CHAPTER 3

GENERAL MATERIALS AND METHODS

3.1 Introduction

This chapter outlines general materials and methods used in the study. Detailed materials and methods that were used for the specific objectives of the study are described in Chapters 4, 5, and 6 respectively.

3.2 Description of study sites

3.2.1 Location of sites

The study was carried out in Masvingo Province in Masvingo and Chivi districts. The location of Masvingo province and the study areas are shown in Figures 3.1 and 3.2, respectively. Masvingo Province lies to the south-eastern part of Zimbabwe and is one of the eight provinces in the country. The province lies between longitudes 30º 00' E and 32º 30' E and latitudes 19º25' S and 22º 22' S and has seven districts, namely, Bikita, Chiredzi, Chivi, Gutu, Masvingo, Mwenezi and Zaka. Masvingo Province lies in NRs III, IV and V and the area occupied by each NR is shown in Table 3.1. The total area of the province is 5 656 600 km^2 (Agritex, 2001a), inhabited by 1 219 655 people who constitute about 10% of the national population, (CSO, 1997). Masvingo Rural and Chivi districts have 186 778 and 157 428 people, from 37 400 and 29 799 households, respectively. The areas covered by Chivi and Masvingo districts are given in Table 3.2. The provincial city of Masvingo is located about 300 km south of Harare, the capital city of Zimbabwe, at an altitude of 1200 m above sea level. Masvingo city is located at 30º 30' E and 20º 05' S.

Table 3.1: Area of Masvingo province by natural region

Natural region (NR)	Area (km^2)	%
III	620 319	11
IV	1 553 515	27
V	3 482 766	62
Total	**5 656 600**	**100**

Source: Agritex (2001a)

Table 3.2: Areas of Chivi and Masvingo districts by natural region

	Masvingo district		Chivi district	
NR	**Area (ha)**	**%**	**Area (ha)**	**%**
III	94 822	14	0	0
IV	556 039	80	162 289	46
V	43 060	6	188 707	54
Total	**693 921**	**100**	**350 996**	**100**

Source: Agritex (2001a)

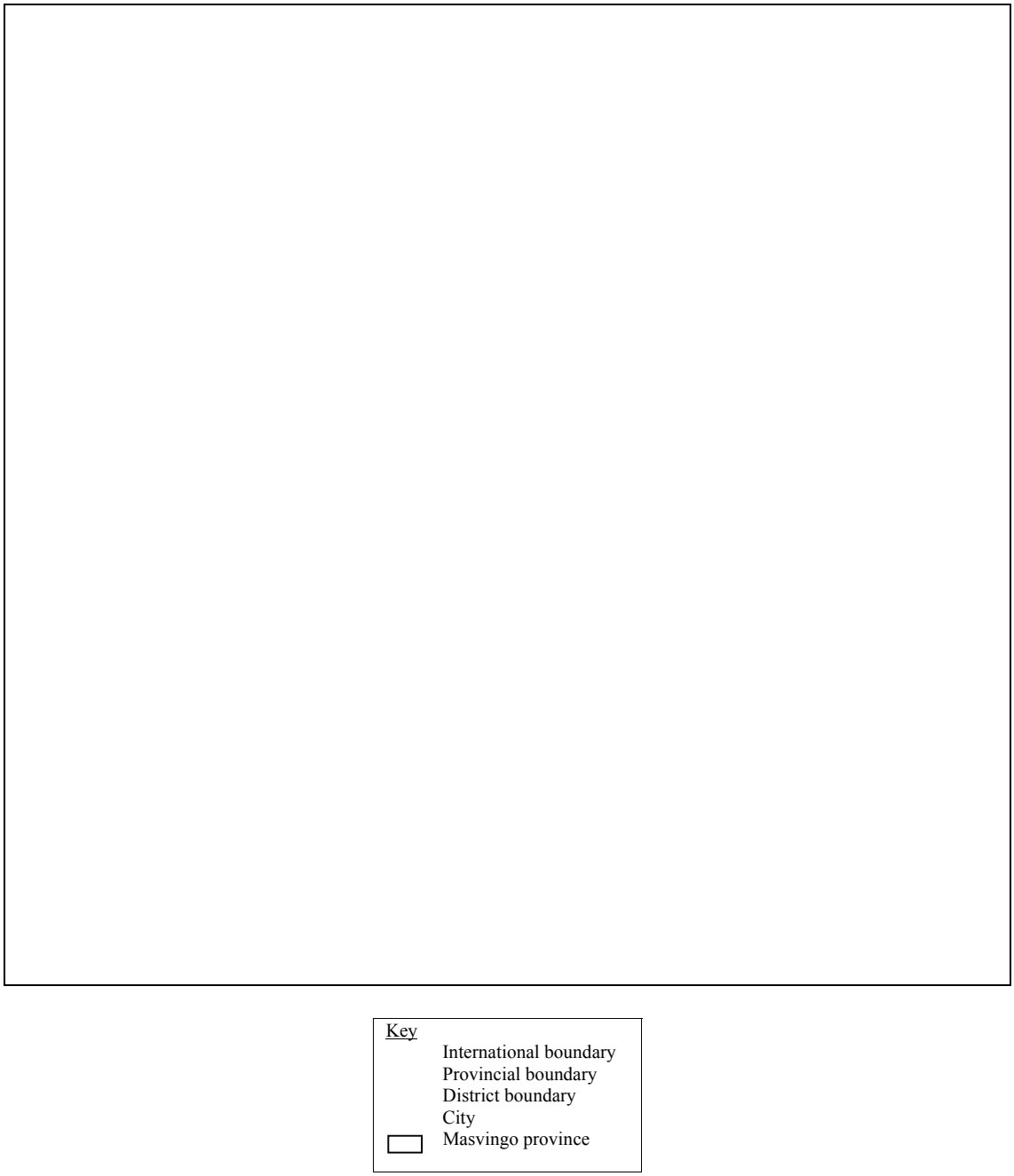

Figure 3.1: Map of Zimbabwe and location of Masvingo province

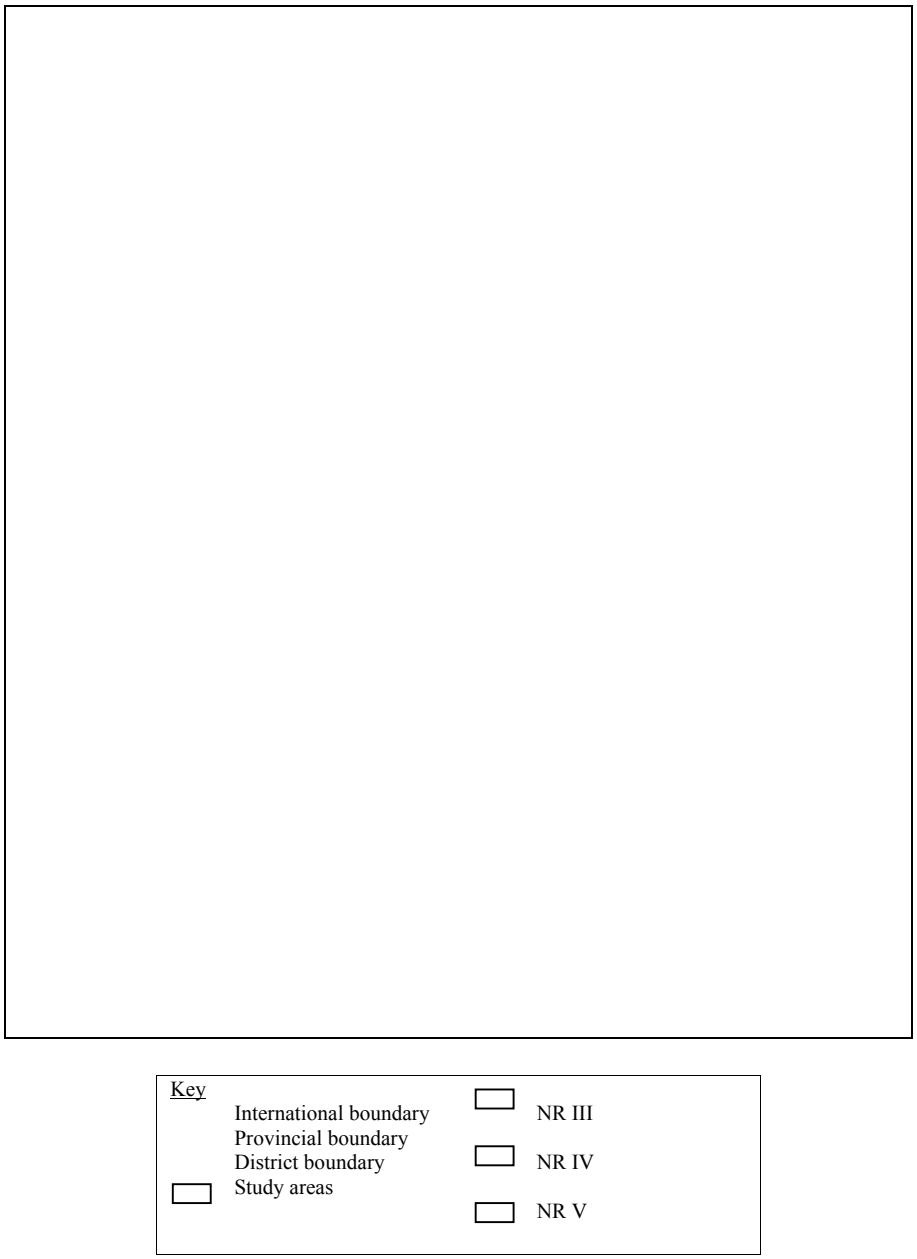

Figure 3.2: Location of study areas in Masvingo province
(1=Chedenje, 2=Gari, 3=Mshagashe, 4=Mushandike, 5=Mutangi, 6=Nyimai)

The main DFID project framework had initially targeted the research work to be conducted with the participation of existing farmer groups working with CARE-Zimbabwe in communal areas of Masvingo province. A project initiation stakeholders workshop, held in September 1999, suggested the inclusion of farmer groups from irrigation and small-scale commercial farming areas which were not covered by CARE-Zimbabwe in order to have a fairly representative sample of smallholder

farmers in Masvingo province. Masvingo and Chivi districts were selected on the basis of existence of the three farming sectors in NRs III, IV and V as well as having established farmer groups. The study areas are described in Table 3.3. Three farmers were selected by farmer-groups from each study area per season to host the implement performance trials.

Table 3.3: Selected study areas in Chivi and Masvingo districts

Masvingo district			Chivi district		
Area	**NR**	**Farming sector**	**Area**	**NR**	**Farming sector**
Mushagashe	III	Small-scale commercial	Gari	IV	Communal
Mushandike	IV/V	Irrigation scheme	Mutangi	V	Communal
Chedenje	IV	Resettlement	Nyimai	V	Communal

3.2.2 Climate and rainfall

The study sites in the two districts fell under the marginal rainfall areas in NR III, IV and V whose total annual rainfall is between 600 and 800 mm and temperatures are generally high. Normal average rainfall per annum in Chivi district, which is predominantly in NR V, is about 500 mm (Agritex, 2001b). The rainfall season starts around the middle of November and tails off towards the end of March with severe mid-season drought spells. The seven months between April and October are dry but some moderate to heavy winter rains can be experienced in May/June. Although not fully representative of study areas, Figure 3.3 shows rainfall received in Masvingo City during the two seasons in which this study was carried out. The mean annual rainfall for Masvingo City for the period 1994-1998 was 664 mm. The 1999-2000 season was exceptionally wet, with a total of 1135 mm, with about 50% of the total rain falling in January and February due to Cyclone Eline. The following season 2000-2001 had a long dry spell in December and January and total rainfall received in Masvingo City was 676 mm.

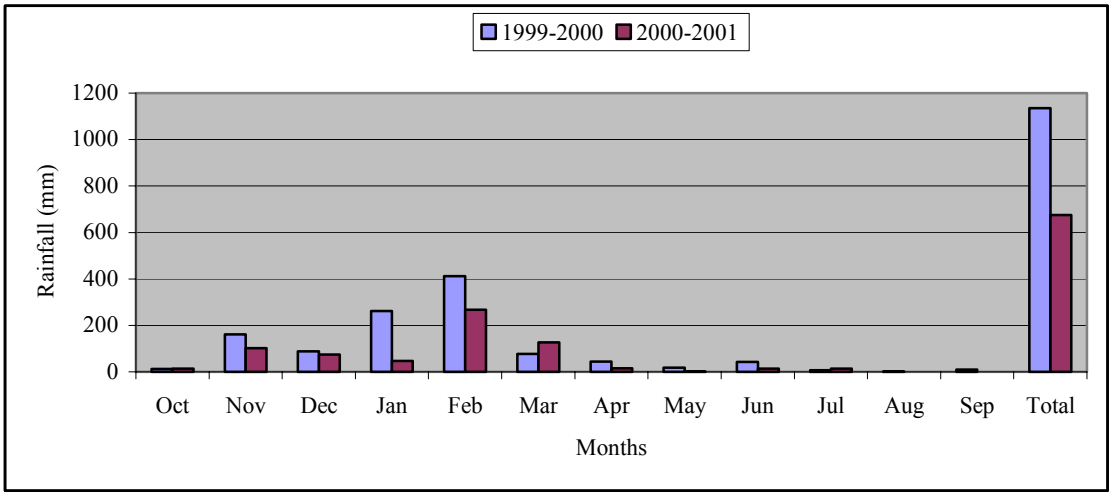

Figure 3.3: Rainfall received in Masvingo City during the study period
Source: Meteorological Department, Harare, Zimbabwe, 2002

3.2.3 Soils

Soils found in the study areas fall under the kaolinitic type and are in the fersiallitic and para-fersiallitic groups (Ministry of Agriculture, 1966). Descriptions of soils in the respective study areas are given in Table 3.4. These soil descriptions cover large areas within which study areas were located and there was likelihood of a mixture or overlaps of soil groups in each area.

Table 3.4: Description of soils in the study areas

Area	Soil group
Chedenje	5G/5P
Gari	5G/5P
Mshagashe	6G
Mushandike	5G/8
Mutangi	5G/5P
Nyimai	5G
Description of soils in the groups	
5 is fesiallitic group-soils with appreciable reserves of weatherable minerals; base saturation over 40%, usually between 60 and 80%; clay fraction contain some 2:1 lattice minerals	
6 is para-fersiallitic group-mainly sandy soils that have some essentiallitic characteristics, but which are not ferrallitic sensu stricto	
8 is sodic group-soils in which the morphology of the profile is attributable ton the presence of significant amounts of exchangeable sodium and or water soluble salts, or to the past influence of sodium during pedogenesis	
5P-Moderately shallow to moderately deep, brown to reddish-brown sandy loams over sandy clay loams; formed on gneisses of various ages and origins	
5G-mainly moderately shallow, greyish-brown, coarse-grained sands throughout the profile, to similar sandy loams over reddish-browm sandy clay loams; found on granitic rocks	
6G-Moderately deep to deep, greyish-brown, coarse-grained sands over pale loamy sands, to similar sandy loams over yellowish-red sandy clay loams or, occasionally, sandy clays; clay fraction essentially ferrallitic but of weatherable minerlas are appreciable	

Source: Ministry of Agriculture (1966)

3.2.4 Crop production

Smallholder farmers in communal areas of Masvingo province crop an average of 2 to 3 ha of land per household. The main crops grown in Masvingo Province are maize, groundnuts, bambara nuts, sorghum, rice, sunflower, beans, finger millet, pearl millet, and cotton. There has been a trend of low crop yields achieved at smallholder level in the province (CSO, 1997). The areas planted to grain, commercial and other crops in communal areas are 186 557 ha, 51 667 ha and 26 125 ha, respectively. The five main crops grown, based on area planted in 2000 are shown in Table 3.5, (CSO, 2001).

Table 3.5: Main crops grown by smallholder farmers in Masvingo province in 2000

Crop	Cropped area (ha)	Yield (t/ha)
Maize	139 748	0.695
Groundnuts	30 374	0.511
Bambara nuts (*nyimo*)	23 586	0.684
Cotton	19 896	0.429
Pear millet (*mhunga*)	13 564	0.145

3.2.5 Available livestock and DAP

Table 3.6 shows the total available cattle and donkey herds in Masvingo province in each of the farming sectors (Agritex, 2001a). CSO (2001) estimated the average size of cattle herd per household in communal areas of Masvingo province to be 6 and 277 274 draught cattle were owned by 82 012 households.

Table 3.6: Available cattle and donkeys by farming sector in Masvingo province

Farming sector	Number of cattle	Number of donkeys
Communal	529 812	47 971
Resettlement	57 144	3 191
Small-scale commercial	39 861	1 601
Commercial	129 316	167
Total	**756 133**	**52 930**

Source: Agritex, 2001a

3.3 Assessing capital resource base of smallholder farmers in study areas

Information on household composition, general farming practices, particularly cropping systems, the use and ownership of DAP and implements was collected during focus group discussions which were held with farmer-groups from communities in the six study areas. Farmers who participated in implement performance trials were nominated by respective focus groups on the basis of their wealth as determined by physical capital as related to draught animals. An implement survey was conducted in the study areas to assess the condition of implements owned by a random sample of 100 smallholder farmers and to evaluate farmers' knowledge and skills in implement use, repair and maintenance. The detailed procedures are given in Chapter 4.

3.4 Evaluation of ploughs and cultivators before and after renovation

Implement performance trials were conducted over a two-year period during 1999-2000 and 2000-2001 seasons. Both spring and autumn/winter trials were conducted with a new set of farmers in each season. Plough and cultivator performance tests were carried out before and after implement renovations in paired plots at each farm site. Implement performance parameters measured included draught, specific draught, speed, depth and width of cut, field capacity, weeding efficiency and field efficiency.

Soil bulk density, shear strength and moisture content readings were taken before implement testing and then monitored together with crop growth on monthly basis after crop emergence. Soil texture samples were taken in the paired plots for laboratory analysis. Crop yields from the paired plots at each farm site were measured at the end of the season and compared. Detailed procedures for field measurements are given in Chapter 5. A flow diagram of the related research activities is shown in Appendix 2

Training of farmers by demonstrating the correct use and repair of ploughs and cultivators was provided during the implement trials. At the end of each growing season, evaluations were conducted by farmer-groups in the respective study sites to share experiences and knowledge gained from the trials. Farmers' opinions on benefits of the trials with regard to the value of implement renovation were recorded and synthesised.

A survey was carried out 14 months after implement trials were completed to assess knowledge and skills acquired by participating households so as to ascertain lessons learnt from the trials and assess any changes in attitudes of households towards implement use, repair and maintenance (Chapter 6).

3.5 Data collection and analysis

Data collected during participatory rural appraisals were recorded on data sheets for each of the six study areas and findings were synthesised. Information from evaluation exercises done by focus groups was recorded on flip charts, synthesised and used in the preparation of reports. Data from the implement performance tests were recorded on data sheets and then entered into a computer using Excel spreadsheet software (Microsoft Corporation, 1997) and then analysed using Statistical Analysis System (SAS) software (SAS Institute Inc., 1996). SAS is an integrated system of software providing control over data access management, analysis and presentation. Questionnaires were designed and analysed in SNAP (Mercator, 1998) for the draught animal implement survey of 100 randomly selected households and the survey to evaluate benefits of trials. SNAP is a computer based survey questionnaire design and analysis package.