



### Section 3: MEASURING CROP LOSSES



*Crop loss in a field visited by elephants, F. Osborn, WCS*

#### **Introduction**

Once a conflict situation has been identified, a manager needs to assess the farmers' perception of the problem, and the actual crop loss, in order to develop an intervention strategy. It is important to identify which species are damaging which crops, and when and where crops are damaged. A researcher can easily create a very detailed study of crop loss that does little to provide a manager with the information needed if care is not taken to select the correct details. Initial consideration should include an assessment of the following:

- I. The amount of detail needed for a crop damage assessment study must be decided within the restrictions of budget and logistics. The minimum amount of data needed to understand the situation should be the baseline. For example, the micro-scale study of a village may require assessments of a few fields in some detail. If one is looking at a macro-scale level, such as the damage in a large administrative area, a broad overview with little detail may be more appropriate. (compare Nchanji with Hoare in Appendix I)
  
- II. What useful information should the researchers collect? The date, location, pest species and a simple measure of damage may be enough. However, in some cases more data need to be collected. Information about spatial and temporal patterns of crop damage, the type of crop(s) involved, area of standing crop damaged or the number of plants damaged relative to the size of the field, and/or an estimate of the monetary losses as a consequence of crop damage may well provide valuable information for researchers and managers alike,

depending on the purpose of the investigation. It is important to have a good idea of how the information will be used by managers before it is collected.

- III. What are the practical constraints on the study? Questions such as how often are researchers able to get to the conflict areas and when should they make their visits, need to be addressed. Other factors for consideration include: budgetary constraints and their implications for methods to be used, the need for provision of training and supervision for enumerators, need for and availability of transport to study sites, etc.
- IV. Will the crop damage survey include a socio-economic component (see Section 4: The Farmers Perspective, pg. 24), and will the assessment be linked to a future intervention?

### **The types of question to address**

The type of information and degree of detail needed in any investigation is dependent on a number of factors as outlined above.

#### *Patchiness of crop-raiding*

Whilst basic information must be collected, there is scope for gathering much more detail, to determine frequency of raiding events by particular species at any given location, and whether raiding is frequent, intermittent or limited to a particular season. Such information can be very useful when trying to determine (i) the severity of crop raiding locally, and (ii) whether more intensive use of particular protective measures at specific times of year might significantly reduce crop losses. Additional information about where potential raiders are coming from (e.g. PAs, forest patches or resident in farmland) is also useful when planning/investigating the construction of physical barriers such as fences, walls, hedges or ditches. If animals are coming from an identifiable location it may suffice to create a barrier between the habitat refuge and cultivated areas (See Biryahwaho, Appendix I).

#### *Importance of crop raiders to farmers*

Farmer's ranking of crop raiding species may also provide some preliminary information to help explain why particular constituents of a conflict situation are considered worse than others. This information can contribute to (i) identifying key species for intervention programmes to focus on, and (ii) explaining why crop raiding is often perceived by many to be a significant problem, even where the reality is that only a relatively small portion of the local population are at risk.

*Importance of crop species to farmers*

Just knowing that farmers are experiencing crop losses due to wildlife raiding may not necessarily give adequate information to determine the impact on local communities or individuals. Data on which crops farmers consider most important to their household, either as sources of food or because they are cash crops, help explain why even relatively small amounts of damage, to certain crops, aggravates farmers considerably, yet they will apparently tolerate quite extensive damage to other food crops (Hill, personal observation)<sup>1</sup>.

It is important to record the type of crops damaged and to measure which crops are considered most valuable and why. Likewise, a farmer's ranking of their crops with respect to their vulnerability to crop damage can provide very insightful information. Aside from giving the researcher more information about the potential vulnerability of different crop species to different kinds of damage such ranking can also help to indicate the value of different crops to different households. There may be occasions where farmers' ranking of crops does not coincide with the ranking according to actual amounts of damage experienced during a monitoring season. This may result because (i) farmers do not 'see' certain kinds of damage, i.e. that caused by small animals or domestic animals for instance, or (ii) that particular crop is not considered an important one in the context of household economic security or (iii) the crop in question is a "women's crop" - if the interviewee is male then they may be inaccurate in their information through lack of knowledge, or interest perhaps, and if one was to speak to a female respondent one might get a very different picture. Such information can help clarify why farmers (i) make the decisions they do, and (ii) may sometimes appear to complain about situations that are not necessarily especially problematic from an outsider's perspective.

*Stage of crop damage*

A consideration of the particular stage of plant growth vulnerable to damage by wildlife may also be useful. For example, bushbucks are known to feed on young bean shoots and may virtually clear a newly sprouted bean stand in a night. However, because the damage occurs early on in the growing season, the farmer is able to replant the field, having first fenced it, and still get a bean crop with relatively little extra work, thus bushbuck damage to beans is not rated as particularly problematic even though the damage can be extensive (Hill 1997). Extensive damage at a later stage in the plant's developmental cycle may well prevent a farmer from gaining any harvest, whereupon the situation becomes much more

<sup>1</sup> On several occasions quite extensive damage to pumpkins, tomatoes and other fruits in gardens in Nyabyeya Parish, Uganda, was observed, yet this was often not reported to the researchers during farm visits and was only mentioned after extensive questioning by the interviewer.

costly/problematic for the farmer. The stage at which damage occurs, and the potential impact it has on final crop yields, has significant implications when trying to quantify crop losses.

*Where crops are planted*

Information about the spatial distribution of crops within a field may also be valuable when considering possible intervention strategies such as the use of buffer crops or placing particularly vulnerable ones furthest away from the raiders' point of entry to the field, or closest to the guard hut, family house (see Osborn & Parker, Appendix I).

*Farming calendars and timing of raiding events*

In some situations it may be beneficial to draw up a calendar of the farming year, taking into account the timing of various labour-intensive activities such as clearing land, planting, weeding, guarding and harvesting, and preparing crops for storage, along with information about which household members are employed in each task. This information can be used to avoid creating potential labour bottlenecks in possible intervention developments. For example, it has been proposed in the primate literature that farmers might intensify their guarding activities during periods of peak conflict, such as just prior to the maize harvest. Whilst this may be a very suitable recommendation for specific sites, in other areas it is not a viable option because people are already working extremely hard at this particular time, and may be guarding fields at night as well as during the day. It is important to separate the information by sex and age of respondent also. Women and children are often responsible for most of the guarding against diurnal species such as squirrels and various primate species. Baboons, which are often cited as problem species, usually show very little fear of women or children and may threaten them to the point where the people guarding flee from the raiders (Hill, personal observation). Thus women and children appear to be less effective guards for these animals as compared with men. Such data can therefore provide valuable additional material, which is pertinent when developing or advising people on more effective ways to protect their crops.

*Estimate quantity of crop loss*

In certain situations it may be appropriate to make estimates of crop losses in order to assess the extent of crop damage occurring. There are a number of different quantities that can be estimated/measured (See Table 3.1 for details). However, all researchers should be aware of the methodological problems in getting accurate data of this kind, and should take time to

consider the likely sources of error in such data and how to minimise them prior to beginning data collection (Further discussion of this and associated issues can be found on page in the next section.

### **How to collect the data**

There are a number of different data collection strategies that can be used when investigating crop damage. Data can be obtained directly from farmers, where farmers are asked to give information such as the species of animals that damage their crops, estimates of the amount of damage caused, and frequency of damage events. These data can be collected retrospectively from farmers, i.e. by interview or questionnaire, or farmers can be asked to keep records of damage events as they occur. One advantage of making farmers the primary source of information is that it can reduce the costs associated with data collection, removing the need to employ full-time enumerators at the study site. However, there are also problems associated with such a strategy, namely the potential lack of objective reporting/recording of information (see below for a more detailed discussion).

Alternatively, trained enumerators can be employed to collect information from farmers, and make independent measurements of crop losses, identification of the species causing the damage, etc. This has the advantage of producing information that is likely to be more objective but, as mentioned above, will add to the monetary cost of the exercise because enumerators have to travel to and from the study site, or be provided with accommodation on site.

**Table 3.1: A summary of the types of information that might be useful in any investigation of crop damage by wildlife.**

	<b>Information to be collected</b>
<b>General information</b>	<ul style="list-style-type: none"> <li>• Date</li> <li>• Location</li> </ul>
<b>Animals</b>	<ul style="list-style-type: none"> <li>• Species causing damage (including domestic animals)</li> <li>• Timing of raiding behaviour, i.e. diurnal/ nocturnal?</li> <li>• Frequency of raiding (i.e. do animals come daily, weekly, only occasionally etc?)</li> <li>• Where do wildlife species come from, i.e. are they moving out specific areas such as Protected Areas (Pas) to enter fields or are they living in and around fields?</li> <li>• Farmer's ranking of raiding species, i.e. species ranked from 'most' to 'least' troublesome sp. (sometimes useful to know something about the reasons why individuals rank a particular species as 'most troublesome')</li> </ul>
<b>Crops and farming strategies</b>	<ul style="list-style-type: none"> <li>• Location of farm,</li> <li>• Description of surrounding vegetation and habitat type(s)</li> <li>• Distance from village/house to farm</li> <li>• List of main crops grown by farmer(s)</li> <li>• Types of crops damaged by wildlife/domestic animals</li> <li>• Quality of crops damaged (i.e. quality prior to damage event)</li> <li>• Other crops present but not damaged</li> <li>• Plant part(s) damaged, e.g. root/tuber, stem, leaves, flowers, fruits etc.</li> <li>• Spatial distribution of crops within fields/farm, with particular reference to their location with respect to Protected Area (PA) boundaries, boundaries with un-cleared/fallow land, riverine forest, etc., i.e. potential wildlife refuge areas</li> <li>• Whether neighbouring fields/gardens were raided</li> <li>• Brief outline of the agricultural calendar e.g. timing of planting, crop protection, harvesting etc.</li> <li>• Farmer's ranking of crops i.e. crops ranked from 'most important' to 'least important' (may also be useful to know why particular crops are ranked as important e.g. household food crops/cash crops etc.)</li> <li>• Farmer's ranking of crops with respect to their vulnerability to crop damage by animals</li> </ul>
<b>Impact on farming households</b>	<ul style="list-style-type: none"> <li>• Measure of crop losses                             <ul style="list-style-type: none"> <li>- farmer's estimate of crop losses (either as area lost or kgs lost)</li> <li>- independent measure of area of standing crop damaged</li> <li>- independent measure of no. of plants damaged/total no. plants (giving the percentage damage incurred)</li> <li>- conversion of area of crops damaged to kg/ha crops damaged</li> <li>- Economic losses</li> </ul> </li> </ul>

### **Farmer estimates versus independent measurements of crop losses**

A number of studies have recorded farmers' or protected area personnel's estimates of the frequency of raiding events by different animals. Similarly, some studies have asked farmers to rank animal species from 'worst' to 'least' troublesome. There are a number of problems with these methods of collecting data (without using additional sources of information to cross check the information) if one is looking for a way of determining accurately how frequently particular animals visit fields, or which animals cause most damage. It is important to bear in mind that informants are not necessarily intentionally giving what amounts to false information. People's perception and memory can be influenced by a number of different factors, and particular events may take on a greater significance in retrospect. To further illustrate this point some studies have used farmer estimates of crop losses, looking at either the amount of crops lost, and/or the monetary value of those crop losses. Where these studies have combined this with an independent assessment of crop losses by the researcher(s) it has become apparent that farmers tend to overestimate their losses by as much as 30-35%. Again, this is not to say that farmers are necessarily inflating their estimates intentionally – aside from the issue of potential compensation – but rather that (i) it can be difficult to estimate accurately in retrospect (simple 24 hour nutritional recall studies give ample evidence of that) and (ii) something as emotive and important to a farmer as crop loss is likely to be a conspicuous and therefore highly significant event, which may well influence their perceptions and thus their accuracy when estimating amounts/values of losses.

It is important to stress here that information from farmers and other stakeholders is not necessarily unreliable and inaccurate. However, such information, as with all data, has to be handled and interpreted appropriately. Having accurate, longer term, knowledge of the situation will enable crosschecking of information and add considerably to the value and usefulness of such results.

### **Putting a quantitative value to crop losses – some possible problems**

Measurement of actual crop losses is potentially both difficult and controversial. Aside from the problems of how to collect data on crop losses there is also the problem of determining what to measure, and therefore whether measures of losses are comparable from study to study or site to site. To put crop loss in perspective, it is useful to compare measures of crop damage, but there are some potential problems. Firstly, how accurate do the measurements of crop loss need to be? Any one who has tried to collect this information is well aware of how

difficult it can be to collect accurate information, and how data collection can be rife with sources of error! Yet, once there is an actual quantitative figure used to describe crop losses, or a monetary value placed on the loss, then this is often used by managers or local communities with an unrealistic sense of accuracy.

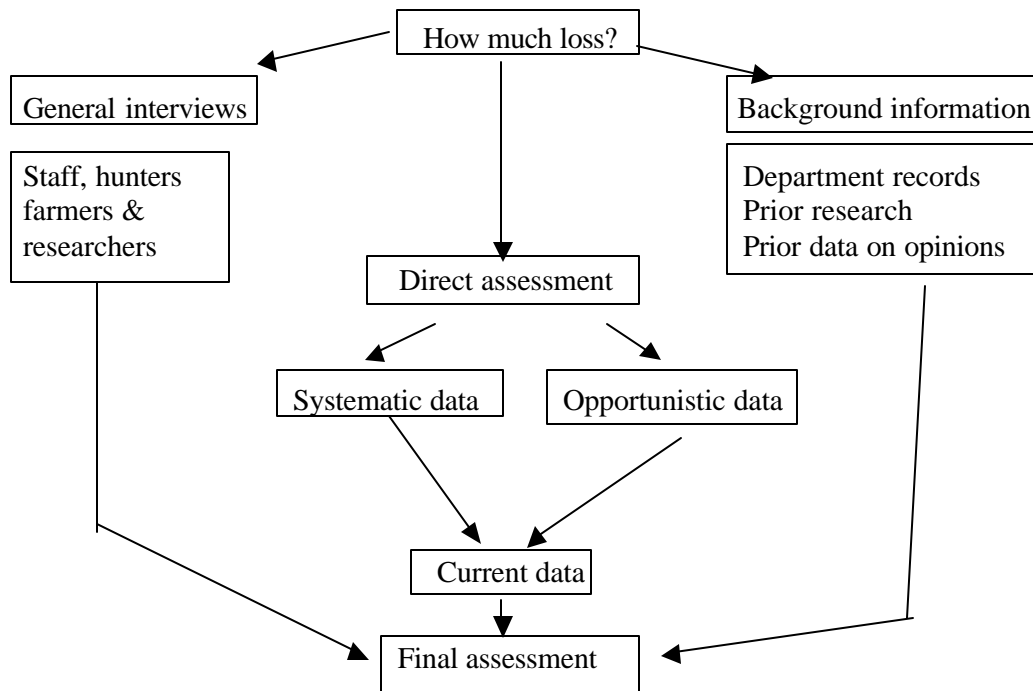
Secondly, different studies make different measurements – some convert an area of loss to an estimate of kg/ha lost – others may present the average percentage loss per field, or the average percentage loss per damage event, or even the overall mean annual percentage loss. It can be difficult to determine whether these figures are comparable or not. Certainly a greater degree of clarification of the exact measures used, and how they have been manipulated by the researcher, would be beneficial when trying to decide whether results across studies are comparable or not. In addition, perhaps some standardisation of methods of data collection and data handling are needed.

Within some of the studies that make use of quadrat techniques for sampling crop losses there appears to be the assumption that all areas within a field/crop stand are likely to be equally affected, therefore any mean percentage loss can be extrapolated to the entire area under that crop. However, case studies have demonstrated clearly that crop raiding wildlife generally only travel a certain distance from a protected area in their search for crop forage, thus it is important to take this into account when extrapolating rates of damage from one area of a field to another, otherwise estimates of crop losses/ha are likely to be unintentionally inflated. In addition, different farmers have different planting strategies. For instance the farmers around Budongo Forest Reserve, Uganda who, on average have small land holdings, tend to plant more than one stand of important staple crops in any one growing season (reasons given for this are that it reduces the risk of suffering high losses through wildlife, insects, disease and variable soil fertility) (Hill 2000). This is not an unusual planting strategy for small-scale farmers in tropical regions but it is not always apparent that this is taken into account when people are calculating the percentage crops lost – so again, losses may unintentionally be inflated. Where such values are extrapolated to the village, community, or district level, there needs to be some factoring in of differential risk across different farms.

Measurement of crop loss can also be a problem from the point of view of distribution of compensatory revenue from sources such as PA gate returns. Ugandan farmers are well aware of this, and express concern about the fact that any benefits that might accrue from living alongside wildlife (e.g. profits from local community run tourist wildlife viewing

facilities) will go to local institutions for the benefit of all people, yet it is only certain individuals that bear the actual costs of living alongside these animals, i.e. those farmers at the forest edge in effect buffer their colleagues farming more central regions (Hill 2000). This is an important issue (Western 1994), particularly when thinking about possible alternatives to traditional forms of compensation scheme.

**Figure 3.1: Flow chart of the different types of options for a researcher to develop a crop damage assessment and monitoring scheme**



### Setting up a crop damage monitoring scheme

The flow chart (Fig. 3.1) outlines some of the questions to be asked when setting up a monitoring programme. Firstly, how much loss is there? There are three main areas for collecting data; (i) through general interviews, (ii) direct assessment and (iii) background information. A combination of all three can give the best basis for developing an intervention. General interviews with PA staff, hunters, farmers and researchers give a sense of the current opinion among people interested in the conflict situation. Conducting a direct assessment either through collecting systematic data (e.g. standardised data sheets and pre-selected farms) or opportunistic data (e.g. reports by farmers/researchers) are the most reliable sources of information. Background information adds an historical context to the study. These sources of information will then guide a manager towards a final assessment of the questions to be asked regarding crop loss.

### **Summary**

Methods need to be tailored to the objectives of the crop loss assessment scheme. Outputs should translate easily into management goals. Data should be handled and interpreted appropriately, and having longer-term knowledge of the situation enables cross-checking of information and will therefore add considerably to the value and usefulness of such results.

Generally, the available literature presents information from case studies. These are potentially very useful, but they would be even more useful if one could compare information directly from site to site. This would enable one to determine what kinds of features are likely to be site-specific (e.g. particular cultural practices, perspectives or beliefs), which features, if any, might be habitat or species specific, and whether there are any general factors that are pertinent at most or all sites of farmer-wildlife conflict. It is important to carefully document the methods used when writing reports on crop-raiding research so that it is clear which measures have been made.