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Participatory methods in the profiling of livestock diseases in the Jos-Plateau, Nigeria

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Abstract: This study was conducted with a view to collecting epidemiological data based on farmers' understanding of livestock diseases in the rural communities of Plateau State. In typical developing nations, animal diseases seem to pose the greatest challenge to human and animal health and welfare. Unfortunately, most of such nations rely so much on inefficient "top to bottom" disease surveillance and eradication policies, as such, negative impacts of diseases are common. Participatory disease surveillance recognizes farmer opinion for timely disease control. Using various tools of participatory epidemiology, the occurrence of important livestock diseases and indigenous traditional knowledge were investigated. In 2009/2010, livestock diseases profiles and ethno-veterinary practices were evaluated in 90 randomly selected villages in Jos-Plateau. Endemic livestock diseases continued to cause significant economic losses to farmers in the Plateau. Institutionalization of participatory disease surveillance would better inform strategic livestock policy reforms and improve national diseases surveillance and reporting system in Nigeria.

Keywords: Interaction, Study, Farm Animal, Ill Health, Outline

1. Introduction

There has been exponential growth of the human population from about a billion in 1900 to several billions in recent years which has consequently led to major ecologic changes in attempts to be food secured [1]. Livestock production constitutes an important component of the agricultural economy in developing countries and it is an instrument to socio-economic change. It plays a significant role in household livelihoods and in some circumstances serve as a pathway out of poverty to rural inhabitants in many tropical countries including Nigeria [2, 3]. However, animal diseases pose significant threats to livestock sectors throughout the world; therefore, the need for animal health impact assessments has become pertinent in recent years, given the increased prominence of animal health issues globally [3].

Participatory approaches are 'bottom-top' developmental initiatives that require joint analysis, planning and monitoring with target communities to empower and find solutions to their developmental challenges. It later became central to the development strategies of international aid donors and non-governmental organizations (NGOs) [4, 5, 6]. Participatory rural appraisal (PRA) became obvious as an intelligent gathering process using multiple probing technique and relevant stakeholders to solve existing community problems [4, 5, 6]. In recent times, participatory epidemiology (PE) arose as a system of joint or shared interaction and analysis of disease status between rural people and professionals so that reliable epidemiological data are generated. PE began with interactive ideas that enhanced the effectiveness of rinderpest surveillance in pastoralist communities. Due to its sensitivity in outbreak detection, it is presently applied in search of animal and human diseases in pastoral and mixed peri-urban to rural based farming communities [6, 7]. PE is at present globally accepted as a proven technique which overcomes many shortcomings of the conventional epidemiological approaches. Common and rare animal diseases have been controlled using PE approach in Africa and Asia [6, 8]. (

It is very clear that animal health surveillance is essential for protecting public health, timely control of animal diseases, enhancing access to international markets for animals and their products, and improving animal health, production and welfare. A global overview established that effective surveillance systems must consist of sets of complementary components that would generate data to inform risk assessment and determine effective decisions and policies for both national animal disease control strategies and international trade [7]. At present PDS approaches have added significant value to already existing surveillance systems by enhancing their sensitivity and timeliness, and especially encouraging the inclusion of marginalized rural communities [6, 7, 10, 11]. It is without doubt that community-based delivery platforms are increasingly being proposed not only to ensure sustainability, but also to build capacity to implement various community based programmes at the grass root.

2. Materials and Methods

This study involved dialogue with the local communities). The committee involved in this study was made up the chief researcher as the facilitator, the key informant who was an agricultural extension officer and a note taker selected from among the participants.

2.1. Study Area

Plateau State is situated in the middle belt zone of Nigeria with a land mass of 30,611.75 square kilometers, population of 3,383,027 and 17 administrative units with the state capital in Jos. From a secondary source of information, the state had about 50 ethnic groups who were predominantly rural based farmers [12].

2.2. Sites and Key Informants Selection for the Study

Based on the states' 3 political zoning (North, Central and South), each zone was considered a cluster for this survey. One district (the smallest administrative units in the state) was randomly selected from each cluster (North, Central and South). Nine villages were again randomly selected from each district making a total of 90 villages used for the study. An agricultural extension worker at each site or closed to the site was co-opted into the PDS team as key informant to assist in the study.

2.3. Interview Formats

2.3.1. Semi Structured Interview

A semi structured or informal interview guided by a check list of 9 items (Introduction, livelihood means, livestock species, constraints to livestock production, diseases, participatory epidemiology (PE) tools application, access to veterinary services, existing veterinary knowledge, questions and comments) designed to obtain important livestock past, present and future events was used. The items ranged from individual introduction to closing remarks that allowed participants to synthesize information and discussed ways forward in terms of livestock health and productivity within the visited communities.

2.3.2. Location, Scheduling, Timing and Group Interviewing

The key informants and the community opinion leaders decided venues suitable for the interview that included among others schools and village halls. Season and daily work habits of the participants were put into consideration so that interviews were scheduled during the dry season. Interviews were conducted in *Hausa* language that all participants understood without the need for an interpreter. Livestock farmers that participated were selected based on gender especially where large crowd existed. An average of 15 persons in each site was used as focus group for the discussion. Average of 30 minutes was utilized for each interview and responses were adequately recorded.

2.3.3. Data Collection

The primary source of data was obtained using semi structured interviewing guided by a check list. In this procedure, open ended questions utilizing why, when, who, where, what and how (known as the six helpers) were used. During the interviews, general information about livestock ownership, types of livestock kept, uses of livestock, constraints to livestock farming among which livestock diseases of economic value were collected. The interviews also collected traditional descriptions of the clinical presentation of common livestock diseases in the communities. Participatory epidemiological tools were applied with a lot of flexibility according to local situation needs so much so that authentic data were collected. The following PE tools were effectively utilized.

2.3.4. Simple and Pair Wise Ranking

A list of livestock species was made by asking the participants to name livestock that are kept in the community. These were written on cards and participants asked to organize or rank the cards in order of population. This procedure was repeated for livelihood activities of the people in the study area, livestock diseases, animal husbandry types, and the results recorded.

In pair-wise ranking (PWR) or simple ranking comparison, each listed item was compared individually with all the other items one-by-one to look in to other possible relationships. It became useful where informants could not reach consensus using SR or where two items had the same scores. PWR seemed to be a probe to SR as it was used to contain disagreement among respondents during the SR exercise.

2.3.5. Proportional Piling

Proportional piling (PP) was used to rank livestock species by numbers and their relative importance in the communities. Participants were asked to list the livestock species kept in the community. Circles were drawn on cardboard papers with each circle representing livestock species mentioned within the communities. Participants then allocated 100 counters (beans) (assuming that the livestock population in the community made up a 100%) to each circles in piles according to the relative numbers of each species with the highest score indicating the most abundant livestock specie in the area. The exercise was repeated to assess livelihood means in the communities.

Relative incidences of the major livestock diseases were also determined using the same procedure.

2.3.6. Disease Impact Matrix Scoring

This involved a two-dimensional grid that was used to score items by at least two sets of categories on the y and x axis. Farmers mentioned benefits derived from livestock keeping and major diseases affecting them. Benefits derived from livestock were written along the *y* axis and the important diseases that affect them on the *x* axis. Participants allocated 100 counters among the livestock-derived benefits according to the relative importance of each benefit mentioned, with the most important benefit receiving the highest number of counters. The counters for each benefit were then sub-allocated to each disease to show the relative negative impact of each disease on a family's ability to achieve that benefit should outbreaks of such diseases occur. In this way the disease having the greatest impact received the highest number of counters. The number of counters allocated for each disease was counted to give a measure of the overall impact of that disease on livestock-derived livelihood means.

2.3.7. Matrix Scoring for Disease Definition

The association between diseases as recognized by clinical signs and risk factors or disease determinants was assessed using matrix scoring method. Simple matrices were constructed on the ground. In the first for poultry, various clinical signs or risk factors formed the *y* axis and probable diseases, one of which was ND that formed the *x* axis. For the second and third, the same was done for cattle and then sheep and goats. In all, risk factors/disease determinants and or consistent disease clinical signs formed the *y* axis and probable diseases formed the *x* axis. For each clinical sign or risk factor, participants allocated 30 counters (AFENET, 2011) in proportion to their relative importance for the different diseases.

2.3.8. Seasonal Calendar

The Gregorian/official calendar was used in all the local communities surveyed. A horizontal line was drawn and divided into 12 months (January-December). Participants were first asked to indicate the relative rainfall during different months using counters across the timeline drawn. They were also made to divide the year into different seasons paying attention to the characteristics of each season. Where seasonal diseases existed, their relative occurrences were indicated using counters at different points along the line of seasons mentioned. Key risk factors and or disease determinants such as rainfall, humidity, vector populations etc in relation to disease incidence were scored. Disease onset, prevalence and seasonality were determined by scoring (PP) using 100 beans. This exercise was continuously debated until all the farmers agreed upon the scores and the actual situation /data were arrived at.

2.3.9. Mapping / Transect Walk

Using this technique, both literate and illiterate farmers contributed to drawing the map of their communities using the actual information obtained from the participants with respect to livestock movement and grazing areas. The procedure also considered information on other natural resources like rivers, streams, forest reserves, ponds, and grazing areas to be located in the sketched map. These areas identified were risk factors to some livestock diseases in the communities.

Walk across the communities referred to as transect walk was conducted after every community interviews. It gave the opportunities of observing the environment of some of the listed natural resources, and particularly to identify risk factors with respect to highly pathogenic avian influenza (HPAI) and other transboundry animal diseases (TADs). We were also able to attend to farmers concern especially where outbreaks of diseases like ND was ongoing. Biological samples (sera and swabs) were collected and further laboratory investigation conducted.

2.3.10. Traditional/Indigenous Veterinary Knowledge

The community traditional veterinary knowledge is often related to clinical, epidemiological, gross manifestations of diseases conditions as well as remedies or solutions to livestock production and health. Most times these are known by farmers, they were given literary meanings that could correspond to specific disease entities in various languages and such information were transferred from generations to generations within communities. Information on these was extracted from livestock farming communities through open ended questions.

2.3.11. Data Management and Analysis

A database was constructed and statistical analysis done in Microsoft Excel (Microsoft Corp., Redmond, WA). Data obtained from the scoring tools were summarized using medians (to determine central tendency) and lower 10th and upper 90th percentiles (to define their dispersion). Timelines were summarized using means.

3. Results

Application of PE scoring tools (PP, SR and PWR) indicated crop farming, Livestock farming, petit trading and local mining to be the most important livelihood activities that the communities were involved respectively. SR and PWR further identified indigenous poultry, goats, sheep, cattle and pigs in order of population as the abundant livestock species kept in the communities. The use of SSI showed that these animals were predominantly kept on free range with little or no veterinary care and feed supplementations.

PP further gave cattle herd age estimate to contain 30% calves, 60% young growers, and 10% older cattle. A mortality estimate of most ND outbreaks was over 70%. With vaccination in place, ND mortality estimate was quantified at 30%. Laboratory result indicated over 50%

ND seroprevalence.

Poultry farmers identified Newcastle disease (ND), fowl pox (FP), lousiness (LS), syngamosis (SY), other respiratory diseases (RD), and salmonellosis (SM) as important causes of poultry morbidity and mortality. As no mention was made of HPAI in all the visited communities, questions on knowledge and practices with respect to HPAI raised indicated non occurrence and poor perception of the disease. *Pest des petit ruminants* (PPR), contagious caprine pleuropneumonia (CCPP) and helminthosis (H) were transboundry as well as endemic small ruminants' diseases of serious magnitude. In cattle, FMD, CBPP, and Trypanosomosis (T) were major diseases of concern across the studied areas, while fasciolosis though equally important was peculiar to lower Plateau (Table 1). Fewer located pig farmers had major disease concerns of African swine fever (ASF) and helminthosis. All these were assessed using PP, SR, PWR and MS participatory epidemiology tools. Disease impact matrix scoring estimated74% ND annual losses in unvaccinated local chickens flocks in the studied areas.

Seasonal calendar put the year into 4 recognizable local seasons *kaka* (harvest period/early dry season), *bazara/hamattan* (cold dry windy season), *zafi* (hot dry season) and *damina* (rainy season). Seasonality of disease vectors was identified, periodic movement of carrier animals (wildlife, cattle populations on transit) were reported to assist the propagation of some diseases like FMD and CBPP. ND, though occurred all year round was found most common during the cold windy hamattan period, SY was associated with rainy season and presence of earth worms in the environment.

Table 1. *Altitude location of studied villages, livestock diseases identified and access to veterinary facilities in representative villages of the upper and lower Plateau*

Elevations	Villages	Poultry diseases	Livestock diseases	Access to Vet. Facility/service
Upper Plateau				
1282m	Nyango	ND,SY,POX,ECT	PPR, ENDO.	Yes
1272m	Waduruk	ND,SY,POX,ECT	PPR, ENDO.	No
1321m	Kanadap	ND,POX, ECT	PPR, ENDO	No
1322m	Dahol-chwuha	ND, POX, ECT	PPR, ENDO	Yes
1256m	Dahol-vwana	ND,POX,ECT	PPR, ENDO.ASF	No
1262m	Chugwi	ND,POX,ECT	FMD,PPR, ENDO	No
1316m	Vwang	ND,POX,ECT	ASF,FMD	No
1321m	T-chwei	ND,POX,ECT	ASF,FMD,PPR	No
1322m	Shen	ND,POX,ECT	ASF,FMD,PPR	No
1382m	Mbar	ND,SY,POX,SY	FMD,ASF, ENDO.	Yes
1353m	Butura-k	ND,POX,ECT	PPR ENDO.	No
1356m	Tenti-b	ND,POX,RD,ECT	PPR, ENDO	No
1282m	Daffo	ND,POX,RD,ECT.	PPR, ENDO	Yes
1247m	Sha/Agari	ND,POX,SY,ECT	PPR, ENDO.ASF	No
1260m	Karfa	ND,POX,ECT	FMD,PPR, ENDO	No
1258m	Gwande	ND,POX,ECT	ASF,FMD	No
1369m	Dambwash	ND,POX,ECT	ASF,FMD,PPR	No
1345m	Hurti	ND,POX,ECT	ASF,FMD,PPR	No
1373m	Manguna	ND,POX,ECT	PPR, ENDO	No
Lower Plateau				
339m	Jarmai	ND,CRD,POX	FAS.CBPP,ECT	No
351m	Kemsengi	ND,POX,ECT	FAS. CCPP,FMD	No
315m	Tuttun	ND,POX,ECT	FMD,CBPP,FAS,TRY	No
331m	Zango	ND,POX,ECT	FMD,PPR,CBPP	No
370m	Gamu	ND,POX,ECT	FMD, CBPP,TRYP	No
365m	Marraban	ND,POX,ECT	FMD,CCPP,PPR,TRY	Yes
383m	Lyonglyon	ND,POX,ECT	FAS,FMD,CBPP,TRY	No
359m	Gishari	ND,POX,ECT	PPR,FAS,FMD,CBPP	No
347m	Gar	ND,POX,ECT	PPR,FMD,CBPP,TRYP	No

Key ND (Newcastle disease) SY (Syngamosis) POX (Fowl pox) ECT (Ectoparasitism) RD (Respiratory disease) CRD (Chronic respiratory disease) PPR (Pest des petit ruminants) ENDO (Endoparasitism) ASF (African swine fever) FMD (Foot and mouth disease) FSA (Fasciolosis) TRY (Trypanosomosis) TRYP (Trypanosomosis) CBPP (Contagious pleuropneumonia)

Table 2. *Different communities traditional terms for some livestock diseases, their literal English meanings and the probable diseases/syndromes as obtained from scientific literatures.*

Local names of disease	Literal meaning	Probable Disease condition
Annoba (H) Ro chono (B) Shasha/shanbaran (BK) Dyang kee (G)	Disaster of chickens Disease that kills chickens in mass	Newcastle disease
Ciwon kuraje (H) Ro benot (B) Mahalma diar (BK) Ndor (G)	Disease of chickens with rashes on combs and wattles	Fowl pox
Kwarkwatan kaji (H) Nyana (B) Bole (BK) Ndilip (G)	Small insects of chickens	Lousiness
Tana (H) Ro tana (B)	Disease associated with earthworm season that kills young chicks	Syngamosis
Taki (H/F) Hanta (H/F)	Cattle disease associated with contaminated pasture Liver	fasciolosis
Huhu (H/F)	Lung	CBPP
Kofoto (H) Boru (F)	Hoof Hoof lesions	FMD
Sammore (F) Tsando (H)	From samorin® Tsetse fly (*Glossina*)	Trypanosomosis
Majina da gudawa (H)	Nasal mucus and diarrhae	PPR

KEY: (Ethnic) B-Berom H-Hausa F-Fulani BK-Bokkos G-Goemai

Summary of local knowledge of poultry diseases in the communities studied is shown in table 1. Traditionally, poultry diseases were managed using herbs like gautan kaji (Solanum nodiflorum), gunan bera (Momordica balsalmina) and tafarnuwa (garlic). Palm and engine oils were commonly used to treat lousiness and pox lesions while kitchen soot and baobab (*Adansonia digitata*) leaves were commonly used to treat diarrhea cases in large animals. Gabaruwa (*Acacia nilotica*) and zuma (honey) were used in the hausa/fulani speaking communities to treat lesions of FMD.

4. Discussion

A detail of representative sites where the study was conducted is shown in table 1. Extensive participatory related researches enabling prioritization of livestock diseases, comparison of case fatality rates, local characterization of the clinical signs and causes of disease and analyses of disease control strategies have been conducted in many communities [11, 12, 13, 14, 15].

In this study, it was discovered that farming, petit trading and local mining were the three major livelihood means in the Jos-Plateau. It is on record that 65% of Nigerians are at present peasant agriculturists contributing more than 70% of non-oil exports and providing raw materials for many agro-based industrial sectors [16]. Plateau state cool weather condition year round had attracted indigenous and foreign settlers. The Jos Plateau had long been tagged “tin city” because of the abundant natural mineral resources including tin and columbite. Today if one travels across plateau state, undulating plains and altered ecosystems due to illegal local mining activities is very evident. The above livelihood ranking during this study is therefore within expectations.

Poultry was ranked top most among all of animal species kept in the communities. Probing technique revealed that there was hardly any house without at least a chicken in the rural areas. The ease of management and low inputs involved in the extensive management of rural based poultry and small ruminants was responsible for their high populations in the surveyed areas. Further, poultry was considered a source of emergency fund, was used in festivities and spiritual celebrations and as gifts to friends and visitors. This made the team to focus and evaluate losses due to ND outbreak being the most important poultry disease in the community.

Newcastle disease is a pandemic, associated with unexpected mass mortality that its impact is appreciated by every poultry farmer worldwide, thus ND is given local names and associated with varying believes in traditional settlements everywhere in the world, these supported the significant position of ND in this study.

Syngamosis appears to be a neglected poultry disease in conventional epidemiological assessment, but in this PDS study, poultry farmers have brought it to the fore signifying its important economic position in the plateau poultry farming communities.

Age structure of livestock herds, disease incidence and mortality estimates by age group, and impact of vaccination on livestock mortality case fatality rates were reported by many authors [17, 18, 19, 20, 21]. In this study profitable cattle breeding project was believed by farmers to have more of the young growing stock while older ones were either exchanged for or sold to purchase young stock. Calf mortality was reported by participating farmers to be common during feed scarcity periods. The measurement of age-specific disease incidence and herd structures using local names and local definitions of livestock age groups for different types of livestock have been documented in recent literatures [17, 22].

Fasciolosis and trypanosomosis appear to be common only to communities at the lower plateau (Table 2), this may be due to the geographical terrain such that these regionsbeing at lower plains of the Plateau with rivers, streams and grazing lands that were liable to periodic flooding, thus favoring vector borne disease like fasciolosis. Grazing lands and water points were also available as compared to the other communities on the upper plateau thus facilitating disease transmission, hence FMD, CBPP, PPR and trypanosomosis were common diseases encountered in these areas.

If due considerations were to be given to the identified livestock diseases of economic value in the studied areas, then vaccination against ND, PPR, CCPP, CBPP and routine deworming should be given priority in order to improve livestock productivity.

Periodic movement of cattle herds (transhumance) in search of pasture and drinking water during annual feed scarcity periods made possible cattle to move closer to game reserves and possible acquisition of infection. Accordingly, trypanosomosis (*sammore/tsando*) was associated with abundance of biting flies as tsetse flies (*tsando*) retreat to densely vegetated game reserves during feed scarcity in dry hot periods (*zafi*). Studies have shown seasonal variation in contact with disease vector populations, neighbouring livestock and wildlife to the extent that local names of seasons were used with local names for livestock diseases and vectors [22, 23, 24]. Seasonality and local characterization of disease vectors, comparison of clinical diagnoses of livestock keepers, seasonal variation in disease incidence and veterinarians' analysis of veterinary service providers were also documented [24, 25, 26, 27].

African swine fever and helminthosis were believed by farmers to be the major swine diseases within pig populations. We know that ASF occupies the top most position of swine diseases in the list A OIE reportable diseases [27, 28, 29].

Only 17% of communities surveyed had access to veterinary and extension services. This serves as evidence that the veterinary research and extension system does not cater adequately and probably might have encouraged traditional disease management to exist to date. Even though Pescatore and Jacob [30] reviewed natural remedies for poultry diseases recently, some of the traditional remedies to livestock diseases in the studied areas did not seem to have scientific authentication.

5. Conclusions

Participatory epidemiology established the true livestock situation of communities in the Jos-Plateau to effect organizational changes that may be more responsive to farmers' priorities. The provision of veterinary services in the study areas is inadequate and where accessible is largely provided and sustained by the government. Therefore, most communities use traditional veterinary knowledge to handle livestock health issues. The Nigerian Government should therefore adopt participatory disease surveillance approach for a livestock policy reform.

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References

[1] Chomel, B.B., Belotto, A., and Meslin, F., (2006). Wildlife, exotic pets and emerging zoonoses. Presented at the *International Symposium on Emerging Zoonoses, March 22–24, 2006, Atlanta, Georgia, USA*.

[2] Lawal, B.O., Torimori, D.O., Makanjoula, BB.A., (2009). Impact of agricultural extension practices in the Nigerian poultry farmers' standard of living. A perceptional analysis of tropical and sub-tropical agro-ecosystems. *International multidisciplinary Journal,* 10, 465-473

[3] Richa, K.M. and Perryb, B.D. (2011). The economic and poverty impacts of animal diseases in developing countries: new roles, new demands for economics and epidemiology. *Preventive Veterinary Medicine*, 101, 133-147

[4] Mariner, J.C and Paskin, R. (2000). Food and Agricultural Organisation. *Manual on Participatory Epidemiology, Methods for the Collection of Action-Oriented Epidemiological Intelligence,* 5-81

[5] Hussain M., Iqbal M., Taylor W.P and Roeder P.L. (2001). Pen-side test for the diagnosis of rinderpest in Pakistan. *Veterinary Record 1*49, 300-302.

[6] Jost, C.C., Mariner, J.C., Roeder, P.L., Sawitri, E., Macgregor-Skinner, G.J. (2007). Participatory epidemiology in disease surveillance and research. *Review Science Technical Office International des Epizootics* 26, 537–549.

[7] Mariner, J.C., Hendrickx, S., Pfeiffer, D.U., Costard, S., Knopf, I., Okuthe, D. Chibeu, D., Parmley, J., Musenero, M., Pisang, C., J. Zingeser., B.A. Jones, S.N., Ali, B., Bett, M. M., Araba, F.A Mehta, P., and Jost, C.C. (2011). Integration of participatory approaches into surveillance systems**.** *Review Science Technical Office International des Epizootics,* 3, 653-659.

[8] Pfeiffer, D.U. (2002). Basic concepts of Veterinary epidemiology, evidence-based Veterinary Medicine. Veterinary epidemiology-an introduction, p. 4

[9] Mariner, J.C., Manzoor Hussain, Rodder, P.L., and Catley, A. (2003). Use of participatory disease searching in Pakistan for rinderpest and more (Vina del Mar, Chile). *Proceedings of the 10th International Symposium on Veterinary Epidemiology and Economics, November 2003*.

[10] National Animal Disease Investigation and Surveillance (NADIS), 2006. Avian Influenza Bulletin No.2, 15th October, 2006

[11] Grace, D. (2003). Taking Stock: Stakeholder Assessment of Community-based Trypanosomosis Control. *Working Paper 6, International Livestock Research Institute, Nairobi, Kenya.*

[12] National Population Commission (NPC) (2008). Report of Census, Nigerian National Population Commission, Plateau State, p.4

[13] Bagnol, B. (200). Participatory tools for assessment and monitoring of poultry raising activities and animal disease control. *Manual Prepared for the FAOHPAI Communication Workshop, 22 January 2007, Bangkok, Thailand. http://www.participatoryepidemiology.info/userfiles/Participatory%20Tools_9_03_08*.pdf (accessed 20 September 2010

[14] Ahlers, C., Alders, R.G., Bagnol, B., Cambaza, A.B., Harun, M., Mgomezulu, R., Msami,H., Pym, B., Wegener, P., Wethli, E., Young, M. (2009). Improving Village Chicken Production. *A Manual for Field Workers and Trainers*, ACIAR Monograph No. 139, 194.

[15] Shiferaw, T.J., Moses, K., Manyahilishal, K.E. (2010). Participatory appraisal of foot and mouth disease in the Afar pastoral area, northeast Ethiopia: Implications for understanding disease ecology and control strategy. *Tropical Animal Health and Production*, 42, 193–201.

[16] Central Bank of Nigeria (CBN) (2005). The Agricultural Credit Guarantee Scheme Fund, Guide lines and Operations, Development Finance Department, p. 3

[17] Barasa, M., Catley, A., Machuchu, D., Laqua, H., Puot, E., Tap Kot, D., Ikiror, D. (2008). Foot-and-mouth disease vaccination in South Sudan: Benefit–cost analysis and livelihoods impact. *Transboundary and Emerging Disease,* 55, 339–351.

[18] Rufael, T., Catley, A., Bogale, A., Sahle, M., Shiferaw, Y. (2008). Foot and mouth disease in the Borana pastoral system, southern Ethiopia and implications for livelihoods and international trade. *Tropical Animal Health and Production,* 40, 29–38

[19] Bekele, G., Akuma, J. (2009). Impact Assessment of the Community Animal Health System in Mandera West District, Kenya. Feinstein International Center, Tufts University,AddisAbaba,Ethiopia.https://wikis.uit.tufts.edu/confluence/display/FIC/Impact+Assessment+of+the+Community+ Animal+Health+ System+in+Mandera+West+District%2C+Kenya (accessed 2 September 2012).

[20] Catley, A., Abebe, D., Admassu, B., Bekele, G., Abera, B., Eshete, G., Rufael, T., Haile, T. (2009). Impact of drought-related livestock vaccination in pastoralist areas of Ethiopia. Disasters. *The Journal of Disaster Studies, Policy and Management*,33, 665–685.

[21] Bett, B., Jost, C., Allport, J., Mariner, J. (2009). Using participatory epidemiological techniques to estimate the relative incidence and impact on livelihood of livestock diseases amongst nomadic pastoralists in Turkana South District, Kenya. *Preventive Veterinary Medicine*, 38, 8-19.

[22] Catley, A., Irungu, P., Simiyu, K., Dadye, J., Mwakio, W., Kiragu, J., Nyamwaro, S.O. (2002a). Participatory investigations of bovine trypanosomiasis in Tana RiverDistrict, Kenya. *Medical and Veterinary Entomology*,16, 1–12.

[23] Catley, A., Osman, J., Mawien, C., Jones, B.A., Leyland, T.J. (2002b). Participatoryanalysis of seasonal incidences of diseases of cattle, disease vectors and rainfall in southern Sudan. *Preventive Veterinary Medicine,* 53, 275–284.

[24] Admassu, B., Nega, S., Haile, T., Abera, B., Hussein, A., Catley, A. (2005). [12] Bedelian, C., Nkedianye, D., Herrero, M., (2007). Maasai perception of the impact and incidence of malignant catarrhal fever (MCF) in southern Kenya. *Preventive Veterinary Medicine* 78, 296–316.

[25] Aden, M., and Catley, A. (1996). Ethnoveterinary knowledge in Sanaag region, Somaliland: notes on local descriptions of livestock diseases and parasites. *Nomadic peoples,* 36, 3-16

[26] Catley, A. (2006). The use of participatory epidemiology to compare the clinical Veterinary knowledge of pastoralists and veterinarians in East Africa. *Tropical Animal Health and Production,* 38, 171–184.

[27] Impact assessment of a community-based animal health project in Dollo Ado and DolloBay districts, southern Ethiopia. *Tropical Animal Health and Production,* 37, 33–48.

[28] Catley, A.P. and Mohammed, A.A. (1996). The use of livestock-disease scoring by a primary animal-health programme in Somaliland. *Preventive Veterinary Medicine,* 23,175-18

[29] Jost, C.C., Nzietchueng, S., Kihu, S., Bett, B., Njogu, G., Swai, E.S., Mariner, J.C. (2010). Epidemiological assessment of the Rift Valley fever outbreak in Kenya and Tanzania in 2006 and 2007. *American Journal of Tropical Medicine and Hygiene*, 83, 65–72.

[30] Pescatore, T. and Jacob, J. (2011). Natural remedies for poultry diseases common in natural and organic flocks. Kentucky College of Agriculture Cooperative extension service 2*,* 1-6.