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Food
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Organisation
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l'alimentation
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Продовольственная и
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организация
Объединенных
Наций

Organización
de las
Naciones
Unidas
para la
Agricultura
y la
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DRAFT GUIDELINES ON SURVEYING AND MONITORING OF ANIMAL GENETIC RESOURCES

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1 INTRODUCTION

Knowledge of animal genetic resources for food and agriculture (AnGR) is fundamental to the sustainable use, development and conservation of these resources. Yet such knowledge is often unavailable to those who need it, whether livestock keepers or other stakeholders whose decisions affect AnGR management. The continuous evolution of livestock production systems means that knowledge needs to be updated regularly so that management can be adapted to changing circumstances. There is an urgent need for systematic and well-organized action to collect, process and disseminate AnGR-related data (Box 1).

Box 1. The case for action

- For about 36 percent of the breeds¹ recorded in the Global Databank for Animal Genetic Resources,² no data are available on the size and structure of the population.
- The inventory of the world's breeds is incomplete – when surveys have been conducted they have revealed previously unrecorded breeds.
- Few local breeds have been comprehensively characterized – meaning that many valuable traits probably remain unknown or undocumented.
- Few studies have effectively compared breed performances taking into account the production environments in which the animals are kept and the full range of products and services that they provide.
- Among breeds whose population size and structure are recorded, more than 30 percent are categorized as being at risk of extinction. They may be lost before their characteristics are fully studied and recorded.
- The geographical distribution of most breeds is poorly documented, hampering effective management: for example, in the event of disease epidemics or other disasters.
- The world's livestock production systems are being transformed at an unprecedented rate – posing an enormous challenge to the sustainable management of AnGR.
- Global climate change is likely both to threaten AnGR diversity and to increase its importance as an asset with which to adapt livestock production to changing conditions.

The *Global Plan of Action for Animal Genetic Resources*, adopted as the first internationally agreed framework for the management of AnGR by 109 countries at Interlaken, Switzerland, in 2007, and subsequently endorsed by all FAO members (191 countries and the European Community) notes that:

¹ Breeds are here defined as follows: “either a subspecific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within the same species or a group for which geographical and/or cultural separation from phenotypically similar groups has led to acceptance of its separate identity” (FAO, 1999).

² The backbone of the Domestic Animal Diversity Information System (DAD-IS – <http://www.fao.org/dad-is>).

“Understanding the diversity, distribution, basic characteristics, comparative performance and the current status of each country’s animal genetic resources is essential for their efficient and sustainable use, development and conservation. Complete national inventories, supported by periodic monitoring of trends and associated risks, are a basic requirement for the effective management of animal genetic resources. Without such information, some breed populations and unique characteristics they contain may decline significantly, or be lost, before their value is recognized and measures taken to conserve them” (FAO, 2007a).

The Convention on Biological Diversity (CBD) calls on countries to identify and monitor their biodiversity, including agricultural biodiversity. It recognizes that these activities are fundamental to the conservation and sustainable use of genetic resources. It calls, in addition, for the identification and monitoring of factors that threaten or are likely to threaten biodiversity.³

Why survey and monitor animal genetic resources?

The need for surveying and monitoring is well expressed in the phrase “you can’t manage what you don’t measure” – with effective management of AnGR being needed to achieve development objectives (food and livelihood security, sustainable utilization of natural resources, etc.) and to deal with the ever-evolving relationships between livestock, human communities and production environments. The following subsections outline some of the main benefits of introducing or strengthening surveying and monitoring activities.

Enhance knowledge of population size and structure and monitor trends. Comprehensive breed inventories and data on the size and structure of breed populations are prerequisites for effective management of AnGR, particularly to identify breeds that are at risk of extinction. Baseline data and regular monitoring of breed populations are thus essential. The country-based early warning and response systems called for by the *Global Plan of Action for Animal Genetic Resources* will rely on the outputs of national surveying and monitoring strategies (FAO, 2009b).

Enhance knowledge of breeds’ geographical distribution. Breeds that are very restricted in their distribution are likely to be particularly vulnerable to some threats (e.g. disease epidemics). If such breeds are identified, steps can be taken to address these vulnerabilities. Therefore, breed distributions need to be mapped and then monitored over time.

Enhance knowledge of breeds’ characteristics. Knowledge of breeds’ characteristics is essential to their use and development. Many local breeds have traits that make them well adapted to harsh production conditions. They may also provide unique products that are not yet utilized or marketed to their full potential. If breeds are not characterized, opportunities to use and develop them to improve livestock production may be overlooked. Surveys are thus needed to explore and document breeds and their uses in their production environments. In many countries, performance recording systems have not been established for most local breeds. Where this is the case, surveys are an important way to improve knowledge of the breeds’ performance.⁴

Enhance knowledge of cross-border genetic linkages: Because of cross-border exchanges of genetic material a national breed population may be part of a common gene pool whose range extends beyond national boundaries. In other words it is appropriate to consider the national population to be part of a transboundary breed. Establishing whether or not this is the case may be important for cross-border cooperation in managing the population. Identifying national

³ Article 7 of the Convention on Biological Diversity (available at <http://www.cbd.int/convention/articles.shtml?a=cbd-07>).

⁴ Methods for phenotypic and molecular characterization are described in more detail in the respective draft guidelines in this series (FAO, 2010c; FAO, 2010d).

populations that should be linked at transboundary level is also important for regional and global assessments of AnGR diversity. Surveys conducted in areas close to international borders are an opportunity to investigate cross-border exchanges.

Enhance knowledge of breeds' production environments. Comparisons of breed performance are only useful if they take into account the production environments in which the animals are kept. Collecting data on the inputs used in animal production as well as the outputs obtained allows a more realistic assessment of productivity. Additionally, recording the production environment in which a breed has been kept over time, and to which it has probably become adapted, is an indirect method of characterizing the adaptations of the breed itself. Effectively matching breeds to production environments is an important means of avoiding the costly mistakes that may occur when breeds are introduced to new areas.

Document cultural aspects of livestock production and breed utilization. Indigenous breeds often play key roles in cultures, religions, traditions and social practices. Understanding these roles is important in the planning and implementation of interventions aimed at promoting better use and development of AnGR at community level. Knowledge of the social context may also be important for understanding the distinctiveness of particular livestock populations. Surveys are a means to record the social and cultural aspects of livestock keeping and how these change.

Document indigenous knowledge. Livestock keepers who have maintained and developed their local breeds over many generations have usually also accumulated a wealth of knowledge on the breeds and their production environments. Understanding the roles and significance of indigenous knowledge is part and parcel of planning effective AnGR management interventions. Indigenous knowledge is often under threat. Where this is the case, it is particularly important that it is documented.

Identify and monitor threats to animal genetic resources. Threats to AnGR are many and diverse. Ensuring that action is taken to protect breeds from extinction requires that these threats be identified. If particular threats are becoming more significant, these trends need to be recognized as soon as possible.

Support strategic planning for the sustainable utilization of animal genetic resources. Without good knowledge of AnGR, decision-makers at national level and in the breeding industry will be unable to develop strategic plans for sustainable use and development. Knowledge of all the breeds that might be drawn upon, and of the production environments in which the animals can be kept, is needed in order to develop or strengthen animal breeding programmes (FAO, 2010a). The information gained from monitoring through repeated surveys is important for identifying trends that need to be addressed in future plans, and provides a basis for assessing progress in the implementation of existing plans and policies.

Improve livelihoods. Information on livestock, their production systems and the livelihoods of their keepers is central to the formulation of development objectives and strategies that support better livelihoods for livestock keepers and the wider community. This information can be used to:

- improve decision-makers' understanding of the links between livestock keeping and social and economic wellbeing;
- shape strategies that better integrate genetic improvement, nutrition, animal health, marketing and other aspects of livestock management;
- ensure that development strategies are acceptable to livestock keepers; and
- raise awareness of the characteristics of local breeds and their products, including any potential for developing special products targeted at niche markets.

Improve priority setting for conservation programmes. The limited availability of resources for conservation programmes to protect breeds that are at risk means that priority setting is necessary. Decisions as to which breeds to target for conservation require up-to-date information on the risk status of all the breeds under consideration and on any unique characteristics that the breeds may possess.

Raise public awareness. Survey outputs such as descriptions of breeds with particularly interesting characteristics or photographs of animals in their production environments, are likely to be useful in the preparation of publicity materials that can promote understanding of the importance of AnGR among decision-makers and the general public. It has also been proposed that regular “red lists” of at-risk breeds should be produced (FAO, 2009a).

Meet international obligations for reporting on the status of animal genetic resources. Within the framework of the CBD, countries are obliged to report on the status of their national biodiversity. In the case of AnGR, the primary route for reporting on the state of diversity is to FAO, via the Domestic Animal Diversity Information System (DAD-IS). The Commission on Genetic Resources for Food and Agriculture (CGRFA) has agreed that FAO should prepare status and trends reports every two years based on data entered by countries into DAD-IS (FAO, 2009a). It has also been agreed that countries should report on their progress in the implementation of the *Global Plan of Action for Animal Genetic Resources* every four years by submitting country reports to FAO (FAO, 2009a). Well-planned surveying and monitoring programmes will help countries obtain the data they need to meet these various reporting obligations.

Scope of the guidelines

These guidelines describe approaches and methods for the collection, management, analysis and dissemination of AnGR-related data. The aim is not only to provide advice on technical and operational matters, but also to help countries consider how surveying and monitoring efforts (see Box 2 for definitions) can be tailored to their specific needs and circumstances, and integrated with wider data-gathering activities and other aspects of AnGR management. A number of surveying “tools” are introduced, including both sample-based surveys and less formal techniques. However, the focus is on planning and operational issues. Technical matters are described only in sufficient detail to ensure that the methods chosen are appropriate to the purposes of the surveys in which they are used. The guidelines do not provide detailed information on how to conduct censuses: i.e. surveys in which the objective is to enumerate all livestock alive at a given time. Further advice on censuses can be found in FAO (2005a).

Box 2. Definitions – surveys, monitoring and censuses

Survey: a systematic exercise in data collection, processing and dissemination.

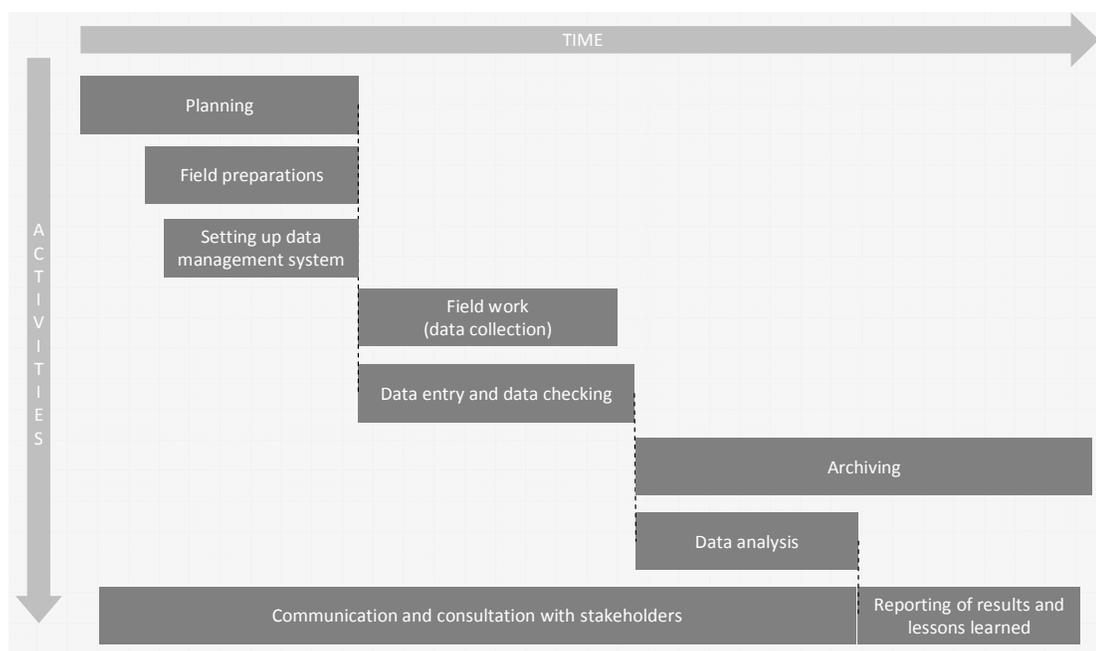
Monitoring of animal genetic resources: a systematic set of activities undertaken to document changes over time in the size, structure, characteristics and distribution of livestock populations, along with changes to their production environments (including their management). In these guidelines, monitoring is considered to be a sequence of surveys, which can be referred to as “monitoring surveys”.

Census: an exercise in the collection, processing and dissemination of data that involves the enumeration of *all* units (e.g. livestock-keeping households) in the area targeted. Large sample-based exercises are sometimes also referred to as “censuses”. Most countries undertake regular agricultural censuses once every ten years (FAO, 2005a). Countries may also undertake specific livestock censuses, but to date most have not collected data that are differentiated by breed.

The guidelines suggest that countries’ AnGR-related data requirements can best be met through the development of “national surveying and monitoring strategies” and provide advice on how to develop such strategies. Surveying and monitoring strategies will comprise a number of

individual surveys. The guidelines describe the various tasks involved in planning and implementing such individual surveys (Figure 1).

Figure 1. Summary of the main activities involved in planning and implementing a survey



Links to other guideline publications

It is important to recall that these guidelines are part of a set of AnGR-related guidelines (either published or in preparation). While each of these publications addresses a different aspect of AnGR management, they should be utilized in conjunction.⁵ The guidelines on surveying and monitoring fall within Strategic Priority Area 1 of the *Global Plan of Action for Animal Genetic Resources*, which is also being addressed by two other guideline publications: one focusing on phenotypic characterization and the other on molecular characterization. The guidelines on phenotypic characterization describe how to conduct a study on a specific animal population and its production environment – including details of what to measure, how to take these measurements and how to interpret them. The guidelines on molecular characterization provide advice how to obtain and use DNA samples to support the management of AnGR. The guidelines on surveying and monitoring present the “big picture” – describing how to plan a national strategy for obtaining AnGR-related data and keeping them up to date, introducing the various types of survey that may make up such a strategy, and outlining the main steps involved in planning and implementing a survey. Despite the differing focus, there will inevitably be some overlap in the subject matter of the three publications.

Another link to consider is that the outputs of surveying and monitoring activities may be vital inputs for planning breeding and conservation strategies. Details of the planning processes for conservation and breeding strategies (FAO, 2010a) are covered in the relevant guideline publications. However, the country’s overall data requirements for AnGR management –

⁵ Once endorsed by the CGRFA, all the guideline publications will be made available in the library of the Domestic Animal Diversity Information System (DAD-IS – <http://www.fao.org/dad-is>) and on the web site of FAO’s Animal Production and Health Division (<http://www.fao.org/ag/againfo/programmes/en/A5.html>).

including breeding and conservation – need to be considered when setting objectives and priorities for surveying and monitoring.

An enabling policy framework – including an effective National Strategy and Action Plan for AnGR – is one of the keys to successful surveying and monitoring. Note the symbiosis in this relationship: effective planning can only be achieved with the knowledge provided by surveys. The links between surveying strategies and national planning are highlighted in these guidelines, but the reader should, again, consult the relevant guideline publication (FAO, 2009c) for further information. Advice on developing the institutional framework for AnGR – another prerequisite for effective surveying and monitoring – is discussed in another guideline publication (FAO, 2010b).

Baseline surveys and monitoring surveys

These guidelines address both the task of obtaining a “baseline” of data on a given livestock population and the subsequent task of “monitoring” this population over time. The baseline provides a reference point for the monitoring. The precise nature and scope of baseline surveying will depend on the state of existing knowledge, the needs and circumstances of the country and production system(s) in question, and the resources available. In some circumstances it may be appropriate to think in terms of a single “baseline survey”. In others, baseline data may have to be built-up through a series of surveys.

If the target population is already distinguished into recognized breeds whose characteristics have been thoroughly studied, the focus is likely to be on establishing the current size and structure of the populations of the various breeds in the population, supplemented as necessary by other data needed to complement existing knowledge (e.g. on the breeds’ production environments, uses and management, cultural and ecological significance, or on threats to their survival). Indeed, for some breeds and production environments, baseline data may to a large extent already be available, in which case the main task is to monitor changes.

The other extreme is a situation in which the target population consists largely of animals that are not assigned to recognized breeds and whose characteristics are largely unknown outside the local area. In such a situation, breedwise population counts and breedwise characterization of phenotypes and production environments will only be possible if steps are first taken to group the animals in the targeted population into breeds and/or defined subpopulations of other kinds (e.g. populations recognized as consisting of multiple crosses of known breeds).

While it is possible to undertake a single survey in which a previously undocumented population is characterized and assigned to defined breeds, the geographical distributions of these breeds are mapped, and their population size and structure recorded – and it is generally more cost effective to collect the various different kinds of data in one rather than several visits to the field – the reality may be that a number of surveys are needed. These activities may include phenotypic characterization studies that focus on describing the animals and production environments within a given area (see the guidelines on phenotypic characterization: FAO, 2010c) but may not allow accurate estimates of the population sizes or the full extent of the geographical distributions of the respective breeds to be obtained. Other surveys may focus on documenting the geographical distribution of known breeds, but contribute little additional information on their phenotypes, production environments or uses (see descriptions of mapping expeditions and aerial surveys in Section 2). However, it is advisable that at some point a baseline of population data be established via a formal (sample-based) household survey (Section 2). Such household surveys may be preceded by “rapid appraisal” surveys (Section 2) that help provide the background information needed to design an effective sample-based survey.

The process of grouping animals into breeds may be addressed by recording their phenotypic characteristics and using statistical techniques to assign them into relatively homogenous groups

(details are provided in the guidelines on phenotypic characterization: FAO, 2010c). This may be complemented by the use of molecular characterization (details are provided in the guidelines on molecular characterization: FAO, 2010d). Moreover, collecting and analysing data on breeding management practices and cultural aspects of livestock keeping may also make an important contribution to determining whether particular populations merit being distinguished as separate breeds (FAO, 2010c; LPPS and Köher-Rollefson, 2005). In approaching the problem it is necessary to recognize that there is no universally accepted definition of the term “breed”.⁶ From an operational perspective, it is as mentioned above generally more efficient to measure the animals, collect molecular samples and speak to the livestock keepers in a single visit than to go back three separate times to the same area.

The primary objective of monitoring surveys will often be to record trends in population size, but monitoring may involve identifying trends in any or all the items covered in a baseline survey. Documenting changes in the nature and intensity of the threats affecting livestock populations is an important aspect of monitoring as envisaged within the framework of the *Global Plan of Action for Animal Genetic Resources*. For example, monitoring activities should record not only the size of a livestock (breed) population but also identify whether widespread cross-breeding with introduced breeds occurs. In these guidelines, monitoring is considered to consist of a sequence of surveys, which can be referred to as “monitoring surveys” (Box 2).

Monitoring surveys should be repeated regularly over time. The appropriate schedule for such surveys will depend on the generation interval of the species concerned and the rate at which changes are likely to be occurring in the relevant production systems (see Section 3 for further discussion). A baseline household survey is an opportunity to develop, test, calibrate (Section 2) and document specific “rapid appraisal” techniques or other tools for use in subsequent monitoring surveys.

Species coverage

The terms “livestock” and “animal genetic resources for food and agriculture” (abbreviated to “AnGR”) refer in these guidelines to avian and mammalian species that are used, or are potentially of use, for agriculture and food production. Farmed animals belonging to other classes (e.g. fish) and phyla (e.g. bees, shrimps) are excluded because of the different challenges involved in their management, as are wild animals. This, of course, does not imply that countries should not carry out surveying and monitoring of these other types of animals (surveying and monitoring is an integral part of countries’ obligations under the Convention on Biological Diversity) and some of the material presented in these guidelines may be useful in planning such activities. While the guidelines do not provide advice on how to conduct surveys of wild animals, it should be noted that many countries are home to populations of wild relatives of domestic species. During the planning of national surveying and monitoring strategies for AnGR, it may be appropriate to consider whether wild relatives are being adequately monitored and to highlight improvements that could be made in this field or, if feasible and particularly if potential synergies can be identified, include such species within the scope of the strategy.

Target audience

The primary target audience for the guidelines are decision-makers who are interested in initiating a process, or improving an ongoing process, that enhances the availability and utilization of data on their countries’ AnGR. As described above, it is suggested that this be done through the

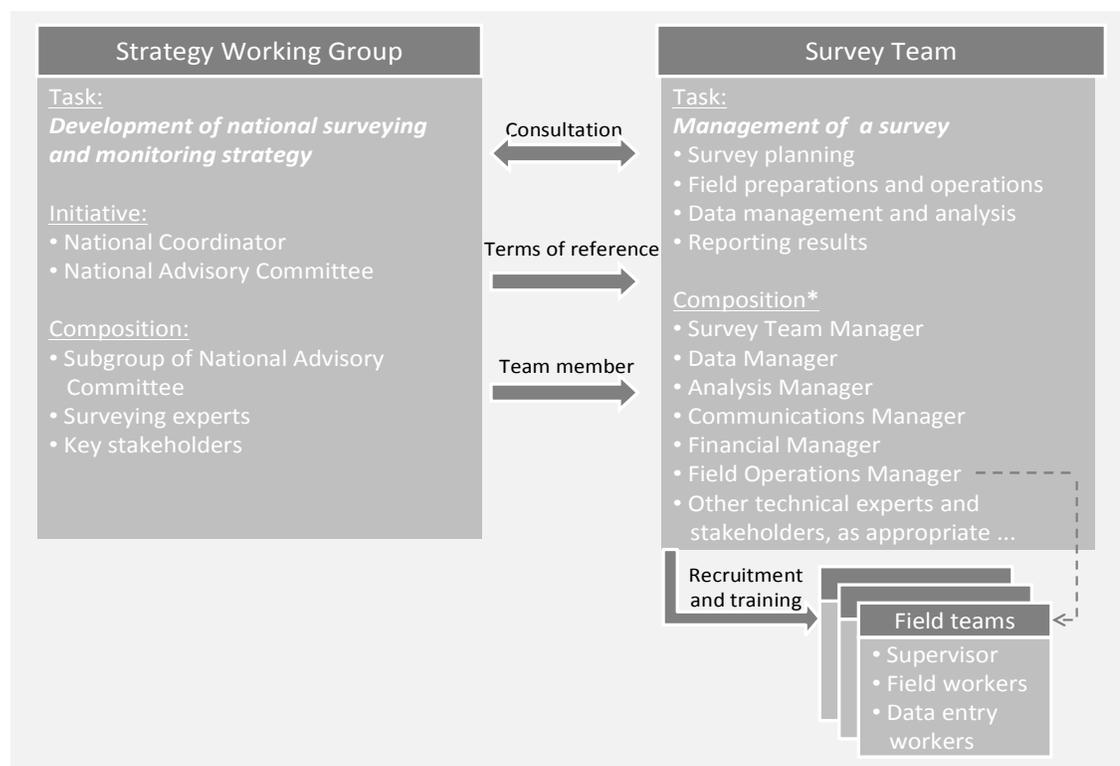
⁶ FAO uses the following definition of the term “breed”: “either a subspecific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within the same species or a group for which geographical and/or cultural separation from phenotypically similar groups has led to acceptance of its separate identity”.

development of national surveying and monitoring strategies, and that working groups – referred to throughout the guidelines as “Strategy Working Groups” – be established to take responsibility for developing the strategies and overseeing their implementation. The guidelines aim to provide the members of such working groups with advice and relevant background information.

The guidelines are also intended to be of practical use to everyone who plays an active part in planning and implementing individual AnGR surveys. It is envisaged that the surveys that make up a national strategy will be organized by “Survey Teams”. Within the Survey Teams, it is important that responsibilities for planning and supervising specific elements of the survey process be clearly allocated. The individuals responsible for these various elements are referred to in the guidelines as the “Communications Manager”, “Field Operations Manager”, “Data Manager” and so on. In large-scale surveys the field work may be undertaken by “field teams” made up of “field workers” and “supervisors”, who may not play a role in planning the survey but need to be familiar with its objectives and all the procedures involved. The relationships among these various groups, teams and individuals are summarized in Figure 2.

The material presented in the guidelines may also help the wider AnGR stakeholder community to understand and evaluate the planning and implementation of surveying and monitoring strategies.

Figure 2. Overview of suggested roles and responsibilities in the development and implementation of a surveying and monitoring strategy



**Depending on the size of the Survey Team, an individual person may take on more than one role. However, it is advisable that no role be shared.*

Structure of the guidelines and advice for users

Section 2 of the guidelines sets out the range of tools that can be drawn upon as part of a surveying and monitoring strategy. The material is intended primarily as reference material for those involved in the process of planning such a strategy or in organizing individual surveys. The focus of Sections 3 to 10 moves from policy matters, through planning, to more operational and technical levels, and then back to policy. Most of the sections are subdivided into a number of steps, which are intended to guide users more or less sequentially through the activities required at each stage of the planning and implementation process.

Section 3 is devoted to planning a national surveying and monitoring strategy. In Section 4, the attention shifts from national strategies to planning individual surveys. The steps within Section 4 guide the user through the planning process. However, Section 4 should be read in conjunction with Sections 5 to 9, as these sections describe the various phases of work that need to be addressed during the planning. Sections 5 and 6 focus on field work. The former describes preparations for the field and the latter provides practical advice on the day-to-day field operations. Sections 7 and 8, respectively, focus on data management and data analysis. Section 9 provides advice on reporting and communicating the results of surveying activities. Section 10 discusses potential first steps in the process of translating the results of the survey into action.

Table 1 shows how the focus of the guidelines shifts from material of general interest, through material particularly relevant to Strategy Working Groups to material that is particularly relevant to Survey Teams and then back to issues of more general interest. Readers may wish to dip selectively into the more operational and technical sections of the guidelines. However, it is important that everyone involved in planning and implementing a survey be familiar with all the main elements of the surveying process and how these relate to the overall objectives. Similarly, those involved in strategic planning need to be aware of the practicalities of the various surveying options. It is therefore advisable that all members of Survey Teams and Strategy Working Groups read through the guidelines in their entirety.

Table 1. Key sections of the guidelines for Strategy Working Groups and Survey Teams

Section of the guidelines	Strategy Working Group	Survey Team
1 Introduction	•	•
2 Tools for surveying and monitoring: the basics	•	•
3 Developing an national surveying and monitoring strategy	•	
4 Planning a survey		•
5 Preparing for the field		•
6 Working in the field		•
7 Data management		•
8 Data analysis		•
9 Reporting and communicating results		•
10 Translating results into action	•	•

Dots indicate the sections that are most relevant to the respective group/team.

2 TOOLS FOR SURVEYING: THE BASICS

- Match tools to survey objectives
- Mix tools – take advantage of complementarities
- Calibrate tools against each other to maintain continuity in outputs

Formulating a surveying and monitoring strategy for AnGR or organizing an individual survey requires familiarity with the range of approaches and methods that can be drawn upon to answer AnGR-related questions. The purpose of this section is to introduce these “tools”, presenting an overview of the options that they provide, including their strengths and their weaknesses. The scope is broad: the term “survey” is used in these guidelines to refer to any structured activities used to obtain data and information on AnGR, their production environments, uses, management and the threats affecting them. The tools described below include both quantitative methods (e.g. household surveys based on random samples and structured questionnaires) and a range of less formal methods. Developing a cost-effective surveying and monitoring strategy requires decisions regarding which tools to use and how they can best be combined. Consideration should be given to how data needs will change as the implementation of the surveying and monitoring strategy progresses from baseline surveying to monitoring.

Some of the tools described below will not be relevant in all countries. However, it is important to keep an open mind as to what tools might be useful. Opportunities can easily be missed if preconceived ideas are not put aside. While circumstances differ greatly, there will generally be some common features in the challenges that countries have to address as they choose the tools that make up their surveying and monitoring strategies: the need for sampling methods that allow sound inferences to be drawn regarding the population as a whole; the need for effective communication with the holders of AnGR-related knowledge; the need to balance the desire for accuracy and precision in data collection against the costs; the need to account for gaps and potential biases in the information provided by particular stakeholders or stakeholder groups; the need to combine different methods to make the most of the particular strengths of each; the need for continuity over time as surveying methods change; and so on.

In reading this section (and the guidelines as a whole) it is important to be aware that collecting data on AnGR does not, in itself, provide a basis for sustainable and equitable management of a country’s AnGR. These guidelines focus on obtaining the data needed for effective AnGR-related decision-making at national level and for improving knowledge of AnGR among the various stakeholders whose decisions may affect their management. The tools presented below are “data-collection” tools that can be used to meet these objectives. However, it must be emphasized that if livestock keepers and livestock-keeping communities are regarded merely as sources from which data and information are extracted, the most important players in AnGR management will be excluded from decisions that affect their lives and the future of the country’s livestock diversity. Fully addressing this broader policy and management context is beyond the scope of these guidelines. Box 11 presents a short discussion of “participatory surveying and monitoring” and Sections 3 and 4 include advice on the inclusion of livestock keepers and their representatives in the planning surveying and monitoring strategies and of individual surveys. Legal and ethical issues related to the collection and use of survey data are discussed at the relevant points in the guidelines.

The tool box

Groups of surveying and monitoring tools are introduced under the following ten headings:

- 1 Mapping expeditions
- 2 Breed search tours

- 3 Transects
- 4 Aerial surveys
- 5 Household surveys
- 6 Rapid appraisals – an overview
- 7 Group interviews and exercises
- 8 Key informants
- 9 Breed societies
- 10 Censuses

This list should not be regarded as a rigid classification – some of the groups overlap. It is also important to be aware that surveys or surveying strategies will often need to combine tools sequentially or concurrently. There may also be opportunities to merge tools, by transferring attitudes and specific techniques into new contexts (Marsland *et al.*, 2001). Boxes 3 and 11 describe cross-cutting issues that are potentially relevant to many of the tools described below.

Box 3 Collaboration with other sectors – piggyback surveys and beyond

A piggyback survey is one that involves collecting AnGR-related data by building on, or “piggybacking”, an activity conducted primarily for a different purpose. Opportunities to collect AnGR-related data may arise during animal disease surveillance work or other activities conducted by veterinary services, wildlife surveys, livestock subsector appraisals or livestock market studies (FAO, 2007b). Such surveys are most likely to be useful in collecting non-specialized data that do not require the individuals collecting the data to have detailed knowledge of animal breeding, genetics or breed characterization. However, there may be opportunities for innovative approaches, such as the use of veterinary surveillance activity to identify differences in disease resistance among breeds.

The term “piggyback” implies that the AnGR-related data collection is a secondary, or subordinate, objective of the survey. If an AnGR element is added to an established programme of activity, this is likely to be the case. However, it may also be possible to initiate new activities, conceived from the start as collaborative efforts, to which AnGR stakeholders comes as equal partners or in which they take the lead.

The strengths of piggyback or similar collaborative surveys include the cost savings that are potentially achievable through opportunistic and synergistic use of resources. The weaknesses include a potential lack of focus on AnGR; the potential difficulties involved in integrating opportunistic surveys into a coherent strategy; and the potential difficulties involved in managing a dataset that is to be used by different stakeholders for different purposes.

Mapping expeditions

The term “mapping expedition” can be used to describe a set of journeys carried out with limited contact with local communities for the purpose of obtaining rudimentary information on the AnGR within a region. If the relevant experience is available among the members of the Survey Team, GIS tools and knowledge of the links between landscape types and livestock production systems may help to focus the mapping expedition. Such a survey can be used to map the approximate geographical distribution of particular breeds and species, and may serve to frame subsequent surveys that will use other methods. However, the lack of contact with livestock keepers will result in very little acquisition of knowledge on production systems, livestock-keeping communities and uses of AnGR.

Box 4. Pros and cons of mapping expeditions – a summary

The advantages of mapping expeditions include:

- speed;
- low cost; and
- opportunities to obtain the data needed to design well-focused follow-up surveys.

The main disadvantage of mapping expeditions is that:

- only very rudimentary knowledge is obtained.

Breed search tours

A “breed search tour” is an expedition that sets out to find breeds that are not recorded in breed inventories. The expeditions may focus on a particular part of the country whose livestock populations have never been well documented by scientists and where it is suspected that there may be breeds that are unknown beyond the local area. Alternatively, the expedition may aim to identify whether a particular breed (or breeds) referred to in historical data or literature, but not included in current inventories, is still in existence in the areas where it was once found. The “tour” involves visiting the target areas armed with as much information as possible on the target breeds or populations, observing the local animals, and speaking to local livestock keepers and other knowledgeable people. If what appears to be an undocumented breed or a surviving population of an “old” breed comes to light, the characteristics of the animals, their breeding management and other aspects of their production environments should be recorded as thoroughly as possible. As it will not be known in advance how many, if any, breeds will be found, it is difficult to plan how much time will be needed for recording activities. Therefore, it may be necessary for the initial search tour to be followed up by further visits that allow more complete descriptions of the populations to be obtained, to determine whether they are fact distinct breeds and, if necessary, to map their distributions more accurately.

Box 5. Pros and cons of breed search tours – a summary

The advantages of breed search tours include:

- opportunities to fill gaps in breed inventories and identify breeds for more detailed characterization studies (see complementary guidelines FAO, 2010c and FAO, 2010d);
- the attention paid to sources of historical information;
- speed; and
- low cost.

The disadvantages of breed search tours include:

- the possibility that no breeds will be found; and
- possible lack of sufficient time to document breeds fully.

Transects

In some locations it may be possible to estimate the numbers of and types of animals present by using transect methods, similar to those that have been developed for surveying wildlife. The approach involves drawing transects *a priori* across the area targeted by the survey and then travelling along them. Counts of the animals observed along the transect are taken, and complex statistical methods are then used to estimate numbers of animals in the area as a whole. Examples from the wildlife sector include Peres (1999), Andriolo *et al.* (2005) and Ogutu *et al.* (2006).

The course and direction of transects may depend on the nature of the questions that the survey is seeking to answer: for example, if the question being asked is “does the popularity of Breed A relative to Breed B depend on a cline⁷ in the production environment?” then the survey is informative if the transect runs in the direction of the cline, not perpendicular to it. Note that if the observations are made over an extended period of time, it may be necessary to mark a sample of animals along each transect so that the degree of double counting can be estimated. The observations made along the transects might be extended to include quantitative measurement of threats or indicators of threats (e.g. degradation of grazing land). Following a transect may involve little contact with local communities, but it may provide an opportunity to identify communities that can be targeted by follow-up surveying activities using other methods.

Transect methods can only work quantitatively if the trajectories travelled along are representative of a wider area whose dimensions have been measured. Thus, meaningful outputs may only be obtainable in a small minority of production systems, such as those in which a uniform environment extends over a wide area (e.g. plains or bushland) or those that are “one-dimensional” (e.g. those that are only found on river banks – in which case the transect can follow the river). It is more usual for livestock to be found in clusters associated with human settlements or particular geographical features (e.g. watering holes). In such cases, to ensure representative sampling, it is more appropriate to sample the clusters in a manner analogous to the household sampling described below. Also note that opportunities to use transect methods to explore relationships between breed distribution and aspects of the production environment are, similarly, limited to particular circumstances (where transects can be matched to clines) and that such an approach requires careful planning if the risk of producing misleading results is to be avoided.

Box 6. Pros and cons of transect methods – a summary

The advantages of transect methods include:

- speed;
- low cost; and
- providing opportunities to estimate population sizes.

The disadvantages of transect methods include:

- providing little information on production systems, the associated communities and the causes behind the outcomes observed;
- limited applicability in the majority of production systems;
- the challenge of identifying representative transects and interpreting them quantitatively; and
- lack of experience in their use to survey livestock.

Aerial surveys

Aerial surveys can be thought of as airborne mapping expeditions and transects. As such, they suffer from a lack of contact with local livestock keepers and the animals themselves (indeed this disadvantage is magnified in aerial surveys). Aerial surveys can be relatively expensive because of the need for costly material resources (equipment, including air transport and cameras) and highly skilled personnel. They are appropriate only for sparsely populated and open landscapes, such as those of sub-Saharan Africa, Central Asia and parts of South America. Despite these limitations, poor accessibility, the unpredictable movements of pastoralists’ herds and security uncertainties may justify considering the use of low-level aerial surveys as a means to estimate the size and structure of livestock populations and their spatial and seasonal distribution. In some areas, such surveys may be the only realistic option for achieving systematic coverage and obtaining the data needed for comprehensive statistical analysis. Aerial surveys alone may not be

⁷ A gradual sequential change over space in some aspect of the production environment.

sufficient to identify livestock populations by breed. However, they may be an important component of a surveying strategy in which other, complementary, methods are used. Descriptions of the use of aerial surveys to survey livestock can be found in Marriott and Wint (1985) and Bourn *et al.* (1994). Further examples (involving wild and feral animals) are provided by Bayliss and Yeomans (1989) and Andriolo *et al.* (2005)

Box 7. Pros and cons of aerial surveys – a summary

The advantages of aerial surveys (in areas where they are feasible) include:

- opportunities to cover large areas rapidly;
- opportunities to quantify the size of livestock populations; and
- the fact that they may provide a starting point for further surveying activities.

The disadvantages of aerial surveys include:

- limited usefulness unless backed up by the use of complementary surveying methods;
- the need for relatively expensive equipment and personnel;
- very limited opportunities to gain information on the production system, the associated livestock-keeping communities and the causes behind outcomes observed;
- poor results if the landscapes are not open; and
- lack of applicability for surveying animals that are animals kept indoors.

Box 8. Can imaging technology contribute to AnGR surveys?

Technology associated with satellite imaging and other image-capture technology has advanced considerably in recent years. This raises the question of whether it might contribute to surveying and monitoring of AnGR. An indication of the current state of the art can be obtained from maps.google.co.uk (and similar web sites) which provide satellite images that are detailed enough to show settlement structure, livestock holdings, even individual animals. It is also possible to capture high-quality 360° images using specialized cameras fitted to vans (see for example, “Street View” offered by Google). In some production environments, it might be feasible to use such technology to capture images that could be used to count animals along transects. It is difficult to anticipate how such technology may develop in the future in terms of coverage, capability and cost. However, a number of limitations would need to be overcome before imaging technology could be widely used for surveying AnGR, even if cost were not an issue.

- The satellite images currently available are not sufficiently clear to allow animals to be identified properly. While, for example, satellite images of the area surrounding Peebles in the United Kingdom show individual sheep grazing the hill pastures, it is only because of a priori knowledge of the animal husbandry of the area that it can be asserted these animals are sheep not goats, and it is impossible to tell which of the several breeds of sheep kept in the area any individual might be. Therefore, currently available images could only contribute to surveys carried out in areas where it is known in advance that all the animals within a given size category belong to a specific species and breed.
- Available images may have been captured on dates that are not appropriate for the purpose of the survey. Furthermore, images from neighbouring areas may have been captured on different dates, perhaps in different seasons. Any assessment based on such images would be very seriously biased.
- Extracting data manually from the captured images would be a very laborious task, and this would add to the cost. Automated processing would be both hugely challenging and prohibitively expensive at this stage of technological development.
- Monitoring programmes would require regular renewal of the images.
- Potential legal issues regarding the use of data obtained from such sources would have to be resolved.

In conclusion, it is possible that imaging technologies might play a limited role in the initial scoping of survey and monitoring strategies: complementing mapping expeditions, aerial surveys or transects in production systems where animals are not kept indoors or hidden by trees. Further applications will need considerable advances in technology.

Household surveys

A household survey involves collecting data from a random sample of households chosen from among all households meeting a specific set of criteria referred to as the “sampling frame”. The larger the sample as a fraction of the whole, the more accurate the survey will be as an estimator of the target group. Information is obtained via interviews, normally held face to face with household members. The interviews are commonly based on a questionnaire, which may be more or less structured depending on the objectives and circumstances of the particular survey.

If the sampling frame is designed appropriately, household surveys allow good control over bias and precision, making them an optimal choice for baseline surveys. Examples of AnGR-focused household surveys include those described by Ayalew and Rowlands (2004), Rowlands *et al.* (2003) and Zulu *et al.* (2003).

It is important to understand that designing a sample frame requires some basic prior knowledge of the production system being surveyed. The same is true for the design of a questionnaire. For example, if the survey is intended to provide estimates of absolute numbers of animals, then it is necessary to have a good estimate of the total number of households from which the sample of households to be surveyed is to be drawn. Therefore, a household survey may have to be preceded by the use of other, more exploratory, tools.

While in many circumstances households correspond closely to livestock holdings, this may not be the case everywhere. Examples might include corporate or institutional ownership, or joint ownership among a group of households (FAO, 2005). In some production systems, livestock-keeping households may be mobile or may split during parts of the year. Such factors have to be taken into account in the design of household surveys and of the surveying and monitoring strategies of which they form a part.

If a survey involves collecting data from all the livestock-keeping households in the area targeted rather than being based on sampling, it can in technical terms be described as a “census”. Few countries are likely to undertake large-scale censuses solely for the purpose of acquiring AnGR-related data. However, there may be possibilities to collect AnGR-related data as part of broader census activities (see below).

Box 9. Pros and cons of household surveys – a summary

The advantages of household surveys include

- opportunities to link the sampling frame(s) directly to the objectives of the survey;
- the fact that the data collected are often easier to quantify, standardize and pool than those obtained in other ways;
- the lack of bias that can be achieved if the survey is conducted properly;
- opportunities to determine the precision of the survey by choosing the appropriate sample size;
- opportunities (depending on how the interview is designed) to obtain a wide variety of both quantitative and qualitative information, including probing for the causes behind the outcomes reported by interviewees;
- opportunities to conduct detailed individual interviews with both male and female livestock keepers; and
- opportunities to probe more personal issues, such as income, if the interviews are conducted sensitively.

The disadvantages of household surveys include:

- the large amount of time needed; and
- the high cost.

Rapid appraisals – an overview

The term “rapid appraisal” is used here to describe data collection activities that involve interaction with livestock keepers and/or other knowledgeable stakeholders, but are not based on formal sample-based surveys. Rapid appraisals are normally field based, i.e. require visits to the communities targeted, and are multidisciplinary in nature (FAO, 1993). Field activities may be framed or complemented by the use of information drawn from secondary sources such as previous studies and reports, government statistics and records, maps of the area, research papers and historical texts (FAO, 2000). Triangulation – the use of several sources in order to validate the data obtained – is a key characteristic of the approach (Box 10). A range of rapid-appraisal tools are available and they can be selected and combined to meet the objectives of particular surveys or surveying strategies. This subsection presents an overview of rapid appraisals. The following two subsections provide more detailed descriptions of groups of tools that are often among the main elements of rapid appraisals – group interviews and exercises and of the use of key informants. These are followed by a subsection that focuses on obtaining information from breed societies, which can be considered a kind of rapid appraisal focusing on a specific group of key informants.

Box 10. Triangulation – an example

The significance of triangulation can be illustrated by considering the case of a rapid appraisal in which one of the objectives is to answer the question: “Is Breed A of increasing importance in the region?” An answer to the question might be obtained by organizing meetings of livestock keepers and asking them whether they are keeping more Breed A animals than they did in the past. Alternatively, it might be obtained by asking abattoir operators whether animals of Breed A are now being brought for slaughter more often than they used to be. Neither source may provide precise figures, but if both are consulted and both indicate similar trends, the findings can be considered more credible than if only one source is used.

Many rapid appraisal techniques were developed in the context of “rapid rural appraisal”, an approach that emerged during the 1980s in response to the limitations of formal surveys as means of obtaining data from rural communities in developing countries (Chambers, 1983; FAO, 1993). However, such approaches are also used in developed-country contexts: for example, to obtain information on how well (human) health and other services are serving the communities that they target (Ison, 2002; Rowa-Dewar, 2008). Rapid appraisals involve the use of techniques that are intended to allow local people to “teach” outsiders about their livelihoods, their problems and their knowledge (FAO, 1993). Such techniques were among the main antecedents and building blocks of the “participatory” approaches to development that gained popularity during the 1990s. The potential benefits of a participatory approach to surveying and monitoring – and some of the challenges involved – are discussed in Box 11.

Box 11. Participatory surveying and monitoring

Approaches to data collection vary in terms of the extent to which they involve the “participation” of the individuals and communities that provide the data: ranging from simply extracting information of a type and in a form determined by the surveyors; through methods that allow the perspectives of the surveyed to be taken on board; to collaborative methods that involve livestock keepers in the planning of surveys, monitoring strategies and the use of the data and information obtained. Adopting a more participatory approach can help to ensure that:

- the data collected are interpreted correctly by the surveyors;
- the social, cultural and agricultural significance of the data is understood;
- the outcomes of the survey and its follow-up activities provide benefits to those who have supplied the data; and
- support for the process is built up, which may facilitate subsequent surveys.

Realizing these positive outcomes will not be easy, particularly for a large-scale programme of surveys. It will require more than choosing techniques from a “participatory tool box”. The way the tools are adapted and combined to the specific needs and circumstances of each survey will be important, as will the behaviour and attitudes of the survey practitioners in the field. Moreover, the challenge of ensuring effective participation will only be met if it is addressed from the earliest phases of the planning process. It is vital that livestock keepers and/or their representatives are involved from the outset and that their involvement is not merely a formality or treated as an opportunity to persuade them to go along with predetermined objectives. They should be provided with realistic information regarding the intended uses of the survey data and the potential benefits for themselves and the wider community. Ultimately, it should be recalled that a surveying and monitoring strategy is only one element of AnGR management and livestock development and that outcomes will be influenced by the socio-economic and policy environment in which surveys and their follow-up activities take place. Unless these broader contexts are addressed, the benefits of attempting to instigate a participatory approach to surveying and monitoring may be limited.

Further information on participatory approaches can be found in the following publications: Chambers et al. (1989); Barahona and Levy (2002); Morton et al. (2002); Gonsalves et al. (2004) Conroy, (2005); Scoones and Thompson, (2009); and from the FAO Participation Web site (<http://www.fao.org/participation/>).

Rapid appraisals often involve obtaining information both from individuals and from groups. Particularly knowledgeable individuals – referred to as “key informants” (see below) – are often targeted. Rapid appraisal interviews are generally “semi-structured”. In other words, they are intended to be sufficiently flexible to allow the interests and concerns of the interviewees to be raised and explored while being sufficiently structured to ensure that the topics that are of interest to the surveyors are covered. A range of specific tools – mapping, seasonal calendars, ranking and scoring exercises, historical timelines, progeny history analysis, etc. – have been developed for use in the context of rapid and participatory appraisals. They are often intended for use by groups, but many can be adapted for use in individual interviews if required. Details of these individual techniques are not provided in these guidelines; further information can be found in Kirsopp-Read and Hinchcliffe (1994); FAO (2000); Conroy (2001); LDG (2003); Conroy (2005); Dorward *et al.* (2005); FAO (2005); LPPS and Köhler-Rollefson (2005) and via the FAO Participation Web site (<http://www.fao.org/participation/>).

There are several reasons why rapid appraisal methods are likely to be important to a surveying and monitoring strategy. One of these is that household surveys are major undertakings in terms of organization and resources and may not always be possible. It is unlikely to be possible to repeat such surveys with sufficient frequency to monitor rapidly changing aspects of AnGR and their management. Moreover, a survey that focuses exclusively at the household level and obtains information only from individual livestock keepers may not be a sufficient means to collect data on some important aspects of the production system – either because they require specialist knowledge (marketing opportunities, forthcoming policy changes or development initiatives, precise diagnosis of animal health problems, etc.) or because dealing with them in individual interviews would be too time consuming or too constrained by the need for structured data that are easy to analyse. Another point to consider is that if households are treated in isolation from each other, there is little or no opportunity for communities to develop a sense of collective ownership of the surveying process or to assert their views regarding the outcomes of the survey and the actions arising from them.

While in some circumstances rapid appraisals may stand on their own, it will often be appropriate to use them in association with a formal household survey. As described above, in order to be effective household surveys may need to be preceded by surveying activities that are more open-ended and exploratory. Rapid appraisal techniques may also be used in parallel with household surveys, in order to provide alternative perspectives and additional details. Another likely scenario is for a household survey to be followed, after some time has elapsed, by the use of rapid appraisals to investigate whether any significant changes have occurred – in other words for monitoring. Parallel use of a household survey and a rapid appraisal provides an opportunity to calibrate the rapid appraisal as a monitoring tool (Box 20). If a country already has a sound baseline of data and information on most of its AnGR, monitoring using rapid appraisal techniques may be the main element of its surveying and monitoring strategy.

Although the use of the term “rapid appraisal” to describe AnGR surveying and monitoring activities in developed countries may be unfamiliar, monitoring in these countries is in reality often based on drawing data from a range of sources and combining them to obtain as reliable as possible a picture of the true situation “on the ground” rather than on repeated use of household surveys or censuses. These “rapid” data collection techniques do not necessarily, or usually, correspond to a classic rapid rural appraisal. Better-developed communication infrastructures mean that information is often sought via telephone or e-mail rather than through face-to-face activities at community level. This, of course, means that some of the usual advantages of rapid appraisals (collective discussions and exercises, direct observation of animals and production environments) are not achieved. The other major difference between many developed countries and many developing countries is the state of development of AnGR-related organizations, particularly breed societies. The collection of data from breed societies is described in a separate subsection below.

Box 12. Pros and cons of rapid appraisals – a summary

The advantages of rapid appraisals include:

- speed relative to household surveys;
- low cost relative to household surveys;
- opportunities for greater involvement of the local communities who manage the AnGR;
- opportunities for investigating the causes behind the outcomes observed;
- opportunities to use approaches and techniques that are particularly suited to exploring the knowledge and views of specific subsections of the community (e.g. women, older people); and
- opportunities for discovering new and surprising information.

The disadvantages of rapid appraisals include:

- greater difficulty in obtaining objective quantitative information than in household surveys;
- greater difficulty in standardizing and pooling data; and
- in some cases, less opportunity for the surveyors to observe animals directly.

Group interviews and exercises

Group interviews and exercises are an alternative to interviews with individual livestock-keeping householders or other informants. They are often an important element of rapid appraisals. They may include community meetings, to which the whole community is invited, and smaller “focus groups” usually of eight to ten individuals selected on the basis of some similarity in their backgrounds. Community meetings offer opportunities for collecting general information on the area and the community; identifying social norms and accepted views; identifying special interest groups; cross-checking information from other sources; identifying collective views and feelings; and promoting participation in the survey activities. Focus groups enable the views of particular social groups to be explored.

Appraisals using groups have potential biases. Problems may, for example, arise because location or timing make it difficult for particular subsections of the population to participate. Moreover, it is important, in all group interviews, that attention be paid to social and group dynamics among the participants. Surveyors should not assume that everyone in the group will be equally willing to express their opinions in a social forum (LDG, 2003). Attention should be paid not only to what is being said, but to who is saying it. Participatory techniques (mapping, seasonal calendars, etc.) are often used in a group context as a complement, or alternative, to straightforward verbal group interviews. As with group interviews, care should be taken to account for the social dynamics among the participants in such exercises (ibid.).

Compared to community meetings, focus groups may provide an easier environment for women, members of minority groups or people of low socio-economic status to make their views known. However, there may still be matters that people prefer not to share in a group environment, and some people in the group may have more at stake than others in the questions being debated. Thus, even if a full household survey is not being conducted, a “mini survey” of individual interviews with members of various social groups may be an important complement to group techniques.

Group interviews may be based on more- or less-structured questionnaires or be based on a simple list of topics. A more structured approach is likely to make the outputs easier to analyse in terms of the objectives of the survey, but may also (as in individual interviews) mean a greater risk of introducing biases arising from the assumptions of the surveyors.

Box 13. Pros and cons of group exercises – a summary

The advantages of using group exercises include:

- opportunities to involve larger numbers of people in the survey in a relatively short period of time compared to interviewing them individually;
- opportunities to employ “participatory” tools designed for use with groups; and
- opportunities to foster community “ownership” of the surveying process.

The weaknesses include:

- the possibility that participants will be reluctant to discuss some topics in a group context, and
- the risk that social dynamics within the groups may be overlooked by the surveyors.

Key informants

Key informants are individuals who are targeted by a survey because of their particular knowledge about some aspect of the location or production system under consideration or because they have broad knowledge that can be drawn upon as an alternative or complement to conducting a household survey of individual livestock keepers. They are often an important source of information during rapid appraisals. Key informants can be drawn from many walks of life: they may be community leaders, individuals involved in the provision of livestock services (e.g. veterinarians) or livestock marketing, representatives of non-governmental organizations (NGOs) or breeders’ organizations, or researchers who have worked in the relevant production systems. They may be livestock keepers with particular knowledge, such as breeders who are known for the quality of their animals, or older people who can provide information on the changes in livestock populations and management practices that have taken place during their lifetimes and the reasons for these changes (LPPS and Köhler-Rollefson, 2005).

The roles that key informants play in the survey process can also be diverse. It may be that they are merely interviewed by the surveyors; alternatively they may become actively involved in surveying activities. In the latter case, in particular, it may be important to involve them during the planning of the survey (Section 4). Information provided by key informants may be used as a complement to a household survey – perhaps to provide technical or policy-related information

that individual livestock keepers are unaware of – or as an element in a process of triangulation (Box 10).

While it may be tempting to rely heavily on key informants rather than to go to the additional trouble and expense of collecting data and information directly from the livestock keepers themselves, it must be emphasized that such an approach risks overlooking vital details of how livestock and AnGR are utilized and how livelihoods and production systems are changing. It will provide, at best, only limited insights into the attitudes of livestock keepers towards particular AnGR or livestock keeping in general. Particular caution should be applied in the use of information provided by “experts” who may in reality only have a fleeting acquaintance with the survey area.

The depth of information required in a baseline survey means that reliance on key informants to the exclusion of a household survey and rapid appraisal methods that involve direct communication with livestock keepers is not recommended for such surveys. Monitoring breed population size and structure is likely to have to rely more heavily on key informants as population data need to be updated regularly and repeating full household surveys every time updates are required is likely to be impractical. Again, it is advisable to seek out informants who actually live and work in the area or production system being monitored. Efforts should also be made to verify the information they provide through the use of other tools. As well as providing information on changes to the size and structure of livestock populations, key informants may also be able to draw attention to other changes affecting production systems, including the dynamics of the threats to AnGR that may have been identified in a baseline survey. Individuals who work in AnGR-related activities, such as conservation programmes, are likely to be useful sources of information on the state of these activities as they change over time.

A system for monitoring based on expert opinion has been developed for the Alpine region of Europe by the Monitoring Institute for Rare Breeds and Seeds in Europe (MIRBSE, 2007). The system – known as the “Alpine Delphi” – was conceived as a follow-up to two earlier more in-depth studies with the intention of providing an infrastructure for biennial rounds of monitoring. As the name suggests, the approach is based on the “Delphi method”, a structured technique used in a variety of contexts to elicit information from experts based on two or more rounds of questionnaires. Such an approach is only likely to be useful if it targets individuals who are actively involved in the use and management of AnGR in the areas being monitored. It is likely that outsiders will simply reinforce their common ignorance. Another prerequisite is relatively well-developed communications infrastructure so that the outcomes of the various rounds of discussion can be circulated among the participants.

Box 14. Pros and cons of using key informants – a summary

The advantages of using key informants include:

- the potential to obtain a lot of information from a limited number of interviews – hence saving on time and costs; and
- the potential to obtain specific and detailed information and interpretation within the key informants’ areas of expertise.

The disadvantages of using key informants include:

- the possibility that the key informants are insufficiently well-informed about the situation on the ground; and
- the risk that the knowledge and opinions of the livestock keepers themselves, particularly marginalized groups, may be overlooked.

Breed societies

Breed societies, if they exist, are likely to be important to any national surveying and monitoring strategy. They can be considered a category of key informant (see above). They are particularly useful for monitoring population size and structure and hence for identifying when breeds come to be “at risk” of extinction. In other words, they can be vital elements of early warning systems for AnGR (FAO, 2009b). Breed societies can be asked at regular intervals to report on the numbers of breeding males and females that are registered in their herd/flock books or (where possible) to provide details of animal pedigrees. Obtaining data from breed societies is a rapid and relatively easy means to keep track of population trends. However, it is not free of potential problems (Box 15). An effective and reliable monitoring strategy based on breed societies requires not only a centralized information system, but also an effective communications strategy and a judicious approach to interpreting the data obtained.

Box 15. Monitoring with breed societies – opportunities and challenges

In many countries, breeds societies have potential to be key providers of data for monitoring population trends. It is vital that national surveying and monitoring strategies take full advantage of the opportunities offered by these societies. However, it is important to be aware of some potential stumbling blocks.

- Breed societies are NGOs, and in the case of smaller societies the decision-making and office work is often done on a voluntary basis. This may make communication difficult, and in some cases the society will not automatically provide information each time a request is made but will consider each request separately.
- Many breed societies are uncertain of the legal status of the information being asked for (e.g. in relation to data protection laws) and clarification of this at the outset, from government, can speed the process along.
- Breed societies are a special interest group, and while information on numbers is documented in the herd and flock books, societies may be open to bias in minimizing certain threats to the breed (e.g. the extent of a recessive disease) and maximizing interest in the breed.
- Many breed societies do not keep all the information necessary to answer questions on the numbers of breeding males and females. Recording the date of birth of animals is common, but recording the date of death is much rarer. Therefore, some calculation is required in order to obtain the desired numbers. It is necessary to devise a series of questions that can be answered simply and reliably by the society and that provide the information needed to perform the relevant calculations. This requires knowledge of recording practices among societies.
- Breed societies may not be well placed to answer some key questions. One example would be the degree of cross-breeding within the breed, although trends in registrations of young stock might provide some information.
- Not all breeds have societies – in the United Kingdom, for example, no poultry breeds have societies. Furthermore, where societies exist, it is possible for one breed to have more than one society, and for the majority of animals within a breed not to be registered with any society.

Breed societies will also be knowledgeable about breeds’ geographical distribution, morphology, performance, main uses, production environments, marketing and so on. Therefore, they are likely to be able to make an important contribution to the accumulation of a body of baseline data. This should not preclude obtaining such data from other informants – indeed this is advisable. It should also not preclude field surveys to explore in greater detail the roles of the breeds in the livelihoods of their keepers and the interactions of the animals with their production environments.

Box 16. Pros and cons of obtaining data from breed societies – a summary

The advantages of obtaining information from breed societies include:

- their focus on breed-related matters; and
- their potential for providing demographic data for monitoring purposes.

The disadvantages of obtaining information from breed societies include:

- incomplete coverage of breeds;
- gaps in demographic data; and
- societies' potential biases in favour of their "own" breeds.

Censuses

In a technical sense, a census is a household survey of wide scope and in which all qualifying households are interviewed. Most countries implement national agricultural censuses once every ten years; they may also implement more specific livestock censuses (see for example, Government of Pakistan, 2006). In some countries, the national censuses are based on sampling rather than on complete enumeration of the target populations.

To date, very few censuses have collected data at the level of the breed rather than the species. However, the inclusion of breedwise data collection in censuses is an option that countries may wish to consider in the future (see Box 17 for further discussion). Detailed guidance on how to organize a national agricultural census can be found elsewhere (FAO, 2005) and is not included in these guidelines. The collection of AnGR-related data in a national agricultural census can be viewed as a form of piggyback survey for AnGR (Box 3).

Box 17. Is there potential for integrating AnGR surveying and monitoring into national agricultural censuses?

One option for obtaining breed population data is to take advantage of the data collection activities associated with the national census of agriculture. The AnGR sector is unlikely to be able to dictate the content of the census – decisions will depend on overall national priorities and on the availability of resources. Nonetheless, this is an avenue to explore.

An obvious advantage of collecting breedwise data within the agricultural census is the opportunity to save some of the costs associated with setting up a separate breed survey. Moreover, the coverage of agricultural censuses is broad – the ideal being to cover all the agricultural activity in the country. They, therefore, represent an opportunity to collect detailed data on the size and structure of breed populations and their geographical distribution throughout the country. Breedwise census data would allow breed distribution to be cross-tabulated against the other holding-level data collected, which are likely to include demographics of household members, agricultural activities and other economic activities of the household, and the size of the holding. The census may also include community-level data – a new element introduced for the 2010 round of the World Programme for the Census of Agriculture – which would offer the opportunity to link breed distribution to land use, infrastructure, the presence of livestock services, market access, the food-security situation, vulnerability to disasters, the presence of development projects, etc.

The outputs of a full breedwise national census would be extremely useful inputs to AnGR management decisions. However, obtaining such data will not be possible everywhere. In some countries, national agricultural censuses are based on sampling rather than complete enumeration. While sample-based censuses, if they include breedwise data collection, can be used as a basis for estimating national population figures, they do not allow the detailed cross-tabulations described above, nor do they allow such precise mapping of breed distributions. Moreover, breeds with small populations may be completely missed out.

Another problem is that the coverage of the census may be limited to holdings above a certain size. In countries where many animals are kept by small-scale livestock keepers, there is a danger

that a substantial portion of the population will be missed from the census. This problem is recognized in the guidelines for the World Programme for the Census of Agriculture (FAO, 2005a). One proposed option is to include all agricultural holdings, but in the case of smaller holdings only to ask a limited number of questions. The issue would then be whether breed-related questions could be included in the subset of questions asked of everyone. Another problem may be that livestock kept on communal grazing land or on fallow land under shifting cultivation are missed from the census unless particular efforts are made to ensure that they are included.

The structure of a national agricultural census is often based on a core module and a number of supplementary modules. The core module consists of questions asked of all the holdings covered by the census. The supplementary modules are used to obtain more detailed data from a smaller sample of holdings. While livestock numbers, by species, are likely to be included in the core module, more detailed livestock related data – type of production system, use of veterinary services, numbers of animals by age and sex, number of animals according to purpose, number of milking animals according to milking status, population dynamics (births, deaths, etc), types of feed utilized – are likely to be included in a supplementary module. If breedwise data are to be included, a decision has to be taken as to whether they should be collected in a core or supplementary module. Inclusion in the core module would be preferable from the perspective of the outputs that can be obtained. The opportunity to record “unusual” items such as rare types of livestock is recognized as one of the criteria that should be considered when deciding which items to include in the core census module (FAO, 2005a). However, the additional cost of including the extra questions in the core module inevitably has to be considered.

While national agricultural censuses offer a good opportunity to obtain data that are comprehensive in terms of the geographical area covered and the number of households enumerated, the level of livestock-related detail will inevitably be limited by the need to keep the overall size of the census questionnaires within reasonable limits. The benefits of conducting more detailed livestock-specific censuses or surveys have to be weighed against the above-described benefits of an approach based on the agricultural census, taking into account the relative costs.

A further point to consider is that national agricultural censuses are normally conducted only once every ten years. The objective is to capture aspects of agriculture that change only relatively slowly: so-called “structural data”. An effective monitoring programme for AnGR requires that population data be collected rather more frequently than once a decade (see Section 3). Hence, national censuses will probably not meet all countries’ needs for AnGR monitoring. Additional data collecting activities will therefore need to be established to complement the census.

The decennial census will often be complemented by more frequent national agricultural sample surveys, intended to capture aspects of agriculture that change more rapidly. In the case of livestock these are likely to include data on production levels and sales, and detailed feed-related data. For example, quarterly surveys of cattle holdings might be conducted as a means to obtain data on milk production, and annual surveys of sheep holdings to obtain data on wool production (FAO, 2005a). Breed-related data for monitoring purposes might be collected during such surveys. Alternatively, specific surveys to obtain data on population size and structure by breed might be included within the national programme of agricultural surveys.

Box 18. Pros and cons of obtaining data via censuses – a summary

The advantages of using censuses include:

- wide coverage
- opportunities to link breed-related data to the other data items collected in the census; and
- (if breedwise data collection is added to a more widely focused census) synergies in the use of resources.

The disadvantages of using censuses include:

- lack of specific focus on AnGR or (in a general agricultural census) livestock keeping;
- the possibility that small-scale livestock holdings or livestock kept in mobile production systems are left out; and
- (generally) long intervals between censuses, meaning that animals with short generation intervals cannot be monitored sufficiently closely.

Matching tools and objectives

Not all tools will be suitable for answering all the questions addressed by a surveying and monitoring strategy. Strategy Working Groups involved in planning national strategies should think in terms of achievable objectives, guided by their countries' priority needs for data and information. The objectives of surveying and monitoring strategies may be complex, but it will often be possible to break them down into simpler questions that can be addressed by individual surveys. Examples are listed in Box 19. Table 2 provides an overview of the suitability of different tools as means for answering different questions. In choosing tools it is, of course, also important to account for the state of capacity to implement them, the social structure of the communities where the survey will take place, the challenge posed by the rural landscape and – last but not least – funding. The process of planning a surveying and monitoring strategy is discussed in more detail in Section 3.

Box 19. Questions to be answered by surveys – some examples

1. IDENTIFYING AND CHARACTERIZING ANGR

- Is Breed A present in the survey area?
- Does the survey area contain breeds that are unrecognized beyond the local area and therefore do not appear in relevant inventories?
- Is Breed A part of a common gene pool that extends beyond national borders?
- What are the characteristic identifiers of Breed A and/or the previously unrecognized breeds?
- How many animals of Breed A are there?
- What is the geographical distribution of Breed A?
- Is Breed A particularly associated with a specific production environment – defined by both natural and management factors – within the survey area?
- What roles does Breed A play within the production system?
- Is Breed A associated with particular socio-economic or cultural groups?
- How does breed A perform in the production environment(s) in which it is kept?
- Does Breed A have any important adaptations or unique traits?
- What are the threats to Breed A?
- Is a recognized threat more serious for Breed A than Breed B?

2. MONITORING ANGR

- Is Breed A increasing or decreasing in numbers?
- Is the population size of Breed A increasing relative to that of Breed B, or as a fraction of all individuals of that species?
- Why is Breed A increasing or decreasing in numbers?
- Is a recognized threat to Breed A increasing or decreasing?
- Is there a trend towards the use of cross-bred animals?
- Has the development plan implemented in the survey area been effective in improving the livelihoods of livestock keepers?
- Has degradation of the production environment been stabilized?

Table 2. An indication of the usefulness of different tools to address different survey questions (when used as a single strategy)

	Mapping expedition	Breed search tour	Transect ¹	Aerial survey	Rapid appraisal	Household survey	Census
<i>Identification and characterization</i>							
Is Breed A present in the survey area and listed in the relevant breed inventory?	*****	*****	*****	*	***	*****	*****
What are the characteristic identifiers of Breed A?	**	***	***	*	*****	*****	*
Is Breed A part of a common gene pool that extends beyond national borders?	**	***	*	*	*****	*****	**
How many animals of Breed A are there?	*	**	*****	**	*	*****	*****
What is the geographical distribution of Breed A?	*****	***	***	**	***	*****	***** *
What role does the breed play within the production environment in which it is kept?	*	***	*	*	*****	*****	**
Is Breed A associated with a particular socio-economic or cultural group?	*	*****	*	*	***	*****	***
Does Breed A have any important adaptations or unique traits?	*	**	*	*	*****	*****	*
What are the threats to breed A?	*	**	**	*	*****	*****	*
<i>Monitoring</i>							
Is Breed A increasing or decreasing in numbers?	*	*	*****	**	*****	***	*****
Is a recognized threat to Breed A increasing or decreasing?	*	*	**	*	*****	***	**

Number of stars represents the usefulness of the tool * = of little use; ***** = very useful.

¹ Assuming this approach is feasible in the production environment.

Mixing tools

During the early stages of a surveying and monitoring strategy, fundamental gaps in knowledge will need to be addressed. It is possible that at this point an aerial survey or a mapping expedition may provide a means to acquire a large amount of valuable information. Rapid appraisals may also be useful during the early stages of the strategy as a means to obtain information that can frame more detailed follow-up surveys. In discussing this point, Marsland *et al.* (2001) quote the following concise summary from ABMRC (1989), which is highly relevant despite its different setting (marketing):

“Prior to any large-scale quantitative study particularly in a relatively unknown market, it is strongly recommended that a qualitative phase of research is initially conducted, the main purpose being to understand the vocabulary and language used by customers as well as understanding their motivations and attitudes towards given services, products and usage associations. The findings of the qualitative research provide invaluable input to the quantitative stage in terms of the line and tone and questioning, and of course the overall structure and content of the quantitative phase.”

Substituting “rural community” for “market” and “livestock keepers” for “customers” is all that is needed for its relevance to AnGR to be recognized. It emphasizes the benefits of using qualitative approaches at an early stage in a survey or surveying strategy when knowledge and understanding are vague.

Even though rapid appraisals may indicate trends and even allow numbers to be estimated (e.g. by scaling answers from representatives at group meetings according to the size of the population they may represent) there are inadequacies and biases in these kinds of methods. Consequently, the results they produce may be very misleading for the purposes of planning. Therefore, it is strongly recommended that at some point a baseline household survey be undertaken. This will provide the opportunity for more comprehensive information gathering and for minimizing biases. Findings that are reliably quantified with reasonable precision have greater impact – people sit up and take notice! Preliminary work based on rapid appraisals should help with the design of effective household surveys. Moreover, if the rapid appraisals have been of a participatory nature, the planning of the household survey should be smoother and communication easier.

Results from a baseline household survey will form a reference point for monitoring. However, the cost and resources required for a household survey mean it is unlikely to be feasible to repeat such surveys at sufficiently short intervals to allow fully effective monitoring of changes in breed population size and structure. Rapid appraisals (including, where possible, obtaining information from breed societies) are therefore likely to be important components of monitoring strategies. It is good practice to conduct rapid appraisals of the type to be used for monitoring at the same time (or very close to the same time) as the household survey in order to enable an assessment of the reliability of the rapid appraisals. This has long-term benefits: first, it will offer an opportunity to change the protocols for the rapid appraisals to eliminate major errors; and second, because a relationship can be established between the rapid appraisal and the more formal survey, the monitoring programme will be able to use the rapid appraisal methods with greater confidence (Box 20). Once in a while, however – say once every decade – a household survey is required to keep the calibration reliable. It is important to recall that an inadequate baseline survey will diminish the quality of information obtained from all subsequent surveys that use it as a reference. This should be taken into consideration when considering the costs and returns of a baseline survey and taking decisions regarding the quantity of resources to commit to it.

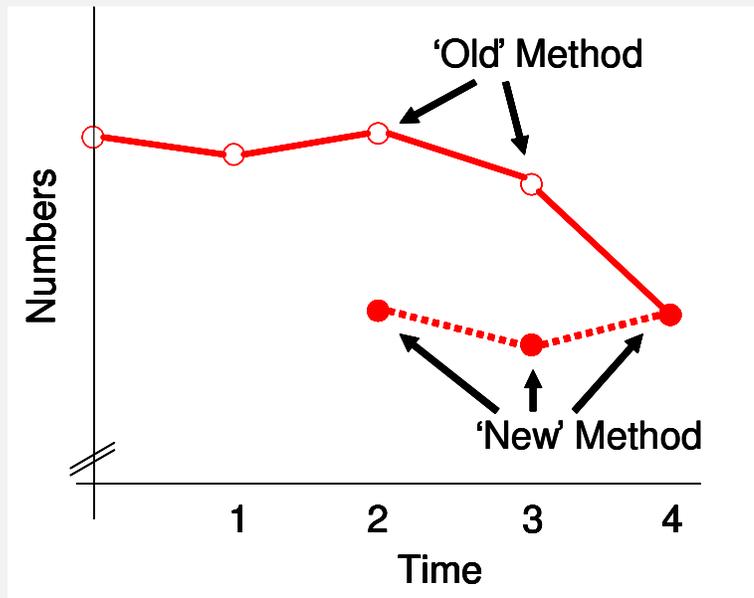
Box 20. Maintaining continuity in survey outputs

The specific methods used to survey a particular area or production system may change over time as circumstances change and as new techniques are developed. A shift from one method to another needs to be carefully managed in order to ensure comparability between older and newer data. It is important that at the time of the change, both the old and the new methods are used at the same time for at least one, preferably two, appraisal(s). This allows the old method to be “calibrated” against the new method, so that continuity of information can be maintained.

The following figure demonstrates the importance of calibration. A survey team has used an “old” method to count the number of animals during several rounds of surveying (the results are indicated by the empty circles in the figure). A decision is taken to introduce a new, more suitable, method of collecting data (results are indicated by the shaded circles). If the new method is introduced at time 4 (see figure) with no preparation, the conclusion may be that a sharp drop in numbers has occurred (the solid line in the figure represents the official figures reported by the surveys). Of course, it may be pointed out that the method has changed, but at best this will only lead to the conclusion that nothing is clear, leaving an uneasy fear that a drop has indeed occurred. In contrast, if the organizers of the monitoring strategy had prepared for the change and used both methods at times 2 and 3, then it would be clear that the new method provides lower values than the old method and that the rate of change indicated by the two methods is very similar. It would further be possible to conclude that there has been no sudden decline in the size of population, and may have been a slight increase.

In order properly to evaluate the benefits, or otherwise, of using the “new” method, it would be useful to understand why it gives lower numbers. Nonetheless, it can be reliably concluded that the transition to the new method been accomplished with no loss of continuity in the data. If the new method had been used alongside the old method on only one previous occasion it would not have been possible to see that (a) the new method tends to result in lower estimates of population size and (b) the sensitivities of the two methods to changes in population size are similar.

An illustration of the importance of calibration when mixing methods



A surveying and monitoring strategy will require the collection of data that are quantitative, such as the numbers of animals of a particular breed, and data that are more qualitative, such as those needed for recognizing and understanding threats to AnGR. Addressing qualitative objectives

may require “broad but shallow” household surveys based on a representative sample, accompanied by “narrow in-depth” rapid appraisals involving a smaller subsample. Further information on combining quantitative and qualitative approaches can be found in Marsland *et al.* (2000). Table 3 presents an example of combined use of participatory rapid appraisals and household surveys in order to investigate the threat to crop production from the long grain borer (*Prostephanus truncates*) in the United Republic of Tanzania.

Table 3. Combining quantitative and qualitative survey methods – an example from crop production in the United Republic of Tanzania

Thematic area	Research approach
Changes in role of crop production in household food security strategies comparing 1985 with 1998	Rapid appraisal (groups of men and women – some single-gender groups)
Changes in farmers’ perceptions of the importance of maize and cassava, comparing 1985 with 1998	Rapid appraisal (groups of men and women – some single-gender groups)
Influence/role of <i>P. truncates</i> (long-grain borer) on production levels, maize and cassava harvests, choice of maize and cassava varieties, duration of storage and volume of sales at farm level	Household survey
Persistence of <i>P. truncates</i> as a problem in the context of major agricultural problems, and other storage problems	Rapid appraisal (groups of men and women – some single-gender groups)
Coping strategies for <i>P. truncates</i> : perceptions regarding the control method used and of storage operations and structures	Household survey

Source: adapted from Marsland *et al.* (2000).

3 DEVELOPING A NATIONAL SURVEYING AND MONITORING STRATEGY

- Follow a step-by-step approach
- Build commitment and support
- Involve all relevant stakeholders

While it is possible to conduct AnGR surveys on an ad hoc basis, they are likely to be far more effective and more efficient in the use of resources if they are integrated into overall national efforts to improve the management of AnGR and, if possible, into wider data collection activities in the livestock sector and beyond. A national strategy for surveying and monitoring is therefore important. This section provides advice on how to go about developing such a strategy, based on the following eight steps:

- Step 1. Obtain the mandate
- Step 2. Organize the planning process
 - Step 2.1 Identify stakeholders and form the Strategy Working Group
 - Step 2.2 Establish the mode of operation of the Strategy Working Group
- Step 3. Assess national needs for animal genetic resources-related data

- Step 3.1 Consider strategic objectives and review the current state of knowledge
- Step 3.2 Consider the sequence and schedule for data-gathering activities
- Step 3.3 Identify priorities
- Step 3.4 Summarize the outcomes of Steps 3.1 to 3.3 and prepare a paper to communicate them to relevant stakeholders
- Step 4. Identify potential approaches to data collection
- Step 5. Review the state of resources, capacity-building needs and funding options
- Step 6. Review the legal status of survey data and outline procedures for data storage and access
- Step 7. Draft the strategy
- Step 8. Conduct a review of the strategy document and obtain formal endorsement

Step 1. Obtain the mandate

A mandate to develop and implement a surveying and monitoring strategy for AnGR is extremely important. In other words, it is vital that the strategy has official status and backing from the relevant authorities. Having such a mandate should make it much easier to mobilize resources and obtain cooperation from a wide range of stakeholders.

It should be recalled that a mandate already exists at international level: countries have committed themselves to surveying and monitoring their genetic resources as a basis for effective conservation and sustainable use. The main legally binding international agreement in this field is the CBD, to which 192 countries⁸ are parties (in 2010). The need to identify and monitor the components of national biodiversity is clearly set out in the Convention text (Article 7)⁹ and is elaborated upon in the CBD's Programme of Work on Agricultural Biodiversity¹⁰. The *Global Plan of Action for Animal Genetic Resources* (FAO, 2007a), endorsed by all FAO member countries, recognizes that there are significant gaps and weaknesses in programmes to inventorize and monitor AnGR, and that urgent attention is required to improve the situation. It calls for "inventories of the location, population status, trends and characteristics of animal genetic resources" to be conducted or completed, and for the expansion of "characterization and monitoring of trends in and risks to animal genetic resources" (Strategic Priority 1).

Obtaining a mandate at national level may, in the first instance, require some initiative on the part of individuals or groups who recognize the importance of surveying and monitoring to the management of the country's AnGR. National Coordinators for the Management of AnGR¹¹ and, where they exist, National Advisory Committees for AnGR are likely to be well positioned to take on such a role.¹² They should assess the current state of plans, policies and legal frameworks for the management of AnGR in their respective countries, and if necessary promote the development of new provisions that give due attention to the importance of surveying and monitoring.

Ideally, the mandate should provide for nationwide surveying and monitoring of mammalian and avian species used for food and agriculture, along with their associated production environments. Where appropriate, wild relatives of domesticated species may also be included. The mandate should indicate the body responsible for overseeing the implementation of the strategy, and clarify

⁸ <http://www.cbd.int/convention/parties/list/>

⁹ <http://www.cbd.int/convention/articles.shtml?a=cbd-07>

¹⁰ <http://www.cbd.int/agro/pow.shtml>

¹¹ <http://dad.fao.org/cgi-bin/EfabisWeb.cgi?sid=-1.contacts>

¹² Advice on the general roles and responsibilities of National Coordinators and on the establishment and functions of National Advisory Committees are included in the draft guidelines on *Developing the institutional framework for animal genetic resources* (FAO, 2010b).

its remit. The responsibilities and competencies of other key actors involved in implementing the strategy should also be set out, as should powers to co-opt other actors as the needs of the strategy develop. Box 21 provides a checklist of items that should be addressed by the mandate.

Box 21. Items ideally included in the mandate for a surveying and monitoring strategy – a checklist

- Objectives of the surveying and monitoring strategy
- Legal framework
- Scope
 - geographic coverage
 - species coverage
 - time frame
- Access and use of data collected
- Stakeholder involvement
- Responsibilities of organizations and individuals (including responsibility for coordinating and overseeing the strategy)
- How the outcomes of the strategy will be translated into action?

The steps needed to establish a mandate for surveying and monitoring, and the precise legal and institutional nature of the mandate, will vary from country to country. Boxes 22 to 26 provide some examples from countries that already have a mandate in place. Note that these cases are presented as examples rather than as suggested best practice. In some countries, legal frameworks explicitly set out provisions for surveying and monitoring AnGR; China, Germany, Slovenia and South Africa are examples. In other countries, the mandate arises from existing powers within the relevant ministries; the United Kingdom is an example.

Box 22. The Animal Husbandry Law of the People's Republic of China

The Animal Husbandry Law of the People's Republic of China became effective on 1 July 2006. The management of AnGR is accorded very high importance under this law, which requires that relevant government bodies at all levels adopt measures and provide resources to strengthen the conservation and sustainable use of AnGR.

The law stipulates that the Ministry of Agriculture is responsible for setting up a national committee that has overall responsibility for the management of AnGR, including:

- 1 conducting national surveys of AnGR in order to prepare and release an updated inventory of AnGR on a regular basis;
- 2 drawing up a national priority list of breeds for conservation at national and provincial levels;
- 3 establishing a list of National Conservation Farms to conserve breeds from the national priority list; and
- 4 facilitating fund raising and fund management at national and provincial levels to finance these activities.

Based on this law, the Ministry established a new National Commission for the Management of AnGR (replacing its forerunner which had been in existence since 1997 under the Breeding Livestock Regulation of 1993) and, in May 2007, established a National Technical Committee for the Management of AnGR. A National Focal Point was established in 2002. The committee is responsible for developing a national AnGR management plan, monitoring the state of AnGR, providing guidance on conservation activities, and conducting and promoting public awareness and training on the subject.

Source: The Animal Husbandry Law of the People's Republic of China, adopted at the 19th Meeting of the Standing Committee of the Tenth National People's Congress on 29 December 2005. Beijing. The

Agricultural and Rural Development Commission of the National People's Congress of the Republic of China (available in English at <http://faolex.fao.org/docs/texts/chn82613.doc>).

Box 23. National legislation on the conservation of Slovenia's animal genetic resources

The Ministry of Agriculture, Forestry and Food of Slovenia, pursuant to the provisions of the national Animal Breeding Act, has adopted legislation on the conservation of Slovenia's AnGR. The regulation brings into force systematic procedures for monitoring and analysing the state of genetic diversity in livestock, and provides arrangements for implementing monitoring and conservation programmes. It also governs the contents and management of a national register of the state of breeds and their utilization; procedures for determining the degree of breed endangerment; procedures for monitoring and assessing genetic variability; conditions for recognition of new breeds; methods and procedures for *in situ* and *ex situ* conservation; provisions for raising public awareness; education and training on the management of Slovenian indigenous breeds; and procedures for providing funds for conservation.

The regulation entrusts the Ministry with the task of conducting regular monitoring of the utilization and endangerment status of AnGR and updating the national register. The information generated is archived in a national database. The Ministry is also responsible for managing international cooperation in this area.

Source: Regulation on Conservation of Farm Animal Genetic Resources. Official Journal of the Republic of Slovenia, No. 90/2004 (available in English at [http://www.bfro.uni-lj.si/Kat_center/genska_bank/Posvet/Regulation%20on%20conservation%20AnGR%20%20Slovenia%20%20\(3\).pdf](http://www.bfro.uni-lj.si/Kat_center/genska_bank/Posvet/Regulation%20on%20conservation%20AnGR%20%20Slovenia%20%20(3).pdf)).

Box 24. The Animal Improvement Policy for South Africa

This policy focuses on genetic improvement as a means for sustainable utilization of livestock as well as the land and feed resources they depend on. The legislation (Act No. 62 of 1998) was prepared and passed in September 1998 and its regulatory framework finalized in 2002. The policy was developed out of the need to have a more effective and efficient national animal improvement programme based on a review of the Livestock Improvement Act of 1977 (Act No. 25 of 1977). It is designed to enable stakeholders to make informed decisions about their animal genetic improvement activities.

The 1998 act includes a provision for the protection of South Africa's indigenous and locally developed breeds through, *inter alia*, the establishment of accurate animal identification, animal performance recording and evaluation, and effective enforcement of legislation. South Africa also has a functioning Animal Identification Act (No. 2 of 2002). Recognizing the urgent need for accurate statistics and information about breeds, their distribution and status, the policy recommends a comprehensive national survey of AnGR, and that the data collected be archived in the national data bank, INTERGIS (<http://studbook.co.za/intergis/collecting.htm>) as part of the animal recording scheme.

Source: Animal Improvement Policy for South Africa. Notice 1652 of 2007. Staatskoerant. 30459: 41–66 (available at <http://www.info.gov.za/view/DownloadFileAction?id=73788>).

One development that many countries are likely to have in common, is the development of a National Strategy and Action Plan for AnGR (FAO, 2009c). Following the adoption of the *Global Plan of Action*, the CGRFA has encouraged countries to develop such plans as a means of translating international commitments into national action (FAO, 2009a). Guidelines on the preparation of national strategies and action plans have been published and endorsed by the CGRFA (FAO, 2009c; FAO, 2009d). The plans should include provisions for surveying and monitoring. Boxes 25 and 26 describe how national plans in the United Kingdom and Germany promote surveying and monitoring.

Box 25. Provisions for surveying, monitoring and documentation in the United Kingdom's National Action Plan on Farm Animal Genetic Resources

The National Action Plan requests the National Steering Committee on Farm Animal Genetic Resources (NSC) to review and update “monitoring data” in the National Breed Inventory in a three-yearly cycle with sequential reviews of (i) sheep and goats; (ii) cattle, pigs and horses; and (iii) poultry. Information is to be obtained from breed societies and breeding companies. It is recommended that breed societies be encouraged to make all herd and flock books available electronically following a standard template in order to facilitate the uploading of monitoring information to the UK National Breed Inventory via the web-based Genetic Resources for Food and Agriculture Information Portal. Procedures for quantifying resources not included within herd and flock books are to be formalized by the NSC. The National Breed Inventory is also to be further developed to provide routine updates of the inventory to the European Farm Animal Biodiversity Information System (EFABIS), from which data will be passed automatically to the UN Food and Agriculture Organization (FAO) Domestic Animal Diversity Information System (DAD-IS).

The objective of the monitoring programme is to answer questions such as: “To what extent, and how quickly, are populations changing in size or structure?” and “To what degree is this breed ‘at risk’?” Population sizes and trends (numbers and geographical location) are to be monitored for each breed. Lack of standard measures for identifying and monitoring geographical distribution is recognized and the need to develop them is highlighted. Regular surveys of the sheep sector have already take place, and the valuable insight given by them into the changing popularity of breeds and crosses has prompted extension to all sectors.

Source: adapted from DEFRA (2006).

Box 26. Provisions for surveying, monitoring and documentation in Germany's National Programme for Conservation and Sustainable Use

Implementation of routine monitoring is one of seven activities laid down in Germany's National Programme for Conservation and Sustainable Use of Animal Genetic Resources. As the main basis for this monitoring, the Information and Coordination Centre for Biological Diversity (IBV) of the Federal Office for Agriculture and Food (BLE) maintain the National Inventory for Animal Genetic Resources in Germany (TGRDEU: <http://tgrdeu.genres.de>). Since 1997, the size of national breed populations has continuously been recorded there, based on herd book registries.

Risk status is determined by the National Committee for Animal Genetic Resources based on effective population size. The variables required to calculate this figure (number of female and male breeding animals) are taken from the National Inventory. Poultry and rabbit breeds are not covered by the animal breeding law that provides the framework for the programme, and therefore are treated separately. Individual breed identification and pedigrees are not yet available in the National Inventory but are required to improve the accuracy of the calculations mentioned above. Hence, activities have commenced to collect data at individual-animal level. Cooperation agreements have been negotiated under which breeding organizations and other organizations that monitor specific breeds or populations will regularly supply the data required.

Another role of the National Inventory TGRDEU is to update the regional European Farm Animal Biodiversity Information System (EFABIS) and the FAO system DAD-IS.

Source: adapted from BMELV (2008).

When establishing the mandate for a surveying and monitoring strategy it is important not only to gain backing from the relevant authorities, but also to consider how support from those who will provide the survey data – particularly livestock keepers, and including indigenous and local

people – can be ensured. It may, for example, be useful to establish mechanisms or guiding principles for stakeholder consultations. In many circumstances there will be pre-existing legal obligations that have to be considered. If, for example, traditional livestock-keeping knowledge is to be sought as part of the data-gathering activities, this should, in the words of Decision 5/16 of the Conference of the Parties to the CBD, “be subject to prior informed consent or prior informed approval from the holders of such knowledge, innovations and practices.” Some international “soft laws” are also relevant: for example, the Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization(2002)¹³; the United Nations Declaration on the Rights of Indigenous Peoples (2007)¹⁴; the International Covenant on Economic, Cultural and Social Rights (1966)¹⁵; and the Convention on the Protection and Promotion of the Diversity of Cultural Expressions (2005)¹⁶.

Customary laws may need to be considered in addition to formal legal frameworks. One interesting development has been the emergence of the “biocultural protocol” (UNEP/Natural Justice, 2009) as a mechanism through which communities describe the genetic resources and traditional knowledge that they use, develop and conserve in the context of their livelihoods and cultures. These protocols are intended to provide a basis for planning the management or genetic resources and traditional knowledge and communicating communities’ voices into policy-making processes.

Step 2. Organize the planning process

A survey and monitoring strategy requires planning – not to be confused with the planning needed to conduct each individual survey. Without planning, the strategy will be inefficient and will fail to target the country’s most urgent needs for data collection. Effective planning requires a basic institutional framework for the management of AnGR. The majority of countries have nominated National Coordinators for the Management of AnGR and established multistakeholder National Advisory Committees for AnGR; some have established National Strategy and Action Plans for AnGR (see Step 1). Countries that have not established these structures are encouraged to do so as a matter of priority. Advice can be found in the draft guidelines on developing the institutional framework for AnGR (FAO, 2010b). Whatever the institutional framework, countries should ensure that the surveying and monitoring strategy is integrated into broader planning initiatives for AnGR management and livestock development, as this will help to ensure that the surveys have coherent objectives, that sufficient resources are available for the surveys, and that the schedule of the surveying and monitoring strategy allows up-to-date information to be made available when it is needed as a basis for management and development decisions.

Step 2.1 Identify stakeholders and form the Strategy Working Group

Stakeholder involvement in the planning phase is paramount to the success of the strategy. Planning should therefore be undertaken by a group that is representative of all relevant stakeholders. The initiative for establishing this Strategy Working Group should come from the National Coordinator in collaboration with the National Advisory Committee for AnGR if one has been established. A subgroup of the National Advisory Committee for AnGR may form the core of the Strategy Working Group – bringing with it a solid understanding of overall national objectives and strategies for AnGR. However, there will be a need for the Strategy Working Group also to include individuals with specialized knowledge of surveying methods and strategies, and representatives of stakeholder groups and institutions that will be involved in or affected by the survey activities or will use the data generated by the surveys. Reading through the

¹³ <http://www.cbd.int/doc/publications/cbd-bonn-gdls-en.pdf>

¹⁴ <http://www.un.org/esa/socdev/unpfii/en/declaration.html>

¹⁵ http://www.unesco.org/education/information/nfsunesco/pdf/SOCIAL_E.PDF

¹⁶ http://portal.unesco.org/en/ev.php-URL_ID=31038&URL_DO=DO_TOPIC&URL_SECTION=201.html#ENTRY

rest of this section will provide an indication of what is involved in the planning process and help in identifying the types of stakeholders to include in the Strategy Working Group. Stakeholder involvement in data collection is discussed in Step 4. Note, however, it may be useful to think ahead and consider bringing stakeholders with potential to act as collaborators in data collection into the planning process at an early stage. Box 27 provides suggestions regarding the composition of the Strategy Working Group.

Box 27. Composition of the Strategy Working Group

Key candidates for inclusion in the Strategy Working Group include representatives of the following groups:

- farmers' or livestock keepers' associations (including, where they exist, indigenous and local people's organizations and women's organizations);
- breed societies;
- breeding companies;
- extension services;
- companies, NGOs or research institutions with experience in gathering livestock-related data;
- public or private sector organizations involved in planning conservation programmes; and
- the national office of statistics and other public bodies that gather or utilize data from the relevant locations and production systems

Step 2.2 Establish the mode of operation of the Strategy Working Group

Before the planning process can get underway, it is necessary to address operational issues such as how often and where the Strategy Working Group meets; whether it consults between meetings by means such as teleconferences or e-mail; how meetings are to be conducted; election of the chair and secretary of the group; procedures for documenting meetings and decisions; and procedures for reporting, communication and review of decisions and outcomes. It is important to ensure that momentum can be retained between meetings – for example that action points are promptly and speedily circulated, and that the secretary of the Strategy Working Group ensures that schedules are being met.

Step 3. Assess national needs for AnGR-related data

Step 3.1 Consider strategic objectives and review the current state of knowledge

The first activities of the Strategy Working Group should be to familiarize itself with its mandate and assess the country's needs for data and information on AnGR, their management and their production environments. Table 4 provides a checklist of information categories that are likely to be important, and a simple framework within which an assessment of data availability can be collated. It may be appropriate to repeat the exercise for every significant livestock species in the country.

Table 4. Framework for summarizing the current availability of AnGR-related data

Type of data*	Available and up-to-date	Available but needs updating	Partly available	Not available
List of breed names for each livestock species**				
Breed population size and structure and their trends				
Breed geographic distributions				
Phenotypic descriptions (including				

appropriate photographs)***				
Molecular analysis of breed genomes				
Description of production environments****				
Comparative performance within defined production environments				
Cultural aspects of livestock production and breed utilization				
Indigenous knowledge related to the utilization of AnGR				
Identification and monitoring of threats to AnGR				
Status of conservation and other management programmes				

**The list is not intended to indicate the order of priority for data collection, which will vary from country to country.*

*** Feral breeds and wild relatives may also be of interest.*

****Photographs should reflect the variation in a breed and the breed's production environment and not attempt to define a breed type.*

*****The term "production environment" is here used in a broad sense, which encompasses the uses to which breeds are put, and social and economic factors such as market orientation, niche marketing opportunities and gender issues (see FAO/WAAP, 2008).*

Consider the goals of surveying and monitoring. It may be useful to try to answer the following questions with respect to the state of AnGR and their management:

- Where are we now?
- Where do we need to be?
- How do we get to where we need to be?

Then consider what data are necessary to answer the questions more comprehensively and to progress towards better use, development and conservation of AnGR. For example, what would be useful in identifying breeds for inclusion in structured breeding programmes (FAO, 2010a), identifying priority breeds for conservation, or establishing national early warning systems that identify threats to AnGR and their production environments? Review the list of categories presented in Table 4 and consider whether any should be added.

Several aspects of AnGR management are described in other guidelines in this series (published or in preparation). Review these publications and consider how the surveying and monitoring strategy can contribute to meeting the data and information needs identified in them. If active national planning is ongoing in any of these areas (e.g. breeding or conservation), ensure that the Strategy Working Group liaises with the working groups (or other structures) that are developing the respective plans or strategies. Note that the draft guidelines on phenotypic and molecular characterization (FAO, 2010c; FAO, 2010d) contain additional guidance on how to collect data on some of the categories listed in Table 4. A minimum objective should be to collect the data needed to allow completion of the breed data sheets¹⁷ and production environment descriptor module¹⁸ in DAD-IS. The demographic data that are needed to update national breed population records in DAD-IS are shown in Box 28.

¹⁷ <http://dad.fao.org/cgi-bin/EfabisWeb.cgi?sid=-1.reportsreport&e>

¹⁸ Global georeferenced datasets for basic climatic (temperature, precipitation, wind conditions, relative humidity, solar radiation, day length) and terrain (elevation, slope, soil pH, land cover, tree cover) aspects of production environments

Box 28. Demographic data needed to update national breed population records in DAD-IS

One objective of a national surveying and monitoring strategy should be to obtain the data that will enable National Coordinators for the Management of AnGR to enter descriptions of their countries' AnGR into the Domestic Animal Diversity Information System (DAD-IS). Detailed descriptions of the data entry requirements of the system can be found in the DAD-IS manual (<http://dad-training.fao.org/cgi-bin/getblob.cgi?sid=-1,668>). The draft guidelines on phenotypic characterization of AnGR (FAO, 2010c) provide advice on how to obtain data on the morphology, performance and distinctive traits of livestock populations and on their production environments. In addition to these phenotypic and production-system data, it will also be essential for the surveying and monitoring strategy to ensure that the demographic data needed to keep national entries in DAD-IS up to date (and essential for country-based early warning systems) are collected. The population data section of DAD-IS includes the following fields:

Year: the year to which the data on population size and structure refer. This will normally be the year in which the survey took place. However, in some circumstances a survey, or the preparation for a survey, may bring "historical" data to light. These historical data should also be recorded in DAD-IS.

Population size: the total number of animals in the population, including all age groups. Note that the size of the population is likely to fluctuate during the year because of seasonality in reproduction and/or slaughtering. The nature of these fluctuations will vary from species to species and from country to country and may vary in the extent to which they are predictable. The monitoring strategy should seek to ensure that the apparent trends in the population are not distorted by the effects of within-year fluctuations. In most circumstances this will mean that each monitoring survey for a particular population should be conducted at the same time of year, but it may also be necessary to take account of moveable feasts. In general, the data to be used as a basis for annual population figures should not be collected at times of year when there are pronounced peaks or troughs in the size of the population.

Number of breeding males: number of breeding males of reproductive age (not necessarily actually used for breeding).

Number of breeding females: number of breeding females of reproductive age (not necessarily actually used for breeding).

Number of registered females: the number of females used for breeding and registered in herd book, studbook or similar registry.

Proportion of females breeding pure: percentage of females that are mated to sires of the same breed.

Herds: the total number of herds/flocks.

Herd size (average): the average number of animals per herd/flock. Note that if a comprehensive survey of the population has been conducted, it will be possible to calculate this figure from the number of animals and the number of herds. In other circumstances, it may be possible to provide an estimate based on expert knowledge.

AI used: whether or not artificial insemination is used.

Number of males in AI: the total number of males used in artificial insemination.

are being incorporated into DAD-IS and breeds can be linked to these if their distributions are entered into DAD-IS by National Coordinators. The data on livestock management needed to complement the georeferenced data has to be collected through surveying activities at national level.

If the country has developed a National Strategy and Action Plan for AnGR (see Step 1), strategic directions for AnGR management should have been identified. The Strategy Working Group should consider what data and information are needed to implement the plan effectively. Attention should also be paid to the country's broader livestock development objectives and strategies: what AnGR-related data and information will be needed to plan, implement and monitor these strategies?

Note that the surveying and monitoring strategy should address not only the status of AnGR (population size, etc) but also the threats facing AnGR and obstacles to their sustainable use. This is called for in Strategic Priority 1 of the *Global Plan of Action for Animal Genetic Resources*: "expand characterization and monitoring of ... risks to animal genetic resources" and in Article 7c of the CBD: "identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects ...". The Strategy Working Group should ensure that this requirement is addressed by the strategy. It should identify in broad terms the types of threat that are likely to affect the country's AnGR (FAO, 2009e) and seek to identify what data need to be collected in order to assess the significance of these threats and to monitor them over time. The planning should not be too prescriptive – the surveys themselves will be opportunities to identify threats.

By this point, the Strategy Working Group's discussions should have enabled it to identify high-level goals for the national surveying and monitoring strategy (e.g. providing the data inputs needed for the implementation of various elements of a National Strategy and Action Plan for AnGR or a livestock development strategy) and broadly which categories of data will be important to meeting these goals. It will have an overview of the availability of data in different categories (Table 4). Armed with this information, and before proceeding further, the Strategy Working Group should consider whether there is a need to refine its mandate in order to allow it to address these goals effectively; if necessary steps should be taken to obtain a refined mandate.

More specific objectives will now need to be identified. These objectives might simply be to complete national data in any of the categories in Table 4. Alternatively, they might relate to a specific region, production system, species, breed or group of breeds. The objectives should make identifiable contributions to meeting one or more of the high-level goals (see examples above). Make a list of these contributions for each objective.

Meeting each objective will probably involve the collection of a number of data elements. For example, characterizing production environments will require data on the climate, the terrain, the prevalent diseases and parasites, the management methods used, and so on (FAO/WAAP, 2008); describing population size and structure will require data on the number of breeding animals of both sexes, the extent of cross-breeding, and so on. Make a list of the data elements needed to meet each of the objectives.

Step 3.2 Consider the sequence and schedule for data-gathering activities

This is a good point at which to start considering the sequence and the schedule for meeting the various objectives of the strategy. Note that fully meeting some objectives will be conditional on others being met. For example, performance measurements cannot be adequately evaluated without a description of the production environments in which breeds are kept; the country's breed demographic data (population size and structure) will remain provisional until a comprehensive inventory has been achieved; some threats will be difficult to evaluate and monitor if the breeds' geographic distributions are unknown; phenotypic and molecular data will contribute to establishing a complete breed inventory; and so on. It may be useful to construct figures or flow charts showing how different objectives feed into each other and into strategic goals.

Consideration also needs to be given to which objectives can be met by “one-off” activities and which need repeated surveys. It will be helpful to distinguish “baseline” surveys from subsequent monitoring surveys (in which a subset of the baseline data items are repeatedly collected). Data within some categories will remain essentially constant over a prolonged period of time, while those in other categories will change. Both types of data will need to be addressed by baseline surveys, but those that change will also need to be monitored regularly.

The schedule for monitoring surveys should ensure that significant changes (those that require a policy or management response) are identified in good time. Items that change rapidly will need to be surveyed more frequently than those that change more gradually. Monitoring should be conducted at least once per generation of the respective species, particularly for breeds classified as at risk or potentially at risk. This requires surveys at intervals of about eight years for horses and donkeys, five years for cattle, buffalo, sheep and goats, three years for pigs and two years for poultry species (FAO, 2007b). Countries should also consider the fact that the CGRFA has requested that every two years FAO prepare status and trends reports for AnGR based on the population data that countries have entered into DAD-IS. Production environments also require regular monitoring, particularly given the uncertainties associated with climate change. A ten-year cycle has been proposed (FAO/WAAP, 2008) but more frequent surveys may be required where change is occurring rapidly.

After considering the sequence and schedule associated with the various data categories, it should be possible to formulate objectives along the lines of: “obtain updated data on the size and structure of all breeds of species x every y years”. For each objective, it will be important to note whether its achievement is dependent on any other objectives being met and also whether it is a prerequisite for, or contributes to, meeting any other objectives.

Step 3.3 Identify priorities

The Strategy Working Group may now wish to establish some priority order among the objectives identified. The prioritization methodology will have to be agreed among the members of the group and should reflect the particular needs and circumstances of the country. There are likely to be several criteria to consider. Generally, the highest priority should be given to collecting the data needed to meet the “high-level goals” of the surveying and monitoring strategy (e.g. to inform national plans and strategies for AnGR and livestock development – see above). The relative importance of different species, regions, production systems, etc. to the country’s goals for rural development and managing biodiversity may need to be taken into account. The output of the prioritization might be a fully ranked list (1, 2, 3 ...). However, it may be more practical to group objectives according to their level of priority (e.g. high vs. medium vs. low, or essential vs. desirable).

Recall that the surveying and monitoring strategy will need to take into account not only the relative desirability of the various potential outputs, but also operational practicalities, costs and opportunities for synergy in data collection. These will be considered in more detail in Steps 4 and 5. In Step 3, the Strategy Working Group will still be seeking to understand the country’s data needs and the connections between the various objectives that have been identified.

Step 3.4 Summarize the outcomes of Steps 3.1 to 3.3 and prepare a paper to communicate them to relevant stakeholders

Table 5 presents a framework in which the outcomes of the Strategy Working Group’s discussions during Steps 3.1 to 3.3 might be summarized. Under “Benefits”, list contributions to the high-level goals and to meeting other component objectives of the strategy. Under “Prerequisites” note any other objectives that need to be met first or simultaneously. Use the next two columns to record the outcomes of the prioritization exercise and the reasons for the

decisions. In the column headed “Risks and assumptions” note any eventualities that might require the priorities to be changed.

Table 5. Structure for summarizing objectives and priorities for data collection

Objective	Data elements required	Benefits	Prerequisites	Priority (level or rank)	Reasons for prioritization	Risks and assumptions

It is recommended that at this point a paper be prepared outlining the objectives and priorities for data collection. The justification for the prioritization should be set out as clearly as possible. The paper should be circulated to the National Advisory Committee for AnGR (if one has been established), relevant decision-makers in national and local government and to other stakeholders likely to be involved or affected. Comments received should be taken into account and if necessary the priorities should be reviewed. The paper, amended if necessary, should form part of the final strategy document drawn up at the end of the planning process.

Step 4. Identify potential approaches to data collection

The range of tools that may form part of a national surveying and monitoring strategy of AnGR are outlined in Section 2. The Strategy Working Group should review these options. The following questions need to be addressed:

- How might the various tools contribute to meeting the objectives identified in Step 3.3?
- What existing institutional and organizational structures can be utilized and who can be involved as collaborators in survey work?
- How can tools be combined in a coherent way in order to provide a more complete picture of the targeted breeds and production systems?

The range of tools upon which the surveying and monitoring strategy will be able to draw will depend to some extent on the state of existing data collection activities in the livestock sector and beyond (e.g. agricultural censuses, veterinary surveillance, monitoring of wildlife populations). Review these activities. Pay attention to the legal and policy frameworks on which they are based, the institutional and organizational structures involved, geographical coverage, time schedules and sampling frames. Are piggyback surveys (Section 2) feasible? Also consider data needs that are not being met by current surveying activities. It is likely that many aspects of national livestock development planning (nutrition, health, marketing, etc.), and broader rural development and poverty reduction strategies, would benefit from improved availability of data. Might it be possible to instigate collaborative surveying initiatives involving stakeholders from these fields of interest?

Representatives from the organizations and stakeholder groups that are candidates for involvement in piggyback surveys or other collaborative approaches may already be members in the Strategy Working Group (Step 2). Draw on their knowledge. If necessary consult more widely and bring new members into the Strategy Working Group.

Try to match objectives with potential tools. Depending on the circumstances, the tools might be broken down by species, region, production system, etc. – e.g. mapping survey for sheep breeds in region X. A simple table or set of tables in which the rows represent objectives and the columns represent tools may be useful. A first draft of the table(s), in which tools with potential to

contribute to a given objective are distinguished from those without potential, can subsequently be refined and annotated with notes on potential collaborators, providers of data, links and dependencies to other objectives (see above), etc. as the discussions proceed. Consider the data elements required to meet each objective. Do these different elements require different approaches in terms of the tools used to collect them?

Evaluate the potential tools in terms of their statistical precision and the scale of resources that will be required to achieve the desired precision. In the case of piggyback or other collaborative surveys, consider whether and to what extent the focus on other data will limit the potential for collecting in-depth AnGR data. Consider also the extent to which the organizational structures required are already in place – noting the opportunities that this may offer for cost savings. A national agricultural census for example will have a wide geographical coverage, high precision and an existing organizational set up; species coverage is potentially good; however, collecting detailed information on breeds and their management is unlikely to be feasible. In contrast, an AnGR-specific household survey will offer opportunities to obtain detailed breed-related data, but may be limited in its geographical coverage; the statistical precision will depend on the sampling frame. When examining options for data collection, remember that tools are often complementary rather than mutually redundant (see Section 2). An expert statistical advisor will be a useful contributor to these discussions even though implementation is not yet being considered in depth.

Consider whether there are constraints that may make the use of some tools impractical – either nationally or in certain regions, species or production systems – and whether anything can be done to overcome these constraints.

Detailed decisions as to who will be consulted in individual surveys will be a matter for the teams responsible for planning these surveys (Section 4). However, it may be useful for the national strategy to provide guidance regarding the types of stakeholder who might be targeted as key informants (Section 2). This is particularly important if there is scope for key informants to become regular suppliers of monitoring data over the longer term. Some candidates are listed in Box 29. Table 6 provides further details of the potential roles of some of these groups of stakeholders. It may also be important at this stage to consider the communication strategies that would be needed to promote the involvement of such stakeholders in surveying and monitoring activities.

Box 29. Organizations and individuals with potential roles in data collection or as key informants – some examples

- local and national governmental and administrative structures
- public services such as animal health and extension
- private operators such as inseminators, private veterinary practitioners, livestock traders, auctioneers and slaughterhouses
- breed associations and societies
- traditional institutions such as council of elders or community leaders.

Table 6. Organizations and individuals that are potential key informants or collaborators in data collection – some examples

Organization, institution or key informants	Potential contribution	Geographic coverage	Activities and their frequency	Contact point
Veterinary service	Collecting information based on guiding questions	Countrywide	Routine visits to livestock keepers	Chief Veterinary Officer
Livestock	Providing information	Regional/provincial	Regular auctions	Head of the

auctioneers	on the number of animals marketed by breed	– depending on the size of the operation	(e.g. biannual)	company
Traditional community leaders	Providing information on production systems and distribution of breeds	Local	Regular involvement in livestock- keeping communities	The individuals themselves (perhaps via an NGO)
Livestock traders and slaughterhouses	Providing information on livestock throughput by breed, market preferences, and sources of animals	Regional/provincial – depending on the size of the operation	Regular throughput of animals	Head of the company, market overseer or relevant local leader
Breed societies	Providing information on breed standards, distribution and population size and structure	Countrywide (wherever the respective breeds are found)	Regular communication with keepers of the breed	Officers of the societies
Artificial insemination services	Providing specific information on service coverage and breed choices	Provincial/local depending on the size of the operation	Regular contact with producers	Head of the company or department

Consider the scope of the potential surveys. It will generally be more cost effective to acquire information via a single larger survey than via several small surveys. For example, it is much cheaper to survey the sheep and cattle breeds in a region by asking householders about both species in the same interview, than to ask about the sheep breeds on one visit and return to the same households later to ask about the cattle breeds.

Step 5. Review the state of resources, capacity-building needs and funding options

The nature and scope of the surveying and monitoring strategy will inevitably depend on the availability of resources and state of capacity (human, technical, infrastructural, institutional, etc.). These should be reviewed in the light of the potential data gathering options identified in Step 4. The potential of government, research and educational institutions and NGOs to undertake surveying activity should be assessed. Consider what capacity-building activities (e.g. training) are necessary to promote effective implementation of the strategy. Consider the financial implications of the various data collection options and the associated capacity-building requirements. (Note that Section 4 provides a description of financial planning for individual surveys; the objective at this point is to compare resource needs and availability as a basis for drawing up a viable national strategy.)

As part of the funding review, consider, for example, whether financial resources can be obtained from existing government programmes, NGOs or the livestock industry (levy boards, etc.). It may be possible to convince levy boards to provide continuous funding for surveying and monitoring. This might be encouraged by demonstrating that a surveying and monitoring strategy is needed in order to assess progress in livestock development, raising awareness of the roles and value of AnGR, and promoting the idea that provision of resources for AnGR-related activity can be a building block for a sustainable livestock industry. Consider the need for a communication strategy to promote the involvement of all potential stakeholders in mobilizing funds for the surveying and monitoring strategy. If the country has a national strategy and action plan for AnGR, it may provide an overall framework for funding and capacity-building in all areas of AnGR management. The respective elements of the surveying and monitoring strategy should be integrated within this framework.

A summary of the review of resources, capacity-building needs and potential funding sources should be included in the final strategy document. A cogent analysis of resource requirements and

funding opportunities, and an effective communication strategy, will help to make stakeholders aware of what resources are required and promote efforts to address these needs. This should facilitate grant applications in support of surveying activities if such opportunities exist. The process of building awareness among stakeholders will take time, but may create opportunities for securing regular support for the surveying and monitoring strategy.

Step 6. Review the legal status of the survey data and outline procedures for data storage and access

As described in Step 1, the policy and legal framework that establishes the mandate for the surveying and monitoring strategy should, ideally, address the question of access to and use of the data produced by the surveying activities. Once options for data collection have been identified, the Strategy Working Group should clarify the legal status of the planned survey outputs and ensure that clear procedures, consistent with the relevant legal frameworks, are established for their management. *Inter alia*, it may be necessary to consider:

- laws that restrict the collection of the data and/or limit access to survey results (e.g. data protection laws);
- laws that promote access but undermine control of the survey data (e.g. freedom of information laws); and
- how these laws may differentiate among the data items within a single survey (e.g. the name and income of the livestock keeper may, in law, be treated differently from the size of the holding and its livestock numbers).

If it is envisaged that the task of implementing individual surveys will be subcontracted to partner organizations, the legal status of the data collected by the subcontracted organizations, access rights to these data, and arrangements for their transfer to the relevant national authorities will need to be clarified. Legal and “soft-law” obligations towards the primary providers of the data (see Step 1) should be reviewed, and mechanisms for meeting these obligations outlined. If a national databank is to be established, responsibilities for setting it up and running it should be agreed upon. Legal advice may be necessary on these matters. If the Strategy Working Group considers that the national policy and legal framework addressing the collection, storage and use of survey data is still inadequate, recommendations for amendments should be put forward to the relevant authorities.

Step 7. Draft the strategy

Based on the work conducted and documented in the previous steps, the Strategy Working Group will have identified national priorities for data collection, options for meeting these objectives, broad resource needs and availability, capacity-building requirements, current availability of funds, and options for mobilizing additional resources. The final elements of the planning process are to draw the analysis together into a coherent strategy and write a document to communicate the strategy to all stakeholders. The surveying and monitoring strategy should, if possible, be published either as integral part of the National Strategy and Action Plan for AnGR or as a supplement to it.

The degree of complexity involved in this step will depend on the number of objectives, the number of feasible alternative approaches, and the degree of certainty with which assumptions can be made regarding the availability of funding. The strategy document should be more than a wish list – it should be realistic and provide guidance for action. Ideally, it should:

- link the surveying and monitoring strategy to the *Global Plan of Action for Animal Genetic Resources* and, if relevant, the National Strategy and Action Plan for AnGR;

- outline the mandate for the strategy and show that it is embedded in the country's legal and policy framework;
- indicate who is responsible for overseeing the implementation of the strategy as a whole;
- provide justification for the strategy based upon the current state of knowledge and a description of the planning process;
- describe the main elements of the strategy (a series of surveys), including:
 - the principal objectives of each these elements;
 - the schedule for implementation;
 - who will be involved in implementing the individual surveys;
 - guidance on the types of surveying tools to be used;
 - guidance on the planning of individual surveys (including stakeholder consultations);
- describe capacity-building needs associated with the strategy and set out a plan to address them;
- describe the communication activities needed to raise awareness of the strategy and to ensure stakeholder involvement;
- indicate the resources required for each element of the strategy, including the capacity-building and communication activities;
- describe how the resource needs will be met;
- outline the procedures that need to be established for storing and accessing the data that are collected;
- outline a strategy to secure ongoing funding for the surveying and monitoring strategy;
- outline procedures for evaluating and reviewing the strategy; and
- describe how the outputs of the strategy will be used at national level and how they will be communicated internationally (e.g. via FAO).

If preparing a detailed schedule for the strategy as a whole is not feasible at this point, start with the highest priority actions. Ensure that the strategy includes mechanisms for further planning and review. Identify means to promote stakeholder involvement and to mobilize resources.

Step 8. Conduct a review of the strategy document and obtain formal endorsement

Once a draft strategy has been prepared, it should be circulated for review by the various stakeholders who will be involved in implementation or who are likely to use the outputs of the strategy. Guiding principles for conducting such reviews can be found in the guidelines on preparation of national strategies and action plans for AnGR (FAO, 2009c). If necessary, the strategy should be revised in light of the outcomes of the review. Send the finalized document to the responsible authorities asking them to agree to and formally endorse the strategy.

4 PLANNING A SURVEY

- A well constructed plan is central to achieving a cost-effective survey
- Build community support before the surveying activities begin
- Timing can be the difference between success and failure

Once a country's surveying and monitoring strategy has been finalized (Section 3), the next task will be to organize its implementation. This section focuses on planning the individual surveys that form part of the overall national strategy.

The national strategy document should clearly state who is responsible for coordinating and overseeing the implementation of the strategy as a whole. The task may, for example, be given to the National Coordinator for the Management of AnGR in collaboration with the Strategy Working Group that drew up the national strategy. This, however, does not mean that the National Coordinator's host institution will necessarily do the surveying work or undertake the detailed planning of individual surveys. It may be appropriate to subcontract or delegate these activities to other organizations. For example, if the National Coordinator works in the Ministry of Agriculture, the surveying might be subcontracted or delegated to other government agencies, to universities or to research institutes.

In some cases the national strategy may envisage that the proposed data-gathering activities will be based on a piggyback survey or a survey jointly managed by more than one organization. The general feasibility of such an approach should have been explored with the relevant organizations during the planning of the national strategy. The Strategy Working Group should now bring the collaborators together at the earliest opportunity in order to establish agreement regarding the modalities for the shared work.

The organization (or consortium of organizations) that is given the task of implementing an individual survey will need to establish a Survey Team whose role it will be to organize, manage and oversee the entire survey process (planning, preparation for field work, the field work itself, data management, data analysis and communicating results). If possible, the Survey Team should include a member of the Strategy Working Group. This will create a channel of communication between the Strategy Working Group and the Survey Team and allow the Strategy Working Group to monitor progress and ensure that its requirements are being met. The Survey Team may find it useful to organize their work according to the following 11 steps:

- Step 1. Clarify the objectives of the survey
- Step 2. Review the composition of the Survey Team and establish clear management structures
- Step 3. Assemble and collate background information and data
- Step 4. Review the legal framework
- Step 5. Start preparing the "blueprint" of the survey
- Step 6. Develop the communication plan
- Step 7. Develop the sampling frame and the analysis plan
 - Step 7.1 Develop the sampling frame
 - Step 7.2 Develop the analysis plan
- Step 8. Develop the Data Management Plan
- Step 9. Develop the Field Operations Plan
- Step 10. Finalize and approve the blueprint
- Step 11. Maintain documentation and costing

Thorough planning is extremely important in ensuring the success of the survey and the quality of the results. It is essential that sufficient time be allocated for planning. A solid foundation for the planning process should be laid by clarifying the objectives survey (Step 1); establishing who will be involved in planning and implementing the survey (Step 2); and setting up clear management structures (Step 2). Only then should the Survey Team proceed to write detailed plans for each area of activity.

Step 1. Clarify the objectives of the survey

The Strategy Working Group should have provided the Survey Team with clear terms of reference that include the following:

- why the survey is being conducted and how the outcomes will be used;
- the scope of the survey; and
- the degree of precision that is being sought (Box 30).

The description of the scope of the survey should consider the following:

- data requirements: what data are required to satisfy the objectives of the survey (e.g. population size and structure, details of specific threats or development opportunities, or aspects of phenotypic characterization)?
- geographical location: is the survey to cover the whole country or only particular administrative units, villages or breeding tracts?
- species and breeds: are all species to be included, or is the survey limited to particular species or particular breeds within species?
- community and social groups: is the survey intended to be comprehensive or focused upon certain communities or groups (e.g. nomadic livestock keepers, women livestock keepers, or livestock keepers living below a particular poverty line)?
- production systems: is the survey addressing particular production systems?
- any other aspects of the scope of the survey that need to be considered.

Box 30. What is meant by “precision”?

The precision of a survey is a measure of how confident we are in the outcome, or what may be the scale of errors caused by sampling. Such errors are unavoidable. For example, suppose that 20 percent of the holdings in a region are sampled and the cattle on each holding are counted. It may be that a reasonable estimate of the total number of cattle in the region is 5 times the total count. However, this estimate is not exact because not all holdings have been visited. The statistical analysis will provide an idea of the precision of the estimate, possibly in the form of a confidence interval. It might, for example, be stated that “the estimated total number of cattle is 12 345 with a 95 percent confidence interval of 9 876 to 15 432”, meaning that the best single estimate is 12 345, and the probability is 0.95 that the interval given includes the true value. This, then, gives an idea of the possible magnitude of the error. The greater the proportion of holdings sampled, the lower the magnitude of the possible errors. Clearly, if all holdings are sampled there is no sampling error, but the cost will be much greater than if only 20 percent of holdings are sampled, and it may be that the estimate obtained with the smaller sample is sufficiently precise for decision making.

The Survey Team should review the terms of reference carefully, and should consult the Strategy Working Group to obtain further guidance about anything that is not absolutely clear. Clarifying the purpose, scope and required precision of the survey is important because these factors will determine the quantity of resources that are required. A more comprehensive and precise survey will require more resources. The scope of the survey will also influence the choice of data-collection tools. This is because the effectiveness of particular tools will depend on the quality of the infrastructure in the locations to be covered by the survey and on the customs and education levels of the people who will be asked to provide information. It may be useful at this point to review relevant secondary literature on the survey area and its AnGR (see Step 3 for more

detailed discussion). Further guidance from the Strategy Working Group may be needed to clarify the “boundaries” of the survey, i.e. what is to be included and what is not.

Once the objectives of the survey are clear, the Survey Team should review Section 2 of these guidelines and consider what tools, or combination of tools, can meet the objectives of the survey with the required precision. Options for data collection are likely to have been considered, in broad terms, during the development of the national strategy. However, the Survey Team should carefully consider the specific needs and circumstances of the survey for which it is responsible. Even at this early stage, two kinds of technical support must be sought:

- statistical advice – to assess the magnitude of the task of achieving the required precision and quality of information; and
- advice on information technology – to assess requirements for data management.

Bearing possible tools in mind, the Survey Team should consider whether the objectives of the survey are realistic given the resources that have been made available and the proposed timescale. If not, they should consult the Strategy Working Group and, if necessary, adjust the plans until a practical and realistic set of objectives for the survey is reached. Note, however, that the feasibility of the survey may not be fully clear until after Step 2.

Step 2. Review the composition of the Survey Team and establish clear management structures

At this point, the Survey Team should explore the feasibility of the proposed surveying activities in greater detail. This process should begin with a review of the organizational and logistical resources, technical expertise and local knowledge that the Survey Team can draw upon. During Step 1, the Survey Team will have given some consideration to the tools that will be employed and will therefore have an idea of what resources are required.

If the relevant technical expertise is not already available in the Survey Team, additional experts will need to be brought in to provide advice. As described above, it will be essential to involve experts in statistics and information technology. Other needs will depend on the objectives and the scope of the survey. For example, if the objective is to understand the economic potential of sheep breeds in a survey area where there is an important market for wool, it may be useful to include experts who can judge wool quality.

The Survey Team should identify organizations that operate in the survey area and that it may be possible to involve in the surveying activities. Likely candidates include the national agricultural research system, universities, extension services, district and local administrations, veterinary services, NGOs, development organizations, livestock keepers and breeders’ organizations. Organizations and stakeholder groups that are potential collaborators in the conduct of surveys should have been identified in general terms during the planning of the national strategy. Representatives of these organizations and groups may have been brought into the national planning process. The Survey Team should review the relevant sections of the national strategy document and if necessary consult the Strategy Working Group regarding progress in the development of terms and modalities for collaboration at national (or subnational) level.

Technical experts and representatives of organizations that are potential collaborators should be invited to a meeting to discuss the tools to be used in the proposed survey and the timescale, human and technical resources and costs that would be involved. While the main objective at this stage is to ensure that the infrastructure and logistics required for the survey can be delivered, it will probably also be useful to involve community leaders from the survey area – they may be able provide valuable information about what will be feasible on the ground. The meeting will be an opportunity to identify previously unrecognized issues and ambiguities that might undermine the effectiveness of the survey, and to plan how to resolve them. The participants may be aware of

existing data that will be useful in the design of the survey or in its interpretation. Box 31 presents some perspectives on the timescale of surveys.

The proposals that emerge from the meeting should be reviewed to ensure that they are consistent with the objectives established by the Strategy Working Group and with the amount of resources and time that are being made available. If they are not, resolve where and why the discrepancy arises. Discuss the issues with the Strategy Working Group. If necessary, establish new terms of reference for the survey. Ensure the any changes to the terms of reference are documented by both the Strategy Working Group and the Survey Team.

Once the terms of reference of the survey are fully resolved, the roles and responsibilities of the various collaborators should be agreed upon. The Survey Team should be expanded, as necessary, to include additional technical experts, representatives of collaborating organizations and community leaders. Note that from here on in the guidelines the term “Survey Team” refers to the expanded team.

Box 31. How long does a survey take?

How long a particular survey takes will depend upon its scope and on the resources used. Nevertheless, some general perspectives should be borne in mind:

- field operations can only take place once the planning and preparations are complete;
- analysis can only be conducted once all the data have been obtained; and
- communicating the outcomes of a survey can only begin after the analysis is complete.

The amount of time required will, therefore, be the sum of the times required for:

- planning and preparing for the field operations;
- the field operations themselves;
- data analysis and interpretation; and
- communicating results.

Planning and preparation

Some of these activities can be conducted in parallel with others. The time required will be at *least* as long as the time taken to complete the most time consuming of the following activities:

- setting up the database needed to manage the data;
- establishing the detailed sampling frame;
- developing the field materials and recruiting and training the field workers; and
- contacting and obtaining support from community leaders and/or local authorities.

These times will depend on the tools used, and the level of experience of the Survey Team.

Field operations

The time required will depend on the scope of the survey and the availability of human resources. Note that the feasible dates for the start and end of the field operations may be determined by the season (see Box 33), either because of the practicalities involved in conducting the field work or because the objectives of the survey require the collection of data during a particular season.

Data analysis and interpretation

The time required will depend on the scope of the survey and complexity of the objectives.

Communicating results.

The time required will depend on the target audience and the modalities used for communication.

It is important that responsibilities within the Survey team be clearly allocated. The individuals given responsibility for overseeing the various elements of the survey process are referred to in these guidelines as “managers” (Box 32). This terminology does not imply that the individuals concerned should not be actively involved in the practical tasks that make up the survey. It is important, for example, that they go to the field and participate in data collection. The managers should, however, take responsibility for planning, quality control and, where appropriate, delegation of tasks.

Box 32. Establishing responsibilities within the Survey Team

It is recommended that the following roles, corresponding to areas of responsibility, be established within the Survey Team. It is possible for an individual person to take on more than one role, but it is recommended that no role identified below should be shared.

Survey Team Manager – takes overall responsibility for the conduct of the survey, including budget and time schedule.

Field Operations Manager – responsible for the organization and conduct of the field activities that are required in order to collect the data.

Data Manager – responsible for receiving survey data from the field and for organizing and overseeing its safe storage and retrieval. This role will require technical knowledge of information technology.

Analysis Manager – responsible for the statistical analysis and technical interpretation of the data collected. This role will require sound knowledge of statistics.

Communications Manager – responsible for communications between the Survey Team and wider stakeholders and for managing the publication of the survey results.

Financial Manager – responsible for managing the finances of the survey in accordance with the budget allocated and, where necessary, raising additional funding.

The areas of responsibility outlined above will inevitably overlap to some extent. Close cooperation among the members of the Survey Team will be essential. Areas of work that will require cooperation include:

- entering data from the field into a database (Field Operations Manager and Data Manager);
- accessing data for analysis (Data Manager and Analysis Manager);
- developing messages based on the results of analysis (Analysis Manager and Communications Manager);
- developing effective communication between the field workers and the survey interviewees (Communications and Field Operations Manager); and
- ensuring that all activities are cost effective (Financial Manager and all other managers).

Step 3. Assemble and collate background information and data

The Survey Team should seek to identify what data and information relevant to the objectives of the survey are already available, what organizations hold them and in what format. It is important to think carefully about what data and information may be helpful. The following list provides some examples:

- For a mapping survey, agro-ecological zones or other biogeographic data for the survey area (e.g. soil, vegetation, epidemiological and climatic variables – both average figures and the risk of extremes) may be invaluable.
- For a household survey, an estimate of the number and demographic structures of households in the area will be useful.
- For a survey that involves characterizing breeds, information obtained from breed societies will be useful, if such societies exist and are considered representative of the wider breed population.

Draw on the knowledge of all the members of the Survey Team in order to identify possible sources of data and information. Relevant material may be available, for example, from government departments, veterinary services, other agencies concerned with livestock, national planning and central statistics units, NGOs and community sources.

Identify whether there have been previous surveys that are relevant to the forthcoming survey. Examples might include surveys with similar objectives conducted in other countries or surveys with different objectives conducted in the same location. Seek out the reports of these surveys. Consider the following questions:

- What lessons can be learned from the previous surveys?
- What worked well and what did not?
- How have circumstances changed since the previous surveys were conducted?
- Are the objectives of the forthcoming survey different from those of the previous surveys, and if so, how might this affect the methodologies to be used?

If any previous surveys seem to be particularly relevant, try to obtain the database(s) that contain the results (this will not always be possible because the use of the data from these surveys may be constrained by confidentiality issues).

In some circumstances, the forthcoming survey will be a follow-up to earlier surveys that have been implemented as part of the national surveying and monitoring strategy. For example, the forthcoming survey may be a household survey that has been preceded by rapid appraisals, or it may be the latest in a series of monitoring surveys. In such cases, the forthcoming survey must be coherent with those that have gone before it. Access to the databases from the previous surveys is therefore a priority.

Step 4. Review the legal framework

At an early stage in the planning, the Survey Team should ensure that it is fully aware of the legal framework within which the survey and any follow-up activities will take place. Careful consideration needs to be given to the question of who owns the data collected, who will have access to these data and for what purposes. The issue should have been addressed during the development of the national surveying and monitoring strategy. However, the Survey Team will need to consider the specific circumstances of the survey for which it is responsible, taking the law and the stipulations of the national strategy into account. It may be necessary for the various institutions that are represented in the Survey Team – and other stakeholders such as the government – to enter into legal agreements on the ownership, storage, access and use of the data. In some countries, data collected during surveys and held on computers (as will usually be the case) are subject both to data protection laws and to freedom of information laws.

The Survey Team Manager should take responsibility for ensuring that the legal framework within which the survey activities take place is clear to everyone involved. The issue will need to be kept under review throughout the planning and implementation of the survey. If problems occur, advice should be sought in the first instance from the Strategy Working Group. If strategic problems that may create obstacles for the country's surveying and monitoring efforts are identified, they should be brought to the attention of those responsible for developing enabling policy for the management of AnGR.

Step 5. Start preparing the “blueprint” of the survey

The Survey Team needs draw up a “blueprint” for the survey. The blueprint should include a series of plans that cover communicating with stakeholders, the sampling frame, field operations, data management, data analysis (see Steps 6 to 9). Individual members of the Survey Team

should be given the responsibility of ensuring that the individual plans are prepared in good time and are fit for their purposes. However, it is essential that the whole Survey Team be involved in ensuring that all the plans align coherently. It will probably be necessary to revise the plans a few times as they are meshed together. If the need arises, additional specialized technical advice should be sought. The background data and information assembled during Step 3 should be drawn upon as necessary.

The completion of the blueprint will define the date of the forthcoming field operations and mark the start of the implementation of the communication plan for raising awareness of the survey among stakeholders who have not been involved in the planning. While the blueprint may be refined if unforeseen problems or opportunities come to light, it will be confusing for the stakeholders if the timing of the field operations does not correspond to what they are first told. Therefore, ensure that estimates of the amount of time needed for preparatory activities are conservative and that the Survey Team is confident in the proposed schedule and committed to being ready on time to start the fieldwork. Box 33 provides some advice on the timing of surveys.

Box 33. The timing of surveys

The timing of a survey can be crucial:

- Travel may be impossible during rainy or cold seasons.
- Livestock keepers may be busy with seasonal tasks such as sowing or harvesting, and therefore unable or unwilling to spend time being interviewed. They may also be involved in seasonal cultural or religious activities.
- Animals of some breeds are kept in mobile systems and for much of the year may not be kept close to the household, whereas other animals are always present.
- Elections and other sources of political tension can make it impossible to collect data.
- The size and structure of livestock populations are affected by breeding and marketing. Camel herds in Rajasthan, India, provide a good example – herd sizes increase between November and March because of the birth of young camels. In October or November, all young male camels are sold at a particular fair, so within the a few days the percentage of young and male animals in the population declines dramatically.
- The stage of the production cycle at which the survey is conducted must be appropriate to the objectives of the survey, and should be taken into account in the interpretation of the results.

Step 6. Develop the Communication Plan

Communication with stakeholders and the wider public is an essential element of the survey and should be planned with care. Advice on planning a strategy for communicating the results of the survey is provided in Section 9. However, is vital that the Survey Team also develop a plan for communicating with stakeholders during the period leading up to the field operations. The Communications Manager should take overall responsibility for the preparation of the communication plan, which should provide a basis for establishing a good rapport with stakeholders who may be affected by the survey. Whatever the circumstances of the survey, stakeholders should be informed about:

- the objectives of the survey;
- the benefits that it may bring and who will receive these benefits;
- the type of activities that the survey is likely to involve and what will be required of the participants;
- who is organizing and conducting the survey;

- when it is planned to take place; and
- who will have access to the data collected and how it will be used.

The communication plan must take into account the need to obtain the “prior informed consent” of those providing the data (see Section 3). This requires particular attention in places where livestock keeping is culturally important and contributes to the identity of social groups.

A summary schedule should be prepared for all the communication tasks that need to be undertaken. For each task, the schedule should detail:

- the stakeholders to be targeted;
- the message(s) to be communicated;
- modalities for delivering the message(s)
- what needs to have been done before each message can be delivered (e.g. do the survey questionnaires need to have been finalized?).

A Gantt chart (Box 34) showing the timing of the various tasks should be prepared.

Box 34. Using Gantt charts

A Gantt chart is a kind of bar chart used to represent graphically the time schedule of a project. Time is shown on the x axis of the Gantt chart and each activity is represented by a horizontal bar, the two ends of which correspond to the start and end dates for the activity. The chart can be used to illustrate the interdependencies among the activities that make up a project: for example, whether the start or completion of particular activities can only occur once others have been started or completed.

Creating a Gantt chart will make it easier to synchronize the various tasks outlined in the blueprint of the survey and to understand the consequences of any delay in completing the tasks. Figure 1 in Section 1 is an example of a rudimentary Gantt chart for a typical survey, but a much more detailed Gantt chart will be required for effective planning of a real survey. The x axis of the chart should be defined in days.

Involving community leaders and/or local officials will often be the key to an effective communication strategy. Their support is crucial, as they may be able to influence community members’ attitudes towards the survey and their willingness to provide information. If leaders can be convinced that the survey will give rise to benefits for them and their communities, data collection will be much easier. The communication plan should prioritize contacting community leaders at the earliest opportunity. NGOs often have ongoing relationships with community leaders and can facilitate their involvement in the survey. In some circumstances, the community leaders may already be involved in the process of planning the survey (Step 2) and may also have been involved in the development of the national surveying and monitoring strategy (Section 3). If this is the case, it should be relatively straightforward to draw up plans for ongoing communication with them. If the forthcoming survey has been preceded by a participatory appraisal, a broader layer of stakeholders may already be well informed about the process. It should be possible to build upon this understanding as the planning and implementation of the survey goes forward.

A communication plan is needed even if communication channels are already well developed. This is because the messages that need to be communicated will change as preparation progresses and details of how the survey will be implemented become clearer. During the early stages of the planning it should be emphasized to the stakeholders that the plans are still in development and may change. Moreover, the messages presented to different stakeholder groups will become

increasingly differentiated as preparation progresses. Maintaining the support of communities that are likely to be directly affected by the survey is critically important. The information provided to them needs to be more detailed than that provided to stakeholders who are less closely involved. The intensity of communication with the communities targeted by the survey should increase as the time of the field operations approaches.

The amount of information that needs to be communicated will depend on the type of survey tools being used. In the case of an aerial survey, for example, it is likely that only very general and occasional messages will need to be communicated. Conversely, a household survey will require much more detailed information and a more intense communication effort. Different communication methods will be suitable for different stakeholders. Options include community meetings, presentations at markets or other gathering places, or using media such as posters, newspapers, radio or television.

When the communication plan is ready, the Communications Manager should present it to the Survey Team who should review it and if necessary propose amendments. The implementation of the communication plan should start as soon the blueprint is agreed upon.

Step 7. Develop the sampling frame and the Analysis Plan

The Analysis Manager needs to develop two inter-related plans. The first of these plans should address the size of the population sample and how this sample will be obtained. The technical name for this is the “sampling frame”. Developing the sampling frame is a task that needs to be addressed early in the planning process as it will determine the type and volume of data that the Data Manager will have to deal with and will be the basis for the Field Operations Manager’s plans for data collection. The second plan should address the data analysis. The content of the latter plan will to a large extent will be determined by the purpose of the survey and by the preceding work on the development of the sampling frame. The analysis may require the use of ancillary (pre-existing) data, such as previous survey data or climate data. The Analysis Plan should detail what ancillary data are required and where they are to be obtained from.

The Analysis Manager should work closely with the other members of the Survey Team during the development of the sampling frame and the analysis plan. For example, the Survey Team Manager will need to address any legal arrangements that are needed in order to obtain access to the ancillary data required for the analysis. The Field Operations Manager should be consulted regarding whether it is feasible to collect the data required for the proposed analysis given the time frame and resources available, and should ensure that the data requirements are reflected in the plans for the field operations. The Data Manager will also need to be closely involved, as the implementation of the analysis plan will depend on effective management of the data collected in the field. The Data Manager will also need to plan the management of any ancillary data required.

Step 7.1 Develop the sampling frame

In essence, the sampling framework is determined by the scope and specific objectives of the survey and by the survey tools being used. A crucial technical consideration in planning the sampling frame for an AnGR survey is the need to capture as much as possible of the measurable diversity (i.e. variation) in the designated survey population, and not to focus on typical features (i.e. averages) of sample populations. It is important to collect data from a representative sample of the designated survey population so that sound inferences can be drawn regarding the attributes of the population. It is therefore important to identify and assess potential sources of variation in these attributes. Factors to be considered may include:

- agro-ecological features of the survey area (variations in elevation, temperature, rainfall, relative humidity, etc);

- management systems (variations in production objectives, intensity of production, access to inputs and services, etc);
- economic and socio-cultural factors (variations in the relative importance of livestock in the local economy, ethnic backgrounds, culture and traditions, human population density, access to markets or socio-economic services, administrative or governance boundaries, etc).

Whether and to what extent such factors potentially influence the current and potential future state of AnGR needs to be assessed before the sampling framework is defined. Knowledgeable stakeholders may need to be consulted. Once agreement is reached on the variables that need to be considered in the sampling process, appropriate sampling techniques can be chosen, guided by technical advice from competent statisticians or biometricians. Depending on local circumstances, the major classification variables for defining the sampling frame might be agro-ecological zones, political boundaries, production systems or spatial distributions of major ethnic groups. The variables chosen can be used to stratify the survey area into more homogenous sub-units to ensure proper coverage of the major characteristics and facilitate selection of representative sampling units that reflect as closely as possible general features of the total survey population.

Determining the sample sizes and the actual procedure of selecting the samples needs to be handled by experts in statistics, as these decisions will have a major influence on the results of data analysis and hence the on the inferences that are made about the survey population. The statistical procedures involved include the identification and selection of units to be enumerated. These units could be households, breeds, livestock units, dip tanks, administrative areas, holdings, etc. It is necessary to ensure that the selected units form a representative sample so that they can be used to make valid estimates for the whole population.

A cost-effective survey design will maximize the precision of the answers obtained to the survey questions, given the resources available. Alternatively, and technically equivalent, it will minimize the resources needed to obtain the precision required in the answers. These guidelines are not intended to be a technical manual on designing surveys. FAO publishes a Statistical Development Series specifically for statisticians dealing with large-scale agricultural data. The Survey Team's Analysis Manager should be familiar with these publications and consult them as appropriate. Two of the series are particularly relevant: No. 3 – *Sampling methods for agricultural surveys* (FAO, 1989) and No. 6 – *Conducting agricultural censuses and surveys* (FAO, 1995). A basic overview is provided in the following paragraphs.

One of the first tasks in developing a sampling frame is to revisit the remit of the survey and reflect upon what is required. An initial step should be to examine the scale and the focus indicated by the remit in terms of provinces, regions, villages and households. Relevant questions include:

- Is there a need to sample all regions in the country?
- Is there a need to sample all villages in the regions targeted?
- Is there a need to sample all households the villages targeted?

As described in more detail below, sampling may be made more efficient by stratifying the process. For example, some regions may be more relevant to the survey objective than others and so justify greater sampling effort. Therefore, it is important to consider whether or not there is reliable prior information available that allows some intelligent weighting of the sampling effort. This is why large-scale surveys may benefit from initial small-scale “scoping” surveys. The following key questions need to be considered:

- Are all regions or villages within a region equally relevant to the survey question?
- Do certain areas require special attention?

For example, in the United Kingdom, sheep production is based on a stratified system, in which “hill” breeds are kept on the uplands of the north and west, while breeds capable of higher production are kept on the more benign downlands of the south and east. A survey to estimate the number of animals belonging to each type of hill breed will waste resources if it gives equal sampling effort to all regions.

Having developed an overview of where the sampling effort should be directed, it is possible to plan the sampling in more detail. It is often helpful to visualize the sampling frame using maps and diagrams. Developing the sampling frame will probably be an iterative process. Precision will depend on the choice of sampling units, stratification, and how important particular strata are relative to others. A balance must be achieved between precision and resources. The following description presents some basic principles of sampling design from which it is possible to glimpse the nature of the trade-offs that need to be made. In practice, resolving these issues will require a statistical expert. No two surveys will be identical.

The basic principles of developing a sampling frame are relevant for all kinds of survey. However, the description provided here focuses on (i) mapping expeditions, aerial surveys and transects, and (ii) household surveys. It is difficult to give detailed guidance on the design of rapid appraisals, as they can involve a very varied range of activities (see Section 2). As outlined in Section 2, one of the key issues in rapid appraisals is to minimize biases through the use of triangulation – whereby different sources of information are used to validate the conclusions. Identifying a means of triangulating data is central to the design of an effective rapid appraisal survey.

A compilation of case studies that describe the remit, design process and application of sampling frames in AnGR surveys – and set out the lessons learned – would be an invaluable resource for those involved in planning such surveys. Such case studies might be included in future revisions of these guidelines.

Mapping expeditions, aerial surveys and transects. Surveys of these types attempt to obtain answers that are representative for an area by collecting data along a series of long thin corridors within it. An overview of sampling for this kind of study (specifically aerial surveys) is provided by Marriott and Wint (1985). To obtain representative answers to the questions being asked by the survey it is important to develop some perspective on the heterogeneity of the survey area in relation to these questions. Assuming that the survey is being conducted at an early stage in a surveying and monitoring strategy when information is limited, the heterogeneity of the survey area may be assessed on the basis of geographical information such as the location of river valleys. The more heterogeneous the area to be surveyed (e.g. the more the livestock occur in clumps rather than being scattered randomly across the area) the more difficult it is to design a transect, mapping or aerial survey that can contribute substantially to answering the kinds of questions that an AnGR survey is likely to be trying to answer. Further discussion of this point can be found in Box 35.

Box 35. Coping with a heterogeneous landscape in a transect survey – an example

Suppose a region is drained by rivers flowing East to West (see Figure). It is likely that the type of livestock present will vary according to whether the land grazed is close to a river or not. In Scotland in the United Kingdom, the land between the rivers is likely to be rough pasture on steep hillsides, whereas along the rivers the land is flatter and more capable of sustaining improved pasture. Therefore, if transect A is chosen the survey may observe few livestock, and these will be of breeds that are adapted to harsh conditions. If transect B is chosen, more livestock will be observed and these will be of different, higher-producing, breed types. If transect C is chosen, then both the production environments will be sampled. A survey will typically consist of several transects. If all transects are East to West then there is likely to be large variation between the

results of the individual transects, some like A and some like B, but it will take a large number to ensure that a representative balance between A-type and B-type transects has been obtained, otherwise there is a serious risk of a large error in the overall outcome. If all transects are C-type, South to North, then the outcome of the transects are likely to show less variation, with each one being more representative of the whole than an A-type or B-type transect, and the required degree of precision will be obtained with fewer resources. A systematic, rather than a random, approach to determining transects is advisable. In this example, such an approach would require using equally spaced C-type transects, but even here it would be advisable to orientate a small proportion of the transects from East to West in order to reduce the risk of missing any East–West trends in the production environment.

Note that in this example transects become unrepresentative because of rivers and the geographical features associated with them. In other cases, however, the infrastructure that enables the transects to be carried out (e.g. roads) may influence the production environment and the associated AnGR (e.g. because the roads allow access to markets and therefore encourage more market-oriented production) or may be influenced by the production environment (e.g. the roads run along valleys where livestock production may differ from that practised on higher land).

Note: the material in this box is modelled on the illustrative examples provided by Marriott and Wint (1985).

More generally, systematic sampling will reduce the sampling error provided that the sampling is firmly based upon the stratification that exists in the population itself and that this stratification is recognized during the design of the survey. The difficulties involved in stratifying a survey area underpins the recommendation (see Section 2) that transect-based methods are most likely to be useful for initial scoping surveys, or in large homogeneous areas in which livestock are more likely to be randomly scattered.

Household surveys. More published information is available on designing household surveys than on other types of surveys. The overview presented in this subsection draws heavily upon Rowlands *et al.* (2003)

Suppose a survey objective is to determine the number of animals of Breed A that are present in a particular village, and n from N households are sampled. If the average number of Breed A animals counted is m per household then the estimate of the total number in the village is Nm . The variation in the number counted at each household is measured by the sample variance $\frac{1}{n} \sum_{i=1}^n y_i^2 - m^2$ where the sum is over the n households sampled and y_i is the number in household $i = 1 \dots n$. The parameter s^2 measures the variability of the numbers of Breed A animals kept in the different households surveyed. If all households keep equal numbers then $s^2 = 0$, but the more diverse the number among households the greater the value of s^2 . This value may vary among the different communities being surveyed.

The standard error, which measures the degree of precision of the estimate Nm as a measure of the true number of Breed A in the village, is $\frac{Ns^2}{n}$. This value can be used to construct confidence intervals (see Box 30). Let $\frac{Ns^2}{n}$, then the standard error can be expressed as $\frac{Ns^2}{n}$ and $\frac{Ns^2}{n}$. There are several points to note with respect to designing the size of the survey:

- Some knowledge of N and s^2 at the design stage is needed to gauge precision, which is why some preliminary surveying may be required to design a cost-effective household survey.
- For a fixed sampling effort of n households the standard error increases, so precision decreases as N and s^2 increase.
- Obtaining precision depends on the proportion, p , sampled: the higher the proportion the greater the precision. When $p = 1$, all households are sampled and the sampled value is the true value.

- Unfortunately, when p is small, doubling the sampling effort does not halve the precision, only reducing the standard error to ~ 0.7 of its previous value.

To expand upon the last of these points, some of the diversity in animal numbers among households, leading to large values for s^2 and lower precision, may be due to identifiable factors such as wealth or perhaps location within the village. Such differences are examples of “stratification”. It is possible to target sampling so as to sample a given number of households within each of these strata. Suppose there are N_1 rich and N_2 poor households, and n_1 rich and n_2 poor households are surveyed, where $N = N_1 + N_2$ and $n = n_1 + n_2$, with an average of m_1 Breed A animals per rich household sampled and an average of m_2 Breed A animals per poor household sampled. Then the village total is \bar{y} where $j = 1, 2$ for rich and poor. The standard error used for precision is then $\frac{1}{\sqrt{n}} \sqrt{\sum p_j s_j^2}$ where s_j^2 ($j = 1, 2$) is the sample variance within the rich and poor groups. If $n_j = p_j N_j$ then $\bar{y} = \sum p_j m_j$, and the standard error can be rewritten as $\frac{1}{\sqrt{n}} \sqrt{\sum p_j N_j s_j^2}$. While this example involves just two strata, rich and poor, it could be generalized to include any number of strata. Note the following:

- If the parameters s_j^2 and N_j are known approximately, i.e. the distribution of households among the strata and how the sample variance may vary within strata, it is possible to minimize the standard error and so maximize the precision by predefining how many of each stratum should be sampled. This is called stratified sampling. On the basis of prior information, it may be reasonable to make some assumptions about how the value of s_j^2 will vary across strata. For example the coefficient of variation may be approximately equal in each stratum, or the numbers may follow a Poisson distribution or some other empirical relationship.
- It is clear that the optimum proportion to sample will depend on both s_j^2 and N_j . To use an extreme example, if $s_j^2 = 0$, i.e. all households within stratum j have equal numbers of animals, then only one household from this stratum need be sampled irrespective of whether there are few or many such households within the village.

The precise optimization of p_j given the constraint on the numbers of households sampled is beyond the scope of the guidelines, but the key point is that with some prior knowledge sampling can be stratified to achieve the greatest precision possible from a given number of households surveyed. This kind of analysis can be extended to optimize sampling when there is more than one dimension of stratification that may be of importance: for example, by wealth or by cultural background.

Having estimated the total number of Breed A animals in one village it may be necessary to estimate the total number of Breed A animals in a collection of K villages, of which only $r < K$ have been surveyed. While the estimation of the total numbers follows the principles described above, the new element is that the total sample variance upon which the standard error is calculated contains two sources of variation. The first is the accumulated variation associated with the uncertainty over the estimate from each of the surveyed villages. The second is the variance arising from not having surveyed all the villages. This is based upon an estimate, S^2 , obtained from the variance in the totals of Breed A found in the villages that were sampled. The second term has the form $\frac{S^2}{r}$. While details will be left to technical publications (e.g. FAO 1989 and 1995) the following points should be noted:

- As more villages in the collection are sampled (i.e. as r increases) so the additional variance arising from sampling the villages decreases, as $(K-r)/r$ decreases.
- If a given number of households are to be surveyed for the whole collection of villages, the more villages sampled, the smaller the number of households that can on average be sampled per village. Therefore, while sampling more villages decreases the between-village component of error it increases the variance associated with the estimate for each village surveyed.

- There may be benefit in stratifying the sampling villages, by geography, by typical wealth and by size.

Optimizing the surveying of a given total number households across villages and households within the villages is complex. However, given some preliminary information on village sizes and on the different strata within the communities, coupled with some statistical assumptions based on prior information about how households within strata vary, it is possible to optimize the design.

Step 7.2 Develop the Analysis Plan

Developing the sampling frame will have involved working through the models to be used in the analysis and considering what other data may be needed to address the objectives of the survey and help in interpretation. However, it is important at this point that the outline of the proposed analysis be documented together with an estimate of the resources required. The Analysis Plan should therefore include:

- a recap of the objectives of the survey;
- an inventory of the data that are to be collected in the survey, a description of what will be estimated from these data, and an explanation of how these estimates will address the objectives;
- an inventory of other data and databases that will need to be linked to the survey data for the analysis and for interpreting the results of the analysis (the owners of these ancillary data will need to be identified);
- an outline of methods and models to be used in the analysis, including possible procedures for checking data quality;
- procedures for quality assurance so that an audit trail can be established (Box 36);
- a list of the equipment required for the analysis, including computer hardware and software (these requirements should be coordinated with the Data Manager to avoid double counting);
- an estimate of the time required to process and analyse data after the database is completed;
- a list of the personnel required for carrying out the plan, including any technical competencies that they must have;
- details of the costs involved, including specialist software and human resources – costs for hardware resources should be included in the Data Management Plan; and
- a Gantt chart for all the data analysis activities.

Box 36. Providing an audit trail in statistical analysis

All statistical analyses require a process of data checking that gives rise to a set of data that can be considered reliable. The term “reliable” in this context means that data points have veracity and are as intended. For example, if a data point is intended to indicate the number of cattle kept on a small holding, then a value of 1 234 567 clearly represents an error, and one of such a large magnitude that all analyses in which the data point is included will be meaningless. Avoiding such problems requires a process of checking, which may result in some data points being excluded from the dataset according to predetermined, objective, criteria. Once the checking has been completed, the data will be subject to a series of analyses: fitting different models to test hypotheses and help in the interpretation of the data, with each model leading to a different set of estimates.

Because the process of data checking may have led to the exclusion of some data points, it may be unclear how the estimates in the final report of the analysis have been obtained from the original data, and nearly impossible to reproduce the analysis. Therefore, it is important to provide an audit trail, which details how the original data were screened, why any data were amended (if at all), and what data files were analysed and contributed to intermediate decisions or to the final report. The method of providing the audit trail may vary from survey to survey, but the test of whether an audit trail is adequate is whether another statistician would be able to repeat the analyses and obtain the same estimates.

Step 8. Develop the Data Management Plan

The Data Manager should draw up the plan for data management. Section 7 of the guidelines gives an overview of key issues that need to be addressed during data management operations and should be read before drawing up the plan. It is important to note that the amount of time needed to develop the database will affect the timing of the survey, because the data will need to be stored as it is collected.

The Data Management Plan should include:

- procedures for data handling in the field;
- procedures for transferring data from the field to the site(s) of data entry;
- database design including procedures for coding the data collected in a relational database this requires defining the set of tables, fields within tables, field attributes, relationships between tables, etc;
- standard operating procedures for entry of data – where will it be done, who will do it, and how it will be verified (e.g. it is common to use double entry as a means to detect typographical errors);
- procedures to monitor data accumulation and data quality in a relational database this will include scripting reports and establishing the frequency with which the reports should be run;
- how the database will be linked or merged to the ancillary data sources identified in the Analysis Plan;
- procedures for data security that meet the legal framework pertaining to the survey;
- procedures for allowing authorized access to data and extracting data for analysis;
- procedures for backing up data to avoid disastrous losses as a minimum, the procedures should protect the data against human errors such as accidental deletion or randomization, and against misfortunes such as damage to hardware or the premises where data are stored;
- data storage in the long term; i.e. archiving and procedures for access beyond the immediate needs of the survey;
- equipment required for data management, including computer hardware and software (these requirements should be coordinated with the Analysis Manager to avoid double counting);
- time required to build the database structure ready for data entry at the start of field operations;
- time required to complete the database ready for analysis once field operations are completed;

- personnel required for carrying out the plan, including any technical competencies needed;
- costs, including hardware, software and human resources – excluding any specialist software required by the Analysis Manager; and
- a Gantt chart showing the schedule for all the data management activities.

The plan needs to be compatible with the Field Operations Plan (Step 9 below) in terms of procedures for capturing the data, and with the Analysis Plan (Step 7.2) in terms of procedures for data extraction and linkages between datasets. The Data Manager should therefore work closely with the Field Operations Manager and Analysis Manager when drawing up the plan. Once the plan is ready it should be presented to the Survey Team who should review it and, if necessary, propose revisions.

Step 9. Develop the Field Operations Plan

Completing the previous steps will have established the purpose and scope of the survey, the tools to be used to conduct it, and the sampling frame. This provides the information upon which to base the plan for the field operations. The Field Operations Manager should take responsibility for drawing up this plan, but the Data Manager and the Analysis Manager should provide support. The field operations are the interface between “the surveyors” and “the surveyed”, and therefore are crucial to the success of the survey. The guidance on preparing for the field and working in the field presented in Sections 5 and 6, respectively, should be consulted before drawing up the plan. The precise content of the field operations plan will depend on the surveying tools that are to be used. The plan for a household survey should cover the following:

- preparing questionnaires;
- kit for field workers;
- recruitment and training of field workers;
- organization of teams in the field;
- logistics and communication in the field;
- protocol for a day in the field;
- conducting interviews and any supplementary data gathering activities;
- being ready for the unforeseen;
- changing the field protocol during field operations;
- arrangements for a pilot trial;
- human resource requirements;
- costs; and
- a Gantt chart for the preparation and conduct of field operations.

When the plan is ready, it should be presented to the Survey Team, who should review it and if necessary propose amendments.

Step 10. Finalize and approve the blueprint

Once the plans for each element of the survey have been prepared, the Survey Team should finalize the blueprint, ensuring that all the component plans align coherently, both in terms of their inputs and outputs, and in terms of timing. The proposed schedules of all the phases of work should be reviewed to ensure that they are realistic. It is particularly important that the proposed

start and end dates for the field operations can be met. A Gantt chart for the whole survey showing the detailed time schedule should be prepared and included in the blueprint. If necessary, the individual Gantt charts included in the component plans (Steps 6 to 9) should be amended and brought into line with the finalized overall schedule. The blueprint should include a realistic indicative budget for each of the phases of work described in the component plans. It should also include clarification of the legal framework for ownership of, and access to, the survey data. Once the blueprint is satisfactory, it should be formally approved by the Survey Team.

Step 11. Maintain documentation and costing

If, as is likely, further amendments to the component plans of the blueprint or to the costings of these activities are required as implementation gets underway, the changes should be fully documented.

5 PREPARING FOR THE FIELD

- Test survey procedures thoroughly, it is too late once field work starts
- Pay close attention to the field kit
- Training yields quality data

This section describes the activities that need to be undertaken during the period running up to the start of data collection in the field. The main focus is on preparing for surveys that involve teams of field workers going to interview livestock keepers face to face. The following steps will need to be followed in most surveys of this kind:

- Step 1. Prepare questionnaires
- Step 2. Prepare the kit for the field workers
- Step 3. Draft plans for the recruitment and management of field workers and their supervisors
- Step 4. Recruit field workers
- Step 5. Conduct a pilot trial in the field
- Step 6. Train field workers and their supervisors

Step 1. Prepare questionnaires

Many surveys will require the preparation of questionnaires. The most common kind of questionnaire is a tool to be used by field workers during interviews with individual livestock keepers or key informants (see Section 2). Such questionnaires may be more or less structured. Highly structured questionnaires include a fixed list of questions that offer only a limited choice of answers. Less structured questionnaires do not restrict respondents' answers and give them opportunities to qualify or explain their responses. They also provide opportunities for interviewers to ask additional questions in order to investigate the reasons behind the answers offered.

Another type of questionnaire that may be needed is a set list of questions for field workers to complete after having conducted a group meeting or exercise. This kind of standardized recording tool will make it easier to analyse the outcomes of such encounters particularly in a large-scale survey, although the detailed field notes made by the field workers should also be retained.

The type of questionnaires to be used should have been decided upon during the planning phase of the survey (Section 4), taking into account the objectives of the survey and the capacity of the Survey Team to manage and analyse different types of data. However, the detailed design of the

questionnaire will still have to be addressed. Designing questionnaires is a time-consuming process, and if they are poorly designed the whole survey may be of little value. Therefore it is important to allocate sufficient time and resources to getting the questionnaires right. Involving community representatives in the design of the questionnaires may be invaluable. At minimum, it is a good idea to ask community representatives to check interviews to identify any questions that may be culturally sensitive. Box 37 presents some tips on the content of questionnaires.

Box 37. Designing questionnaires – some tips

- An introduction that describes the purpose of the survey is very useful. A good introduction can dispel mistaken impressions regarding the objectives of the survey (e.g. that it is a tax-collection exercise) and put the respondents in the right frame of mind to answer the questions.
- All questions should be consistent with the objectives of the survey.
- Questions should be formulated very precisely, so that the desired information is obtained as quickly as possible (beneficial to both respondents and field workers).
- Questionnaires should be designed so that they can be administered in a reasonable period of time – preferably not more than half an hour – in order to avoid taking up too much of the respondents' time and to ensure that they do not lose interest.
- Questions must make sense in the context of the production system and take account of the season in which they will be asked.
- Be aware of cultural sensitivities when formulating questions. An insensitive question can undermine community support. For example, the camel breeders of Rajasthan (India), both Hindu and Muslim, would be extremely upset if asked whether they slaughter or use their camels for meat, because traditionally camels are not eaten.
- Ask open questions rather than leading questions. For example, instead of asking “Are livestock important for your income?” ask “Can you list sources of income in their order of importance to you?” To continue the previous example involving the camel breeders, the information required could be obtained by asking the question “What do you use your camels for?”
- Ask sensitive or personal questions, such as those related to income or ethnic group, only if they are required, and if they are required leave them until the end of the questionnaire. By the end of the interview, a rapport may have been established between the field worker and the respondent and a response may be easier to obtain. If, on the other hand, the respondent becomes unresponsive because of the unwelcome question, then the rest of the interview will already have been completed.

Once the questionnaire has been drafted, it should be tested on a small number of livestock keepers in the target communities to see whether the questions are correctly and easily understood, and how long it takes to complete an interview.

Step 2. Prepare the kit for the field workers

The kit for the field workers should be standardized and a checklist of the items in the kit should be prepared. Field workers will need to have easy access to the checklist to reduce the chance that equipment is forgotten or mislaid during field work.

The kit should include some means of identifying field workers that will be understood by interviewees or other members of the public, and (if literacy allows) a handout that can be distributed. See Box 38 for a list of issues the handout should address. If more than one type of interview is to be conducted – for example, group interviews and household interviews – it may be useful to have separate handouts for each type of interview. The kit should also include contact numbers and/or e-mail addresses for the field worker to contact in emergencies. The other items in the kit will depend on the specific survey, and may include: GPS equipment; colour charts (for use in recording standardized descriptions of, for example, coat colour); mobile phones for

communication; cameras for photographing livestock in their production environments; and “analogue” field measures (Box 39). Consider including rods, or other objects, of known length that can be recognized in photographs and used to infer the sizes of the other objects shown. The equipment needed for phenotypic characterization studies is discussed in greater detail in the respective guideline publication (FAO.2010c).

Box 38. What a respondent needs to know about the survey – a checklist

- The organization that the field worker represents.
- Why the survey is being conducted and what its objectives and context are:
 - what benefits for the public good are expected;
 - what is the scale of the survey (e.g. whether it is national or regional).
- Whether or not local political and traditional leaders are aware of the survey (good planning should have ensured that they are aware).
- Why particular livestock keepers been chosen to participate (e.g. a sample of villages has been selected and a sample of households within these villages are being interviewed, with the particular households selected at random).
- What the field worker would like the respondent to do, and how much time this may involve.
- What, if any, are the benefits of participating for respondent.
- What procedures are in place to protect the confidentiality of the data.

All items in the kit should be standardized. The standards should be carefully planned and thoroughly documented. The level of detail that needs to be considered may be surprising. For example, the printing of colour charts needs to be controlled, as significantly different results can be obtained if different printers or toners are used, or if the toner needs replacing.

Box 39. Using analogue field measures

A useful tip for obtaining field data on quantitative traits is to record information using an “analogue” unit that is familiar to the respondents rather than in an SI unit. For example, more accurate responses on daily milk yield may be obtained by asking “How many buckets?” rather than “How many litres?” Field workers can be provided with a standardized “typical bucket” to carry in the field in order to assist quantification. As the volume of the bucket would be known, converting the answers into litres would be straightforward. Moreover, this approach avoids the need for the field workers to be familiar with the local units and able convert them into the SI units.

Step 3. Draft plans for recruitment and management of field workers and their supervisors

Before beginning the task of recruiting field workers, the Survey Team should consider the attributes will be required in the field workers and how the field work will be organized.

In the field, it is essential to have a sufficient number of field workers to undertake all the interviews that are needed, that the field workers can understand what is said by the interviewees, and that the exchanges (both what is said and what is done) are interpreted appropriately for the purposes of the survey. To achieve this, the field workers should be able to communicate effectively in the language of the targeted communities. It is also very advantageous if they have prior knowledge of local livelihoods, customs and agricultural practices.

The composition of the teams of field workers should be planned with the objective of ensuring that weaknesses in one team member (e.g. a lack of cultural awareness or agricultural knowledge) can be compensated for by other members. The mix of genders within the field team may be critically important to ensuring that all the necessary interviews are carried out openly and freely.

In many cultures, different genders have different roles in the management of livestock, and therefore both men and women will need to be interviewed. Cultural restrictions on conversations between people of different genders may mean that informative dialogues are impossible unless the field worker and respondent are of the same gender.

Supervisors of field workers should have some technical knowledge of livestock production, statistics or (preferably) both. Local linguistic and cultural knowledge is not essential for supervisors, but awareness of, and respect for, the local language and culture are essential. Ideally, one supervisor will be capable of supervising six to eight field workers. However, if the survey is large scale, the survey sites are highly dispersed, and the field work is being done by local people, it may be necessary to have a longer management chain involving “supervisors” and “managers of supervisors”, in which the supervisors organize only two or three field workers each and some decision-making responsibilities are referred back to their managers. Longer chains of responsibility in the field management require a strong communication network.

Step 4. Recruit field workers

As described above, important attributes for field workers include the ability to understand the local language, honesty and integrity, awareness of agriculture and livestock production, and understanding of the local production system(s). Formal qualifications in agriculture, animal science or statistics are not essential. Moreover, it is not essential for all field workers to have all the desirable attributes, as it is possible to form teams of field workers that compensate for individual weaknesses. However, a field worker who does not have either technical or local knowledge is unlikely to be useful. The mix of attributes required, including the appropriate gender balance, should have been identified during Step 3.

Suitable field workers can be drawn from a variety of sources and may include workers from research centres or other agricultural institutions, university students, workers from NGOs or community farms, or locally respected livestock keepers from the survey areas. Each of these groups will have their strengths and weaknesses. Box 40 provides an indication of where these strengths and weaknesses may lie, but this will vary according to the particular circumstances of the survey as will the weight given to each of the criteria listed in the table. It is advisable to consider recruiting from a variety of sources with the aim of establishing field teams in which a mix of backgrounds generates synergy. During the recruitment a small group of field workers that can be used for the pilot trial should be identified.

Box 40. Field workers recruited from different sources – potential strengths and weaknesses				
The following table gives an indication of the likely advantages and disadvantages of recruiting field workers from various sources. The scoring ranges from 1 to 5 stars, with more stars indicating more benefits to the operation of the survey.				
	Research institutes	University students	Non-governmental organizations	Local livestock keepers
Appropriate technical knowledge ¹	*****	***	***	*
Appropriate local knowledge ²	***	*	****	*****
Logistics of training ³	*****	*****	*****	**
Logistics of equipping ⁴	*****	*****	*****	**
Logistics of communication ⁵	*****	*****	*****	**
Remuneration costs	*	****	***	*****

Travel costs	*	**	***	*****
<p>¹Technical knowledge can be beneficial if the field worker has to make unexpected and unavoidable sampling decisions in the field. It may give the field worker greater insight into the purpose of the survey, which in turn may promote more informed reporting. Moreover, the previous training through which the field worker acquired the technical knowledge may promote greater discipline in recording and hence make the results more reliable. Technical knowledge is more valuable if backed up by experience.</p> <p>²Local knowledge is essential for interpreting production systems and the information obtained in interviews with local livestock keepers.</p> <p>³Training is easier to organize if field workers are located close to training centres. Previous experience of surveys can reduce the amount training required.</p> <p>⁴Equipping field workers can be simpler and more secure if there is a central point from which field work kits can be distributed.</p> <p>⁵Communication networks that can be used for the purposes of the survey may already exist within institutions and NGOs.</p>				

Step 5. Conduct a pilot trial in the field

Conducting a pilot trial in the field is a critical step in preparing for the survey. Wherever possible the components of the survey should have been tested as they were developed. For example, questionnaires should have been tested during their development. However, it is vital that the survey is tested in the field as a full dress-rehearsal, and it is best carried out before the main training of field workers takes place, as the lessons learned from the pilot trial need to be included in the training.

The Survey Team should identify a village or small group of villages and seek permission from the community leaders for the pilot trial to take place. A small number of the recruited field workers should be trained (see Step 6 for details) to carry out the survey as envisaged. The pilot trial should involve all aspects of the field work:

- interpreting the instructions for sampling as given in the sampling frame;
- recruiting interviewees and conducting interviews or meetings;
- using equipment in the field in the context of the survey;
- recording results;
- communicating in the field and reporting back to supervisors; and
- data transfer, storage and retrieval.

After the pilot trial, everyone who took part – field workers, supervisors and community participants – should be consulted. They should be asked to provide feedback on whether the field operations achieved what was intended, where problems occurred, how they might be overcome, and what other improvements can be made. The Data Manager and the Analysis Manager should be closely involved in scrutinizing and assessing the pilot trial. The Field Operations Plan (see Section 4) should be updated to reflect the lessons learned.

Step 6. Train field workers and their supervisors

Both field workers and their supervisors need to be trained to understand the precise purpose of the survey, to carry out the required procedures, and to respond appropriately to unforeseen circumstances. This is best achieved by conducting a training course. A typical course for a full household survey is presented in Box 41. In some circumstances, such as where NGOs that are experienced in surveying are being used, detailed training may be less necessary. However, it is better to provide too much rather than too little training, as poor field procedures may undermine the whole survey. The timing of the training course should be as close as possible to the survey

dates, so that the training remains fresh in the minds of the field workers when they apply it in the field.

On the first day of the training it is important to address issues that may be of concern to the field workers and may help to keep them motivated, such as remuneration, expenses and logistics.

Box 41. Example of a training schedule for field workers and supervisors

Day 1

- Objectives of the survey.
- Overview of what is required in the field.
- Administrative and logistical issues such as:
 - distances to be travelled to carry out the interviews
 - what transport will be available
 - remuneration including expenses.
- Overview of equipment and supply (e.g. breed identification charts, GPS equipment, mobile phones and laptops if appropriate).
- Communication channels (whom to report to, phone numbers, e-mail addresses, etc.).
- Background and overview of the theory and concepts of surveys, stressing the importance of accurate and consistent recording, and the need to flag any anomalies that may be encountered.

Day 2

- Cultural briefing.
- Briefing on what is known of the production systems that are to be covered.
- Training in the modalities of data collection to be used in the survey (e.g. filling in questionnaires, conducting focus group discussions, use of breed identification charts, photographing livestock, and use of scaling aids and analogue measures).
- Demonstrations by trainers.
- Practical session on breed identification and taking measurements or photographs.
- Practical sessions on the use of any codes or descriptors used to summarise data obtained.

Day 3

- Mock surveys, including challenging situations, both for data interpretation and interview techniques.
- Training for supervisors on their additional responsibilities.

Day 4

- Plenary open discussion among all supervisors and field workers, providing an opportunity for all queries to be addressed.
- Exploration of the data from the mock surveys.
- Explanation of the consequences of wrong or inaccurate answers, or unauthorized tampering with the procedures – give examples.
- Final discussion.

A cultural briefing (Day 2 in the example course shown in Box 41) is essential in order to ensure the survey is carried out in a manner that is respectful of the communities visited and their sensitivities. Understanding local customs is fundamental to good field operations, and unless the field workers are local people the only way of achieving this is for all field workers to be fully briefed beforehand by people who have detailed social knowledge of the communities. Lack of cultural awareness will undermine opportunities for informative dialogues in the communities surveyed. Further advice can be found in Section 6.

The training course should ensure that the field workers and supervisors are aware of the survey's rules with regard to accepting gifts or food from respondents and whether respondents should be compensated in any way for the time they have given up to participate. Local customs and practices should be taken into consideration in deciding upon these rules.

The course should also cover the practicalities of work in the field, such as how to handle unexpected sampling decisions, how to conduct interviews, and how to handle the equipment that is to be used in the survey. In the example course shown in Box 41, this occurs on Day 2. If the survey is to involve interviews, the training course must ensure that the field workers acquire detailed understanding of the information that the survey is trying to elicit, so that the follow-up questions that they ask will be relevant and the information that they record will be appropriate to the responses provided by the interviewees. If a questionnaire is to be used either for interviews with individuals or for reporting on group activities, the questions should be discussed one by one during the training.

It is essential that by the end of the training course the field workers are familiar with all the tools that they may have to use during the survey. Hands-on experience is important for consolidating the learning. For example, the field workers should practise identifying colours from colour charts or taking photos that fully illustrate animals' body characteristics and provide information on scale and context. If the field workers are going to conduct interviews, it is useful to simulate challenging situations that will help them gain some experience of what may be required.

6 WORKING IN THE FIELD

- Awareness of local practices is critical to success
- Respect respondents and their culture, customs and taboos
- Daily meetings between field workers and supervisors promote data quality

All the investment and planning for a survey can be undone by failing to manage the collection of the data in the field effectively. Unlike Sections 3 to 5 this section has no sequence of steps but instead provides advice on various aspects of field work based upon experience of the problems that can arise in the field.

Communicating in the field

Field workers and supervisors should meet regularly, preferably at the end of each day. Such meetings will provide an opportunity to discuss issues that have arisen in the field and to learn lessons from the experiences of the day. All the data collected during the day should be reviewed. This will give the supervisors an opportunity to provide feedback to the field workers, check whether quality standards are being met, and where necessary take remedial actions (e.g. it may be possible to repeat an interview or to go back and obtain a new photograph to replace an inadequate one). The supervisors should then provide daily reports to their managers.

Procedures for communication between the field workers and their supervisors, and between the supervisors and the wider Survey Team should be set out in the Field Operations Plan (see Section 4). Consider the use of mobile phones (if the mobile network covers the survey area) or e-mails. Make sure that telephone numbers and e-mail addresses are written down and carried by field workers, and not only stored in a computer or in the phone's memory – in case the equipment is lost in the field.

Promoting data quality

It is useful to the field workers know that there will be inspections by their supervisors and/or senior members of the Survey Team during the field operations. This will encourage the field workers to adhere to the protocols and in doing so increase the quality of the data they collect. Feedback can be given during the regular meetings between field workers and supervisors (see above). An additional means of promoting data quality is to carry out a small proportion of repeat

samplings. However, while repeat sampling has the advantage of directly calibrating the repeatability of the data obtained, it has the disadvantage that if the survey involves meetings with groups and individuals the repeat sampling may cause additional disruption in the communities involved. It is also possible that different answers will be obtained *because* it is a repeat visit – the livestock keepers’ views may have changed as a result of discussions during or following the first visit or the livestock keepers may be less willing to cooperate for a second time.

Making unforeseen sampling decisions

It is inevitable that some sampling decisions will have to be made in the field. These guidelines cannot substitute for the professional statistical advice that should be available within the Survey Team and should provide guidance on foreseeable sampling decisions that may be necessary in the field. However, a good guiding principle for avoiding bias when unforeseen sampling decisions arise is to randomize. This can be achieved using a random number generator, but can also be achieved by a fair system of drawing lots. For example, if three out of ten households need to be interviewed, three lots should be drawn blind from among ten labelled and thoroughly mixed lots.

Amending field protocols

Unforeseen circumstances may make it necessary to consider changes to the field protocols after the field work has started. A standardized procedure for doing this is required. The procedure must have been decided upon before the field operations begin and be included in the Field Operations Plan (Section 4). Field workers and their supervisors should understand clearly to whom they must send any requests for amendments of the field protocols. It is recommended that requests should be sent directly to the Field Operations Manager. However, authority to change protocol should lie with Survey Team as a whole. This will ensure that Field Operations Manager, Data Manager and Analysis Manager are all involved in the decision. This is important, as any change may affect the areas of responsibility of each of them. The Survey Team should:

- decide whether the requested amendment is feasible and justified;
- document any amendment clearly, including:
 - background information on the circumstances that prompted the amendment;
 - a detailed description of the updated protocols;
 - an assessment of how, and to what degree, the amendment overcomes the problem; and
 - the date when the amendment becomes effective.

If any amendment is approved, the Field Operations Manager must inform all supervisors and field workers, particularly those affected by the amendment, and supply them with the documentation of the amendment. Field workers should not change their practices until full approval has been given and not until the effective date given in the documentation.

Avoiding bias in recording

Guard against the desire to avoid recording “negative” results, to simplify recording of “uninteresting” results or to make them more “interesting” by adding embellishments. For example, suppose the survey instruction is to count the number of chickens kept by the household at the time of the interview, and the livestock keeper reports none, but adds that ten hens had been taken to market the previous day. The number of chickens must be entered as zero not ten. Such mistakes are surprisingly common and can dramatically diminish data quality. They sometimes arise because of misplaced attempts to be helpful, but they should be resisted at all times. No groups are immune from the temptation to introduce biases of this kind. Anybody can be affected – even statisticians may feel the pull of irrationally choosing one model of analysis over another if they become emotionally attached to the data outcomes.

Achieving informative dialogues with interviewees

The guiding principle for field work should be respect for the livestock keepers and their culture, local customs and taboos. It is important to be aware of what may offend. Box 42 illustrates some ways in which customary behaviour can vary within a country.

Box 42. Variations in local customs – examples from Zimbabwe

- Greetings customs vary from one community to another. For example, in some cultures people greet each other by clapping hands. Shaking hands, especially with women and children, is not a common practice everywhere.
- The means of expressing thanks varies from one community to another. In some cultures clapping hands is a means of expressing thanks.
- Sitting arrangements may vary according to local customs. For example, men and women may sit on different sides of the house, or men may sit on stools while the women sit on mats.
- Dress can cause sensitivity. For example, female field workers wearing trousers may be frowned upon in certain communities.
- Male heads of household may not feel comfortable being interviewed by female field workers.
- Words of offence differ between dialects, so an unprepared field worker may receive an unexpected and unwelcome reaction.

First contact

First contact with a household should always be with the head of the household. In this first contact, it is important that the field worker identify himself or herself, whom they are working for and purpose of the interview(s). This process will be easier and faster if a handout has been prepared prior to the survey (see Section 5). If a handout is not available, the field worker should provide a verbal introduction covering the points listed in Box 38. Ideally, field workers will have rehearsed these verbal introductions ahead of time. The introductions should be concise but important facts should not be omitted. In multilingual areas, the language of the interview should be established during the introductory exchanges and whenever possible should be chosen to suit the livestock keeper rather than the field worker. Field workers should not give guarantees or make promises that go beyond the agreed protocols of the survey.

The field worker should not assume that the interview(s) will take place immediately after the first contact has been made with the household, and should seek to establish the most appropriate place and time to conduct the interview(s). This will help to demonstrate that the field worker recognizes that the livestock keepers' time is valuable. The field worker should try to identify who among the household members is the best person to interview – the decision should not be based on prior assumptions about who in the household will know the answers that are required. Permission to interview household members should be sought from the head of the household.

Conducting a household interview

All the arrangements for the interview should be made for the convenience of the livestock keeper. Field workers should accept that the times of the interviews may have to change because the livestock keeper has pressing duties to attend to. The work schedules for the field workers should be sufficiently flexible to allow for these kinds of eventualities.

Sufficient time should be allowed for conducting the interviews. The field worker should establish a rapport with the livestock keeper who should be made to feel valued and appreciated. This will be easier if the field worker uses appropriate language and salutations (Box 42). It is

recommended that if possible two field workers be involved in an interview, with one talking while the other notes the answers. Field workers should look out for signs of fatigue in the respondent and should terminate the interview as quickly as possible if the respondent appears to be getting tired. Some tips on conducting interviews are provided in Box 43.

Box 43. Conducting interviews – some tips

- Be aware of potentially difficult questions and allow sufficient time for the respondent to respond.
- Gently refocus the respondent if he/she begins to wander away from the point at issue.
- Politely rephrase the question if the respondent misses the point of it.
- Do not ask leading questions. For example, don't ask: "Are livestock diseases a big problem for you?" Ask instead "What problems do you have with your livestock?"
- Do not engage in conversations on sensitive subjects, such as religion, politics, gender issues or other subjects that have potential to cause offence or concern and may bring the survey into disrepute.
- Make it clear to the respondent through verbal responses and body language that he/she is being listened to.
- Emphasize the value of the respondent as a source of local information.
- Fill in the report or questionnaire as the interview progresses while ensuring the respondent does not get frustrated by having to wait.
- View and measure animals at the beginning of the interview, so that if an interview takes a long time, the respondent will be able to release the animals to graze if he/she wants to.
- Pose sensitive or personal questions for example those related to income or ethnic group, only if required and, if required, at the end of the interview – any rapport established may encourage a response and other information will have been obtained already.

The end of an interview

Thank the respondent for his or her time and contributions and give him or her an opportunity to ask questions. Check the report or questionnaire before leaving. Do not contravene the survey's policy about accepting gifts or food, but always be polite when declining offers. If the protocol of the survey is to offer a gift at the end of the survey, be aware of local customs regarding how gifts are given and received.

Taking photographic records

Photography is a good means of recording information about livestock and their production environments, provided that some simple techniques are employed to add value. Photographs of individual animals should show:

- the whole animal – legs or other body parts should not be cut off the picture;
- a standardized measuring stick, positioned so that the size of the animal can be inferred from the photograph; and
- background that helps to illustrate the animal's role in its production system.

Photographs should be accompanied by a brief description covering location, date and a little background information on what makes the photograph of interest. The name of the photographers should also be recorded so that credit can be given in any publications in which the photographs are used.

Photographs of groups of animals are also important, as they provide some information on the scale of variation among individuals, and illustrate individuals interacting with each other and

with the production environment. Photographs of groups of individuals can also be important in publicity materials, as they avoid establishing the idea that one individual is a model for the breed.

If photographs are to be used in publications, they must be of high quality. For FAO publications, it is recommended that photographs be submitted as TIFF or as EPS files (not compressed JPEG or GIF); preferably at the approximate size in which they are to be reproduced; with a resolution of 300 dpi; and always accompanied by the name of the photographer. Do not touch up the photographs.

7 DATA MANAGEMENT

- Plan data management prior to data collection
- Do not underestimate the magnitude of the task
- Give as much attention to how to get data out of the database as how to get the data in
- Ensure that the database is properly documented

Data collected during a survey needs to be compiled, checked, entered into an appropriate database, prepared for immediate analysis and archived for future use. This phase of the work is generally referred to as “data management”. Each individual survey will have different requirements, and the guidelines do not provide step-by-step instructions on how to plan or implement data management activities. However, the issues described in the following subsections will always require attention. A checklist of items for inclusion in the Data Management Plan is included above in Step 8 of Section 4.

Plan data management in advance of data collection

It is absolutely essential that data management is planned in advance of data collection. A data management plan should be one of the main outputs of the planning stage of the survey (see Section 4). The time and resources needed for designing appropriate data management procedures, including risk management, should not be underestimated.

It is also essential that the plan for data management is not developed in isolation from the plans for field operations and data analysis (see Section 4). All three elements need to be aligned with each other and with the objectives of the survey. However well-planned and implemented the field operations may be, if the data-management procedures are unable to cope with the material brought back from the field, the whole survey will be undermined. Likewise, if the data-management procedures do not provide efficient mechanisms by which data can be extracted for meaningful analysis and reporting, the survey will not serve its purpose of providing the information needed for planning future improvements to AnGR management. The main focus of data-management planning is often on the first phase of the work – how to store data systematically – with much less consideration given to the need for data to be efficiently extracted. This is a mistake. It is crucial that as much attention be given to how to get data out of the survey’s data management system as to how to get it in. Thinking about how data will be analysed and archived will provide insights both into how the data should be collected and into how it should be managed.

Data management involves a series of activities – designing the database, building the database structure, handling material brought from the field such as completed questionnaires, data checking, data coding, data entry, data storage and archiving – each of which presents its own set of challenges. A further challenge is presented by the need to integrate these activities efficiently, particularly if the survey is large and if data management activities take place in dispersed locations. The following subsections provide overviews of these issues and some practical advice. Detailed descriptions of procedures and standards for data management in large-scale household

surveys can be found in FAO (1996) and FAO (2005), published as part of the programme for the World Census of Agriculture 2000. Brief overviews of handling and analysing large-scale survey and census data are provided by Fink (2008) and Fowler (2008).

Arrangements for ownership and custodianship of survey data

Legal and ethical issues related to custodianship and ownership of the survey data, and access to and use of these data, must be addressed (see Sections 3 and 4). If the country has a national surveying and monitoring strategy, the general framework for the ownership and custodianship of data collected should already have been established. The arrangements for individual surveys should be in line with the national framework. It is important also to consider the practicalities of the data custodianship arrangements. One option is to take advantage of the services offered by national research and statistics offices. Whatever the arrangements, relevant users will need to be able to access the data efficiently both in the short and the longer terms. The nature of the data collected may justify operational linkages with existing databases, such as those containing agricultural census data, georeferenced biogeographic data, data on human population settlements, data on socio-economic services (e.g. roads, telecommunication, schools and veterinary services) or detailed maps of administrative boundaries. Using data of this kind can add substantial value to the depth and breadth of survey reports. It is, therefore, imperative that plans for data management give due consideration to the need for compatibility, linkages and possibly interoperability¹⁹ among the various databases. Any such linkages should be taken into account in the development of data custodianship and ownership arrangements.

Choosing the software to use for data management

Because of rapid developments in data-capture and management software and the associated hardware, these guidelines do not provide specific recommendations on the selection of software or hardware. Up-to-date advice should be sought from competent experts in the field of statistics and information technology, particularly with respect to customized applications. The data-management software chosen must allow efficient capture of data, construction of a database, querying of the database to extract summary data, and be appropriate to users' needs for data analysis. In the recent past, Microsoft Excel software has been widely used for capturing and archiving survey data despite the fact that the software was not designed for this purpose (see Box 44).

Box 44. Excel is not database software – an example from the United Kingdom

In the United Kingdom, some experimental procedures within research institutes are legally regulated. At Roslin Institute, compliance procedures involved entering data records daily into an Excel spreadsheet, with each record entered in a row spanning several columns, each column containing different aspects of the required information. One of the workers sorted the spreadsheet, and by a simple mistake allowed a single one of these columns to be sorted rather than ensuring that all other columns were also sorted into the same order. In so doing, the contextual link between the data stored in the newly sorted column and all the other data was broken, making the entire spreadsheet – with several months of records contained within it – worthless. Fortunately, in this case, the Institute's own back-up procedures meant that only the records entered on that particular day needed to be re-entered. It might have been much worse.

This example illustrates that Microsoft Excel is not purpose-built database software. Purpose-built database software such as Microsoft Access or Sequel Server, Oracle or CSPro (free open-source software available from US Census Bureau – <http://www.census.gov/ipc/www/cspro/index.html>)

¹⁹ Interoperability is achieved when programs are able to exchange data via a common set of formats, read and write the same file formats and use the same protocols.

intrinsically recognize that data are organized into records, that each record may contain several different bits of information, and that one set of records may need to be associated with another set of records in a flexible fashion. For example, in a simple survey taking place in a number of villages, in which several livestock keepers are interviewed each day about the different livestock kept, one set of records may contain information about a villages (population size, access to water, proximity to market, etc); another set of records may contain information about respondents (age, size of holding, size of household, etc); and other records may contain information on each of the livestock species kept in each holding (numbers, breeds, etc).. Clearly, it is important that the data on livestock can be related to the data on the holding, and likewise, the data on the holding can be related to the data on the village.

Provided by John Woolliams, Roslin Institute, United Kingdom.

The data to be handled may include several different types:

- Metric data: i.e. classical quantitative variables such as milk yield. Note that such variables may need to appear more than once in the database: milk yield may be recorded in the field as standardized buckets (see Box 39) and subsequently converted to kg or litres. The field record should not be omitted from the database.
- Ordinal data: i.e. categorical data that have a rank order. For example, livestock keepers might be asked the following question: “Does Breed A survive droughts better than Breed B (1) much better, (2) better, (3) same, (4) worse, (5) much worse?”. In this case, the numbers 1 to 5 represent a rank order of relative adaptedness to drought.
- Nominal data: i.e. numerical codes of qualitative variables. For example, “What happens to the milk produced? (1) Sold at market, (2) Consumed within the household, (3) Both, (4) Other.” Here codes 1 to 4 provide for easy recording, but the ordering has no underlying quantitative value.

It may also be necessary to handle discrete text codes, free text, images, video files and audio files. Software options for efficient capture and archiving of these types of data need to be considered at the planning stage so that data can be collected in the right format and size. It is likely that opportunities to collect unexpected, but highly relevant, explanatory information will arise during the survey. To give an example: the survey might unexpectedly find that pastoral goat flock owners in the sample select against does that give multiple births, as a means to reduce the risk of kid mortality (this happens, for example, among the Borana pastoralists in southern Ethiopia). The data management arrangements should allow for unanticipated findings of this kind to be captured, stored and subsequently accessed for analysis.

The database created for the survey may need to be updated over time, particularly if a baseline survey is to be followed by a series of monitoring surveys. This may require adjustments in the structure and organization of the database, and should be accounted for in the choice of software.

The databases for major surveys have sometimes been established using custom software. Experience shows that this approach has often been regretted. It is strongly recommended that survey databases be built using established database packages (e.g. Microsoft Access, Sequel Server, Oracle, MySQL). The reasons for this are:

- a custom database software requires spending additional time writing code for standard database operations;
- the burden of documentation is much larger, as established manuals cannot be used; and
- it becomes necessary to retain long-term staff who understand the custom software, rather than having the option to recruit staff who are already trained to use established packages.

Documenting operating procedures

Documentation is an essential part of data management; the best laid plans are worthless if those who are meant to implement them are not aware of what is required. Therefore, in order to ensure consistent application of data management activities, a handbook of approved procedures should be prepared and issued to everyone who will be involved in the collection, coding, checking, entering, querying and analysing the data.

It is easy to overestimate how long people will remember details of matters that they are no longer actively dealing with, even if the details are of immense importance. For example, the use of jargon can create problems. An acronym may have been in common use by the Survey Team at the time of field operations and data entry, but be completely incomprehensible a few years later when the data are retrieved from an archive. In order to avoid such problems, data fields and their coding conventions must be clearly and unambiguously documented and linked explicitly to the field questionnaire or other data source. The adequacy of the documentation should be tested by asking someone who is not involved in the survey to explore the database with the aid of the documentation, and to report on whether data can be identified correctly and easily.

Standardizing procedures for managing the raw data

The interface between the field activities (Section 6) and data management activities should not be overlooked. The protocols for a day in the field should ensure that all field workers know when, where and to whom the questionnaires and any supplementary materials (photographs, audio recordings, diagrams prepared during group exercises, etc.) should be handed over for the first phases of data management. Responsibility for ensuring that nothing gets lost or mislabelled should be clearly assigned. Consideration should be given to the practicalities of handling, moving and storing the material safely.

As described in Section 6, it is good practice for the field teams – field workers and supervisors – to meet together after the day's field work to discuss any issues that have arisen during the day. This meeting is an opportunity to check completed questionnaires for obvious problems. For example, field workers can be asked to clarify illegible handwriting. If data that appear to be exceptional outliers come to light at this stage, it may be useful to record comments related to the circumstances in which these data were collected. Procedures for recording such comments should be established. In some circumstances, it may be possible for someone to return to the source and investigate the apparent outliers further. However, field workers, and even supervisors, must not be allowed to modify raw data just because they notice a result that they consider unexpected. It is essential to recognize that surveys are as much about quantifying natural variations as they are about estimating average values.

Establishing procedures for data entry

“Data entry” – the transfer of data from questionnaires or other paper formats into an electronic database – can be a major undertaking, and the amount of time, patience and attention required should not be underestimated. If the survey is small in scale and the field work is not being conducted in a remote location, the physical arrangements for data entry may be quite straightforward. The completed questionnaires can be brought regularly to a single location, not far from the survey site, and entered into computers by a small group of trained data-entry workers. In a larger survey, more elaborate arrangements, such as one of the following two methods, will be required.

Method 1: Establish multiple data entry stations and employ trained personnel to enter and verify data using a suitable data-capture system, with a central database being continually updated after data checking and clearance. The number of data entry stations required can be estimated once practical experience has allowed an estimate to be made of the average time needed to enter the

data from a single questionnaire (e.g. FAO, 1996). An example of a customized and user-friendly data-capture system developed for such a purpose is BREEDSURV (Rowlands *et al.*, 2003), which was developed in Microsoft Access 2000 by the International Livestock Research Institute (ILRI), and used for livestock breed surveys in countries of the Southern African Development Community and in Ethiopia (Ayalew and Rowlands, 2004). By now other, more suitable, specialized database software that can serve this need are available. As noted above, there is limited scope for using such custom databases after the survey is completed because of the additional effort needed for design, documentation and training staff.

Method 2: Establish a web-based data-entry system via which field workers can key data directly into the database using hand-held computers. Automated data checking and editing can be done soon after data entry. Alternatively, optical readers can be used for automatic entry of data direct from suitably designed data-collection formats (FAO, 1996). Such advanced options may prove too expensive in developing countries at present (2010) but given rapid advances in technology they are likely to become more widely applicable in the future. However, manual data checks and data entry may be advantageous because they make it possible to detect poor enumeration and inconsistent responses, allowing for data sources to be immediately revisited/re-interviewed so that data can be verified or corrected. Box 45 describes the use of information technology for recording and monitoring cattle in Ireland.

Manual data entry inevitably gives rise to both random and systematic errors. Using automated optical data scan and capture systems can circumvent much of the human error in data entry. However, as noted above, such systems are unlikely to be widely applicable at this point in time. Attention should therefore be given to reducing human errors in manual data entry. One proven procedure for identifying and managing such errors is duplicate manual entry and cross-checking of data. Specialized database software, such as those listed above, provide options for doing this. Such databases may also provide in-built internal procedures for checking data for coherence and consistency. However, software cannot substitute for close human supervision of data entry to identify and correct errors.

Box 45. The development of recording and monitoring technology – experiences from Ireland

The Republic of Ireland is focused on the provision of excellent systems for all aspects of animal health and traceability. The recording infrastructure in Ireland is sufficiently well developed that the animal identification and movement database operated by government and its agencies contains a record of all the cattle kept on a holding and all birth, death and movement details pertinent to these animals. The database links to the Animal Health database (Java J2EE platform, three-tier architecture with an Oracle database at root). The government animal health offices and laboratories (1 500 persons) are also connected in real time to these databases via an official intranet, while a number of government staff and 1 000 private veterinarians, abattoirs, cattle markets, assembly centres, export locations and even some farmers have differing levels of access, as appropriate to their needs and functions, via the internet. Modules for various disease-control programmes and vaccination programmes have been developed. The system facilitates rapid responses to a situation if necessary and has revolutionized the working practices of hundreds of people, taking a vast amount of paperwork out of the system.

For example bovine tuberculosis surveillance involves a visit to each holding annually. During these visits all cattle on the holding are tested, and a return visit is made three days later to read and record the results of the test. In the past, this surveillance was entirely paper based. Now, when a farm is to be monitored for bovine tuberculosis, the unique ear tag identities of all cattle

expected to be present on the farm are downloaded to an electronic data recorder/logger in the local veterinarian's premises via an XML²⁰ interface with the Animal Health computer system. The veterinarian takes the data-logger out to the farm. During the first visit, the veterinarian electronically records the presence of the animal and the initiation of the test and, on the return visit, the results of the test. The records made on farm are then uploaded back to the official Animal Health surveillance database, and the information processed to identify any mismatch between those animals expected and those found, and then to schedule any further actions that may be required as a result of the test. The data in respect of bovine tuberculosis accumulated in the surveillance database annually include 14 million individual animal health checks for tuberculosis and brucellosis, slaughter surveillance findings and laboratory results. These data are also used for the development of improved control procedures and various research projects.

Provided by Margaret Good, Department of Agriculture and Food, Ireland.

Establishing procedures for data checking

Apart from the above-mentioned opportunities that will arise for identifying and correcting obvious errors soon after data collection, substantial data checking and editing of survey data may be necessary at a later stage to achieve consistency within the dataset (e.g. ensuring that measurements of impossible events, such as the milk yields of bulls, are not recorded), and to detect, verify, correct and eliminate outliers that may otherwise cause extreme deviations in data summaries. Such alteration of the data should be done by expert statisticians after due consideration of the nature and extent of any outlying values, as there can be valid as well as invalid outliers.

In large-scale surveys, computer editing of data may be justified as a means to enhance the credibility of the data, for instance, by identifying missing data, checking data against expected ranges of values, or checking for logical and/or numerical consistency among data on related variables. Likewise, coding of data on common variables can be automated and handled by computers once the range of values and their frequency are known (FAO, 1996). Some of the errors detected may be impossible to correct without revisiting the data sources in the field. If returning questionnaires to the field is not possible, two standard statistical procedures can be followed at the data-analysis stage to remedy errors without producing major effects on the final results: 1) such entries are declared as missing values, or 2) on the basis of available knowledge from the survey data, expected average values can be estimated and keyed in – a procedure known as imputation (for details see FAO, 1996). Imputation is described further in Section 8. It is recommended that at the data-entry phase any missing data that cannot be obtained by revisiting the source be entered as “missing” and that imputation be left to the data analysis phase. This approach is clear, unambiguous and protects the integrity of the database as a faithful record of the field operation.

Data entry error rates should be estimated early in the of data entry process so that measures can be taken to reduce errors to acceptable levels: for example, identifying staff and hardware that are associated with errors and assessing whether problems can be rectified by retraining staff or fixing computer keyboards. The error rates give a general indication of data quality and accuracy. Generating data summary tables at the end of every data-entry session is another way of controlling data quality and identifying and managing outliers and missing data.

Establishing consistent procedures for data coding

One aspect of data management that can present a significant challenge is the process of coding data for entry into the database. The extent of this challenge will depend on the nature of the data

²⁰ XML (Extensible Markup Language) is a set of rules for encoding documents in machine-readable form.

being dealt with, which will depend on the nature of the questionnaires used in the field, which in turn be influenced by the objectives of the survey.

In some circumstances coding is a straightforward matter, amounting to converting the full names of clearly defined items or concepts – that can be interpreted consistently along the chain of communication that runs from the livestock keeper, via field workers and data entry workers to data analysts – into short “codes” that can be more easily and efficiently manipulated by data management and analysis software. For example, the names of livestock species might be coded: cattle = 1; buffalo = 2; goat = 3; sheep = 4; and so on. Moreover, for some types of survey questions, the range of possible answers will be predictable in advance and can be coded before the field work starts. Examples might include the significant livestock species in the survey area or the names of villages to be visited. For such data items, coding should present few theoretical or logistical problems.

In contrast, for some survey questions, the range of answers may not be predictable in advance. One reason for this may be local variations in language. For example, livestock diseases may be known by many different local names, and there may be nobody in the field team who is able to match the names used by the livestock keepers to the scientific names of the diseases. Alternatively, difficulties may arise because the Survey Team had insufficient knowledge to predict in advance all the various ways in which livestock keepers live and work. Examples might include particular traditional animal health treatments. Thorough piloting of the survey questionnaire, and preliminary “rapid appraisals” in which key informants or groups of livestock keepers are consulted, should help to minimize the number of difficult-to-code responses (see Sections 5 and 6). However, the Data Management Plan should set out procedures outlining what data-entry workers should do if they come across a problem and how such problems should be addressed by the managers of the survey.

The more “open-ended” the survey questions, the more delicate the problem of coding may become. If the survey attempts to obtain information, for example, on livestock keepers’ problems, preferences or motivations, or to probe for the reasons why livestock or particular breeds are used for particular purposes, the answers obtained may describe processes, relationships or conditionalities, rather than a list of discrete, easily coded, items. Moreover, the significance of particular responses may only be fully clear once responses to other questions, perhaps offered by different respondents, have been taken into consideration. In such cases, substantial coding and reclassification of raw data may have to be done after the data collection.

The general rule should be that decisions on coding and reclassification of raw data should not be taken by field workers or even supervisors, as this part of data management should be unified and managed centrally. Integrating this centralized-decision making into the data management arrangements is likely to be a challenge, particularly in a large-scale survey in which data entry is undertaken by a number of people in different locations and in which data entry and field work overlap in time. In some cases, the final decisions regarding the coding and classification of data are best treated as part of the data analysis. Providing detailed advice on managing and analysing qualitative data is beyond the scope of these guidelines. However, it is important to recognize that if qualitative “open-ended” data collection methods such as semi-structured interviews are to be used in a large-scale survey, data management (and coding in particular) will require expert attention and thorough planning. Failure to account for the potential complexities of managing qualitative data may mean that livestock keepers’ detailed responses remain only on paper and do not inform the analysis and the outputs of the survey – in which case little will have been gained from the use of the qualitative tools.

Establishing procedures for data storage and security

Data storage and security measures need to be applied both to completed questionnaires and to electronic data. Even if survey databases are considered public-domain resources, unauthorized access to the data should be prevented.

The database should be duplicated securely to create backup copies. Backups should be maintained both at the data centre (the primary site of data storage) and at a secondary site (“off station”). Having a backup in a separate location and system will help to ensure that the database can be retrieved in full if working copies and local backup copies become inoperable due to human errors, computer problems or disasters of other kinds.

Always archive two copies of the primary database (for security), prior to analysis – as this will retain a faithful record of the field operations. It is good practice for the analysis to use copies of the primary database rather than interfere with the original data.

The original completed data collection formats (e.g. questionnaires) should always be archived safely for later reference. The length of time for which data need to be kept may depend on the nature and extent of their ongoing use, but it is generally advisable to keep the material until a minimum of two subsequent surveys of the same kind have been completed. For instance, in countries where livestock surveys are undertaken every ten years, raw data should be maintained for about twenty years. Electronic copies of raw data are likely to have a much longer-term utility value. For example, they might be used in time-series analysis of how AnGR management is affected by climate change.

8 DATA ANALYSIS

- Do not delay analysis once data are available
- A statistical package is no substitute for a statistician
- Do not release results that may be subject to change

It is tempting to think that having planned, organized and conducted all the field work, and filled a database with data, the survey has been completed and the Survey Team can relax. This is not so. It is important to press on with answering the questions posed at the start of the survey by conducting a thorough analysis of the data. It is dangerously misleading to think that simple summary tables will be sufficient for this purpose. Given the investment made in the survey, a poor and uninformed analysis that produces untrustworthy results is a false economy. The following four steps will need to be addressed:

- Step 1. Review the schedule for the analysis
- Step 2. Analyse the data
- Step 3. Add value by linking to complementary databases
- Step 4. Prepare the report of the analysis

The guidelines do not describe statistical methodology in detail, as other publications that do this are available. Moreover, it is important that the data analysis is overseen by a qualified and experienced statistician, who tailors the analysis to the objectives of the survey rather than following a set series of instructions.

Step 1. Review the schedule for the analysis

The schedule for data analysis should have been considered during the planning phase (Section 4), but should be reviewed immediately prior to the start of the analysis and either confirmed or amended as necessary.

Timing in relation to data collection

The analysis should be carried out as soon as possible after the completion of the field work and data entry. There are several reasons for this.

- The momentum generated by previous activities will not be lost, and stakeholders will be focused on the survey questions and eagerly anticipating the results.
- It is helpful to conduct the analysis when the planning and field activities are fresh in the minds of those involved. Documentation from the previous phases of work may not always be as clear as it should be.
- Continuity within the statistical team from planning to analysis is important, because the statistical design should lead naturally to the models and approaches used for analysis.
- The sooner the analysis is done, the sooner the results will be communicated, and the sooner the consequent actions can be taken. This increases the benefit to cost ratio of the survey.

Resources allocated for analysis

As this is perhaps the most technical of the sections in these guidelines, it may be difficult for those without statistical expertise to relate the subject matter to their own experiences. This, coupled with the fact that experience of conducting AnGR surveys is limited, means that there is a high risk that the time required for data analysis will be severely underestimated. The amount of time required will depend on the complexity of the sampling frame, the number of questions the survey is attempting to address, and the number of variables that are needed in order to provide answers to these questions. Given that the analysis will be carried out using computers, the amount of time needed to complete the work will not, in principle, depend heavily on the size of the sample, although if it is necessary to check data quality retrospectively, there may be an element of the work that is affected by sample size.

It is likely that a team of analysts will become more efficient over time as they gain greater familiarity with statistical approaches used to answer the survey questions, greater awareness of issues related to the reliability and interpretation of the data, and greater knowledge of how to access sources of ancillary data that may add value. Therefore, if a team of analysts is to be involved in a series of surveys, the analysis of the data from the first survey in the series may take longer than that for the later ones. However, the later surveys may require that additional work be undertaken to account for the implications of any changes in the design of the survey or significant events that have affected livestock production in the survey area during the period since the preceding survey. The time needed to address these issues will offset some of the benefits of experience.

Step 2. Analyse the data

Model fitting

The objectives of the survey will have driven the design (sampling frame) of the survey, and in turn this will direct the models and statistical approaches that are required for the analysis.

Missing data

As described in Section 7, data-checking procedures may reveal data errors that are impossible to correct. Two approaches to this problem can be followed during data analysis:

- the erroneous entries can be treated as missing data; or
- on the basis of knowledge drawn from the survey data, expected average values for the entries in question can be estimated and keyed in – a procedure known as imputation (for details see FAO, 1996).

From a statistical point of view, the first of these approaches is to be preferred, providing that statistical methods are used to overcome the problem of missing data in a flexible, data-sparing fashion, i.e. without wholesale deletion of other aspects of the data. Such methods may often involve imputing values, but do so in an optimum way. When the second approach is used, the database must record which data points are imputed and which are real, and the statistical methods need to account properly for the fact that the data collected were not as complete as they might appear to be. For example, unless the issue is properly addressed, the confidence intervals that are derived will be shorter than appropriate. When preparing the report of the analysis, it is important to describe how missing values were treated.

Statistical packages

The computational algorithms necessary for fitting statistical models are available in a wide range of general statistical packages, and some packages are specifically targeted at analysis of numerical survey data. Using well-respected packages is advisable as their algorithms are more widely understood and accepted by others, and they are more likely to be free of bugs. The package chosen must be able to cope with the size of the database that will be produced in the survey, and this may need to be checked with the software suppliers. Think ahead to future surveys and make sure that the package can fit models that are appropriate for monitoring as well as baseline surveys. Seek specialist professional advice on this if in doubt.

The fact that a package is able to process data and produce “results” is no substitute for professional knowledge. The models available within the package may not be appropriate or give efficient estimates of the values being sought in the survey – other models may provide better estimates with lower confidence intervals. The existence of a statistical package that can fit particular models *may* influence design choices at the planning stage, but the design should not be sacrificed so that the analysis can be carried out with a particular package.

There is a growing “open source” movement in analytical software which may provide an alternative to commercial packages. One such example is “R” (see for example, Lumley 2004). Using “R” has the benefit of allowing tools to be shared among different groups, while still allowing them to be customized. This may be an issue for discussion among the teams responsible for different surveys.

Circulating “emerging results” to partners

During the analysis it may be considered desirable to circulate “emerging results” to important sponsors or partners in the survey, even while uncertainties remain over the models that have generated the results. The pressure to distribute such results may arise from several sources including the need to:

- maintain the interest of stakeholders;
- provide evidence of activity to sponsors;
- prompt emergency actions; or

- obtain further information or follow-up data to address an unexpected result (potentially resolving whether the result is an artefact of a design flaw or a “real” result).

In such circumstances, reports containing “emerging” results should always include prominent *caveats* stating that they are preliminary and subject to change. The reports should always be marked as confidential, and treated as such until after they have been considered by the Survey Team as a whole and by the Strategy Working Group. Premature publication of results that are later retracted will present mixed messages to stakeholders, which is likely to create confusion and a lack of trust in the final results of the survey. This will undermine all the investment of time, effort and money that has been put into the survey and will threaten future surveys.

Step 3. Add value by linking to complementary databases

Other data, collected for different purposes, may be useful for interpreting the survey results and adding value to the outcomes of the survey. One area of interest may be using biogeographic information that allow the range or density of particular breeds to be related to features of the climate, terrain (elevation, soil type, surface characteristics, etc.) or flora, or to disease epidemiology.

Step 4. Prepare the report of the analysis

The report on the analysis should be comprehensive, but it should be written in a way that is comprehensible to non-specialist members of the Survey Team and the Strategy Working Group. The task of communicating the results beyond these groups is addressed in Section 9. To make the report comprehensible, it is recommended that technical detail be placed in annexes. This should allow an informed, but non-expert, reader to appreciate the technical quality of the analysis and understand the significance of the results for AnGR management without having to work through all the technical material. Box 46 presents a checklist for the adequacy of the report of the analysis. This report will form part of the final report of the survey (see Section 9). It is recommended that the survey results also be written up in a paper submitted to a scientific journal. The journal *Animal Genetic Resources*²¹ is one option.

When preparing the report of the analysis, it will be useful to start thinking about how the detailed results may be summarized for presentation to different stakeholder groups, taking into account their different concerns and capacities. For example, what summary statistics may be needed? What graphical figures will best convey the results? Communication strategies are described in Section 9, but early consideration of the possible uses of the results will save a lot of time and effort later.

Box 46. The report on the data analysis – a checklist

- 1 Are the survey objectives listed?
- 2 Are the sampling frame and other field methodology adequately described?
- 3 Is the description of the statistical methods adequate, including the methods used for any data cleaning or transformation, so that it could be repeated unaided by a statistician?
- 4 Is the choice of models justified?
- 5 Are the assumptions underpinning the models listed? (References to other published work may be sufficient.)
- 6 Do the models:
 - address the objectives;
 - recognize all the design variables?
- 7 Do the results described in the report:

²¹ <http://journals.cambridge.org/action/displayJournal?jid=AGR>

- address the objectives;
 - provide measures of confidence for the estimates and predictions made;
 - assess possible biases and their potential magnitude;
 - assess the effects that invalid model assumptions would have on the results;
 - identify significant sources of experimental error and, if appropriate, how these may be better controlled in future surveys;
 - flag unexplained results that may merit further investigation to determine whether they are artefacts of a design flaw or unexpected but “real” findings;
 - identify emergency actions that may be required as a result of the analysis?
- 8 Has consideration been given to how the presentation of results may be customized for the range of stakeholders?

9 REPORTING AND COMMUNICATING RESULTS

- Distribute results promptly to stakeholders
- Chose communication method and messages appropriate to each target group
- Distil key messages and keep them as simple as possible

Once data collection and analysis have been completed, it is very important to communicate the results promptly to all relevant stakeholders so that they can integrate the results into their work – and ultimately contribute to better sustainable use, development and conservation of AnGR. If a communication strategy is not implemented efficiently and in good time, databases become “information black holes”.

Communication methods and messages need to be tailored specifically to the stakeholder groups targeted. It is important that key messages be distilled and presented as simply as possible. Effective reporting and communication is time consuming and needs to be well planned. Several rounds of discussion among the Survey Team may be necessary to develop the communication strategy. One member of the Survey Team – probably the Communications Manager – should be entrusted with the task of preparing materials for these meetings. It may be helpful to bring in experts in communications and graphic design. The Analysis Manager should be closely involved in the planning in order to ensure that the survey outcomes are interpreted correctly in the development of the communication messages.

The survey may have produced outputs that will need further analysis before they can provide a basis for specific communication messages. Examples might include biological samples for molecular-genetic or other analysis. Procedures for channelling these outputs to relevant stakeholders (research institutions, etc) should have been identified during the planning phase. It is important to ensure that they accompanied by the contextual information needed to allow meaningful analysis and communication messages (e.g. details of the geographical location and the production environment).

The Survey Team may wish to frame their discussions in terms of how the survey results can be used to meet the stated objectives of the survey. However, the process should allow for unexpected insights to be explored and disseminated. A seven-step approach is recommended:

- Step 1. Match the outcomes of the survey to the relevant stakeholder groups
- Step 2. Develop specific messages for each group of stakeholders
- Step 3. Consider communication methods
- Step 4. Consider the impact of disseminating the survey results
- Step 5. Develop and implement the communication strategy

Step 6. Evaluate lessons learned about the survey process

Step 7. Prepare the final report

Step 1. Match the outcomes of the survey to the interests of relevant stakeholders

Preparing a two-way table of survey outcomes versus stakeholders may help the process of identifying appropriate messages. Table 7 provides an example, but it is important that Survey Team develop its own version of the table that accounts for the specific outputs of the survey and the specific needs and characteristics of the stakeholder groups in question. In some circumstances it may be useful to break down the outputs in more detail, or it may be appropriate to subdivide the stakeholder groups (e.g. national vs. local policy-makers; school vs. university educators). There may be several different ways in which a particular output is relevant to a given stakeholder group.

Partners (national and international) and the survey respondents should be the first to receive the results of the survey.

Table 7. Identifying communication messages – some examples of how survey outputs may be relevant to specific stakeholder groups*

Outputs	Livestock-keeping communities	Policy-makers	Extension services	Animal health services	Researchers	Educators	General public	International partners
List of breed names for each livestock species	Improve understanding of livestock diversity as a potential resource for breeding		Improve understanding of livestock diversity as a potential resource for breeding		Inform research on “nondescript” or newly discovered breeds	Improve AnGR-related education	Enhance awareness and appreciation of livestock diversity and the roles and values of AnGR	Provide greater clarity regarding the status of transboundary breeds
Documentation of breed population size and structure and their trends	Improve understanding of the potential for exchange of breeding material	Inform national conservation strategies	Improve understanding of the status and trends of AnGR		Inform research on trends and identification of conservation priorities			Promote and inform transboundary breeding or conservation programmes
Documentation of breeds’ geographical distribution	Improve understanding of the potential for exchange of breeding material	Inform national conservation strategies Inform climate change adaptation and mitigation strategies.	Improve understanding of the potential for exchange of breeding material between locations	Promote linkages between animal disease surveillance systems and AnGR management	Inform research on adaptation by considering geographic distribution in relation to natural environment			Inform transboundary breeding or conservation programmes
Phenotypic descriptions (including photos)	Improve understanding of breeds’ specific qualities	Inform national conservation and breeding strategies	Improve understanding of breeds’ specific qualities		Inform research on breeds’ adaptation and comparative performance			Provide greater clarity regarding the status of transboundary breeds
Descriptions of production environments	Improve understanding of breeds’ adaptation and comparative performance	Inform national breeding strategies Inform climate change adaptation and mitigation strategies	Improve understanding of breeds’ adaptation and comparative performance		Inform research on breeds’ adaptation and comparative performance			Improve understanding of adaptation and comparative performance of breeds. Enable better evaluation of potential imports.
Documentation of cultural aspects of livestock production and breed utilization			Improve understanding of cultural aspects of livestock production and breed utilization and roles and values of AnGR	Improve understanding of cultural aspects of livestock production and breed utilization and roles and values of AnGR	Inform research on cultural aspects of livestock production and breed utilization and on the roles and values of AnGR			Promote recognition of and respect for cultural aspects of livestock production, breed utilization and roles and values of AnGR

Outputs	Livestock-keeping communities	Policy-makers	Extension services	Animal health services	Researchers	Educators	General public	International partners
Documentation of indigenous knowledge related to the utilization of AnGR			Improve understanding of indigenous knowledge related to the utilization of AnGR	Improve understanding of indigenous knowledge related to the utilization of AnGR	Inform research on indigenous knowledge related to the utilization of AnGR		Promote recognition of and respect for indigenous knowledge related to the utilization of AnGR	Promote recognition of and respect for indigenous knowledge related to the utilization of AnGR
Identification and monitoring of threats to AnGR	Enhance awareness of potential losses and the factors driving them	Inform the development of measures to counteract threats	Inform the implementation of measures to counteract threats	Promote recognition threats to AnGR in the planning of disease control strategies	Inform research on, and monitoring of, threats to AnGR		Improve understanding of threats to AnGR and the need for specific measures to address them	Improve understanding of threats to AnGR at national, regional and international levels

**NGOs are another important stakeholder group. However, they are not listed separately as their objectives and activities are diverse and overlap with those of the other stakeholders described in the table.*

Step 2. Develop specific messages for each group of stakeholders

After matching the survey outputs to stakeholder groups, specific messages should be developed addressing each of the stakeholder groups. This might again be done by preparing a table of stakeholder groups and listing the range of relevant messages for each of them. It may be necessary to re-analyse certain aspects of the datasets in view of the information needs of the different stakeholder groups, but good planning of the original data analysis should have minimized the need for this (see Section 8). The messages should be discussed with the Analysis Manager to make sure that they properly reflect the survey outcomes.

Step 3. Consider communication methods

Once messages for each stakeholder group have been defined, appropriate communication methods need to be chosen. Some of the strengths and weaknesses of different communication methods are summarized in Table 8.

Table 8. Strengths and weaknesses of different communication methods

Communication method	Strengths	Weaknesses
Face-to-face events: <ul style="list-style-type: none"> • conferences • workshops • field days • shows, markets • extension activities 	<ul style="list-style-type: none"> • interactive • encourage collaboration • more direct impact • opportunity to distribute printed and other communication materials 	<ul style="list-style-type: none"> • higher costs • more difficult to organize • time bound • lower outreach • one-time events
Printed material: <ul style="list-style-type: none"> • red lists²² • policy briefs • leaflets, brochures • reports • pocket books²³ • books • scientific journals (national, international²⁴) • farming press • local newspapers • national newspapers 	<ul style="list-style-type: none"> • lower costs • wider outreach • permanent 	<ul style="list-style-type: none"> • not interactive • less direct impact
Audio: <ul style="list-style-type: none"> • radio • CD-ROM • internet audio streams 	<ul style="list-style-type: none"> • lower costs • wider outreach • permanent 	<ul style="list-style-type: none"> • not interactive • high technology requirement

²² A red list is a published record of the state of a country's AnGR that is used to inform members of the public of the status of breeds of livestock and to draw attention to the breeds that are most at risk. The idea comes from the field of wildlife conservation where red lists feature species that are at risk of extinction.

²³ A pocket book is a pocket-sized booklet that contains basic headlines and simple diagrams.

²⁴ FAO oversees the publication the journal *Animal Genetic Resources* (for further information send an e-mail to AnGR-Journal@fao.org or visit <http://journals.cambridge.org/action/displayJournal?jid=AGR>).

Communication method	Strengths	Weaknesses
		<ul style="list-style-type: none"> • less direct impact
Film: <ul style="list-style-type: none"> • television • DVD • internet video streams 	<ul style="list-style-type: none"> • wider outreach • permanent 	<ul style="list-style-type: none"> • high initial costs • not interactive • high technology requirement • less direct impact
Web-based information system <ul style="list-style-type: none"> • national • international (e.g. DAD-IS) 	<ul style="list-style-type: none"> • low running costs • wide outreach • permanent 	<ul style="list-style-type: none"> • high initial costs to establish a national system* • high technology requirement to establish a national system* • less direct impact

* *DAD-IS and related FABISnet information systems have already been established and so additional costs and technology requirements are low.*

Using the communication methods listed in Table 8 in combination will help maximize the impact of the messages. For example: printed material can be made available to workshop participants for further distribution, or it can be made available on the web; members of electronic networks can be informed about the availability of printed documents or supplied with electronic versions. Television, radio, e-mail or the web can be used to disseminate audio material, visual images or textual information. Some countries may have national information systems for AnGR in which summary data and images can be published.

Printed and reproduced materials (CD-ROMs, DVDs) need to be developed, designed, produced and distributed in appropriate numbers. The costs involved and the expertise required for each step of product development need to be identified and planned for.

Step 4. Consider the impact of disseminating the survey results

Before proceeding to develop the communication strategy and produce the communication materials, their potential impact on different stakeholders should be evaluated. For example, publicizing the discovery of “new” breeds via the mass media may lead to unwanted attention and disruption for the livestock-keeping communities concerned. If such impacts are foreseen, the people likely to be affected should be consulted about what they think is appropriate and how they would like the process to be managed.

Step 5. Develop and implement the communication strategy

After careful consideration of the options identified in the previous steps, develop and document a communication strategy including timing, estimates of resource needs, and allocation of responsibilities.

After securing the resources required, the communication strategy should be implemented. The results should be summarized and presented in a simple and understandable manner, taking the objectives of the survey into consideration. Attractive graphics, tables, boxes and images will catch the attention of the audience and help them to recall key messages. The potential need for figures and tables for communicating the survey findings should have been considered during the preparation of the report of the data analysis (Section 8).

The communication plan should include provisions for reporting summary data to international bodies such as FAO. National Coordinators for the Management of AnGR, or co-workers nominated by them, should ensure that summary data are entered into DAD-IS (or an associated FABISnet information system) to inform people in other countries and to enable the preparation of up-to-date international and regional status and trends reports on AnGR.

Step 6. Evaluate lessons learned on the survey process

The Survey Team should consider dedicating one of their meetings to evaluating lessons learned on the survey process (e.g. strengths and weaknesses of particular approaches or methods, practical problems that arose in the field). These should be summarized and included in the final report for future reference.

Step 7. Prepare the final report of the survey

The process and the findings of the survey should be documented in a final report. The whole of the Survey Team should be involved in its preparation. If the steps outlined in these guidelines have been followed, much of the report will already have been prepared. The importance of the report is that it: (i) provides a reference for those considering action in response to the findings; (ii) provides a reference for both planning future surveys and interpreting their outcomes – for example when the current survey is part of a routine monitoring scheme; (iii) highlights the need to conduct additional or complementary surveys, or further monitoring; and (iv) draws attention to opportunities to strengthen methodology. It should incorporate the following elements:

- Summary;
- A statement of the problem, followed by the purpose and scope of the survey, with justification related back to the problem this should be based on the remit obtained from the Strategy Working Group (Section 3);
- Methodology, based on the report on the analysis (Section 8) with further details available in the annexes;
- Results, based on the report of the analysis (Section 8);
- Implications of the results;
- Recommendations for further work to address unresolved issues;
- Lessons learned on the process of conducting the survey what might have been done better and how?
- References.
- Annexes, which should include:
 - The Field Operations Plan (see Section 4) with amendments noted;
 - The Communications Plan (see Section 4) with amendments noted;
 - The Data Management Plan (see Section 4) with amendments noted;
 - The Analysis Plan (see Section 4) with amendments noted;
 - Description of data archive (see Section 7);
 - Technical annexes arising from the report on the data analysis (see Section 8);
 - Where possible, material used for communicating results (see Section 9);
 - A list of the persons and institutions involved.

The final report should be made available to, among others, the Strategy Working Group, other members of the national AnGR network (FAO, 2010b) relevant ministries and the research community. A good way to reach an international audience is to send the report to FAO for inclusion in the library of DAD-IS and distribution via the DAD-Net e-mail discussion network.

10 TRANSLATING RESULTS INTO ACTION

It is important that a survey does not end simply with the production of a report that gathers dust on a shelf. The objective of the whole process should have been to improve the management of AnGR as part of broader strategies for the management of the livestock sector, biodiversity and rural development. A sound reporting and communication strategy (Section 9) should ensure that the results are widely distributed and that the stakeholders whose actions can make a difference are targeted with appropriate materials. However, given the potential benefits of effectively using the information generated by a well-organized survey, additional efforts should be made to ensure that the results feed into development strategies and actions.

Organize a stakeholder workshop

A workshop or meeting that brings people together to discuss the outcomes of the survey and to identify next steps is likely to be an effective means of engaging stakeholders, drawing their attention to the new data and getting everyone thinking about how to use the survey findings.

A baseline survey will have produced a wide range of new data. An event organized in the follow-up to such a survey should therefore involve a wide range of stakeholders, including individuals and organizations involved in running conservation programmes, breeding, marketing and research – as well as the livestock keepers themselves. It is important that the workshop also provides an opportunity to promote better integration of AnGR-related matters into wider policies and activities within the livestock sector and beyond. Stakeholders from outside the immediate AnGR sector – from animal health, nature conservation, social and economic development, etc. – should therefore be invited.

In the case of a more limited, follow-up survey organized as part of a monitoring strategy, a smaller meeting may be sufficient: the National Advisory Committee on AnGR, perhaps supplemented by a few additional stakeholders brought in to help address particular concerns that have arisen as a result of the survey.

It may be useful to frame the workshop discussion in terms of revisiting the objectives of the survey, which should have been thought of in terms of their potential to translate into practical action. However, the workshop should also discuss any unexpected findings that the survey has brought to light and the implications of these findings for future AnGR management activity. The broader picture – how the findings can be used to improve food security, rural development, etc – should be borne in mind throughout the discussions. Consideration should be given to how the outcomes of the survey might be used in the development of breeding strategies for local breeds.

Strengths, weaknesses, opportunities and threats within each potential area of action should be carefully considered, along with the potential roles and contributions of different stakeholder groups. An attempt should be made to identify actions that can be implemented quickly, cheaply and easily. Such actions may be an important means to maintain momentum in the process once the workshop is over.

One important objective should be to assess what can be done to manage any threats to AnGR identified during the survey. If urgent needs have been identified – for example, if it has been found that a breed that is on the very brink of extinction – the workshop should serve as a springboard for immediate action.

Another point for discussion should be whether the outcomes of the survey shed light on the effectiveness of past or ongoing development actions in the livestock sector, or on the reasons for their success or failure. Consideration should be given to how development strategies should be amended in view of such findings. If the country has developed a National Strategy and Action Plan for AnGR, the workshop should consider whether any amendments are needed. If a list of priority breeds for conservation has previously been drawn up, the workshop should assess whether there is a need for it to be reviewed. Breeding and marketing strategies should similarly be assessed: see LPP, LIFE Network, IUCN–WISP and FAO (2010) for examples of innovative marketing strategies. If substantial modifications to existing strategies are identified as being necessary, there may be a need to propose mechanisms by which planning can be taken forward beyond the timeframe of the workshop itself.

At the end of the event, a subgroup should be given the task of producing a summary of the outcome, outlining the way forward. However, it should be emphasized that the main objective is not to produce another document, but to ensure that all participants take on board the implications of the survey for their own areas of work. Opportunities for common action and for better communication and networking identified during the workshop should be developed.

Potential topics for discussion at the workshop are summarized in Box 47. Box 48 presents experience from China of how the outcomes of an AnGR survey influenced the development of AnGR management policies.

Box 47. Potential areas for discussion at the stakeholder workshop

SWOT analysis – explore the strengths, weaknesses, opportunities and threats affecting AnGR and its management in the area covered by the survey.

Stakeholder analysis – explore the potential of different stakeholder groups to take action.

Breeding strategies – consider whether the survey results bring to light opportunities for the development of breeding strategies or whether any amendments to existing breeding strategies are required in view of the findings.

Marketing opportunities – consider whether the survey has brought to light opportunities to improve the marketing of livestock products. Consider what action is needed: research and development of the product; improved marketing infrastructure; etc.

Priorities for conservation – consider how the survey results can be used to identify breeds, species, production systems or geographical areas that should be targeted for conservation efforts.

Threats – consider how the survey results can be used to improve the management of threats affecting AnGR.

National Strategy and Action Plan – consider whether the country's National Strategy and Action Plan for AnGR needs to be amended.

Policy integration – consider how AnGR management can be better integrated into policies in the livestock sector and beyond.

“Low-hanging fruit” – identify low-cost opportunities to achieve a quick impact in improving AnGR management.

Emergency actions – consider whether the survey indicates the need for any immediate actions (e.g. to protect a breed from extinction).

Data management – consider how the data acquired during the survey and stored in the survey’s database can be integrated into other information systems.

Box 48. How a national survey can influence policy – experiences from China

The first baseline survey on AnGR in China was conducted by the Chinese Academy of Agricultural Sciences, starting in 1976. As an integral part of Natural Resource and Agricultural Census, it was included as a key project of the National Scientific and Technological Programme 1978–1985. The first phase of the survey was completed in 1984, with results published between 1986 and 1990. A further phase of survey work was conducted by the same team in 1995 and 1996, focusing on the southwestern mountainous area and the Himalayan–Tibetan plateau, which was not included in the first phase.

Ninety scientists were closely involved in the survey; approximately 10 000 local technicians from 29 provinces, municipalities and autonomous regions also contributed. The survey results comprised six volumes and more than 2 million Chinese characters. They described the evolutionary history and development of AnGR in China, along with detailed descriptions of more than 260 indigenous breeds – population size, distribution, phenotypic characteristics, production performance and special features.

“The survey is remarkable,” wrote the Agricultural Minister in the foreword to the Survey Results, “it is a comprehensive record of the historical heritage and a systematic study on status and trends of our rich and precious animal genetic resources.”

The direct or indirect outputs of the survey greatly affected the following policies:

- Based on the survey results, the Ministry of Agriculture announced the national inventory of AnGR.
- Based on the survey results, the Ministry of Agriculture issued a priority list for conservation. The first list contained 78 indigenous breeds.
- In 1995, the central government launched a regular budgetary allocation for the conservation of breeds on the priority list. The annual budget started at 4 million Yuan and increased year after year, reaching 32 million Yuan in 2010.
- Since 1995, many provinces have announced their own priority breed lists for conservation. Provincial budgets for conservation have increased significantly.
- In 1996, the Ministry of Agriculture established the China National Commission for Animal Genetic Resources Administration. The Commission took overall responsibilities for AnGR management, including conducting surveys and monitoring trends on a periodic basis.

Provided by Hongjie Yang, National Animal Husbandry Service, China.

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