These are Gode Research Center and Dollo Addo Research Center having the mandate of technology generation along Wabi-Shebele, Genale and Dawa river banks; Jijiga Research Center and Fafan Livestock Research Center with the mandates of rain-fed crop production and livestock and forage technology generation respectively; and three sub-centers are Kalafo, Jareti and Dabafayd.

Objectives

- To generate and develop technologies appropriate and amenable with the regional agricultural development strategy and policy
- To demonstrate, popularize and disseminate generated technologies
- To evaluate and test technologies generated elsewhere
- To improve the living standard of the pastoralists and agro-pastorals in the region through concerted research and development endeavor and efforts
- To establish and strengthen participatory research and development including farmers research groups (FRGs)
- Research capacity building and provision of advisory services

Research Activities and Achievements

The development and use of improved technology is a key factor in the promotion of increased production and productivity in Somali Regional State. SoRPARI since its establishment in 2002 has conducted wide range adaptation and verification activities on introduced technologies. The developed and promoted agricultural technologies for the past years are thus tested at different locations in different agro-ecological zones in the region to assess their adaptability and performance compared to the existing agricultural techniques especially crop and forage. Further, SoRPARI has been involved in other important research activities including:

- On-farm trials in order to evaluate crop and forage varieties under farmer's field conditions and practices
- Participatory Variety Selection (PVS) was conducted in different agro-ecological zones both rain-fed and irrigated conditions, and following the success of that program 60 FRGs were established in the region to undertake community based seed multiplication of the various selected crop and forage varieties.
- Strengthening of farmers organization: The institute has been making efforts to organize, and assist farmers' organizations through field days and farmers' days, awareness creation workshops, exchange visits and experience sharing with other farmers research groups (FRGs) in the country
- Necessary materials and equipments: apart from the continuous input supply, SoRPARI purchased and distributed high value pre and post harvest machines and materials (hand tractors, animal traction, hand tools, combine harvesters, multi-crop threshers par-boilers, rice-polishers/millers, maize Sheller etc) to the FRGs and client farmers
- Capacity building: farmers research groups (FRGs) were provided appropriate training to upgrade and capacitate how to handle, develop and disseminate technologies
- Production of improved crop and forage seed to cover seed requirements in the region
- Market creation for the FRGs

Crop Research

The crop research directorate has tested 664 varieties and released 5 rice varieties; 3 rice and 3 sesame varieties are in the pipeline; and 31 well adapted cereal, pulse and oil crop varieties that have been recommended for use were distributed.

Livestock Research

Livestock research focuses on different activities including:

- To improve quality and quantity of livestock feeds, forage varieties were introduced to the region to evaluate and test their adaptability. Those that performed well were distributed to the FRGs while some others are still under adaptation trail
- Livestock disease distribution was studied and research results were published with the appropriate recommendation for cure and prevention
- Sheep breeding: local Somali black head with white body from Harshin District was selected and after four years of research, the best offs lambs reselect and in 2001 the first cross breeding was made with Dorper rams brought from South Africa as nucleus stock. The first F1 generation has registered improved sheep body weight by 14 kg, from 25 to 39 kg
- Dairy camel: Dabafayt camel sub-center at Adadle District in Gode zone is the center of excellence for camel research in the country. The center started its activity with locally purchased camels and forage production to evaluate and compare the effect of free grazing and supplementary feeding on on camel weight and milk production. There is also one RCBP-ARP supported activity at West Gode to study and compare weight and milk production on three types of camel
- Shoats fattening: Young males of black head sheep with initial body weight of 15-18 kg are purchased and fattened at Fafen livestock research center to increase the their carcass weight in condition of free grazing at the day time and supplementary feeding at night. The result of fattening experiment is promising
- Cattle fattening: Bulls of Borane type are purchased to fatten in Fafen Livestock integrated research center
- Cattle cross breeding: There is 20 pure Frisian cattle with 4 breeding bulls and 8 young local heifers (Borane type) to make cross breed with Frisian bulls

Soil, Water and Forestry Research

Natural resources rehabilitation and conservation research activities were undertaken including: establishment of nurseries of plant species resistant to unfavorable environmental conditions Further research activities are being conducted on soil and water.

Yehib is an endemic shrub which grows under harsh conditions and it is one of the main indigenous edible wild fruit trees that naturally occur in the Bokh District in Warder Zone. This essential plant is used for livestock feed, as construction material, for medicinal purposes, firewood and food for humans, and thus over used for decades and it is now considered threatened and in danger of extinction. National workshop was held to discuss its regeneration capacity come up with recommendations for its rehabilitation. Following the workshop research activities were initiated and established propagation and seedling establishment..

Range, Ecology and Management

Although rangeland research directorate is new in the SoRPARI structure, less than two years old, some useful activities were carried out at Fafen with the objectives:

- Conserve and preserve genetic materials of endangered plant species and multiply seeds of perennial grasses
- Propagate and restore most valuable medical and wild fruit bearing plants
- To manage indigenous floras for sustainable utilization, research and development

Agricultural mechanization & farm implements research activities
Major activities of this new directorate were:

- Training of FRGs on rice processing machines (threshers, polishers, par-boilers)
- Installation of rice polishers and oil millers at Dollo-ado and Jarati research center and sub-center respectively
- Maintenance of post harvesting machines at Gode and Kelafo
- Establishment of promotion center (workshop, machines and marketing for rice technology)

Extension

The major extension research activities implemented include:

- Establishment of more than 60 FRGs throughout SoRPARI mandate areas
- Transfer of improved technologies to the FRGs
- Capacity building and training of the FRGs and
- Organizing different exchange visits and experience sharing tours within and outside the region
- Develop extension manuals, posters, pamphlets and promotional materials
- Organize field days

Socio-economic Research

A wide range of studies were undertaken on socio-economics including the following. Studies on the resource allocation, utilization and productivity in pastoral and agro-pastoral production areas; marketing systems, opportunities and constraints of agricultural production; studies on gender roles, relations and resource ownership; characterization of pastoral and agro-pastoral livelihood systems etc.

Regional Agricultural Research Fund (RARF) Projects

There are five agricultural research projects on five different thematic areas (milk production and calf growth of dromedary camels, evaluation of water wheels, on tick and tick borne diseases, Parthenium management, and rice production and marketing) funded by RCBP RARF. The project activities are progressing well, except one project which depended on rainy season as depicted on table 1.

Scaling-up

The Ethiopian Institute Agricultural Research (EIAR) in collaboration with Somali Region Pastoral and Agropastoral Research Institute (SoRPARI) are implementing a multi-stakeholder initiative to stimulate research and development in the region. The initiative has involved all key stakeholders in the region including Somali Regional Bureau of Livestock, Crop and Natural Resource Development (SoRLCNRD), NGOs and others.

The main purpose of the project is to scale up crop and livestock production and demonstrate these technologies packages in order to improve the livelihood of agro-pastoralists community in Somali region. The project focuses on few very important and high impact crops selected through stakeholders' consultative meetings. Rice (NERICA-1), sesame (Kelafo-74 and Serkamo) and sudan grass for irrigated areas; and early maturing varieties of maize (Melkass-1), sorghum (Teshale), forage (cowpea, alfalfa, lablab and Rhodes grass) for rain fed areas (See Tables 1 - 6).

The initiative started with consultative meeting of regional and federal stakeholders. Other key activities undertaken include:

- Regional taskforce was established to lead the scaling-up activities
- Eight district level taskforces were also established
- Innovative 910 farmers/agro-pastoralists were selected from eight participating weredas
- Training of trainers was given to 144 of agro-pastoralists, DA's, experts, technical and field assistants
- Each household prepared 0.25 ha of land (a total of 165 ha in all eight weredas) and implemented all recommended cultural practices
- Farmers/agro-pastoralists at riverine areas with water pumps were selected for scaling up in the irrigated areas
- 37 q of seed of rice, sesame, maize and sorghum, Sudan grass, lablab, alfalfa, cowpea and Rhodes grass, and 42 q of fertilizer and other required inputs were distributed
- There was constant supervision and participation of the activity by SoRPARI focal team, research centers and sub-centers and EIAR
- At the end of the season scaling-up field day was held at Jijiga

The main beneficiaries of the program outputs were agro-pastoralists and cooperatives, and the whole agricultural development sector. Aside from technology transfer and resultant food and forage crop yield improvements, the scaling up program has served to mobilize communities and increase their awareness and perception about improved technologies.

To facilitate forage seed production, it was planned to plant 50 ha of forage varieties through irrigation at Fafen research livestock. So far

land clearing and preparation is done, and irrigation canals are under construction. On the other hand a good forage seed yield was obtained at Gode where two improved forage varieties were planted on 3 ha in the aim of making adequate seed available for scaling up.

To facilitate sharing of experiences and learn from best practices field days and exchange visits were organized and conducted in the rain-fed and irrigated systems. The scaling-up program results were appreciated by all stakeholders and they have pledged to continue the program for the next season by increasing the number of participants and districts covered. For 2010/11 participants agreed to involve 1140 pastoralists/agro-pastoralist from 14 districts on five food and three forage technology packages.

Table 1: Training of trainers for 2009 scaling up participants

Trainees	District								
	Jijiga	K/Beyah	Gursum	Shinile	Gode	Kelafo	D/Ado	Jerati	Total
Agro-pastoralists	12	12	12	12	20	18	16	15	117
DAs & Experts	3	3	3	3	4	4	4	3	27
Total	15	15	15	15	24	22	20	18	144

Table 2: Number of participating households by wereda (2009)

Crop type	District								
	Jijiga	K/Beyah	Shinile	Gursum	Gode	Kelafo	D/ado	Cherati	Total
Crop	50	50	50	100	125	150	60	50	635
Forage	50	-	50	-	125	-	40	10	275
Total	100	50	100	100	250	150	100	60	910

Table 3: Farm inputs supplied by wereda (2009

Type of input	District							
	Jijiga	K/Beyah	Shinile	Gursum	Kelafo	D/Ado	Cherati	Total
Sorghum (kg)	-	150	150	-	-	-	-	300
Maize (kg)	300	-	-	600	-	-	-	900
Rice (kg)	-	-	-	-	1000	200	500	1,700
Sesame (kg)	-	-	-	-	210	192	30	332
Sudan grass (kg)	-	-	-	-		160	30	210
Rhodes grass (kg)	35	-	35	-	-	-	-	70
Lablab (kg)	45	-	45	-	-	-	-	90
Cowpea (kg)	42	-	42	-	-	-	-	84
Fertilizer								
Urea (kg)	-	-	-	1250	1000	200	500	2,950
DAP (kg)	-	-	-	625	500	100	250	1,475
Fuel for irrigation (ltr)	-	-	-	-	9,000	6,000	3,600	18,600

Table 4. Summary of area used and improvement in crop productivity observed

Crop/ forage type	Land Cultivated	Mean production per (ha)	Production Range	Advantages as compared to locals	Total yield(q/ha)
Sorghum	25	8	5-12	3	125
Maize	37.5	12	8-20	5	300
Rice	32.5	20	10-30	5	482.5
Sesame	35	3	2-5	1	105
S/grass	10	3	2-5		30
Rh/grass	10	2	1-3		20
Cowpea	10	2	1-3		15
Lablab	5	1	0.5-2		5

Table 5. Number of participating agro-pastoralists by zone & wereda (2010)

Zone	District	No. of households	Total
Jijiga	Jijiga	200	480
	Awbare	100	
	K/bayah	80	
	Gursum	100	
Shinile	Shinile	50	150
	Erer	100	
Gode	Gode	80	200
	Kelafo	70	
	Adadley	50	
Adher	Cherati	60	160
	Dolobay	50	
	Hargele	50	
Liban	Dolo-ado	100	150
	Filtu	50	
Total			1,140

Table 6. Technologies selected for scaling up by wereda (2010)

Zone	District	Crop type	Forage
Jijiga	Jijiga	Maize, wheat, sorghum	S. grass, E. grass, Panicum, Rhodes grass
	Awbare	Maize, wheat, sorghum	S. grass, E. grass
	K/bayah	Sorghum	S. grass
	Gursum	Maize, wheat, sorghum	S. grass, E. grass, Panicum, Rhodes grass
Shinile	Shinle	Sorghum, maize	S. grass, E. grass
	Erer	Sorghum, maize, wheat	S. grass, E. grass
Gode	Gode	Rice, sesame	S. grass, E. grass, Panicum, Rhodes grass
	Kelafo	Rice, sesame	S. grass, E. grass, Panicum
	Adadley	Rice, sesame	S. grass, E. grass, Panicum
Afdher	Cherati	Rice, sesame	S. grass, E. grass, Panicum
	Dolobay	Rice, sesame	S. grass, E. grass, Panicum
	Hargele	maize, sesame	S. grass, Panicum
Liban	Dolo-ado	Rice, sesame	S. grass, E. grass, Panicum
	Filtu	Maize, sesame	S. grass, Panicum

The Rural Capacity Building Project (RCBP)

SoRPARI is a beneficiary from the capacity building component of RCBP through long and short training opportunities. So far 18 higher degree training (PhD and Msc) opportunities were offered. The institute was not able to exploit short term training opportunities to a similar

degree but there are encouraging developments. In 2009/10, a number of skill upgrading trainings were organized including training for junior researchers on different research fields at Melkasa and Holeta research centers; leadership training for research center managers and directors at Civil Service College; training for JARC laboratory technicians at Addis Ababa; gender training for SoRPARI researchers; training on biometry and research proposal writing methodologies for researchers at jijiga; crop simulation and modeling for ten researchers at Haramaya University.

Challenges

The region in general and SORPARI are facing a host of constraints associated with infrastructure, institutional and human resource capacity. As related to research the major ones include:

- Lack and scarcity of transportation facilities
- Lack of enough budget for the research activities
- Lack of field equipments for research data collection

Agricultural Research and Technology Transfer in Benishangul Gumuz Region: Achievements, Challenges and Prospects

1Mulugeta Atnaf and 2Fitsum Sahlemariam
1Pawe Agricultural Research Center
2Assosa Agricultural Research center

Introduction

Benishangul Gumuz national regional state is one of the natural resource endowed part of Ethiopia having ample rainfall, numerous rivers and of course untamed huge arable land. The region is located in the western part of the country bordered by Amhara and Gambella regions in the north and south, and Sudan and Oromia from the west and east respectively. It has three administrative zones, 20 Woredas and 633 kebeles with an area of nearly 4.5 million hectares and a population of 671,000 (CSA, 2004). The topography is mostly plain and undulating, steep sloppy hills and mountains having 12, 25 and 62 slope percentage respectively. The peak of the region is mount Belaya (2731 m.a.s.l) found in Metekel Zone, altitude drops down to 600 m.a.s.l near the border with Sudan. The river Abay crosses the region in to two on its way out to Sudan appearing out of gorges from its route in the country. Rainfall is uni-modal which last for 5 to 6 months of the year, usually between May and October. The mean annual rainfall is about 1275 mm, most being received between May and September with the highest in July or August. Rainfall occurrence is generally adequate both in amount and distribution in most parts of the region, except in Woredas near the border wit Sudan. Various soil types are available in the region which are: Dystric Nitisol found in all woredas of Assosa zone and in one wereda (Dibate) of Metekel zone; Orthic Acrisols dominant in Bambudi, Mankush and Debre Zeit (Wonbera woreda) areas of Metekel zone. Besides, 90% of Kemashi zone is covered with this type of soil;

Chromic and Orthic Luvisols; Calcaric and Eutric Fluvisols found in parts of Assosa, Kurmuk, Gizan and in areas South West of Bambasi.
Woodlands and shrub lands are the dominant forest resources, covering 77% of the region. Two main woodland types have been recognized: Boswellia-Commiphora-Acacia Woodland (Xerophylous Woodland) in the drier lowlands and Terminalia-Combretum Woodland (Deciduous Woodland) in the eastern part of the region. The former type consists of trees producing valuable gums and resins. Today the woodlands are modified by shifting cultivation. Bamboo representing 9% of the region occurs extensively below 1600m masl. The largest coverage is in Assosa Zone. In addition, some 3,850 ha of plantation forests are found in the Region. Shrub lands/ bush lands cover 28% of the area of the region. Grasslands cover about 3% of the total area of the region. The cultivated area occupies about 5% of the area, where shifting cultivation is the predominant agricultural practice in the region. The agro-ecology of the region can generally be characterized by moist (M1) and sub humid lowland (SH1), to tepid to cool moist plateau (M2) and warm to tepid to cool sub-humid (SH2) zones and a small fringe area of sub moist zone (SM1). These agro-ecological zones, except the sub moist zone (SM1), receive reliable rainfall for at least 120 days in most parts of the region.

Research in Benishangul Gumuz Regional State was started following the tragic famine in Ethiopia in 1977 E. C which led to massive resettlement of drought affected communities from several parts of the country. Pawe Agricultural Research Center was established at Pawe in Metekel Zone in 1977 E.C. Soon Assosa Agricultural Research Center was founded as sub-center of Bako Agricultural Research Center at Assosa in 1978 E.C, got destroyed during the civil war of the late 1980s, and re-established with ARTP support in six years ago.
This paper tries to summarize past efforts at the two centers in technology generation and scale up of proven technologies. Attempts are also made to highlight the gaps, challenges and future prospects.

Achievement in Research, Technology Transfer and Scaling up

Achievement in Research

The research centers, since their establishment, developed a number of technologies and information mainly in areas of crops and livestock production and management; natural resource management and socioeconomics. The details of these achievements are presented as follows;

Crops Production and Management

Based on the agro-ecological settings, the research centers mainly gave due attention to cereals mainly for food security; pulses and oil crops mainly for market, and some horticultural crops as well.

Among cereal crops; maize, sorghum, finger millet and rice are the major ones being cultivated in the region and to backup this by research, a number of improved technologies of these crops have been developed and adapted as presented in table 1. Crop management information like planting time, population density, weeding time and frequency of these crops, striga management through intercropping legumes on maize, among others are the major ones. Besides, teff and wheat are the other cereal crops being cultivated and some improved varieties showed better adaptation as compared to the local ones.

As to the pulses and oil crops, large number of successful improved varieties of soybean, haricot bean, sesame, and groundnut have been developed (Table 1). Crop management information like planting date, population density, weeding time and frequency, cercospora leaf spot management on groundnut among others are the major ones. Research efforts on other pulses and oil crops such as chickpea, fababean, field pea and niger seed showed that some improved varieties have been adapted.

Regarding horticultural crops; some improved varieties of vegetables (tomato, onion, and hot pepper), root crops like potato, and fruits like banana have been adapted. Research is under way on some fruit crops and spices

Table 1. Improved Varieties of different crops developed and/or adapted

Crop type	Variety name	Productivity (q/ha)	Adaptation range	Remarks
Maize	BH140	36		Farmers' field
	BH530	50-60		
	BH540	60-80		
	BH543	50-60		
	QPBH542	50-60		
	*Gibe 1-OPV	40-45	Low to mid altitude areas	
Rice	Pawe 1	42		Research field
	Nerica 3	45		
	Nerica 4	46		
	Superica 1	51		
Sorghum	Emahoy	45		Farmers field
Finger millet	Baruda	30		
	Dibatsi*	20-25		
Teff	Kuncho	15-20		
	DZx37	10-15		
Wheat	Kubsa	41		
	Simba	38		
Sesame	Abasena	6-12		
Ground nut	Manipiter	17		
	Roba	13		
	Bulki	19		
	Ioti	19		
Soybean	Belessa 95	24		
	Awassa 95	18		
	Afgat	28		
	Wegayen*	18-20		
	Gizo*	17-20		
	Gishama*	15-18		Research field
Haricot bean	Roba 1	17		Farmers field
	Nasir	21		
	Dimtu	13		
	Awash melka*	16		
Potato	Guassa	300	High lands	Farmers field
Banana	Dwarf cavendish	250	Low to mid altitude areas	Research field
	Grandie nain	240		

*Those varieties having other merits like oil and protein content, color, market and earliness.

Livestock production and management

Initially, basic information on livestock resource potential, production constraints and challenges was generated through surveys. Based on the survey findings, research was done mainly concentrating on cattle management basically on feed and health, poultry improvement and honey bee management. As a result the following technologies and information have been generated.

Pawe Agricultural Research Center released two improved high yielding forage varieties, a grass species "Dirk Ayferie" with 9.2 tons/has and a cowpea variety "Sewnet" 4.8 tons/ha dry matter yield, for the first time in the country. Focusing on management of the natural pasture, the effect of cutting date on the quality and dry matter yield of hay making from natural grazing lands of Metekel zone was studied. In addition, characterization and evaluation of selected indigenous tropical forage grass species are under way and some promising materials have been identified for further evaluation. In an adaptation trail around Assosa, forage varieties, Chloris gayana and Sesbania macranta are identified to be suitable for the area with substantial yield of palatable dry matter. Nutritional composition which results in faster exportable weight of local goat breeds has also been identified.

To solve another very bottle neck of livestock production in Metekel area, seasonal density, prevalence and species of tsetse and trypanosomes, and its economic impact on the local farming community have been identified. An overall prevalence of 12.1% of trypanosomosis was registered where majority of the infections (42.5%) was due to Trypanosoma congolense and Trypanosoma vivax (34.6%), while the remaining 14% and 9% was due to T. brucie and mixed infection (T. vivax and T. congolense or T. brucie) respectively. Seasonal variation of the disease showed significant level of difference which is highest in the rainy season (17% infection incidence) and lowest (6.2%) in the dry period. The peak infection incidence is highly associated with the temporal abundance of tsetse fly. Glossina tachinoides was the only tsetse fly species prevailing in the study area with an overall fly density of 1.13 flies/trap/day.

Research on poultry focused on introducing exotic breeds. The first exotic poultry breed introduced was Bovine goldline. The egg

production performance was evaluated on-farm and found to be below the average of the local birds (50 eggs per bird per year). Another potential breed, Fayoumi poultry breed from Egypt was evaluated and found to be promising at Metekel and Assosa. Efforts to scale up this technology are underway.

Research on apiculture was focused on assessing the performance of local honeybee races under different management regimes and characterization of the production system in Metekel area, mainly the opportunities and constraints. Bee keepers in the zone have 19 colonies on average, but this can go as high as 300 colonies; and a total of 62865 colonies have been found in Metekel zone. Diversity of bee plants (105 species) were identified comprising 45.3% herbs, 37.7% trees and 17% shrubs. However, Honeybees are managed traditionally, 99% on traditional hive and only one percent on transitional and modern hives. Absconding is one of the major characteristics of bee colonies in Metekel area and on average 11 colonies are absconding per year from individual beekeeper. And most beekeepers believe that this is a natural phenomena and that is why most do not take measure to revert the situation. Other major constraints include aggressiveness of the local bees, seasonality of bee forage, agricultural chemicals, and lack of knowledge, skill and information.

Forestry

On a study to asses diversity of non-timber forest products around Pawe, great diversity of this products have been found and this products have a potential to contribute to the economic development of the local community. However, processing and marketing of the products remain as problems which needs research intervention. On the other hand, study was conducted to asses the diversity of woody species focusing on Riverine forest, Acacia dominated grass land and Bamboo dominated grass land. And it was found that the riverine forest of Abat beles has the highest species diversity and hence it needs special protection as it has important ecological significance.

As the region is center of excellence for low land bamboo, a number of research information have been identified. Natural regeneration of low land bamboo (Oxytenanthera abyssinica) has been studied in area

enclosure technique at Mandura district of Metekel zone. It was found out that the natural regeneration of low land bamboo from seed is possible through area enclosure made after flowering and seed setting of the species (this the physiological cycle of bamboo whereby the stand totally dies including the rhizome). Other information like weeding time and frequency, storage conditions and time of lowland bamboo are being studied.

In the other thematic area, a study was conducted to identify the types of agro-forestry practices and their associated problems. Accordingly four major types of traditional agro forestry practices have been identified. These are scattered trees on farm land, home garden, shifting cultivation and live fence. The study also reveals that, despite the fact that there are promising agro forestry practices; there are some problems with the management and species selection for better agro forestry practices.

Nursery life span and better soil mix were determined for 9 commonly grown tree species around Pawe. In addition, an experiment was conducted to identify tree species that are resistant to termite and fungus attack. Inline with this, different wood treatment methods were tested and motor oil showed more effectiveness.

SOIL AND WATER MANAGEMENT

Concerning soil fertility, a number of research outputs in maize, finger millet and rice are documented. From partial budget analysis, under all price assumptions the treatment 69/0 kg N/P2O5/ha gave highest MRR (152.6%) suggesting that the fertilizer rate was the most profitable under the current conditions. Therefore, farmers at Pawe area and its surroundings can produce maize cost effectively by applying 69kg Nha-1 alone. Although, P application may not be profitable under the current input and output price, over the years it is observed that phosphorous fertilizer application is very important for enhancing maize production.

Under Pawe (nitisol) condition, application of N and/or P fertilizer is not profitable on finger millet. To come up with full conclusions and recommendations, however, undertaking permanent trials like finger

millet exhaustion trial may be recommended. Although, the data are not significant and the application of N and/or P fertilizer is not profitable in this experiment, a series of observations in the last decade clearly indicate that the application of phosphorous and nitrogen containing fertilizers is important for finger millet production.

In Pawe, with hot humid-tropical type of climate and receiving an abundant precipitation, one can apply the entire P source 50kg TSPha-1 and 46kg Nha-1, at the time of planting while the remaining half amount of N, 46kg Nha-1 at time of panicle initiation stage of rice crop production. Hence, 92/23kg N/P2O5ha-1 gave highest MRR, 267.35%, suggesting that it was the most profitable fertilizer rate under the current finding, and gave an additional grain yield advantage of 197.2% over control.

An experiment on the effect of different inorganic nitrogen sources on grain yield of rice (Oriza sativa L.) grown in the hot-humid northwestern part of Ethiopia revealed that DAP can be used as an appropriate inorganic N fertilizer source followed by ammonium sulphate to improve grain yield performance of rice, the latter suggesting the need to fertilize rice with sulfur containing fertilizers. Considering rice crop's wider ecological adaptation, all aspects of nitrogen management and water requirement study should be given special attention. As concluding remark, therefore, more inclusive fertilizer combinations (NPK and micro elements such as S, Mg and Zn) will need to be further investigated for higher productivity of rice in the country.

Study was conducted to determine the efficiency of Orga fertilizer (bone meal) on maize in selected districts of Metekel Zone, and the field and laboratory study results indicated that there was yield response and no deleterious effects. Therefore, use of 69 kg P2O5/ha in the form of orga and 69 kg N/ha (recommended N for maize), resulted in the highest mean maize yields. Further results of a preliminary experiment confirmed the interaction effect of nitrogen fixing bacteria and inorganic fertilizers on nodulation, grain yield and bio-mass of soybean and groundnut.

On the other hand, assessment on water management methods and practices was conducted in Metekel Zone and the results are summarized in Tables 2 and 3 below. Similarly, crop water requirement of some selected crops has been determined as described in Table 4.

Table 2. Indigenous species used in traditional soil management (Metekel zone)

Local name of the material		Family name	Method of propagation
Amharic	Oromiffa		
Baleabeba simmiza or moign kitel	-	Convolvulaceae	stem cutting, layering & seed
Nech s'aar	-	Poaceae	tiller and seed
Simmiza/Sensel	-	Acanthaceae	Stem cutting
Chakimma/Jatrofa	-	-	stem cutting & seed
Kolla sembelet	Dagalta	Poaceae	tiller/sackers & seed
Chirret/kacha	-	Agavaceae	underground rhizomes & seed
Korch	Wollenso	Fabaceae	stem cutting
Kolla shimmel/kerkeha	-	-	Seeds, rhizomes & sackers
Sindedo	Migirra	Poaceae	tillers/sackers & seed
Amabacho	Dangago	Polygonaceae	stem cutting & layering
Kolla sembelt	-	Poaceae	Coppicing & seed bank in soil
Digita	-	Fabaceae	Seed

Table 3. Other indigenous soil and water management practices widely used in metekel zone

Name of practice as used in the study areas	Agronomic soil conservation practice	Agronomic soil fertility maintenance practice
Shina(weed mulch)	✓	✓
Gull		✓
Cut off drain	✓	
Counter plough	✓	
Stone bund with weed mulch	✓	

✓ = yes

Table 4. Crop water requirement of some selected crops

Crop	Growth stage	Kc	Planting date	Stem length	CWR (mm)
Tomato	Initial	0.6	10/10	30	541.6

	Development	0.8		40	
	Mid	1.15		45	
	Late	0.8		30	
Pepper	Initial	0.6	20/10	30	456.7
	Development	0.75		40	
	Mid	1.05		40	
	Late	0.9		20	
Cabage	Initial	0.7	5/11	25	356.7
	Development	0.85		35	
	Mid	1.05		25	
	Late	0.95		15	
Onion	Initial	0.7	5/11	20	341.4
	Development	0.85		30	
	Mid	1.05		30	
	Late	0.95		15	
Maize	Initial	0.3	20/12	25	541.6
	Development	0.75		40	
	Mid	1.2		40	
	Late	0.5		30	

Technology Transfer and Scaling up

Formal Technology packaging and extension in the region was started through the Bureau of Agriculture in 1988 E.C. mainly on hybrid maize technology. At the research centers, several proven technologies have been demonstrated and popularized to create awareness and opportunity for better use of the technologies by farmers. However, due to many reasons, the access of farmers to technologies has remained inadequate.

A technology scaling up initiative was launched by the Ethiopian agricultural research institute to demonstrate how improved technologies can contribute to agricultural development provided they are implemented widely as complete packages. In this regard, Pawe Agricultural Research Center has registered exemplary achievement in

the region and in the country at large. The national awards are witnesses of this fact. Assosa is also doing well. This initiative was started in one district (Dibate) of Metekel zone with only 18 farmers in one technology in 1997 E.C and it has reached more than 23,000 farmers in more than 10 districts with alternative crops, livestock and natural resource technologies during the last five years. The plan is to reach 40,000 participants during the 2002/03 cropping season only. Generally, farmers, Woreda agriculture and rural development offices, Woreda administration, research centers, non-governmental organizations and private organizations were all major actors during the process. Throughout the 5 years period, the degree of involvement of the stakeholders remained the crux of the matter. On top of that, defining the roles and responsibilities of these parties from the outset had a pivotal role for the successes. More over trainings, field days and farmers exchange visits played a very crucial role in technology scaling up accomplishments. These all create a wider awareness and opportunity for better use of technologies for the surrounding community and others at national level as these are communicated through different Media outlets.

Table 2. Crops Technology scaling up participant farmers, and grain yields gained in quintals per hectare (1997/98-2001/02 cropping season).

Type of technology	Participating Woredas											Total	Yield Q/h
	Dibate	Pawe	Dangur	Mandura	Bullen	Wombera	Guba	Assosa	Bambasi	Maokomo	Homosha		
Sesame	691	595	898	1006	206	22	22	-	-	-	-	3440	26691
H/bean	1188	-	88	378	105	-	-	-	-	-	-	1759	20904
Soybean	-	1598	406	-	-	-	-	450	200	190	40	2892	41250
G/nut	-	21	417	66	-	-	13	200	-	150	70	937	11946.75
Sorghum	-	124	65	18	33	9	10					262	6120
F/millet	516	55	44	68	133	27	-	100	50	144	-	1137	34200
Maize	275	563	272	289	85	87	36	300	60	-	70	2037	93100
Teff	-	-	-	-	-	-	-	250	80	-	-	330	825
Potato								60	-	83	-	143	1215
Total	2679	2999	2193	1827	562	145	81	1360	390	567	180	12937	236251.75

Table 3 Number of participants on community based trypanosome control and bamboo plantation

Intervene woreda	Types of technology			Total
	Livestock		Forestry	
	Community based trypanosome control	Forage	Bamboo*	
Pawe	3329	16	160	
Dibate	3807	14	66	
Dangur	2233	-	19	
Mandura	-	6	15	
Bullen	-	-	75	
Assosa	-	50	-	
Bambasi	-	36	-	
Moakomo	-	15	-	
Total	9369	137	335	9841

Bamboo* -Minimum seedling size per participant is 50

The other determining factor in technology scaling up was seed of improved varieties. In the first years of the period, improved seed was totally supplied by research centers. However, as the number of participant farmers increased, it became very difficult to fulfill the seed demand of all the participants. As a result, community based seed multiplication system was organized to produce improved seed of self pollinated crop varieties. This effort was crucial to narrow the seed demand supply gap and made the system a bit sustainable. And those innovative farmers being organized in the system were beneficiaries from the seed business.

One thing that the authors would like to mention is that, for such accomplishment, the commitment that the research system showed was extraordinary. Researchers were committed to support farmers being with them right from land preparation to the whole growing season. In the process, there was a mutual benefit by researchers, development workers and farmers through experience sharing, and exposure.

In addition to these, the approach of farmers research and extension group (FREG) has been implemented in different woreda of the region. These FREGs contributed a lot in technology transfer and technology scaling up. Generally FREGs were organized in seed production, adaptation of some improved crop technologies and technology transfer as those are their priority problems.

Gaps and Challenges

During the establishment phase, the research centers were faced with lack of researchers and infrastructure. Senior researchers of the institute were forced to stay and work at the centers, staying in tents. Long distance from the center of the country, poor road infrastructure and limited capacity (cars etc) were factors which made it difficult to stay, work and generate technologies at the centers. The primary challenge so far faced is the question of high researcher turnover due to the harsh natural conditions and remoteness of the areas. Researchers do not have entitlements such as hardship allowances, which can serve as incentives to stay for long.

Limited performance ability of most governmental organizations and poor infrastructure in the region are the most challenging and enduring gaps that constrain technology transfer.

Future Direction in Research and Technology Transfer

Future Direction in Research

Considerable achievements are registered so far but there is still much more left to be done. Even though the region is endowed with natural resources including livestock most research outputs of the past were predominantly on crops. To meet the ever growing demand for improved technologies future research must focus:

Crop Research

There is need to generate more technologies for moisture stress areas of the region. It must also be stressed that considering the region's unique peculiarities in terms of environmental characteristics, capacity needs to be developed at the two centers to enable them generate technologies specific to the agro-ecology of the region. The demand in cereals is partly answered through the availability of maize hybrids, but there is huge demand for sorghum and finger millet varieties which requires breeding for that specific adaptation. With regards to pulses

technologies; attention was devoted to soybean and haricot bean only, there is thus a need for alternative technologies. Much has to be done with respect to haricot beans around Assosa and Kamash zones. On oil crops especially sesame and niger seed, a lot of work remains to be done to come up with varieties with wider adaptation; so far only one variety of sesame is being produced widely in Metekel zone. Together with this alternative variety for groundnut must also be generated. There is a very big gap in horticultural crops starting from vegetables to fruit trees. There is huge demand for mango, papaya, banana, onion, tomato, hot pepper, coffee etc which has not been answered in the past. On top of that, there are crops that are being used by the natives in the region such as okra and kerkede (Hibiscus) that must be improved, identified for their nutritional values and so on.

Livestock

Much of the past efforts have been concentrated on generating technologies related with feed and feeding. The region is endowed with huge potential for production of honey, goats, poultry and cattle and research must deliver technologies in these areas promptly. Cattle production is greatly hampered by trypanosomes, which in turn affect crop production by weakening and killing oxen. Building on past experiences, control efforts must be strengthened however for the future introduction and improvement of known indigenous trypanosomes resistant breeds must also be considered.

Soil and Water

In Assosa and Kamashi zones of the region, much has not been done in research so far, therefore emphasis must be placed on solving crop management problems, acid soils management and soil fertility. There is also ample resource with regards to irrigation which needs studies of scheduling and water requirement. Together with this, the nature of soil in the region is very fragile; the top soil is very shallow very much vulnerable to loss with the heavy rainfall coupled with clearing of natural vegetation for increasing production. So targeting in watershed management and natural resource conservation is of paramount importance.

Forestry

Much of the regions forest land is covered with bamboo and frankincense. Due to its natural properties, bamboo is becoming endangered, and urgent solutions are needed on alternative multiplication methods, and appropriate utilization and management. Frankincense is being produced in the region both by small scale producers and investors, however there is lack of knowledge on appropriate harvesting, utilization and maintenance methods. Together with this basic information with regards to the available forest resources specially gum and resin of the region must be generated, because there are other forest products that are already being used by the natives and sold in the informal markets at the Sudan border.

Mechanization

So far nothing has been done on mechanization. Although there is a center for farm mechanization in the region established by Bureau of Agriculture at Assosa; its function is limited for various reasons. There is a pressing need to improve the hand tools of the natives. Natives of the region use their hand tools in a very traditional form of production and this must change through the introduction improved farm tools. In addition, the whole agricultural development should be backed by agricultural mechanization to improve land preparation, crop management and to reduce pre and post harvest losses.

Future direction in technology transfer and scaling up

The region is one of the areas in the country recognized as an emerging region seeking special attention. So far, the technology scaling up burden was by enlarge shouldered by the research centers. The extension wing was not leading. Several constraints ranging from lack of awareness to lack of knowledge and skilled human power have hindered the process. To fill those gaps and further create the necessary awareness, the two research centers being backed by Ethiopian Institute of Agricultural Research have gone as far as they can get to. The effort so far has reached and benefited thousands. Considering the current capacity of the centers and the ever increasing demand for technologies it will be impossible to continue and stretch beyond this for the centers to satisfy the need. At this junction, it is important to note it is time for

the region to implement the formal technology transfer or extension method. It is also time to create and capacitate cooperatives and unions to facilitate a continuous and sustainable flow of inputs Availability and supply of all types of inputs was a huge bottleneck of previous scaling up efforts. The only way out of this is for all stakeholders to do their part to alleviate the problem. Mobilizing and creating accountability of development agents must be of primary concern of Woreda administrations. Ensuring the commitment of the administration at different levels is vital at this point. Finally, the partnership network must be strengthened further for successful economic development in the region and in the country at large.

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Agricultural Research in Gambella Region: Achievement, Challenges and Future Prospects

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Background

In Gambella, agricultural research was started by American scouts only in one station in 1952 EC. In 1977 EC in connection with the resettlement programs a new centre; Abobo Agricultural Research centre was established under the Ethiopian Institute of Agricultural Research at Abobo, which stayed operational up to 1983 EC. In 1999EC, the Gambella Regional Agricultural Research Institute was founded comprising three centres Abobo, Lare and Godere.

Description of Research centres

Description	Centre		
	Abobo	Lare	Godere
Year established	1977EC	1999EC	1999EC
Location	2km from Abobo town	2km from Lare town	Meti town
Annual rainfall	1000-1100mm	1000-1100mm	1900-2100mm
Mean maximum temperature	35^0c	35^0c	32^0c
Mean minimum temperature	18.5^0c	18.5^0c	20^0c
Altitude	500m.a.s.l	480m.a.s.l	950-2100m.a.s.l
Soil type	Reddish brown clay loam type	Darkish brown clay loam type	Reddish brown clay loam type
Testing sites	Abobo, Goge Dipach PinkiYo Gambella	Lare	Akash, Kabo,Cheme

ACHIEVEMENTS

CROPS

Two improved open pollinated composite varieties, Abobako and Gussawo (Gambella Composite) were identified and released in collaboration with Bako National Maize Research Coordination Centre. These two varieties are endowed with high resistance to the region's major constraints, maize streak virus and lodging, often caused by strong winds in the region. In sorghum one high yielding and disease resistant improved variety (G 1107) was released in collaboration with Melkassa National Sorghum Research Coordinating Centre. Similarly, three rice and two soybean varieties (Belesa and Awassa 98) varieties were selected for Gambella, jointly with Pawe and Awassa Research Centres, respectively. From the nationally released oil crops, two varieties each from groundnuts (Manipenter and Roba) and sesame (Adi and Argana) are released and currently in use. From horticulture crops, one variety of sweet potato (Dubbo) and two varieties of tomato (Melkasalsa and Melkashola) were found to be well adapted therefore recommended for use in the region.

CROP PROTECTION

Survey and yield loss assessment studies have been conducted on major crop insect pests and disease in Gambella region; particularly on cowpea storage method, extent of loss due to pulse beetle, Callosobrucus maculates and its management has been determined. A yield loss due to northern leaf blight in Gambella has also been surveyed.

A range crop protection research was conducted at the institute including variety screening for resistance, biological, chemical and, cultural. Variety screening of maize against maize streak virus and northern corn leaf blight was carried-out and promising materials were advanced. Information has been generated on efficacy of some insecticidal plants and soap on cowpea field pests. Furthermore, effect of seed dressing for the control of soil born insects (millipedes and termites) was determined. The other area addressed was cultural

Sustainable development and environmental protection and conservation and wise use of natural resources is the order of the day, therefore in the future livestock and natural resource research should get equal attention with crop research. Human resource development plan should be revisited accordingly. The high turnover of research directors and researchers should also be averted to ensure continuity in research. Building the capacity of the institute in all aspects including laboratories, research centres and testing sites etc. Should be considered a matter of urgency to enable the institute contribute to the small scale as well as the rapidly expanding commercial agriculture in the region.

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Technology Transfer and Extension on Livestock, Crop and Natural Resources Development in Somali Region: Achievements, Gaps and Prospects

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Introduction

Somali Regional State is one of the regional states comprising the Federal Democratic Republic of Ethiopia. It is located in the southeast of the country, bordering with the Afar region and Djibouti in the north, Oromiya region in the west, Somalia in the east and southeast, and Kenya in the south. According the latest census (unpublished) the population in the Somali Region is estimated to be 4.5 million of which 54.5% are male and the remaining 45.5% are female. Out of the total population 86% live in the rural areas and the rest reside in the urban areas.

It is the second largest region in the country next to Oromia with an estimated landmass of 36 million hectares. The topography is dominated by low lying vast plains and the altitude varies from 300 to 2100 m.a.s.l. The region is in the semi-arid and arid agro-ecological zones with an annual rainfall ranging from 200 to 750 mm. Rainfall pattern in is bimodal with two rainy seasons: long rainy season known Gu' (April-June) and short rainy season Deyr (September-December). Frequent sever droughts as well as rampant endemic livestock disease are increasingly experienced across the region with devastating effects on the livestock, the leading source of food and income sources in the region.

As a pastoral and agro-pastoral region, livestock is a vital resource for subsistence and economic development. The region's livestock population is currently estimated at 20,378,000 heads of cattle, sheep,

goats and camel (SRS BOA, 2002). This enormous resource can attract investment and serve as a source foreign currency earning. However, due to poor management and production practices, drought, shortage of feeds both in quality and quantity, lack of marketing facilities the region at the moment is not benefiting to the desired extent from this sub-sector.

There is also abundant arable land which is suitable for mechanized farming and production of high value crops. The use of primitive production practices and technologies, frequently draughts and long dry season, lacking improved technologies and extension services have been negatively affecting crop production, making the region one of the most food insecure regions in the country.

The water resources potential in the four perennial river basins (Shabele, Genale, Weyb and Dawo) is estimated to be 100 billion cubic meters which can irrigate about 772,000 hectares of land. Moreover there are also seasonal rivers (Faten, Jarar, Dakato, Erer etc) with more than 6 thousand hectares of land suitable for rain-fed agriculture.

Table 2. The major four river basins and their potential for irrigation

No	River basin	Irrigation land (ha)
1.	Shabelle	417.000
2.	Genale	135.000
3.	Weyb	112.000
4.	Dawa	108.000
	Total	772.000

Sources: SRS planning bureau (1999)

Further, the natural resource endowment of the region include mineral resources, forests and forest products as well as other immense untapped resources, which are not fully exploited by the pastoral and agropastoral communities due to mainly shortage of qualified human-power and lack of financial resources.

The Somali Regional State Livestock, Crop and Natural Resources Development Bureau, established on 15 May 1993, has 52 sub-offices in the districts and its activities expand through out the region at the

community and peasant association levels. The bureau undertakes its activities through technical departments and supporting service sections at the regional and the district level offices.

Objectives

- Increase agricultural production and productivity in the region
- Supply improved agricultural inputs/ technologies
- Deliver agricultural inputs and give technical and operational services to the districts
- Minimize the severity of post harvest of crops, livestock and natural resource losses
- Develop Grazing Reserves and Ranches for keeping livestock during drought seasons
- Promote irrigation development at the river banks
- Provide well designed extension services and prepare contextualized extension packages and implement them.
- Establish linkages between research and extension
- Prepare agricultural extension packages of different crops, livestock, natural resources
- Design participatory water shade development, conserve and develop natural resources.
- Identify and survey agricultural production marketing outlets and take appropriate actions to establish improved marketing system
- Promote animal health and plant protection services and coverage in the region

Progress and Achievements

Livestock

- In order to improve the health condition of the livestock in Somali Region 2,089,103 animals were vaccinated and 640,303 were treated.
- Vaccination and treatment was performed in twelve districts i.e. Moyale, Hudat, Wardher, Danot, D/bour, D/madow, Gursum, Dhanan, Mustahil, Adadle, Bokh, and Galadi.
- Forty three animal health posts in Jijiga zone (10), Shinile (3), Liban (9), Gode (4), Afdher (5), Qorexey (6) and D/bour (2) were furnished and made functional.

- Thirty one animal health technicians were given disease surveillance training
- Disease surveillance of foot and mouth, and lumpy skin diseases is going on in Afdher, Gode, Liban, jijiga and Shinile zones to estimate and analyze the actual prevalence of those diseases, and for this purpose 1,800 serum will collected and examined.
- Rangeland development activities were undertaken in10 woreda namely: Ayshaca, K/bayah, Gashamo, Bokh, Adadle, Mustahil and Dollo Bay including:
- Identification of site selection and community awareness creation of rangeland were carried out, therefore:
- Land enclosures are started at Filtu, Mustahil and Adadle, and particularly at Mustahil 300 ha of land were fenced and vegetation recovery is already being observed.
- Dollo Bay rangeland was converted in to fodder bank.
- Out of the 500 ha fodder bank, 165 ha was planted with the most favored forage species, Sudan grass and it is doing well in all the woredas, particularly Gode (100ha), Dollo Ado (10ha), D/bay (10ha), Charati (30ha), Gursum (10ha) and Shinile (13ha).

Crops

The crop production and protection department provides services such as protection of migratory pests, insect and diseases, improved seeds and farm tools, pesticides, conducts pre and post harvest assessments, irrigation promotion assessments in riverine areas, gives assistance to the small scale irrigation schemes and trains on pesticide applications and about the importance of improved farming practices.

Agricultural extension services

The agricultural extension service undertakes transfer and dissemination of new technologies; distribution of improved seeds, fertilizers; and conducts livestock fattening activities, water harvesting, DA training, construction of DA houses. Further, the service has undertaken the following:

- Due to inconsistency in improved seed supply in the past, the bureau decided to overcome the dependence of seed purchase from other regions or elsewhere and started to look for local options and made agreement with the local cooperatives to produce the required

amount of seeds with satisfactory price. As a result so far 351 quintals of wheat was obtained from the growers.

- 4000 quintals of fertilizers and 3,370 litre and 1005 kg of chemicals were purchased and distributed to farmers to improve the crop and forage production and productivity
- 36,666 different manuals on AHP, clinics etc for FTC functionalization were distributed to 29 woredas
- Organizing and mobilizing of 15 farmer extension development groups were carried out in Jijiga ansd K/bayah
- Out of 500 HH, 230 HHs have benefited from compost preparation skills obtained.
- The bureau has distributed, with the help of FAO, 2265 quintals of sorghum, maize and sesame to plant 9080 ha. Similarly, FAO, provided all transportation and distribution costs
- Regional plant health clinic was fully functionalized after laboratory equipments and chemicals were procured

Strengthening Farmers Training Centers (FTC)

It was planned to strengthen the farmers training center up to second level, and to functionalize 8 FTCs by establishing FTC management committee at Kebele level, excavation of water ponds, fencing of FTCs and purchase of demonstration materials. Accordingly, the establishment of committee, excavation of pond, fencing and procurement of demonstration materials were carried out, and the eight FTCs are functioning now

Capacity Building

- 20 Regional SMS and 500 Woreda DAs improved their qualification through long and short term training
- Twenty six DAs from 20 woredas were provided BSc degree training at different local universities
- Crop protection Training was offered to 7 Regional plant health clinic experts and technicians
- Training was organized on conducting yield estimation assessments to 16 regional and district SMS technicians
- Training on natural compost fertilizer preparation for seven woreda DAs
- Training on agronomic irrigation practices for 10 DAs and 100 farmers from West Gode settlement areas

- Thirty one Animal health technicians were trained on disease surveillance data base management
- 189 animal health technicians have graduated from Jijiga University and they were assigned to the woredas
- 305 new DAs were assigned to the woreda agricultural offices
- Training of 467 DAs from Shinile, Gode, Liban and Afdher zones and related manuals were distributed

Natural Resources Management

Natural resources development involve degraded land rehabilitation, improvement of land productivity, land policy and environmental protection Natural resource department carried out soil and water conservation activities (seedling production, hillside terracing, pond constructions, rural roads maintenance, water harvesting structures, and stone check dams, soil band constructions, controlling of gullies and erosions) and various studies on incense and gum in 7 potential zones, conservations of Garale Park, wild life population census for two years and land use study in Jijiga District.

Currently there are 347 DAs working on natural resources and environmental protection, and the major activity accomplished include:

- Training of experts and DAs from Gode, Kelafo, Mustahil W/Eimey and Adadley for community based watershed management
- Training of experts from 28 woredas in the region for afforestation with the establishment of nurseries and purchase of nursery materials
- Construction of two ponds at Garale Park

Agricultural Sector Support Project

- Construction of Erer woreda irrigation canals in which 1.5 km were finalized
- Under this ASSP, there were also two water ponds (12,000 m3) constructed at Gursum and Awbare woredas
- Jijiga human pond water was constructed
- Design of two potential small scale irrigation Shemes in Gursun and Jijiga completed

MERET Project

- MERET project was involved in different land rehabilitation activities in Jijiga, Awbare and K/bayah for the last five years. The main focus of

the project is food for work involving the local community. So far the project accomplished 18 different activities at those woredas
- The project aims also income generating activities to cater partly for families' cash requirements. 16 modern beehives with enough wax, and 8 water manually operated water lifting pumps, which can pull water from30 m, were purchased and dispatched to the woredas
- 80 energy saving stoves were purchased to minimize the wood requirements of the families and distributed
- 20 hard workers including five pastoral women were trained so that they could be able to make energy saving stoves

Forestry and Land use Policies

- The Bureau established two committees to initiate consultation at four selected centers, namely Shinile, Bokh, Filtu and K/Dahar
- The Bureau is planning to formulate policy and prepare proclamations to protect the land and forest

Agricultural Marketing

- Establishment of market information system (MIS) is being undertaken at Jijiga, Gursum, D/Bour, K/Bayah, Moyale and Gode so as the pastoralists are directly linked to the traders. Experts involved in data collection were trained in each woreda. The Bureau is planning to broadcast market information through Fana Radio
- The Bureau is planning to develop website to disseminate important market information and the available agricultural investment opportunities in the region. The website is under construction with the agreement of Walta Information Center through the domain of www.srslcdb.com
- Establishment of ten livestock market in the region is underway
- To improve livestock marketing in the region, existing obstacles have been assessed, and to organize the system, the first three local livestock traders groups were established in D/buor
- Two milk processing centers will soon be established in Jijiga and Gursum
- 10 woreda and 6 regional market experts were trained for market facilitation at Nazret
- To stop illegal exporting of the livestock, with the discussion of Custom Authority, a workshop involving 20 livestock wholesalers in the region was held

- Grading and standardization procedures were identified for the huge gum and incense resource in the region which are not properly utilized

IFAD/AMID Program

The goal of this program is to contribute to sustainable reduction of poverty by securing, safeguarding and increasing real income and ensuring of food security of rural households. The main achievements include:

- More than 20 livestock marketing groups were organized and merged in to six strong livestock trading cooperatives in D/bour woreda. Their legalization is under process through the cooperative agency
- Seven fruits and vegetable cooperative was organized in Erer woreda of Shinile zone and two milk producing groups was organized in Gursum
- 215 farmers who were drawn from seven cooperatives, and 288 livestock traders from six different cooperatives were trained on the basic principles of cooperatives

Rural Capacity Building Project (RCBP)

The Rural Capacity Building Project (RCBP) focuses on the following components: (i) Agriculture Technical Vocational Education and Training, (ii) Agricultural Extension (iii) Agricultural Research. (iv) Improving Information and Communication System within MoARD. (v) Development of Agricultural Market Institutions

Somali Regional State is one of the beneficiaries of the project and launched the implementation phase in July 2007. The region has seven project woredas namely; Jijiga, Gursum, Awbare, Gode, Kelafo and Dollo-ado, and 40 farmer/pastoralists training centers. These woredas were selected based on their potential for agricultural development and human capacity building interventions.

So far, the Bureau benefited much from the agricultural extension sub-component and many activities of RCBP were implemented including:

- Long and short term training, of experts, DAs farmers etc.
- Different experience sharing programs were conducted for experts, DAs and farmers

- Agricultural materials were procured and distributed
- Equipments and office furniture were purchased and distributed to zones and woredas

Productivity Safety Net Program (PSNP)

This program is aimed to help households that face regular food shortages during difficult times by way of asset loss at households level (e.g sell of key breeding livestock); prevent long-term problems caused by short term food shortage and builds assets at the community level (e.g. improved access to existing water points, construction of markets; improved access to the markets. The program has two components:

- Labour-intensive public works for able-bodied (fit and healthy)
- And direct support for households that face regular food shortages

In the region, six woredas (Afdem, Babile, Dollo-ado, Dollo-bay, Filtu and Barey) were selected for the implementation of pilot program. Two woredas (Babile and Afdem) are handled by government, whereas in the other four woredas (Dollo-ado, Dollo-bay, Filtu and Barey) implementation is the responsibility of NGOs (Save the Children/USA, SC/USA, ADRA and PCAE). In the region there are 157,271 beneficiaries from the six woredas out of these more than 75% are involved in labour based public works whereas the remaining are receiving direct support.

With regards to the implementation of the PSNP, there is strong collaboration and coordination between the Bureau and woredasl that has shown improvement over the last year due to various trainings including participatory watershed management, monitoring and evaluation, and reporting systems that were held at woreda and kebele levels.

Challenges

- Scarcity of skilled human power

- Shortage of transport service, scarcity of farm-machineries and equipments
- Weak managerial skills
- No encouragement and incentives packages for employees
- Poor working conditions and environment
- Poor budget utilization
- Top down planning (everything is expected from the bureau heads at all levels)
- Inadequate data availability and poor information flow among the stakeholders
- Poor partnership and networking among stakeholders
- Poor monitoring and evaluation mechanism systems

Agricultural Technology Transfer and Extension in Afar Region: Status Report

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Introduction

General Description of the Region

The Afar Region which is one of the nine administrative regions of Ethiopia, consists of 5 administrative zones, 32 districts and 401 kebeles. Afar borders with Oromiya region in the south, Tigray region and Eritrea in the north, Djibouti and Somalia region in the east and Amhara region in the west (PARuDB Annual Report, 2001) and its current capital city is Samara. The altitude of the region ranges from 1500 meters above sea level in the western part to -120 meters below sea level in the Danakil/Dallol depression (northern parts of the region). The southern part of the region is in the Awash River Valley. The river ends its journey and empties itself into lakes found along the Ethiopian-Djibouti border. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA, 2007), the Afar region has a total population of 1,411,092, of which 786,338 are men and 624,754 are women. Of the total population, urban inhabitants are 13.4% while the remaining 86.6% live in the rural areas. The region has a total area of 100860 square kilometers with an estimated population density of 14.59 people per square kilometer (Investment Bureau of ANRS, 2000).

History of Agriculture in the Afar Region

The pastoralists in the Afar region are mainly dependent on livestock rearing. The Afars lived for centuries by adopting a pastoralist lifestyle, utilizing scarce resources by migrating from place to place

(http://en.wikipedia.org/wiki/Afar_Region). The Afar people have strong ties to their ecosystem and have unique traditional values that promote harmony between human, livestock and nature. The region is endowed with high number of livestock resources, which is estimated to be 8,707,518. Out of the total number of livestock in the region 2,688,734 are Sheep, 3,229,761 are Goats, 2,336,483 are Cattle, 649,425 are Camels, 52,401 Chicken and 116,140 are Equine (PARuDB Annual Report 2001).

Elder people in Afambo district described that crop production in the region started about 300 years ago by the Arab people by planting date palm trees, sorghum and maize in Afambo district at Haressa kebele. Since then, the people who lived in Afambo and Asaita districts have been cultivating mainly maize and sorghum among cereals, and date palm and to some extent banana among fruits along the Awash River between Asayita and Lake Afambo.

Modern agriculture in the region, on the other hand, started in 1950 EC by the British investors during the reign of Emperor Haile Sellassie at Lower and Middle Awash areas following the Awash River, and the target crop was cotton. However, there were conflicts between the pastoralists and investors because the investors used the grazing lands found along the riverbanks for cotton production. To solve the problem, the government of Ethiopia established the Second Livestock Project with Proclamation in 1956 EC with the objectives of assisting the pastoralists through introduction of different crop production technologies and food for work, and later replaced by the Relief and Rehabilitation Commission (RRC) and Third Livestock Project in 1971 EC. The main objective of RRC was to assist the pastoralists through the production of different crops and food for work. On the other hand, the Third Livestock Project was established with the objective of developing very extensive rangelands for the pastoralists with irrigation water and at the same time to encourage the pastoralists to produce various food crops using irrigation.

It was during the 1990/91 EC cropping season that the first extension program was launched in the region and the implementation of the

program started through introduction of improved maize, sorghum and livestock fattening programs (PARuDB Annual Report, 2000). In 1999/2000 cropping season, the scope of the extension program expanded to include sesame, groundnut, horticultural crops, forage crops, milk yield improvement and agro-forestry packages in several districts within the region. Currently, the agro-pastoralists in various districts are trying to produce different food and cash crops as shown in table 2 below.

Climate

The Afar region is generally characterized by an arid and semi-arid climate with low and erratic rainfall. The temperature varies from 20oC in higher altitudes to 50oC in lower elevations in the northern parts of the region. Rainfall throughout the region is bi-modal with a mean annual rainfall below 500mm in the semi-arid western escarpments and 150mm in the arid zones in the eastern and northern parts. The evapo-transpiration rate in the lowland zones is above 2700mm on average therefore crop production in these areas is totally dependant on irrigation water.

Soil and Vegetation

The major soil type found along the Awash and other perennial river banks is alluvial black soil (alluvial deposits) resulted from accumulation of soils eroded from agricultural lands of Oromiya, Tigray and Amhara regions, and gravely out washed arenosol on non-irrigated plains. Outside of the flood plains (drier areas), the area is dominated by rocky leptosols and regosols. Most soils found in the riverbanks are very conducive for production of cereals, pulses, horticulture, forage, oils and fiber crops. Along the flood plains of Awash River, the dominant tree species is the deciduous acacia. Away from the Awash River on both sides, vegetation varies from closed dry thicket to open shrub lands with occasional scattered trees to grazing plains with no woody vegetations.

Geographical Features of the Region

Afar regional state is located between 39O 38′ 3.48″ – 42O 27′ 28.8″ North latitude and 8O 50′ 28.68″ – 14O 34′ 51.24″ East longitude (PARuDB Annual Report, 2000). The altitude of the region ranges from 1500masl in the western highlands to -120 meters below sea level in the Danakil/Dallol depression in the northern parts of the region. The Awash River Valley makes up the southern part of the region. The river completes its journey and empties into lakes in the Ethiopian-Djibouti border. The region is classified in to three agro-ecologies, lowland (99.3%), mid-altitude (0.61%) and highland (0.06%) (PARuDB Annual Report, 2001)

Resources Potentials

According to the Afar State Pastoral Agriculture and Rural Development Bureau, the region has more than 1.3 million hectares of cultivable land and vast expanse of rangelands, suitable for livestock rearing (Table 1). While most of the irrigable land is found along the bank of Awash and other rivers, only 75299 hectares have been cultivated so far, of which 32,000 hectares are managed by the state and private farms. The Afar State has, besides huge cultivable land and several perennial rivers, other natural resources such as salt, potash, sulfur, bentonite, gypsum, hot springs and geothermal energy. There are also two National Parks (Awash and Yangudi Rasa) where more than 53 big wild mammal animals including Abyssinian wild Ass, Grevy's Zebra, wild fox, wildcat, lion, Cheetah and 453 different species of birds such as Ostrich , etc. are existing (Statistical Bulletin, 2005). Exploitation of these resources has not yet started and the benefit to the local population remains minimal. Only the salt trade, traditionally carried out by camel caravans from the Danakil depression in Afdera (Zone 2) to Mekele (Tigray Region), provides direct inputs to the economy of local Afar peoples. Most of the region's mineral resources are found in Daloll, Brhale and Afdera in districts of Zone-2; Elidar, Dubti and Mile in Zone-1; and Gewane in Zone-3 (http://en.wikipedia.org/wiki/Afar_Region).

Table 1. Land use and population size in the rural areas

Districts	Cultivated land (ha)	Cultivable land (ha)	Rangelands (ha)	Forest (ha)	Water bodies (ha)	Stony, sandy and baren land (ha)	Total land (ha)	Total Population in the rural areas
Gewane	3308	8796	26412	18156	1382	9382	67436	25331
Buremudaitu	1657	42524	64585	39704.25	1285.53	6425.8	156181.6	31786
Amibera	13299	164745	170947.2	57578.2	4451.45	59650.15	470671	31194
Awash Fentale	2157	25931	162148	8645	3600	3450	205931	12931
Dulecha	303.4	20767.54	74615.35	36143.04	4153.44	23584.76	159567.5	19494
Argoba	3841	5020	14560.22	13049.2	681	10223.58	47375	19625
Semurobi	1081	16286	38268	68000	1312	22539	147486	31079
Hadele-Ela	140	31730.4	49833.6	70825.35	52	6352.05	158933.4	33136
Dalifagie	118	82182	86714	3628	3023	41117	216782	31174
Dewe	122	44461	91721	1583	1006	11068	149961	40043
Telalak	104	76892	127595	11274	709	2118	218692	36011
Millie	305	250668	232674.01	14332.02	5541.88	84102.47	587623.4	78572
Eli-De-Ar	5	23415.2	6292.68	13989.12	630.66	123012	167344.7	69764
Afdera	6	14537.48	108914.52	0	11264	849380.52	984102.5	28647
Asaita	10488	10512	19900	10100	1782	96530	149312	31162
Afambo	11982.8	151145.76	49920	2950	25031.44	102115.76	343145.8	23329
Dubti	12026	22545	43800	19690	64956	398572	561589	32400
Kuneba	201	1298	39824.3	2008.8	0	4925.9	48258	51138
Berehale	303	215	27700	2776	0	108021	139015	72752
Dalol	2335	2300	NI	NI	NI	NI	4635	82162
Abe-Ala	9651	1038	24315	9339	0	128875	173219	27655
Arebti	NI	NI	73457	NI	NI	NI	73457	35484
Megalle	309	7825	54232.5	44718.75	0	83339.75	190425	27403
Yallo	87.60	4413.4	80156.70	51007.42	0	33649.28	168314.4	46670
Gulina	92	42808	40360	40840	0	41508	165608	45867
Awra	206	170074	123840	46224	0	139330	479674	34106
Ewa	101.5	2800	NI	NI	NI	NI	2901.5	45965
Teru	10	NI	NI	NI	NI	NI	10	73504
Chifra	690	NI	NI	NI	NI	NI	690	81946
Bidu	0	NI	NI	NI	NI	NI	0	-
Ade.Ar	370	1300	11300	30000	56935	148330.42	248235.4	-
Kore	NI	NI	NI	NI	NI	NI	0	21790
Total Sum	75299.3	1226230	1844086	616561.2	187796.4	2537603	6, 487, 576	1222120

Despite the presence of these huge potential resources (livestock, rangelands, cultivable lands, perennial rivers, long sunshine hours, workforce and suitable agricultural technologies for the region), the Afar people are currently not benefiting to the desired extent from these resources and as a result they have very low income and food insecurity is still a huge problem. Therefore, the objective of this paper is to assess the status of improved agricultural technology transfer and promotion works so far made by the bureau and other stakeholders, the gaps and challenges faced, and suggest on way forward.

Achievements in Technology Transfer and Extension Service

Livestock

In the past five years, the livestock development department has done some works on dairy, poultry, forage and rangeland improvement technologies transfer and extension. In addition to this, successive awareness creation training on the available livestock technologies (haymaking, industrial by-product feed resource utilization and animal production) have been delivered to development agents, pastoralists and agro-pastoralists.

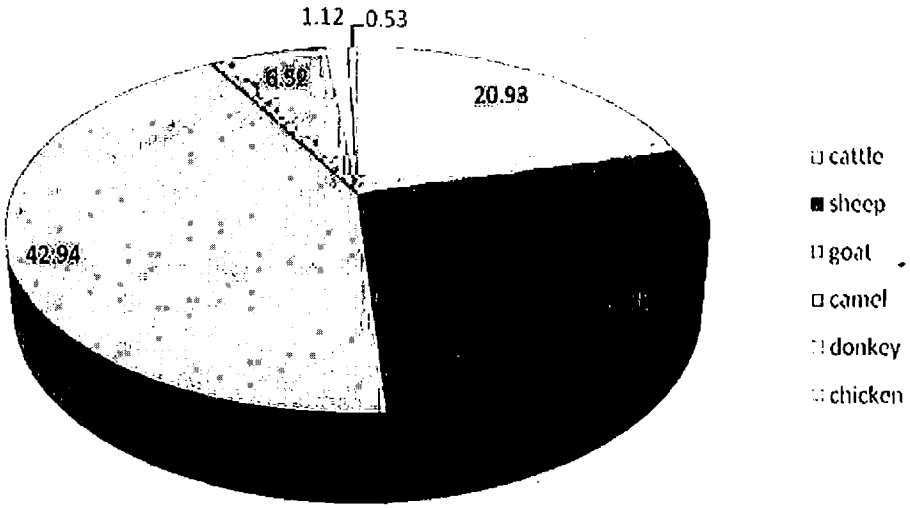
Camel

Even though camel is a precious animal to pastoralists and agro-pastoralists, there are no appropriate technologies so far developed or adopted by research and transferred to end users.

Cattle Milk

Increasing milk and meat production in the region through use of improved technologies is very important to assure sustainable food security of the pastoral and agro pastoral communities. During the past five years, PARDB has tried to improve cattle milk productivity by

introducing indigenous cattle from other regions, which are better milk yielder than the Afar cattle. The introduced breeds were 181 Begayite from Tigray and 50 Boran cattle breeds from Oromya regions. The Begayte cattle breed were distributed to the northern parts of the region (Abala, Kuneba, Dallol, Brehale and Chefera) while the Boran breed to southern and eastern parts (Gewane, Assyita and Afambo districts). Even though, the dairy cattle technology transfer activities have started recently, promising results have already been obtained.

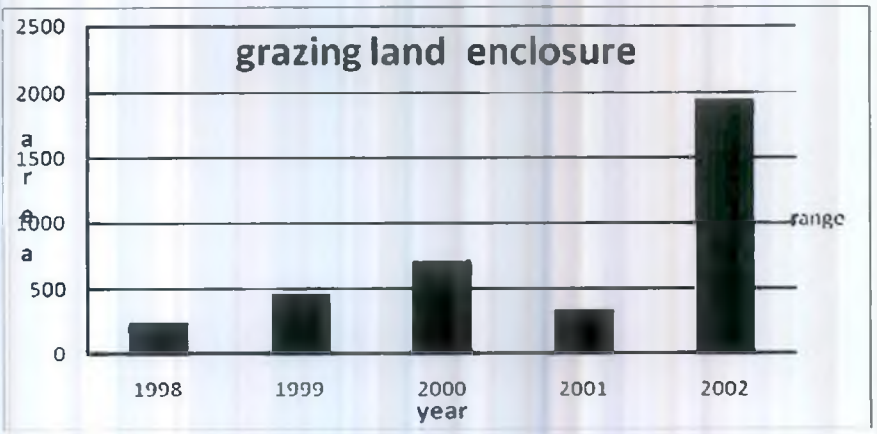


Graph1. Livestock population percentage in the region

RANGELAND MANAGEMENT

Although the pastoralists' livelihood depends on livestock, the livestock production system is by en-large traditional. The traditional system of grazing is based on exploiting the extensive rangelands that possess a wide variety of grazing and browse feed resource including native grasses, bushes, shrubs and tree species. At present the expansion of large scale irrigated agriculture; invasion of rangelands by Prosopis juliflora, bushes and other noxious weeds; depletion of seed banks due to recurrent drought and other reasons have led to severe shortage of feed resources. To solve the problem, the bureau has set five-year strategic plan focusing on improving the degraded rangeland by area enclosure and reseeding. So far, 6718 ha (687 ha in 1999, 2767 ha

in 2000 and 3264 ha in 2001) of overgrazed land has been protected from animal and human interference to restore the potential of the rangelands in different districts. The major reason for this success is the pastoralists' attitude shift created through provision of continuous training.



Graph 2: Progress with grazing area closure in the region

Forage and Pasture

PARDB has followed two approaches to transfer improved forage and pasture technologies. The first approach focuses on establishing fodder banks near the agro-pastoralist farmlands. The fodder bank has three advantages: it serves as forage seed multiplication site, demonstration and training center for the local community, and provides a source of feed during long dry season for calves and lactating animals. Therefore, by taking the above advantages into consideration, the bureau has established 21 fodder banks in 23 districts on 105 ha land. The second approach promotes developing backyard forage cultivation. So far, about 2926 agro-pastoralists have participated in the activity. Furthermore, the bureau has distributed 3028.5 kg seed of different improved grasses, 1808 kg of improved legumes and 411 kg seed of improved fodder trees to agro-pastoralists since 1999 EC.

Poultry

APARDB livestock development division has developed its own strategies to bring about significant change in terms of food security

and income generation. One of the strategies implemented for the past five years was promoting poultry technologies. Therefore, the bureau in collaboration with NGOs such as World Vision has distributed 654 improved layer chickens to agro-pastoralists in Asayita, Argoba, Gewane, Amibera and Abe-ala districts but the performance of the chickens has not yet been assessed and documented.

APICULTURE

Currently, the bureau is giving due attention to apiculture. It has distributed 445 hives with full accessories in 13 districts since 1998 EC. The districts considered in this program include Afambo, Millie and Dubti from zone-1; Kuneba, Berahle, Megale, Erbeti and Ab-Ala from zone-2; Argoba, Amibera and Dulessa from zone-3 and Tellalak and Dalifagi from zone-5.

CROP

FOOD, OIL AND FIBER CROPS

Well-adapted crops technologies suited mainly to the irrigated areas along the riverbanks of Awash have been identified and recommended by Werer Agricultural Research Center, including cotton, sesame, maize, onion, rice, sorghum, durum wheat, chickpeas, tomatoes, banana and sweet potatoes.

Though significant portion of the population is residing in high potential areas involved in crop production, the access to new improved crop technologies has so far been very limited except maize, onion and sesame to some extent. During the past 10 years, relatively successful technologies transfer efforts have been made by Bureau of Pastoral Agriculture and Rural Development (PARDB), Werer Agricultural Research Center (WARC) and Afar Pastoral Agro-pastoral Research Institute (APARI) on maize, sesame, onion and forage crops in Amibera, Asaita and Afambo districts (PARDB Annual Reports, 1998, 1999, 2000 and 2001 EC). Currently, agro-pastoralists in Amibera, Asaita, Dubti and Afambo districts are extensively producing improved maize varieties (BH-140), sesame (Adi and Tate) and onion (Adama and Bomby Red).

In the 2009 crop season, in the Ethiopian Institute of Agricultural Research (EIAR) led multi-stakeholder initiative to improve access of the farming community to advanced technologies, maize (BH-140 and BH-540) and forage (Panicum) crops technology packages were widely promoted involving 450 agro-pastoralists in two districts (Asaita and Afambo). The improved packages (variety and management) performed in both districts significantly better than the local farmers' practice as shown in the table below. This showed that proper transfer of crop technologies to end users (agro-pastorals) is the key for improving crop productivity and total production in the region.

Table 2: Performance of improved maize production packages at Afambo and Asayita

Variety	Afambo			Asaita		
	Yield (q/ha)			Yield (q/ha)		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
BH-140 package	66	72	70.1	58	67	60.5
BH-540 package	43	52	49.6	44	56	49
Farmers' practice	24	29	25.8	19	23	20.3

N. B. Average grain yield data samples from 10 agro-pastoralists fields in each district (plot area - 100m2).

PARDB is engaged in agricultural technologies transfer in different districts on other horticulture, cereals, oil and pulse crops, however progress report is yet not made available indicating the need to strengthen the supervision and follow-up to monitor progress and challenges.

Table 3: Areas covered by and productivity of different crops in the region

No	Crop	1998/99			1999/2000			2000/2001
		Area (ha)	Total yield (q)	Productivity (q/ha)	Area (ha)	Total yield (q)	Productivity (q/ha)	Area (ha)
a	Cereals	34432.1	512620.6	14.89	40740.8	683462	16.78	43995.8
1	Maize	27040.6	452353.8	16.73	27848.0	494999.3	17.78	30128.5
2	Sorghum	3576	33136.0	9.27	3388.4	93999.5	27.74	4114.3
3	Teff	2001.5	9717.8	4.86	4634.4	37967.4	8.19	4809.0
4	Barely	1814	17413.0	9.60	48700	56496.0	11.60	4944.0
b	Pulses	432.3	2812.6	6.51	344.5	1926.5	5.59	75.5
1	Haricot bean	120.3	731.6	6.08	129.5	780.5	6.03	3.5
2	Chickpea	150	1050.0	7.00	143.0	858.0	6.00	-
3	Masho	162	1031.0	6.36	72.0	288.0	4.00	72.0
c	Oil crops	65.3	231.3	3.54	341.3	1991.1	5.83	334.3
1	Sesame	58.3	188.3	3.23	216.3	1356.1	6.27	209.3
2	Groundnut	7	43.0	6.14	125.0	635.0	5.06	125.0
d	Vegetables				1184.0	110778.3	93.56	1175.0
1	Tomato				273.0	32840.0	10.89	274.0
2	Onion				839.0	77154.5	91.96	829.0
3	Pepper				72.0	783.8	10.89	72.0
e	Fruits							75.4
		34929.7			42610.6			45656.0

Sources: PARuDB Annual Reports. 1998. 1999. 2000. 2001

The above table shows the important crops grown in different districts using irrigation and rainfall. The pastoralists are shifting to agro-pastoralist in increasing numbers and consequently cultivated land has increased from 34929.7 ha in 1998 EC to 45656.0 ha in 2001 EC. It is evident that the training and capacity building efforts so far delivered on crop production techniques by agricultural experts, development agents, researchers and other stakeholders have contributed to this shift.

From the available data on the maize technology transfer and promotion work carried out by the regional PARDB, one can easily access the information on the amount of improved maize seed distributed and the number of participants involved in the extension work. However, further information on the types of maize varieties/hybrids distributed and their performances (productivity) at farm level is hard to come by. Greater efforts need to be made to retrieve such data from implementing weredas to assess the impact of technologies being disseminated.

Forestry

In forestry, seedlings of different trees species have been distributed and planted in several districts within the region since 1999 as shown below (Table 5). The strive to widely disseminate useful tree species in the region is noteworthy, however, again organized data on the status of planted trees in each district is scanty and this needs to be rectified.

Table 4: Area covered by improved seeds of maize crop by district

Districts	1998/1999		1999/2000		2000/2001		2000/2001	
	Distributed seed (q)	Number of agro-pastoralists	Distributed seed (q)	Number of agro-pastoralists	Distributed seed (q)	Number of agro-pastoralists	Distributed seed (q)	Number of agro-pastoralists
Gewane	62	192	38.37	387	39	382	18	555
Amibera	19	152	23	191	36	300	41	342
Awash Fentale	86	280	0	0	0	0	55	849
Dulecha	-	-	20	75	20	62	0	0
Argoba	23	250	0	0	0	0	0	0
Hadele-Ela	-	-	25.5	90	25	80	0	0
Dalifagie	-	-	12.5	80	0	0	0	0
Millie	24	60	21	168	0	0	0	0
Asaita	35	140	85	620	330	1630	330	1630
Afambo	185	320	242	410	282	397	28	370
Dubti	163	652	410	328	20	185	3800	2157
Berehale	73	220	0	0	0	0	0	0
Dalol	7.5	60	0	0	0	0	0	0
Abe-Ala	21.25	171	0	0	40	320	50	400
Arebti	1	2	0	0	0	0	0	0
Gulina	-	-	0	0	2	20	0	0
Chifra	33	264	0	0	0	0	0	0
Total Sum								

PARuDB Annual Reports, 1998, 1999, 2000, 2001

- Weak linkage between federal research institute and pastoral agriculture and rural development bureau
- Lack of improved livestock breeds and livestock management practices
- Limited soil and water management technologies
- Lack of appropriate rangelands management systems for sustainable utilization of feed sources
- Lack of appropriate extension system
- Inadequate information on socio-economic conditions of the pastoralist system
- Lack of adequate supply of improved seeds

Challenges

- Poorly developed agricultural information documentation system at all levels in the region
- Limited market access and opportunities (for crops and livestock products)
- Frequent occurrence of drought and animal diseases
- Lack of wafering points in the rangelands
- Shortage of experienced human power in the research institute and rural technology research and promotion center
- Salinity and poor irrigation drainage systems
- Water borne diseases, malaria, and the heat stress which create difficulties to work for long hours

Future Directions in Technology Transfer and Extension

Livestock

The existing local livestock breeds are generally low yielder in both meat and milk. At the same time the amount and accessibility of feed and drinking water to the livestock is meager mainly due to the frequent occurrences of drought in most of the seasons. Therefore, future technologies transfer within the region should focus on:

- Introduction of improved exotic and/or indigenous livestock breeds
- Develop appropriate livestock management systems
- Establishing good rangelands management systems that would serve as sustainable feed and drinking water sources to the livestock

- Forage technologies scaling-up works have to be implemented extensively in each district within the region
- APARI and WARC should develop new improved forage species along with their appropriate (improved) management practices
- Strong linkage must be established among stakeholders (Research Institutes, PARDB and end users)
- Collect and evaluate the indigenous grass species to improve the natural rangelands

Crop

The major crops which need to be given high emphasis in the future technologies transfer and promotion works are cereals (maize, sorghum, durum and bread wheat, rice and barley), pulses (chickpeas, haricot beans, soy beans and cowpeas), vegetables (onion, and tomato), fruits (banana, date palm, mango), root crops (sweet potatoes, cassava) and oil crops (sesame and groundnuts). Further, future crop technology intervention plan should focus on:

- The available crop technologies suitable for irrigated and dry areas of the region must be identified, multiplied and scaled-up widely. The technologies scaling-up works should be implemented for each potential crop grown in each district.
- The regional research institute and Werer Agricultural Research Center should conduct extensive varieties development/adaptation trials on different food and cash crops under both irrigated and rain fed areas of the region to release and recommend high yielding varieties of the respective crops.
- Sustainable improved seeds production and supply systems have to be established within the region to fulfill the huge improved seeds demand of agro-pastorals. In this case, PARDB should encourage private investors, NGOs and other stakeholders to involve in the production of improved crop varieties seeds with close supervision of APARI and WARC.
- Appropriate agronomic and crop protection packages should be developed and transferred to end users
- Unless the agro-pastoralists sell their produces at reasonable prices, they may loose interest to grow crops. Therefore, strong market chains have to be in place in each district so that the agro-pastoralists can sell their produces with attractive prices.

Technology Transfer and Extension in Gambella: Achievements, Gaps and Future Directions

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Introduction

The Gambella regional state is located in the south western part of the country, 777 km from Addis Ababa. The region covers an area of 34063 km2. The region boarders with the Sudan on the west and south west, the Southern Nations Nationalities and Peoples Regional State of Ethiopia on the south and east, and the Benshangul Gumuz and Oromia regional states on the north. The altitude in the region ranges between 300 - 2300 meters above sea level and is characterized by different topographic factures. According to CSA 2007, the total population of Gambella regional state is estimated at 306916, 229038 (75-80 %) live in rural areas. The region is characterized by different climatic features, its average temperature increase from east to west and annual rainfall decreases accordingly. The average temperature is 17 0C (min.) and 270C (max.) and the mean annual rainfall is 1000 mm. The Gambella Peoples Regional State has vast land that can be used for rain-fed and irrigated agriculture. The Baro Akobo master plan study indicates that the potential land for irrigation development is about 380,000 - 500,000 ha. The region has 290410 tropical livestock units (TLU) comprising 256,200 cattle, 9000 sheep, 10;450 goats and 14,760 poultry (Regional Land use study, 2003). Fish is the main resource in the region. There are about 100 species, with a potential for production of 250,000 tons/year.

Achievements in Technology Transfer

Crops

Since 1987 EC, 15899 households have participated in different technology packages, 2411 quintal of seeds, 1142 quintals of fertilizers and 774 kg of pesticides were distributed to the participants. However distribution of fertilizers and pesticides has not taken place from 1995/96 cropping season onwards due to various reasons.

Table 1. Participants in crop technology package promotion, and distribution of inputs.

No	Cropping season	Number of participants	Inputs		Fertilize (quintal)
			Seed(quintal)	Pesticide(kg)	
1	1987/88	12			
2	1988/89	200	41.4	36.37	204
3	1989/90	513	98.00	100.5	336
4	1990/91	377	73.31	60.27	
5	1991/92	68	15.3		74
6	1992/93	1943	165.95	78.04	156
7	1994/95	1619	268.76	228.96	164.5
8	1994/95	2127	346.72	340.72	138
9	1995/96	2141	323.39	15.56	70
10	1996/97				
11	1997/98	192	184.42		
12	1998/99				
13	1999/2000	6707	900		
	Total	15899	2411.25	773.73	1142.5

Livestock

From 1993/94 to 1996/97 budget years 1708 participants in sheep and goat production technology packages promotion, 37 participants in dairy, 5124 on sheep and goats, and 60 on modern beehives.

Table 2: Participants in animal technology promotion, and distribution of inputs

No	Year	No of participants				Inputs distributed			
		Sheep/ Goat	Dairy	Apiculture	Total	Sheep	Dairy	Beehives	Total
1	1993/94	13			13	39			39
2	1994/95	60		20	80	180		60	240
3	1995/95	877			877	2631			2631
4	1996/97	758	3/		797	2274	37		2311
5		1708	37	20	1767	5124	37	60	5221

Forestry

In 1994/95 cropping season 15487 different forest seedlings, 160 farm tools and 1350 kg of polythene sheets were distributed to participants.

Capacity Building

Establishment of Farmers Training Centers

The region has 3 zones (Agnuwak, Nuer and Mejengir), 12 woredas and a total of 229 PAs. Even though the establishment of FTCs should be considered in each PAs, the there are only 34 of them in the whole region. The FTCs are fairly well equipped in terms of class rooms, office furniture, farm and demonstration materials, training materials with the support of RCBP.

Recruitment of Development Agents (DAs)

Up to 2002 E.C, many DAs were trained and graduated from different ATVET colleges, and 575 them were recruited and assigned in different FTCs and PAs.

Training

Training of trainers was organized with the support of rural capacity building project for nine regional experts and 180 woreda experts using developed modules i.e. practical extension method, knowledge management, networking, participatory innovation development, post harvest, farm management, marketing, project planning, and practical skills on PRA. There is plan to offer similar training to DAs. Further training on different disciplines were give to 160 regional and woreda experts and DAs, 13 woreda officials and 48 farmers in 2001 EC..

Rural capacity building project has also supported degree training to enable experts and DAs to improve qualification. Thirty six experts and DAs were beneficiary of this arrangement and have managed to upgrade to BSC and 12 to MSc. Twenty others were beneficiary mid-career education program offered by Haramaya and Hawasa universities.

Experience Sharing

Experience sharing visits to other regions were organized for 27 woreda experts, 24 DAs, 5 supervisors and 5 farmers with the support of rural capacity building project.

Strengthening Linkage between Development Partners

Development partners have their respective essential roles to play in the technology generation and delivery process. Rural Development Partners Advisory Councils were organized at regional and zonal level to strengthen the partnerships.

One of the strategies followed to strengthen the linkage between extension and research was Farmers Research and Extension Groups (FREGS). In different woredas of the region, 20 FREGS were established focusing on different technologies. These activities were again supported by rural capacity building project. Many rural development partners were awarded at federal level for their success in the past four years.

Establishment of Farmers Innovation Fund

With the support of Rural Capacity Building Project in four FTCs, 24 farmers innovation fund groups were organized on new technologies, indentified by farmers themselves.

Gaps and Challenges

- Lack of community participation in rural development
- Extensions services were delivered without agricultural inputs, this was because
    - o No rural credit facilities for farmers to purchase agricultural inputs
    - o No efforts were made to organize farmers in cooperatives to support rural credit service and agricultural input supply,
    - o Even for those farmers who have the capacity to purchase it was difficult to get inputs due to lack of suppliers in the region
- Lack of awareness by different parties about agricultural extension service, and
    - o The service is considered the responsibility of one organization.
- Shortage of skilled human power and lack of commitment at different levels.

Several food, oil and forage crops and vegetables grow in the region. Sorghum, maize finger millet and teff are the major food crops in order of their importance. Among the perennial crops mango stands first in abundance and importance.

Progress and Achievements of the Regional Extension Program

Following the launching of the National Extension Implementation program by the Federal Government and, the Participatory Demonstration and Training Extension System (PADETES) by the Ministry of Agriculture to implement it, we did introduce diverse crop and livestock package of improved technologies with the aim of achieving food- self sufficiency. Farmer- managed extension management training plots were conducted. Farmers unable to purchase the required inputs were encouraged to acquire them through credit at a down payment of 25-50 per cent. Out of the 600,000 farmers in the region 70720 adopted various technology packages since the commencement of the program in 1988 G.C. It is believed that many more have adopted the technologies through the process of diffusion (Table 1).

Table 1. Participants in the intervention program from the year 1988 to 2001

Year	Participants						
	Berta	Gumuz	Shinasha	Mao	Komo	Others	Total
1988/89							507
89/90							2242
90/91							4285
91/92	642	572	1113	156	130	3843	6444
92/93	981	898	1756	245	204	7163	11243
93/94	852	781	1526	213	177	10136	13685
94/95	895	820	1602	223	186	10068	13794
95/96	893	804	1638	264	196	7686	11481
96/97	710	320	980	124	101	5200	7035
97/98-01/02	3034	9121	10777	1003	304	15770	40009
TOTAL	8007	13316	19392	2226	1298	59866	278705*

* Since the adoption period for some of the packages covers more than one year; there was likelihood of repetitive counting of an individual participating over the whole duration

The program started with cereal packages but soon diversified approach was followed to include technologies on post harvest,

livestock, high value crops including coffee, agro-forestry, bee-keeping, feeds and nutrition.

Agricultural inputs including seeds and fertilizers, live animals for fattening and for breed improvements, and modern beehives with accessories and other technologies were given on credit to farmers who implemented the package programs. They were supplied with a down payment of 25-50 percent of total cost. For ten years (1988-1997) the regional government made credit available from its recurrent annual budget. A total of 14,586,559 Birr was expended as a credit however the repayment rate was poor (Table 2). Ever since 1997 all of the credit was supplied by the Regional Credit and Saving Organization on the basis of a group collateral. Here too, the repayment of the loan is not that encouraging.

Table 2. Supply and repayment rate of credit from 1988/89 to 1997/98

Year	Credit supplied	Percentage change	Re-collected loan	Remaining Balance
1988/89	168538		110728	57810
89/90	734595	335	440555	294041
90/91	961028	30	73996	221033
91/92	1723004	79	1031387	691618
92/93	2216333	28	1218373	997961
93/94	3424816	54	1007860	4043431
94/95	2611519	-23	314651	670393
95/96	854222	-67	700000	154223
96/97	885530	4	580006	305524
97/98	1,007,170	18	874000	133170
TOTAL	14,586,559		*7017556	7,549,003

* The part of the repayment above this amount expected to go the Regional Micro finance institute is not included.

It is fourteen years from now since the intervention program commenced. Improved crop and animal management methods and others were successfully introduced to various communities. Now, development agents are full heartedly speaking that farmers have changed their behaviors towards the adoption of the packages. During this period, 70720 farmers directly implemented demonstrations and tens of thousands of others were followers who are believed to have acquired behavioral changes towards the uses of new agricultural

technologies and techniques through the trickle down process. Participating farmers have experienced substantial increases in productivity, and scale-up/out of the technologies can be launched provided credit and inputs are made available. Extension experts at all levels in the region feel that the only major factor to boost production is the supply of enough credit to graduate farmers. Credit institutions such as banks must find the means to work closely with and avail credit to the farmers. This must be done as a matter of urgency as the regional government cannot continue to supply credit from its meager resources. It must be underscored that unless a conducive credit supply system is created all the efforts made so far would be in vein. A more comprehensive analysis of the impacts of the extension program is required to evaluate its strengths and weaknesses so that, if need be, appropriate intervention systems can be developed, specially for the indigenous communities.

Gaps and Challenges

The agricultural development prospect of the region is constrained by a host of agricultural problems including:

Crop

- Lack of high yielding and pest resistant verities
- Lack of high value crop varieties with industrial and export qualities
- Lack of appropriate cultural practices
- Lack of sustainable cropping systems (rotations, intercropping etc) that fit well to the different farmer circumstances
- Lack of appropriate tillage practices for different soil types and growing conditions
- Lack of appropriate soil fertility information and fertilizer recommendation for different soil types and cropping systems
- The prevalence and severity of pests (weeds, insect, diseases and vertebrates).
- High storage losses due to weevils, rats and molds. High wastage of fruits (mango) and vegetable due to lack of appropriate storage facilities and market out let.

Livestock

- The major feed sources for the different animal species in the region are mainly grazing on native pasture and crop residues. Conserving available feed resources during the wet season to use in the dry season is not practiced. Feed conservation methods are in short supply.
- Animal diseases are the major constraints to livestock production. Although animal health service coverage has reached 40.6%, Trypanosomiasis, and other infectious diseases such as contagious Plueropeneumonia (CBPP) and CCPP are still highly prevalent. Effective preventive measures (vaccination programs) can control these diseases.
- An effort made to improve the poor genetic potential of the indigenous animals is insufficient, although limited efforts were made to introduce exotic breeds of poultry and hybrid pregnant heifers. Seventy four calves have also been produced through artificial insemination using semen from high quality bulls. This is encouraging development that needs to be pursued further concurrent to conservation of local germplasm.
- Despite the high potential insignificant work is done on irrigation. There is little available information on crop water requirement and irrigation systems, that can be readily disseminated to growers, and this has hampered the development of irrigated agriculture in the state.

Way Forward

In spite of the great efforts made through implementation of the national extension intervention program, the desired impact has not be achieved. This is partly because of the adoption of an extension approach that does not adequately take socio-economic variabilities between different target groups into account and poor and incomplete implementation of the rural development policies.

It is not right to assume that one size fits all approach will work and try to impose an extension system designed to serve a particular target area. Therefore it is appropriate to design tailor-made extension approaches for every target category. With this consideration a draft document to revise PADETES has been produced regionally and

workshops are being expected to finalize it. The desired extension system should focus on the promotion of cash crops and animals for local and international markets. It is also important to focus on integration of agriculture and non agriculture sectors in the rural areas to improve efficiency.

There is often a great need for close cooperation between networks of actors for innovations. For e.g. scientists can get innovative ideas from practitioners. Innovations often require the integration of ideas, knowledge and experience of a variety of actors including farmers, researchers, service providers and others who play a role in rural development.

MOA's Challenges and Achievements in Pastoral Areas of Ethiopia

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Introduction

The entire pastoral and agro-pastoral regions i.e. Afar, Somali, Gambella, and Benshangul Gumuz, and pastoral and agro-pastoral areas in Dire Dawa, east and south Oromiya (Fantale and Borana) and south Omo of Southern Nation and Nationalities Peoples cover about 625,000 sq. km of the Ethiopian landmass. They are characterized by low population, low and erratic rainfall, environmental degradation and recurrent drought.

Livestock is the main source of livelihood in these areas. The pastoral livestock resources play a significant role in the national economy. The cattle and sheep coming from the pastoral regions make up over 90 percent of the live animal export. Furthermore, the cattle provide around 20 percent of the draught power for the highlands (Teshome, et al, 2009). The rangelands are not only known for livestock resources; but also for their many wildlife sanctuaries and natural reserves.

In pastoral areas human population is increasing at a faster rate than livestock and grazing land is.diminished from time to time due to poor management and drought. Hence, the livestock head owned by pastoralists has gone down from 1.6 to 0.5 per person in fifty years (PADS, 2004) affecting severely the basic food balance and forcing the community to rely on food aid every year for survival.

Pastoral communities usually have a detailed knowledge of the environment, the grazing and range lands. This knowledge is acquired through extensive observation during continuous herding practices (Mapiduze et al, 2003). The action of pastoralists are carefully planned,

but constantly adjusted to match the changing conditions. The system is dynamic to suit the unpredictable environment. Information is linked to mobility of pastoralist in order to make the herders to keep in their mind. Information sharing between pastoralists is important for creating deep knowledge, and to keep dispersed societies to link together.

The interventions undertaken by MOA based on current policies and strategies, and the major challenges faced are summarized as follows.

Pastoral and Agro-Pastoral Development Intervention

There were various attempts for the development of pastoral areas. Mostly, the funding came from multilateral and bilateral agreements with organization such as World Bank, ADB, FAO, IFAD and Governments in the form of projects. Through those projects efforts were made to spur multi-dimensional social, economic and political development of pastoral communities by working with traditional institutions. Past and present programs implemented in pastoral areas include:

Livestock Health and Regulatory Services

During past regimes livestock health and regulatory services were rendered in pastoral areas. In 1973 and 1976, the Second Livestock Development Project (SLDP) and the Third Livestock Development Project (TLDP) were initiated by different donors and animal health service was launched as one component to provide vaccination and treatment. Under SLDP there were three sub- projects namely Southern Rangeland Development Unit (SORDU), North Eastern Rangeland Development Unit (NERDU) and Jijiga Rangeland Development Unit (JIRDU). These projects offered broad range veterinary services in their animal health clinics, until the facilities were destroyed during Ethio-Somalia war in late 1970s.

In 1988, Fourth Livestock Development Project (FLDP) started again with provision of veterinary service as its main activity. The veterinary

service was organized to give animal health service through service cooperatives as entry point. FLDP was implemented mainly in the high lands, and under SORDU project in Borana. The veterinary service of FLDP in Borana was given by social traditional institutions reorganized into service cooperatives. FLDP implementation continued until the infrastructure of the project was rendered non operational during the overthrow of the Military Government in May, 1991.

All livestock projects implemented in the past have benefited pastoralists and other members of the society through veterinary services awareness creation. At present, the animal health and regulatory service mainly focuses on livestock disease protection. The strategy it follows include:

- Human and physical resource development i.e.
    - o training of animal health technicians, animal health community
    - o Construction of animal health laboratory in each region, animal health clinic and health post
- Providing quarantine service at check point for export animals

Livestock Marketing and Market Information

There is huge livestock resource in pastoral areas, but due to the inefficient marketing system it has contributed very little to food insecurity and poverty alleviation. In 1964, the Livestock and Meat Board (LMB) were established to coordinate livestock marketing. During the SLDP and TLDP despite the efforts livestock marketing has remained rudimentary and was functional only in a few places. However the projects have contributed in terms of improving awareness and experience of pastoralists in livestock marketing. One of the factors leading to weak market infrastructure was lack of marketing policy. Due to this the pastoralists do not have direct access to major wholesale traders. More often, trade transaction take place through brokers which take higher margin from the final price of the livestock. Furthermore, pastoralists did not have access to market price information and they were forced to sell to brokers without information on actual market prices. Currently, the livestock products and by

products marketing proclamation has been approved, and the livestock marketing policy is on pipe line to be approved. Recognizing its crucial importance, the Government is committed to develop livestock marketing infrastructures by focusing on the following strategies.

- Construction of market infrastructures and establishing market information system.
- Construction of abattoirs for export meat.
- Creation of livestock marketing chain between pastoralist and live animal exporters.

Natural Resource Management

There was no intervention on natural resource management in pastoral areas; it totally lacked due attention. Recently, the natural resource management proclamation is approved by regional governments of Afar and Somali. The interventions major focus includes:

- Area closure
- Watershed management
- Establishment of nursery sites
- Diversion of rivers
- Water harvesting
- Digging well and, construction of pond and small dams for improved access to water for irrigation, livestock and human beings

Agricultural Extension

When agricultural extension intervention program started in 1954, it has largely focused on highland crop production and no attention was given to pastoral systems. From 1971-1991, during project extension approach (MPP1, MPP2, WADU and ARDU) and Peasant Agricultural Development Program (PADEP), extension intervention programs were again concentrated on mixed farming systems and they did not give any emphasis to pastoralists and the work done to improve the livestock sector was minimal.

In 1995, when Participatory Demonstration, Agricultural Extension and Training Program (PADET) was launched in line with the Agricultural

Development Lead Industrialization (ADLI) strategy, the focus was on three main production areas i.e. areas with reliable moisture, moisture stressed, and pastoral areas. Pastoral areas received equal and high attention for the first time. However, shortage of improved technologies was a bottleneck for moisture stress and pastoral areas. Nevertheless, production of cereals crops like maize, wheat, teff, etc, was greatly increased. But marketing proved to be a big problem for the farmers/agro-pastoralists to sell their products with fair price. To alleviate the problem the extension has started to advise farmers/pastoralists not only on production, but also marketing in recent times.

Currently, the extension service in pastoral areas is focused on the following interventions.

- Integrated minimum-package: To meet the need of pastoralists/ agro-pastoralists, integrated demonstration of different technologies has been implemented to disseminate technologies. Based on this, about 17 pastorals and 25 agro-pastorals production oriented minimum packages focusing on fodder production, water harvesting, and diary development have been developed (Abera et al, 2008). Recently, these different packages are under different implementation stages. In addition to the minimum extension package, the previous conventional extension service focusing on inputs distribution, vaccination, and training are underway.
- Agricultural Technical, Vocational Education and Training (ATVET) and Pastoral Training Centre (PTC): Human resource development is one of extension intervention program to produce skilled, competent and motivated work force that would be capable to provide effective extension service for pastoralist communities. On this line, four ATVET colleges have been established in pastoral areas and from these colleges 3459 frontline extension agents have graduated (Abera et al, 2008). These graduates are now serving as trainers of pastoralist/ agro-pastoralist at PTC and as frontline extension workers at village level to give extension service for pastoralist/ agro-pastoralists.

Agriculture and Mechanical Arts (IECAMA) popularly called 'Alemaya College of Agriculture', now Haramaya University (HU). On the following day, 16 May 1952, another agreement signed between the Technical Co-operation Administration of the United States Department of State, now United States Agency for International Development (USAID), and Oklahoma Agricultural and Mechanical College, now Oklahoma State University, gave to the latter the mandate: to establish and operate the College; to establish and operate a nationwide system of agricultural extension; to set up agricultural research and experiment stations; and to furnish technicians and administrative staff to start the College.

The academic programme of the College was modelled on the Land-grant College system with three fundamental but related responsibilities: training of highly skilled workers; promotion of agricultural research; and dissemination of appropriate technologies. In the decade following its establishment, IECAMA was active in building the national agricultural research and extension systems. In 1963, the national agricultural extension work was transferred to the Ministry of Agriculture, with the suggestion that IECAMA concentrates its outreach efforts in its vicinity. Since this time, the Ministry of Agriculture has been the authority responsible for the national agricultural extension system.

As to the agricultural research, for more than a decade, IECAMA and its central experiment station at Debre Zeit had a national mandate to carry out and co-ordinate agricultural research. In 1966, the Imperial Government transferred the responsibility for agricultural research to the newly established Institute of Agricultural Research (IAR). The IAR was established in February, 1966 with a mandate to formulate the national agricultural research policy, to carry out agricultural research on crops, livestock, natural resources, and related disciplines in various agro-ecological zones of the country, and to coordinate national agricultural research (Negarit Gazeta, 1966). With the establishment of the IAR, agricultural higher education, agricultural research and extension split up and were made answerable to three separate and independent administrative structures. This structural change nipped

in the bud the burgeoning linkage among agricultural research, extension and education systems. This weakness persisted up until now during which there has been no clear mechanism of linkage among the Ministry of Agriculture, the national agricultural research system and agricultural institutions of higher education.

Since the establishment of IAR, Ethiopia has a national agricultural research system with an autonomous management and with major and minor stations covering the major ecological zones, and the major commodity and discipline groups. Until its replacement by the Ethiopian Agricultural Research Organization in 1997, the IAR had been the only organization in the country with a clear mandate solely for agricultural research. Over the years other organizations, which had been involved in agriculture related research activities, had been established. These included: the Plant Protection Research Centre (PPRC), which was established in 1972 and operated under the Ethiopian Science and Technology Commission and was merged with IAR in 1995; the Plant Genetic Resources Centre of Ethiopia, which was founded in 1974, which later became the Biodiversity Institute (BDI); the Forestry Research Centre (FRC), which was established in 1975; the Wood Utilization Research Centre (WURC), which was founded in 1979; the National Soils Laboratory (NSL), which was established in 1989; and the Institute of Animal Health Research (IAHR), which became operational in 1992 (Getinet and Tadesse, 1999).

In addition to the aforementioned organizations, other organizations, such as some divisions of the Ministry of Agriculture, the Coffee and Tea Development Authority and the now defunct Ministry of State Farms Development had been engaged in experimental work in support of their development activities. Moreover, some institutions of higher learning, such as the Haramaya University, the Hawassa University, the Mekele University and the different units of Addis Ababa University (Faculty of Veterinary Medicine, Institute of Development Research and the Department of biology) have been doing some agriculturally related research.

Agricultural research underwent significant reform in the 1990s when the new government committed itself to put in place a decentralized political system in the country. More precisely, in 1993, some IAR centres were decentralised to create independent research centres run by the respective regional governments, and became the Regional Agricultural Research Centres (RARCs) generally under their respective regional bureaus of agriculture. However, over the past five years, the Afar, the Amhara, the Gambella, the Oromia, the Somali, the Southern and the Tigray regions have established their respective Regional Agricultural Research Institutes (RARIs), which have agricultural research as their central mandate and coordinate research activities of agricultural research centres within their respective regions.

As discussed earlier, agricultural research has been undertaken by different organizations without proper co-ordination. The end result was duplication of efforts and wastage of resources, which proved to be an extravagance the country could ill afford. The problem seems to have been appreciated by the current Government for it reorganized the national agricultural research system, in June 1997, under the umbrella of the newly created Ethiopian Agricultural Research Organization (EARO). During its establishment EARO merged all the existing agricultural research institutions (IAR, BDI, FRC, WURC, IAHR, NSL and the Debre Zeit Agricultural Research Centre) except the Regional Agricultural Research Centres. Proclamation number 79/1997, which established the EARO states that its objectives are: to generate, develop and adapt agricultural technologies that focus on the needs of the overall agricultural development and its beneficiaries; coordinate research activities of agricultural research centres or higher learning institutes and other related establishments which undertake agricultural research on contractual bases; build up a research capacity and establish a system that will make agricultural research efficient, effective and based on development needs; and popularize agricultural research results (Federal Negarit Gazeta, 1997). The EARO was renamed as the Ethiopian Institute of Agricultural Research (EIAR) on the 25th of October 2005.

Research Performance of Agricultural Institutions of Higher Education

It is evident that manpower training is the primary mission of AIHE. However, in addition to their primary function, AIHE are expected to play a developmental role by establishing linkages with public, private and non-governmental organizations engaged in agricultural and rural development and with farming communities. Available evidence shows that, in Ethiopia, AIHE have been involved in agricultural research activities, although there have been some differences in emphasis from one institution to another. Whereas some AIHE (like the Ambo College of Agriculture, and the Jimma College of Agriculture and Veterinary Medicine) serve only as teaching institutions, others take part in research and/or extension activities. However, only HU has been participating actively in the NARS. More precisely, unlike other AIHE, HU has been commissioned to conduct adaptive and applied research to support development in Eastern Ethiopia and in this capacity it shares responsibility for public sector agricultural research in the country.

Available evidence shows that academic staff members of the AIHE are not active participants in the NARS in terms of both undertaking research (basic and applied) and contributing to policy formulation. However, there is an agreement among the academic community that staff of the AIHE could be made to play a more proactive and leading role in the national agricultural research system. At present, factors that explain the limited involvement of agricultural institutions of higher education in development-oriented agricultural research programmes include, among others, lack of funding for university research; missing incentives for university staff to do research; absence of linkages with users and potential clients of research; missing functions of planning, coordination, and evaluation of research at the AIHE; absence of an explicit mandate for national agricultural research; and absence of research priorities related to national research needs (not addressing national agricultural research priorities).

A closer look into the research performance of the AIHE reveals that, thus far, they developed and released 130 crop varieties and 16 different technologies. A closer look at the research outputs of individual institutions reveals that not all AIHE have been developing and releasing improved technologies/varieties. More precisely, of the 130 crop varieties and 16 technologies produced and released by the AIHE, 125 crop varieties and all of the 16 technologies were accounted for by Haramaya University (the College of Agriculture and Environmental Sciences at Haramaya and the Debre Zeit Agricultural Research Station) and the remaining 5 crop varieties by the Awassa College of Agriculture. It must be noted that in addition to their direct involvement in agricultural research activities, the AIHEs have been contributing to research capacity development of the country mainly through producing qualified manpower for the NARS and upgrading the professional skills of NARS staff through short-term, summer and in-service training programmes.

Some of the serious criticisms levelled against agricultural research performance of the AIHEs include: researchers have been engaged in research activities, which were not on the farmers' priority list; limited linkage and working relationships with other components of the NARS; almost all the AIHE undertake applied/adaptive types of research and no basic research; due to lack of research funds from local sources, some AIHE rely on funds from external sources and carry out research projects, which in some cases do not fit into local/national priorities; and many research projects have often addressed topics of personal interest (with the goal of publishing results) and have been found to be less relevant to the basic and urgent needs of poor farmers (Amare, 2004; Belay, 2004; Belay et al., 2010; Teshome, 2004). Of equal importance, but often unnoticed by the researchers, is the fact that in most instances farmers have not been encouraged to take part in the identification of research problems. Moreover, researchers have paid little regard to the farmers' opinions, attitudes, customs, practices and priorities. In general, research efforts should fall in line with the needs and pressing problems of farmers so that research results become more acceptable and meaningful to farmers.

Agricultural Institutions of Higher Education and their Linkages with Other Components of the NARS

A closer look at the existing linkages between agricultural institutions of higher education and other components of the NARS shows that they are very weak. Some of the factors attributable to the absence of effective linkages between agricultural institutions of higher education and other components of the NARS include: differing research objectives and research activities; differing organizational structure, especially with regard to planning, coordinating, and monitoring and evaluation (their accountability to different organizations with different budgets, rules, regulation and demands); differing reward systems; differing qualifications of staff members; and missing incentives for staff members to link.

The author's discussion with some General Managers of the Regional Agricultural Research Institutes and the Directors of the Federal Research Centres, where most of the AIHE are located, revealed the existence of limited interactions between AIHE and the different components of the NARS. This view is shared by the heads of the AIHE in question. It was also reported that the collaborations and interactions took the form of conducting joint research, attending periodic meetings of different committees, participation in research review workshops, involvement of the research staff in the academic programmes of the AIHE (teaching courses both at undergraduate and post-graduate levels, supervising postgraduate thesis research work, and serving as members of board of examiners during thesis defence sessions). The discussion with officials of the research centres and the AIHE further points to the fact that where collaborations and interactions were reported, they tended to be limited between individuals (in both AIHE and other components of the NARS) rather than between the institutions in which they work. It is, however, heartening to learn that the Southern Agricultural Research Institute envisages pursuing an innovative approach to forge closer working relationships with the Hawassa University. The new approach focuses on funding M.Sc. thesis research projects of students enrolled in the School of Graduate Studies

of the Hawassa University on condition that they work on high-priority areas of the southern region.

A review of experience from other countries shows that it is possible to design different mechanisms to strengthen linkages between agricultural institutions of higher education and other components of the NARS (Belay and Knerr, 2007). These mechanisms could take the form of: utilizing research infrastructure jointly; institutionalizing and facilitating staff exchange (creating conducive conditions whereby senior NARS staff spend part of their time, teaching and supervising graduate students, at AIHE and vice versa); maintaining the current good practice of convening regular consultative meetings and reviewing research projects jointly; and encouraging joint research projects. Furthermore, reviving the former Administrative Board of the Ethiopian Institute of Agricultural Research where representatives of AIHE were serving as members could be one other way of strengthening the weak linkages between AIHE and other components of the NARS.

Challenges Facing Agricultural Institutions of Higher Education in the Areas of Research

Challenges facing AIHE in undertaking research differ from one institution to another and are very complex and diverse. In what follows only those challenges which are not institution specific will be discussed.

Shortage of Highly Qualified, Competent and Experienced Staff

The ability of institutions of higher education in agriculture and related fields to attain their mandates is heavily dependent on the quality and experience of their staff. The present staffing situation of these institutions reveals the fact that most of them suffer from the chronic shortage of highly qualified and experienced staff. This problem is believed to have diverse causes, which include, among others, low salaries of staff compared to private and non-governmental organizations, non-competitive terms of service, poor social services, and lack of rewards for outstanding research and teaching.

Highly qualified and experienced teachers and researchers leave the AIHEs to work for the private sector, NGOs, international organizations, or foreign universities/research centres that offer better pay and working facilities. Because of the high turn over of experienced teaching and research staff, the transfer of experience and knowledge to junior faculty members, which has given institutions of higher learning their character and values, has broken down. Moreover, at present, there are different signs that point to the fact that most of those remaining in the higher education system have been involved in informal activities in view of supplementing their inadequate basic income. These activities take the form of doing a second job for another employer, part-time teaching elsewhere or moonlighting that misuse the working time of those involved and their respective institutions' hardware and software. The involvement of teaching and research staff in informal activities is believed to impact on the quality of teaching and research output, the time available for consultations with students and outreach activities.

In general, available evidence suggests that high turn over of experienced teaching staff coupled with a sharp rise in the student population forced the institutions to rely heavily on recruiting young Ethiopians, with little or no experience in teaching and research, and foreign nationals. The AIHE are now dominated by young national staff who are not very experienced and foreign nationals who have little or no basic knowledge of Ethiopian agriculture (Ayalew et al., 2009; Belay and Ferdu, 2008).

Lack/Shortage of Funding for University Research

Available evidence shows that almost all Ethiopian AIHE are teaching-focused institutions. It is also interesting to note that only few of the AIHE (Addis Ababa University, Bahir Dar University, Haramaya University, Hawassa University, Jimma University and Mekele

University) have been receiving government funding for research . A closer look at the research funds received by these AIHE reveals that the amounts have been very modest, and limited the institutions to undertake only applied/adaptive types of research. Over the past few years, some universities have received research funds from external sources and carried out research projects, which in some cases did not fit into local priorities (Belay et al., 2010). It is, therefore, important that the AIHEs take greater responsibility for setting priorities, generating research funds from own sources, building their research capacity, managing research and disseminating knowledge.

Insufficient Attention Given to Research/Knowledge Generation

At present, in almost all AIHE research culture has not yet fully developed. For instance, research undertaking is not considered as a mandatory activity and there is little/no recognition for research undertaking. Even worse, research work on policy related matters is non-existent. However, experience from other parts of the world reveals that the involvement of the teaching staff in research undertaking has multiplier effects in that students benefit from research outputs by gaining basic and applied knowledge and skills that would enhance their performance on jobs (Ayalew et al., 2009).

It is also important to note that in all AIHE there is no incentive for staff to embrace a research culture. In this respect, it is interesting to note that until very recently, all institutions of higher education measured academic achievement of staff members (and thus promoted them to the next higher academic rank) in terms of publishing research results in internationally recognized scientific journals. However, in 1997 HU took a bold measure to recognize and thus use locally-oriented research results (generation of improved technologies and practices that address local needs) for promotion purpose. Currently, this criterion is incorporated in the promotion guidelines of all institutions of higher education in the country.

These Universities are the only ones among the AIHE that are actively engaged in agricultural research both through direct involvement of the staff and graduate students' thesis research work.

Shortage/Lack of Research Infrastructure and Facilities

The availability of basic research infrastructure and facilities is very important for the involvement of academic staff members in research undertaking. At present, in most AIHE, there is either a serious shortage or an absolute lack of research infrastructure and facilities required for research undertaking. This has led to a situation where in the few AIHE that are actively involved in agricultural research activities staff are increasingly dependent on foreign-funded projects for the procurement of research facilities and supplies. The shortage/lack of funds to put up research infrastructure and acquire the necessary laboratory equipment and chemical supplies has made it difficult for staff to undertake agricultural biotechnology related researches, which proved to be instrumental in increasing crop and livestock productivity in other parts of the world.

Weak/Limited Interaction with Key Stakeholders

Regular contacts with key stakeholders (farmers, community-based organizations, members of other components of the NARS, policy makers, governmental and non-governmental organizations involved in rural development activities etc.) are essential elements that help promote awareness about research activities/ outputs of AIHE. These contacts are also extremely important in that they enable AIHE to receive first hand feedback about the strengths and weaknesses the technologies that are generated and promoted. At present, the AIHE in the country are not proactive in terms of maintaining strong linkages with key stakeholders and adapting their research agenda in response to changing needs and feedback of potential users of their research outputs (Belay and Ferdu, 2008; Belay et al., 2010).

Conclusion

This paper examined the status of agricultural research in the Ethiopian AIHE and the interactions and working relationships between AIHEs and other components of the NARS.

The results of the historical review reveal that the linkages between AIHE and other components of the NARS were generally weak. The problem has been compounded by the fact that agricultural research and agricultural higher education have been carried out by different bodies with very limited contact and working relationships. A review of the research performance of AIHE reveals that all the Ethiopian AIHEs are teaching-focused institutions where research is relegated to a second position. Given the fact that there is an agreement in the literature that institutions of higher education play a leading role in generating and disseminating knowledge and technologies required for national development process, it is imperative that the Ethiopian AIHEs give adequate attention to research/knowledge generation. This paper shows clearly that currently, due to various factors, the Ethiopian AIHEs play a marginal role in the NARS. The paper underlines also that AIHEs must direct their research attentions to problems of local relevance and define their research agenda through interaction with all relevant stakeholders if they want their research efforts to mean anything at all to the society in which they are embedded.

Finally, it is imperative that AIHEs give due emphasis to building research capacity, developing a research culture and generating new knowledge. Towards this end, there is a need to provide strong support to research work by AIHEs. Some of the measures that need to be taken include: developing research policy and guidelines; defining research priorities oriented to needs of the country; creating budget line for university research; providing strong incentives for conducting research; promoting multi-disciplinary research on societal problems; allocating realistic time to research, teaching and other activities; providing staff, facilities, equipment and other essential factors; putting in place a system that encourages the employment of research staff (75 % research and 25 % teaching); streamlining student research, both graduate and undergraduate under the general framework of the

university research; and disseminating research findings for the effective transfer of knowledge and for the betterment of society.

It is equally important that AIHE formulate their research strategic plans taking into account national agricultural research priorities and relevant local considerations (preparation of research strategy outlining research priorities and how research is linked to users, other components of the NARS, and the teaching and extension programmes of the AIHE). At the national and regional levels, agricultural research strategies need to recognize and define the roles of AIHE in research. Such recognition gives AIHE legitimacy.

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PASTORAL COMMUNITY DEVELOPMENT PROJECT II: AN OVERVIEW

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BACKGROUND

The Pastoral Community Development Project (PCDP) aims at establishing effective models of public service delivery, investment and disaster management in the pastoral and agro pastoral areas of Ethiopia that address pastoral communities' priority needs, improve their livelihoods and reduce their vulnerability. Over a fifteen-year period, Project interventions are designed to empower communities and local administrations at woreda and kebele level as well as Regional governments to better manage local development in their respective pastoral areas, with the objective of increasing, stabilizing and diversifying incomes, improving infrastructure, increasing access to public services and reducing vulnerability.

This is being achieved through a community-based demand driven development planning process linked to a community investment fund, which flows through local government structures down to the beneficiary communities at the grass roots. The Project will also support a participatory disaster management program to reduce the risk to pastoral communities of drought and other natural threats to livelihoods.

While recognizing the central role that livestock production plays and will continue to play in pastoral life, the PCDP will not place exclusive emphasis on increasing incomes and productivity from livestock. Thus, the Project would also identify and develop alternative sources of income, including sedentary agriculture and non-agricultural activities

by both men and women in pastoral communities, with a view to the more sustainable use of resources and improved livelihoods in the lowlands of Ethiopia.

The PCDP is built around the principles of decentralization, which is now the established policy of the Government of Ethiopia (GoE). To promote and accelerate decentralization the PCDP (i) is implemented primarily by the Regions; (ii) channels substantial resources directly to woreda administrations; and (iii) strengthens the chain of technical and regulatory authority from national to regional and woreda level. The PCDP also gives due emphasis to community empowerment, by enabling communities to identify their own priorities, propose modest development projects and gain access to the financial resources and training necessary for their implementation. These reforms provide an opportunity for building pastoral advocacy at the national level, strengthening technical service delivery and improving participation of pastoral men and women in resource allocations at the woreda level.

It is well known that periodic drought and weak infrastructure and services constrain lowland development. The GoE has established institutions, systems and protocols for mitigating and managing disaster and for delivering improved services for land, agriculture and animal husbandry, education and health to pastoral communities, but lacks the resources for their further development and delivery. A recent feature of the GoE decentralization policy is the development of community-based water supply, veterinary, health and education services suited to pastoral lifestyles. Non-Governmental Organizations (NGOs) frequently collaborate with Regional governments to deliver these services; however, coverage is still very low and inadequate and NGO programs regularly experience funding shortfalls. Thus, the PCDP will build on existing systems and programs, raising capacity within government and community institutions and forging and expanding GoE-NGO-Community coalitions to deliver sustainable services to pastoralist's structures at different levels.

This will be achieved through a community-based development planning process linked to a community investment fund, which flows through local government.

The PCDP design is based on the assumption that pastoral livelihoods can be improved by strengthening the self-management capacities of indigenous institutions found within communities, giving them control of decisions and resources during all stages of the local sub project cycle. This approach is built around a sustainable livelihoods approach, which means that it is meant to be people-centered, responsive and participatory, multi-level and partnership based, sustainable and dynamic.

PROJECT WOREDAS

Strong acceptance of the PCDP development approach within government and at community level has created demand for an expanded project area under phase II, which will include 25 new woredas across the pastoral region, selected on the basis of criteria detailed below, raising the total phase II woredas to 57. Their regional distribution of existing and new Project woredas is detailed in table 1 below.

The inclusion of additional pastoral and agro pastoral woredas in to the program will be decided on the availability of resources.

The selection criteria of new woredas under PCDP phase II is based on the following criteria.

(i) Adequate security for implementation, supervision, monitoring and evaluation;
(ii) Minimal overlap with similar projects (e.g., FSP);
(iii) Road and communication accessibility;
(iv) Population;
(v) Poverty and vulnerability as measured by food security needs;
(vi) Proximity to existing project woredas whenever possible.

Rural Livelihoods Program (RLP)

This sub-component will support the establishment of rural savings and credit cooperatives in beneficiary communities at *woreda* and regional level and the capacity-building of associated support services, drawing from the experience of the Ethiopian Rural Financial Intermediation Program (RUFIP) and other actors, with appropriate modifications to respond to pastoral social and economic environments and characteristics. Support for establishing Pastoral Rural Savings and Credit Cooperative (RUSACCO) will be extended to both members of income generating grant beneficiary groups established under PCDP I and other members of the respective communities as well as to interested new groups in selected *woredas*.

Support for establishing Pastoral RUSACCOs will include awareness building programs and committee training, which are preconditions for registration. Once registered, Pastoral RUSACCOs will be eligible for Project provision of basic office equipment, account books and promotional material and a grant of 200% of their pre-registration compulsory and voluntary savings as seed capital for income-generating activities, up to a limit of Birr 50,000 per Pastoral RUSACCO. The amount of seed capital per Pastoral RUSACCO can be increased for those Pastoral RUSACCOs having more than 50 members, based on their performance regarding savings mobilization and repayments of loans. Pastoral RUSACCOs will lend to their members under commercially viable lending terms and conditions, including at least 2 loan guarantors per loan, with members' borrowing limited to 200% of their savings at the time of loan signature. Group lending will be encouraged.

The details of implementation of this sub component are described in the Guideline for RUSACCOs Establishment, which are part of this PIM. The implementation of this sub-component will draw upon the experiences of the ongoing Rural RUFIP and build upon successful savings and loans group interventions implemented by NGOs in a number of pastoral *woredas* in southern Ethiopia. Moreover, the activities initiated by the Small Scale Enterprises Development Project,

where available, will support capacity building activities to the anticipated RUSACCOs.

Pastoral Risk Management

Pastoral risk management is the second component of the project. It will harness community awareness on disaster risk, improve the accuracy of risk assessment and support strategies for risk management and abatement. The component will consist of two subcomponents (i) Pastoral Early Warning and Response Program (PEWRP) (ii) Disaster Preparedness Investment Program (DPIP).

Pastoral Early Warning and Response Program

This sub-component will build on and deepen an ongoing woreda-level, livelihoods zone based early warning process. This sub component will be managed by Early Warning and Response Department of Ministry of Agriculture and Rural development (MoARD) under a Memorandum of Understanding (MoU) with MoFA and its underlying structures. Accordingly, PCDP will, on the basis of annual work plans and budgets, provide the necessary physical, financial and technical supports to enable EWRD to collect, analyze and disseminate basic early warning and household welfare information for the early identification of the onset of disaster so as to take appropriate early responses. Making use of the household economic analysis (HEA) methodology being used for early warning and response system, the pastoral and agro pastoral woredas will collect and compile information on trends in household, environmental, economic and social conditions in discrete livelihoods zones with the help of part time data collectors at community level. This data will flow to regional and federal EWRDs at regular intervals. The data will be further analyzed at regional and federal levels to provide information to relevant stakeholders and decision makers so as to trigger timely responses to declines in the welfare of pastoralist communities. The sub-component will include the preparation of woreda level Disaster Contingency Plans (DCP) /"shelf Plans" to be implemented in case of emergency.

small budget will be available for pastoral communities to support their PAL activities.

Knowledge Management and Networking (KMN)

Knowledge management will be supported at federal and regional levels; including through the establishment of small resource units on pastoral research and development, and strengthening of existing networks at region and woreda level. This subcomponent will also support information exchanges and peace-building meetings between communities, including the support for the Annual Pastoral Day, and promote dialogue around pastoral research and policy studies of interest to conflicting communities.

Generally speaking, the technical research related to pastoralism will be decentralized, with decision-making being done and implementation managed at regional and woreda levels; pastoralists with the support of MSTs will be directly involved in identifying researchable issues. Communication and results dissemination and cross-regional networking and capacity building activities will be coordinated at FPCU level.

Especial efforts will be made through PAL facilitator attached to selected MSTs. The PAL facilitator will identify as to how pastoralists are already trying to respond to locally perceived problems or opportunities, i.e. identify the local experiments and innovations by pastoral men and women. These could offer starting points for pastoralist-led participatory research.

Policy Implementation Studies

This sub component is designed to enable the Ministry of Federal Affairs and regional Pastoral Development Bureaus/Commissions conduct studies on matters concerning policy implementation at federal and region level respectively. For this purpose a modest budget will be earmarked for this subcomponent to be managed by these stakeholders.

Project Management and Coordination

As in the case of PCDP I, project coordination and central financial management will be carried out by the Federal Project Coordination Unit (FPCU) housed in the MoFA. Given the decentralized structure of the PCDP II, the Project will be managed substantially at the regional and *woreda* level. At regional level, the Pastoral Development Bureaus/Commissions will house the Regional Project Coordination Units (RPCUs), which have overall responsibility for PCDP II implementation at regional level.

The Rural Livelihood Program (RLP) will be overseen by the Federal Cooperative Agency (FCA) and implemented through the Regional Cooperative Promotion Bureaus (RCPBs) and relevant *Woreda* Cooperative Promotion Desks (WCPDs).

The Pastoral Risk Management (PRM) component will be coordinated/facilitated by a senior PRM officer in the FPCU and supported at regional level by PRM officers located in the RPCUs. The Pastoral Early Warning and Response sub-component will be coordinated and managed by the MoARD/EWRD under the terms stated in the MoU with the FPCU/MoFA. Similarly, the Disaster Preparedness Planning and Investment Program will be coordinated and managed by the regional PDB/Cs with the support of the FPCU/RPCU PRM Officers.

The MoFA will have overall responsibility for the implementation and coordination of the Project at higher level. MoFA will, on a periodic basis, organize meetings to consult the Federal Inter-ministerial Board (FIB) and other stakeholders to discuss the integration of activities and other issues on pastoral development.

At federal level the FPCU, which is a semi-autonomous entity based in Addis Ababa, will be tasked with the following responsibilities:

(i) Coordination of project activities at the federal level;
(ii) Fiduciary obligations;
(iii) Liaison with stakeholders;
(iv) Project communication;
(v) Project monitoring and Evaluation;
(vi) Capacity building and technical backstopping; and

(vii) Institutional support for integration.

Institutional Arrangements

The Pastoral Community Development Project is implemented by line agencies at federal, regional and *woreda* levels of Government that are accountable for the oversight and coordination of the Project, with implementation of project activities being undertaken by *woredas* and communities, sector ministries/agencies and other partners.

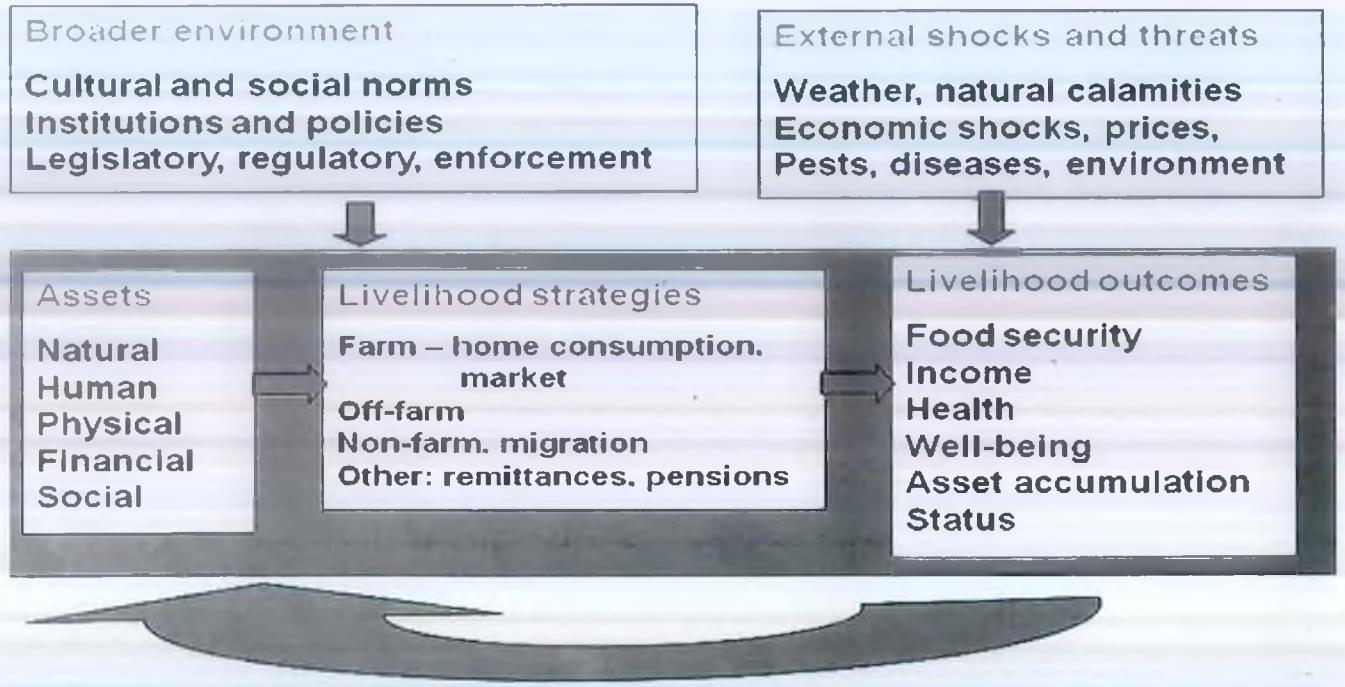
Key institutional stakeholders include:

Federal	Regional	Woreda
o FIB	o Regional PCDP Steering Committee	o Woreda Development Committee
o MoFA	o Regional PDB/C	o Woreda PDO
o PCDP/FPCU	o PCDP RPCU	o Woreda Sector Offices
o MoARD/DPFS	o Regional DPFS	o WoFED
o FCA	o Regional CPB	
o MOFED	o BOFED	

1.Summary:

PCDP 's achievement towards sustaining pastoral livelihoods

Sustainable livelihoods framework



Models of Public Service Delivery

- education,
- public health
- water supply (animal and human)
- veterinary
- road access
- cooperatives
- finance institutions and IGAs for diversifying livelihoods
- environmental and social management framework
- Mobile Support Operation and equity based socio economic development
- Harnessing social capital towards development
- Early warning System and Rapid response
- Disaster Preparedness Strategic Investment Plan at pastoral region

Pastoral knowledge generation especially on dry-land agricultural system (in collaboration with relevant stakeholders EIAR, APARI, OARI and SoRPaRI well as academic institutions)

- Participatory Variety Selection (PVS) especially on paddy and rain-fed rice (NRERICA)
- Capacity building support for women rice producing cooperatives (threshing machine and motorcycles, etc) in Gode and Kelafo, Somali region
- Introduction of multipurpose trees (Moringa , Neem etc) in Afar region in collaboration with Neem Foundation and Irish aid in the implementation of one-man-one tree green Samara project, in Afar region
- development of guideline for prescribed fire for bush and alien species control in Borana rangelands
- Establishment of pastoralist research groups for research-extension linkage in Yabello Pastoral and agro pastoral research center, Borana zone

Pastoral knowledge Management and Networking

- Support to Ethiopian Annual Pastoral Day
- Support and facilitate social networking meetings (conflict, HTP, etc)
- Establishment of pastoral stakeholders forum at all levels

- Establishment of pastoral knowledge resource center
- Facilitation of communities in technology transfer (e.g., Rope pump and micro-drip irrigation from Arbaminch university)
- Documentation of Indigenous Knowledge and community best experience (practices) in a Participatory Action Leaning manner
- Production and translation of simple guidelines for wereda/kebele level reference
- Documentation of implementation processes by communities within the project, other developmental programs
- Preparation of timely messages for communities continuous access to project information using different communication formats (radio broadcasting, videos, pictures, beneficiary storytelling, etc)
- Website development and different promotion materials production
- Undertake regular forums for knowledge sharing at different levels (newsletter, brochure, posters, etc)
- Undertaking Policy Implementation Studies at regional context for generation of evidence based policy/strategy recommendations

ANNEXES

STEPS TAKEN DURING THE IMPLEMENTATION PROCESS OF THE MULTI-STAKEHOLDER INITIATIVE

Multi-stakeholder initiative to strengthen research for development in emerging regions

Consultative workshops

Scaling up projects were separately developed, thoroughly discussed, and endorsed by stakeholders in consultative workshops. The forum helped to build consensus among partners on technological packages appropriate for each region, agree on outline of activities to be shared and executed, ultimately, and create team spirit.

Multi-stakeholder initiative to strengthen research for development in emerging regions

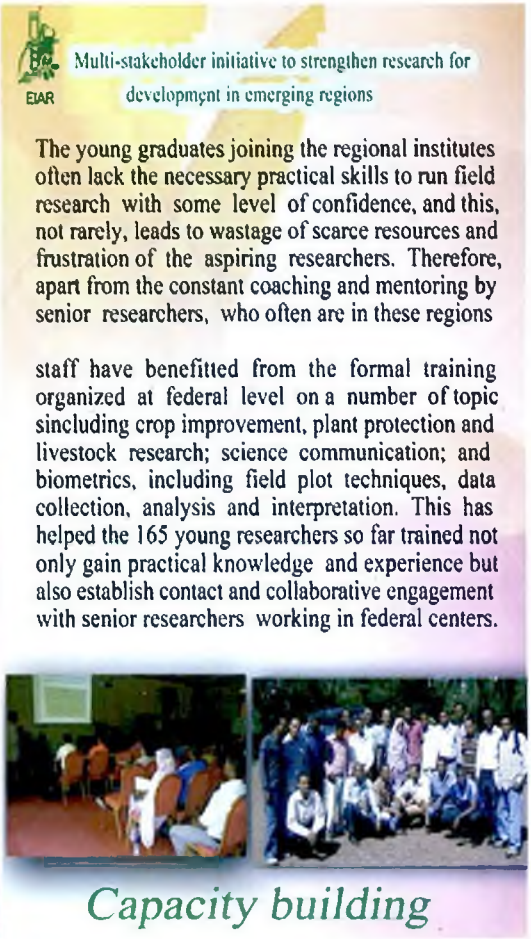
Innovative and motivated pastoralists, agro-pastoralists, farmers, development agents and experts received training on selected technologies. Knowledge subsequently passed on to all participating pastoralists and farmers through

Poster 1. Stakeholder consultative workshops held in the regions to agree on course of action, share tasks and establish administrative structure;

Poster 2. Training of trainers for implementing pastoralists, agro-pastoralists and farmers;

Poster 3. Field operations

Poster 4. Technical back-stopping, monitoring and evaluation by focal group members, senior researcher teams and representatives of stakeholder institutions;

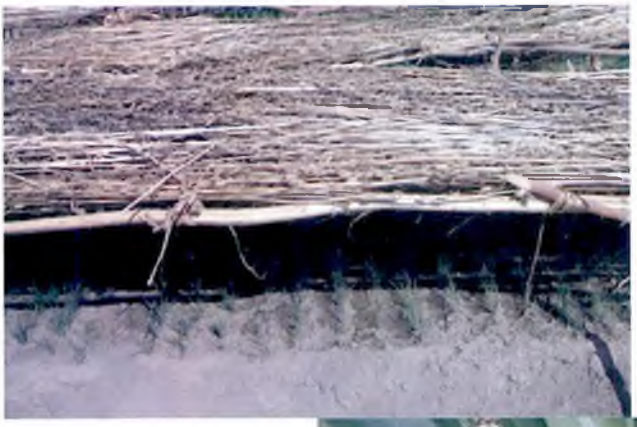


Poster 5. Field days and exchange visits to facilitate flow of knowledge and information;

Poster 6. Need based skill upgrading training for young researchers and technicians from regional research institutes

Pictorial Display of Technologies in the Field

Promotion of Improved Fodder Species in Afar Region



SCALING UP OF IMPROVED ONION SEED PRODUCTION IN AFAR REGION

THE FIRST ATTEMPT TO INTRODUCE WHEAT TECHNOLOGY TO AFAR REGION HAS BECOME INSTANT SUCCESS
(FIELD DAY IN FEBRUARY 2 2011)

A VIGOROUS SESAME CROP IN SOMALI REGION

FIELD DAY PARTICIPANTS IMPRESSED BY THE COB SIZE AND OVERALL PERFORMANCE OF MELKASSA 1 MAIZE AT GURSUM WEREDA (SOMALI REGION)

ASSOSA ZONE FARMERS FOR THE FIRST TIME REAPING THE BENEFITS OF IMPROVED POTATO TECHNOLOGICAL PACKAGE

INCREASING NUMBER OF NATIVE GUMUZ FARMERS (METEKEL ZONE) ARE EMBRACING ADVANCED TECHNOLOGIES TO IMPROVE THEIR LIVELIHOODS


Workshop on Strengthening Agricultural Research
Development in Imerging Regions