

## THE PARADIGM OF COMMUNITY-BASED PARTICIPATORY EPIZOOTIOLOGY: A REVIEW

BABALOBI, O.O. and \*IDOWU, O.

*Department of Veterinary Public Health and Preventive Medicine,  
University of Ibadan, Ibadan, Nigeria.*

*\*Corresponding author*

**Key Words:** Paradigm, community-based, participatory epizootiology.

### **Abstract**

Community-based participatory approach has been used for decades in rural sociology and the humanities in the design, implementation, monitoring and evaluation of development and intervention projects. Community-based medical and health education paradigm has become the accepted standard for undergraduate medical education worldwide since its evolution in the sixties. Its application to veterinary medicine is a recent phenomenon, but is now largely and effectively entrenched in veterinary epidemiology education and practice in East and Central Africa, as well as other third world countries. Within the ongoing Pan African Programme for the Control of Epizootics (PACE) in 32 African countries, the Community-based Animal Health and Participatory Epidemiology (CAPE) Unit actively promotes the participatory approaches in pastoral areas of the Greater Horn of Africa region. This paper discusses the application of community-based participatory techniques to epizootiology and seeks to promote its use in Nigeria

### **Introduction**

A paradigm has been defined as a set of rules and regulations that serves two functions: first, it establishes boundaries and second, it tells us how to be successful at solving problems that fall within those boundaries. In human medical and health sciences, community-based education (involving participatory inputs) has been an accepted standard paradigm worldwide since the sixties with an International Network of Community-Oriented Health Science Institutions. At the University of Ibadan Medical School, Community-Oriented and Community-based Medical Education started in the 1962/63 academic session, peaking in the early 70's. It involved a 6-8 week rural posting of medical students to rural Ibarapa Local Government and her

many rural communities (Oyediran and Breiger 1989; Asuzu 1993, 2004; Network of Community-Oriented Educational Institutes for Health Sciences, 1997).

Participatory research (PR) is a process which incorporates "systematic inquiry, with the collaboration of those affected by the issue being studied, for the purpose of education and taking action or effecting social change" (Green *et al* 1994). It is a process of collective, community-based investigation, education and action for structural and personal transformation, a method of investigating problems involving the people to identify their problems, providing solutions and taking collective action (GTZ, 2003). It has been long applied in various disciplines of agricultural research, agricultural extension and rural/community development.

Participatory Learning and Action (PLA) and Participatory Rural Appraisal (PRA) represent two of a wide range of terms used to describe those concepts and methods used for the full participation of people in the processes of learning about their needs and opportunities, and in the solution or action required to address them (IIED, 1994). Participatory epidemiology is the application of participatory rural appraisal techniques to the collection of epidemiological information (Mariner *et al*, 2001).

In veterinary medicine, participatory epidemiology (more correctly known as participatory epizootiology), (PE), is the use of participatory approaches and methods to improve the understanding of animal diseases and veterinary services, and to design solutions to disease problems with livestock keepers. PE draws heavily on systems of learning and action such as Rapid Rural Appraisal and Participatory Rural Appraisal (Participatory epidemiology website: <http://www.participatoryepidemiology.info/index.html>, 2005). It relies on the techniques of participatory rural appraisal, ethno-veterinary surveys and qualitative epidemiology (Schwabe, 1984) and its use has been upheld and promoted by both the Food and Agricultural Organization (FAO) and the International Office of Epizootics (OIE) (Catley, 2000; Mariner, 2000). Mariner (2000) traces the history of participatory epidemiology. In the early epidemiological studies of Snow (1836) on cholera or Budd (1931) on typhoid conducted in the mid-19th century, are striking similarities between their techniques and what is described as participatory epidemiology. Both of these men relied heavily on direct observation and oral testimony from affected individuals and communities to deduce basic mechanisms of disease transmission.

In 1848, Snow concluded that water from the Broad Street pump was the cause of an outbreak of cholera in the Golden Square area of London and used the elegant solution of removing one pump handle to interrupt the epidemic. Budd by observing the commonality of village conditions and establishing by 'scrupulous' enquiry the apparent disease freedom of some villages, concluded that miasmas were not the cause of typhoid. He went on to find that typhoid was a contagious disease where the infectious 'matter' was passed in the 'discharges' of diseased individuals. Thus, direct observation and the use of qualitative enquiry to collect epidemiological intelligence from the community are at the foundation of modern epidemiology.

PE is not a recent development (Mariner, 2000). Indeed, indigenous knowledge often predates or has been associated with major paradigm shifts in the development of modern disease ecology with these examples-the discovery of insect vectors and sylvatic cycles of disease transmission (Schwabe, 1984). In the first world, livestock owners provided the clue that led to the recognition of the first insect vector in the transmission of disease. Kilbome's famous experiments on tick transmission of bovine babesiosis conducted in 1889-92 were based on the cattle owner's hypothesis that ticks caused the disease.

In human medicine, the 'discovery' in 1932 of sylvatic transmission cycles of yellow fever in monkeys was predated by a report (Balfour, 1914) that communities on Trinidad could accurately predict the occurrence of epidemics of yellow fever based on observations of red howler monkey mortality. Even more striking, Cosme Bueno wrote in 1764 that Andean peoples of Peru attributed leishmaniasis and bartonellosis to the bite of the uta or sand fly (Herrar and Christensen, 1975).

Community knowledge related to animal health has been termed existing veterinary knowledge (Mariner, 2000). Existing veterinary and medical knowledge has made important contributions to Western medicine. It was the Maasai of East and Central Africa who suggested that the wildebeest was associated with the epidemiology of malignant catarrhal fever. In Maa, the words for wildebeest and MCF are the same (Barnard *et al.*, 1994). The Maasai recognize that the wildebeest calving season as a high risk period for the transmission of MCF and protect their cattle by avoiding wildebeest during the calving season. With regards to rinderpest, Plowright (1998) has indicated that 'nomadic cattle owners could give uninitiated professionals a firm diagnosis of rinderpest and even husbanded mild strains purposely to immunize their young stock.'

PE is a community-based animal health problem solving component of epizootiology (also known as Veterinary Epidemiology). There are three main forms of veterinary investigation-clinical, laboratory (including pathological) and epizootiological. Unlike epizootiological observations in animal populations, clinical and pathological observations can be seen mainly in individual animals brought to the clinic, or laboratory specimens of sick or dead individuals. In contrast, epizootiological investigations are field-based, involving the investigator visiting animal populations in their natural environment.

PE is a relatively new branch of epizootiology that is still developing. The approach is based on qualitative inquiry. According to the needs of a given intervention, PE can also combine the benefits of participatory tools and methods with quantitative inquiry. PE uses a wide range of interviewing, scoring, ranking, and visualization methods, sometimes combined with

conventional veterinary investigation and epidemiological tools (Catley and Mariner, 2002). Although professionals in a wide range of disciplines regularly use participatory approaches, veterinarians have been slow to adopt participatory ways of working.

### **Participatory research tools**

These are the methods used in participatory exercises, including participatory epizootiological research and development. They are essentially interactive, visual and diagrammatic constructions that facilitate the sharing of information. They are specifically adapted to respond to local conditions using, where possible, visual and locally comprehensible symbols that aid communication processes, especially with and among illiterate persons not used to abstract communication terms. Majority of them have been developed in initiatives deriving from Sociology, Community Development, Agricultural Extension or Research, as well as in the Health sector. Examples include: Venn diagramming, Semi-structured interviewing, matrixes, mapping, seasonal calendars, and timelines.

### **Uses of participatory epizootiology**

#### ***i. Community based animal health systems.***

Probably the most common use of PE has been during animal health surveys and problem analysis during the early stage of community-based animal health worker (CAHW) projects. Participatory methods have been used for many years during the design of community-based animal health worker (CAHW) projects. The design of community-based animal health projects requires attention not only to diseases, but also a range of issues concerning the selection of CAHWs, incentives for CAHWs, and drug supply and supervision by private professionals. These issues are described in

detail by Hadrill *et al* (2002).

Typically, CAHW projects aim to prevent or treat a limited number of locally-prioritized animal health problems, rather than tackle all diseases. For example, Rinderpest control in the Afar region of Ethiopia and in southern Sudan was achieved via CAHW programmes arising from participatory analysis with communities. (Participatory epidemiology website: <http://www.participatoryepidemiology.info/PEUsesCAHWs.html> 2005).

#### **ii. Animal health surveys, needs assessments and action plans**

Participatory research has been used widely during animal health surveys conducted by NGOs as part of community-based animal health projects (Catley and Mariner, 2002). For example, Intermediate Technology Development Group (ITDG) began using participatory methods in 1986 during a baseline survey in Kamujini, Kenya. The survey was an initial needs assessment or feasibility study and was intended to provide a rapid overview of key issues, relationships and services in communities, and locally-prioritized livestock diseases. The survey included the use of methods such as wealth ranking, progeny histories, ethnoveterinary question lists, and informal interviews, transect walks, mapping, and ranking exercises. Similarly, the use of participatory research methods was central to the community-based programmes established by the Operation Lifeline Sudan Livestock Programme (Leyland, 1996) and the Pan African Rinderpest Campaign (PARC) (Mariner, 1996).

#### **iii. Monitoring, impact assessments and evaluations**

Increasingly, PE methods are also being used in impact assessment of CAHW

programmes. For example, 'before and after' methods enable local perceptions of changing disease patterns to be understood and related to possible causes, such as the activities of CAHWs. Indirect PE methods can also be a useful way to assess the impact of specific diseases (Participatory epidemiology website: <http://www.participatoryepidemiology.info/PEUsesImpact.html>, 2005). Although participatory methods are widely used during the initial stages of veterinary epidemiological project implementation, their use in project monitoring and evaluations has been less extensive (Catley and Mariner, 2002). In the pastoral areas of the Horn of Africa, ActionAid-Somaliland used participatory methods as part of a soft systems approach in programme reviews in 1994 and 1998 (ActionAid-Somaliland, 1998). A review of Oxfam UK/Ireland's community-based animal health project in Karamoja, Uganda (Catley, 1997) also used participatory scoring tools.

#### **iv. Ethno-veterinary studies**

Specific studies to collect and document indigenous veterinary knowledge have, to varying degrees, used participatory methods. In comparison with the various participatory methods used in the development of community-based animal health services; ethno-veterinary studies have tended to use a narrow range of interviewing methods (Catley and Mariner, 2002). Often these methods have been more formal than informal, with questionnaires and structured owner interviews forming the basis for data collection. Working with ITDG in Kenya, Wanyama (1997) used various ranking and scoring methods in a more participatory ethnoveterinary research approach to produce a methodology book.

#### v. *Participatory disease searching*

The later stages of animal disease eradication programmes require the final remnants of disease to be sought out and removed from a population. Participatory Disease Searching (PDS) evolved in the Pan African Rinderpest Campaign and used pastoralists' knowledge of rinderpest to locate disease outbreaks in remote areas. The approach was based on participatory methods such as semi-structured interviews and in particular, the use of probing questions to delve deeply into local knowledge about rinderpest. Also, mapping and time-lines were used to build an historical picture of rinderpest outbreaks in a given area (Mariner and Flanagan, 1996; Mariner, 2000). These methods were used in combination with conventional veterinary investigation methods such as clinical and laboratory examinations. When the searching team actually located a rinderpest outbreak, the involvement of livestock keepers during the disease search meant that discussion on the action required to control the outbreak was easily initiated.

#### vi. *Participatory research*

PE has been used in various types of descriptive, exploratory and analytical research. (Participatory epidemiology website: <http://www.participatoryepidemiology.info/PEUsesResearch.html>. 2005). The various research activities conducted by the Participatory Approaches to Veterinary Epidemiology (PAVE) Project of the International Institute of Environment and Development (IIED), involves participatory research methods (Catley and Mariner, 2002). In each research location, livestock keepers identified the diseases under investigation as priorities. In each case, participatory diagnosis followed by discussion on appropriate control

measures was the main field-level activity. In Kenya, research findings were presented to community representatives and an action plan for further work was agreed with the Kenya Trypanosomosis Research Institute (KETRI) (Catley *et al.*, 2002).

#### vii. *Disease modeling*

Computer simulations of disease transmission can assist epidemiologists to develop disease control strategies. By understanding the way a disease moves between animals in a population, appropriate methods to interrupt disease transmission can be identified. Disease modeling often makes use of expert opinion provided by technicians to estimate parameter values where hard data is limited or too expensive to collect.

A common criticism of disease models has been that the people actually developing the model or providing the expert opinion are isolated from the realities on the ground (Catley and Mariner, 2002). Frequently, this means that the validity of the available field data used to run the model is not fully understood and therefore, inappropriate conclusions are drawn. Similarly, recommendations for disease control should be informed by knowledge of local preferences for different control options.

In southern Sudan, participatory methods were used to generate basic data for a rinderpest disease model (Mariner, 2000). Constructing a model requires an understanding of herd age structure and mortality rates due to rinderpest in different age groups of cattle. Participatory methods such as proportional piling were used to produce this kind of data (Catley and Mariner, 2002). Development of the model also requires understanding of livestock population structure and the degree of contact between herds. This herd-to-herd contact is directly related to

spatial, temporal and social relationships between adjacent communities. Participatory methods were ideal for studying linkages between communities. Methods such as mapping were used to quantify contact between communities and herds as well as seasonal variations in contact levels.

### **Challenges of using participatory approaches in epizootiology**

In common with the use of participatory approaches and methods by workers in other technical sectors, veterinary uses of participatory methods are affected by various difficulties. For example, a survey revealed that the number of veterinarians involved in the use of Participatory tools exceeded the number who had received training in it (Catley, 2000). Furthermore, a commonly cited complaint was 'negative attitudes among colleagues and superiors' and insufficient training courses and manuals. It is rare to find a report or proposal that uses methods other than structured interviews or proposes training in participatory research methods for veterinary researchers (Catley and Mariner, 2002). In the participatory research activities carried out by Participatory Approaches to Veterinary Epidemiology (PAVE) Project and implemented by the International Institute for Environment and Development (IIED) and the African Union/Inter-African Bureau for Animal Resources (AU/IBAR), this project conducted field research in southern Sudan, Kenya and Tanzania to assess the reliability and validity of participatory methods. The project ran from 1998 to 2000, and was funded by the Department for International Development (UK). While some researchers readily grasped the concept of open-ended inquiry and enjoyed asking further questions, other researchers focused solely on recording

farmers' responses, regarding this as the main output of the method (Catley and Mariner, 2002). This experience has much in common with reports from other participatory approaches workers in other fields. Thus attitude, behaviors and a certain mindset are central to effective participatory inquiry. For an effective and efficient use of PE, the researcher should

- i Have respect for local people and local knowledge
- ii Be willing to learn from the local respondents
- iii Adopt Flexibility in asking/changing questions and reacting to responses
- iv Be systematic in questions and follow-up
- v Be detailed and specific in recording data
- vi Be willing to be interactive (with the respondents) in the analysis of the results
- vii Adopt "Triangulation", the act of gathering information from several intentionally different community perspectives. Various levels and sources of information are tapped with the aim that they should be used to cross-check and verify each other (Mariner, 2000).

### **The future of participatory epizootiology**

Although participatory epizootiology is used by only a handful of veterinarians, there are opportunities to promote its wider development and application. For example, the Pan African Programme for the Control of Epizootics (PACE) presently covers 32 countries and aims to eradicate Rinderpest from Africa, improve control of other epizootics and develop the capacity of national veterinary epidemiology units (Catley and Mariner 2001).

Within the PACE, the Community-based Animal Health and Participatory Epidemiology (CAPE) Unit is planning to encourage key regional and national-level veterinary agencies to learn more about participatory approaches in pastoral areas of the Greater Horn of Africa region (Catley and Mariner, 2002).

Some of the main activities of the CAPE Unit are as follows (Catley and Mariner 2001):

- i. Dissemination of experiences in participatory epidemiology via academic and informal publications, and workshops.
- ii. Training in participatory epidemiology for senior-level epidemiologists in government veterinary services, veterinary schools and research institutes, followed by application in the field e.g. as a component of disease surveillance systems and research in pastoral areas.
- iii. Encourage veterinary epidemiologists to become involved in the design, monitoring and impact assessment of community-based animal health programmes in pastoral areas; create links between government epidemiologists and NGO programmes.
- iv. With veterinary schools, explore options for incorporating community based animal health and participatory epidemiology into undergraduate or postgraduate curricula; support postgraduates to conduct participatory research in pastoral areas.

Ultimately, these activities will improve animal health information flow both from and to pastoral communities, enable wider application of community-based animal health services and encourage the inclusion of pastoralists into national and international

livestock research and development projects and programmes. Veterinary Authorities and Institutions therefore have the responsibility to actively include the participatory epizootiology approach to both practice and education.

### Recommendations

- i. The concept of community-based PE should be promoted and adopted in Nigeria through a review of undergraduate and postgraduate epizootiology curricular to include PE.
- ii. Training of Trainers (TOT) workshop should be organized by relevant bodies for faculty staff and other interested veterinarians in Nigeria on the PE concept
- iii. Veterinary faculties in Nigeria should adopt the 6-8 weeks of rural posting of medical students of the College of Medicine, University of Ibadan, to Ibarapa LGA, by for example posting final year veterinary students of the Faculties of Veterinary Medicine in Nigerian Universities for a 6-8 weeks PE rural posting in recognized veterinary field stations or institutes.
- iv. Veterinary researchers in Nigeria should be facilitated with grants to conduct PE researches in Nigeria, to verify some of the positions canvassed by Catley and Mariner in their researches in other parts of Africa.

### Conclusion

Despite the gamut of modern skills, knowledge and expertise provided in this computer technology era, the adoption and inclusion of livestock owner information in project design and disease control strategies is a necessary prerequisite for validated, more accurate outputs of all phases of epizootiological investigations - including diagnosis, descriptive

(population, place, time), analysis, field-action intervention/decision-making; as well as the monitoring, evaluation and the reporting/documentation of such investigation. This will lead to more appropriate and acceptable animal health preventive and control interventions by the animal-owning public. Community based participatory research certainly falls within the boundary of the paradigm of epizootiology, and its input definitely makes the discipline the better for it. This has been the experience in East and Central Africa (Sones and Catley, 2003). Veterinary authorities, researchers and teachers in West African countries are required to adopt this same line, otherwise suffer from 'Paradigm Paralysis'-the failure to recognize, and be willing to adopt new paradigms (Barker, 2002).

## References

- Action Aid-Somaliland: Programme Review by the Sanaag Community-based Organization. *ActionAid, London* (1998).
- Asuzu, M.C: Community-based medical education: A Review of the oldest programme in Nigeria. *Annals of Community-Oriented Education*. 6:69-81, (1993).
- Asuzu, M.C: Modern paradigms in medical and health sciences education: Wither Ibadan? University of Ibadan PostGraduate School Interdisciplinary Discourse. 60pp, (2004).
- Balfour, A: The wild monkey as a reservoir for the virus of Yellow fever. *Lancet* 1:1176-1178 (1914).
- Barker, J: Discovering the future: the business of paradigms®. In Sones, K. R. and Catley, A. (Eds.) Primary Animal Health Care in the 21st Century: Shaping the Rules, Policies and Institutions. Proceedings of an International Conference held in Mombassa, Kenya, 15-18 October 2002. African Union/InterAfrican Bureau for Animal Resources, Nairobi, Kenya. Pp. 9-10 (2002).
- Barnard, B.J.H; Van der Lugt, J.J. and Mushi, E.Z: Malignant catarrhal fever. In: Infectious diseases of Livestock. Coetzer JAW, Thomson GR and Tustin RC (Eds). (Oxford University Press, New York, Pp 946-957, 1994).
- Catley, A.A: Review of the Oxfam UK/Ireland Kotido Livestock Development Project (Animal Health Component), Kotido District, Karamoja. Consultancy Report for the Renewable Natural Resources Sector, Overseas Development Administration (UK), Uganda, March 1997. Vetwork UK, Edinburgh (1997)
- Catley, A: Methods on the Move: a review of veterinary uses of participatory approaches and methods focussing on experiences in dryland Africa. International Institute for Environment and Development, London. (1999)
- Catley, A: The use of participatory appraisal by veterinarians in Africa. *Office International des Epizooties Scientific and Technical Review*, 19 (3): 702-714 (2000).
- Catley, A. and Mariner, J.C: Participatory epidemiology: Lessons learnt and future directions. Proc. of a workshop held in Addis Ababa, Ethiopia, November 15-17<sup>th</sup> 2001 (2001).
- Catley, A. and Mariner, J.C: Where there is no data: Participatory approaches to veterinary epidemiology in the pastoral areas of the Horn of Africa. International Institute for Environment and Development, Drylands. Program issue paper no. 110 (2002)
- Catley, A; Irungu, P; Simiyu, K; Dadye, J. Mwakio, W; Kiragu J. and Nyamwaro, S.O: Participatory investigations of bovine trypanosomiasis in Tana River District, Kenya. *J. of Med. and Vet. Entomol.*, 16: 1-12 (2002).
- Green, LW; George, M.A; Daniel, M; Frankish CJ; Herbert C.J. and Bowie, W.R: Study of participatory research in health promotion. Ottawa: The Royal Society of Canada; (1994)
- GTZ, Deutsche Gesellschaft fur Technische



- Zusammenarbeit. GIZ Information notes. GIZ, Eshborn, Germany. [www.giz.org](http://www.giz.org) (2003). Accessed 25/7/2005.
- Hadrill, D; Catley, A. and Iles, K: Getting started. In: Community-based animal healthcare: A practical guide to improving primary veterinary services. ITDG Publications, London. <http://www.itdgpublishing.org.uk> (2002).
- Herrar, A. and Christensen, H.A: Implications of Phlebotomus sand flies as vectors of bartonellosis and leishmaniasis as early as 1764. *Science* 190: 154-155 (1975).
- International Institute for Environment and Development (IIED): Rapid Rural Appraisal RRA. Issue No. 20. Special Issue on Livestock. IIED, London, 1-35 (1994).
- Leyland, T: The case for a community-based approach with reference to Southern Sudan. In: The world without Rinderpest. *FAO Animal Health and Production Paper* 129, 109-120. (1996).
- Mariner, J.C: The World without Rinderpest: Outreach to marginalize communities. In: The World without Rinderpest. *FAO Animal Health and Production Paper* 129, 97-107. (1996)
- Mariner, J.C: Manual on participatory epidemiology-method for the collection of action-oriented epidemiological intelligence. *FAO Animal Health Manual No.10*. Food and Agriculture Organization, Rome. 81p. (2000).
- Mariner, J.C; Catley, A; Akabwai, D; Jones, B. and Leyland, T.J: Participatory epidemiology: setting the scene. In: Catley, A. and Mariner, J.C. (eds). Participatory epidemiology: lessons learned and future direction. Proc. of a workshop held in Addis Ababa, Ethiopia. Nov. 15th -17th (2001).
- Mariner, J.C. and Flanagan, F: Epidemiological intelligence on the prevalence of Rinderpest in North-Eastern Kenya and Somalia. FAO, Rome (1996).
- Network of Community-Oriented Educational Institutes for Health Sciences: Membership List, Network Secretariat, P.O. Box 616, 6200MD, Maastricht, The Netherlands (1997).
- Oyediran, A.H.O. and Breiger, W.R. (Eds.): 25 years of the Ibarapa Community Health Programme. Department of Preventive and Social Medicine, University of Ibadan, Ibadan, (1989).
- Participatory Epidemiology website <http://www.participatoryepidemiology.info/index.html>. Maintained by Vetwork UK. Accessed 25<sup>th</sup> July 2005.
- Participatory epidemiology website: <http://www.participatoryepidemiology.info/PEUsesCAHWS.html> 2005. Maintained by Vetwork UK. Accessed 25<sup>th</sup> July 2005.
- Participatory epidemiology website: <http://www.participatoryepidemiology.info/PEUsesImpact.html>. 2005. Maintained by Vetwork UK. Accessed 25<sup>th</sup> July 2005.
- Participatory epidemiology website: <http://www.participatoryepidemiology.info/PEUsesResearch.html>. 2005. Maintained by Vetwork UK. Accessed 25<sup>th</sup> July 2005.
- Plowright, W: Professional Commitment to the success of the global rinderpest eradication campaign. Technical Consultation on the Global Eradication Campaign, FAO Rome. 28-30<sup>th</sup> September (1998).
- Schwabe, C. W: Veterinary Medicine and Human Health. (Williams and Wilkins, Baltimore 680p, 1984)
- Sones, K. R. and Catley, A. (Eds): Primary animal healthcare in the 21st Century: Shaping the rules, policies and institutions. Proceedings of an international conference held in Mombassa, Kenya, 15-18 October 2002. African Union/InterAfrican Bureau for Animal Resources, Nairobi, Kenya. P 9 -10. (2003).
- VetWork website, Edinburgh UK <http://www.vetwork.org.uk/>. Accessed 25/7/2005.
- Wanyama, J.B: Confidently used ethnoveterinary knowledge among pastoralists of Samburu, Kenya. Book 1. Methodology for results. Intermediate Technology, Nairobi, Kenya pp. 25-31 (1997).