Statistical Brief

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Statistical Brief on the National Agricultural Research System

of

LESOTHO

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Philip G. Pardey
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ISNAR INDICATOR SERIES PROJECT: PHASE II

International Service for National Agricultural Research

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ISNAR INDICATOR SERIES PROJECT PHASE II

Decision making in the agricultural research policy area in either domestic, regional, or international fora can only be aided by access to reliable and comprehensive data on these systems. It is for this reason that ISNAR initiated its Indicator Series Project in 1986. The major objective of this project is to collect, process, and analyze reliable and comprehensive time-series data on national agricultural research systems (NARSs) throughout the world in order to identify and report on major trends and emerging policy issues with regard to the development of NARSs. To this end a database has been developed that contains time-series data on agricultural research expenditures and personnel for more than 150 developing and developed countries. These data provide a quantitative basis for more in-depth research policy studies by ISNAR and others.

During the first phase of the project (1986-91), the Indicator Series project team produced two major publications published by Cambridge University Press, namely:

Pardey, P.G., and J. Roseboom. (1989) *ISNAR Agricultural Research Indicator Series: A Global Data Base on National Agricultural Research Systems*, 547 pp.; and

Pardey, P.G., J. Roseboom, and J.R. Anderson, eds. (1991) *Agricultural Research Policy: International Quantitative Perspectives*, 462 pp..

The first publication is a statistical reference volume that provides system-level data on agricultural research personnel and expenditures for 154 countries. The second publication draws on the database to report on the major policy dimensions of agricultural research, with a primary focus on less-developed countries.

Phase II of the Indicator Series Project was initiated in 1992 and seeks to update the database and the policy analyses that accompany it. New ISNAR survey data are being used in conjunction with a large variety of published and "informal" reports in order to produce reliable as well as up-to-date information and statistics about the NARSs.

The country-level data are being published in a series of NARS Statistical Briefs. These briefs include more detailed descriptive information about the institutional structure of the NARS as well as a more comprehensive set of statistics than were reported in the 1989 Indicator Series volume. It is envisaged the country-level data will be assembled and analyzed in a series of regional research reports.

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Contents

Acronyms

ARD	Agricultural Research Division
CGIAR	Consultative Group on International Agricultural Research
DED	Director of Extension and Development
DFS	Department of Field Services
DTS	Director of Technical Services
DPS Technical	Deputy Permanent Secretary Technical
FA/NUL	Faculty of Agriculture/National University of Lesotho
FAO	Food and Agriculture Organization
FTE	Full-time Equivalents
FRS	Forest Research Section
FSR project	Farm Systems Research project
	Institute of Southern African Studies
ISNAR	International Service for National Agricultural Research
LAC	Lesotho Agricultural College
LAPIS project	Lesotho Agricultural Production and Institutional Support project
LWP	Lesotho Project
MACM	Ministry of Agriculture, Cooperatives, and Marketing
NARS	National Agricultural Research System
NUL	National University of Lesotho
OECD	Organization for Economic Cooperation and Development
PPP	Purchasing Power Parity
SACCAR	Southern African Centre for Cooperation in Agricultural Research
USAID	United States Agency for International Development
UBBS	University of Basutholand, Bechuanaland and Swaziland
UBLS	University of Botswana, Lesotho and Swaziland

1. Introduction

The primary purpose of this brief is to provide various statistical and institutional details on the development and current status of the public agricultural research system in Lesotho. This information has been collected and presented in a systematic way in order to inform and thereby improve research policy formulation with regard to Lesotho's NARS. Most importantly, these data are assembled and reported in a way that makes them directly comparable with the data presented in the other country briefs in this series. And because institutions take time to develop and there are often considerable lags in the agricultural research process, it is necessary for many analytical and policy purposes to have access to longer-run series of data.

NARSs vary markedly in their institutional structure and these institutional aspects can have a substantial and direct effect on their research performance. To provide a basis for analysis and cross-country, over-time comparisons, the various research agencies in a country have been grouped into five general categories; government, semi-public, private, academic, and supranational. A description of these categories is provided in table 1.

Table 1: *Institutional Categories*

Category	Description	Examples
Government	Agencies directly administered by government.	Research department within a ministry
Semi-public	Agencies not directly controlled by government and with no explicit profit making objective.	Research institute under a commodity board
Private	Agencies whose primary activity is the production of goods and services for profit.	Agricultural machinery or chemical company
Academic	Agencies that combine university-level education with research.	Faculty of agriculture
Supranational	Agencies whose mandate covers more than one country.	CGIAR institutes

Note: Adapted from OECD (1981).

The concept of a NARS used throughout this report includes only those institutes that can be classified as government, semi-public, and academic agencies. Where it is useful to do so, private and supranational research agencies have been discussed, but for reasons of comparability they are not included in the NARS data reported here. More detailed information on the definitions and concepts used in this brief is provided in appendix 2.

Section 2 provides a brief description of the institutional development and current structure of the NARS. Section 3 presents a statistical overview of the longer-run investment trends in agricultural research along with a more detailed look at contemporary investment orientations. The appendices provide further descriptive details and present the basic research personnel and expenditure data in disaggregated fashion. For general background information and statistics on Lesotho we refer to appendix 1.

2. Agricultural Research Institutions

2.1 Historical Evolution[1]

Agricultural research in Lesotho began relatively late compared with most other African countries. The Agricultural Research Station in Maseru was established as a section within the Crops Division of the Ministry of Agriculture, Cooperatives, and Marketing (MACM) in 1952. To encompass the various agroecological zones within Lesotho, experiment stations were established later at Machache, Matsieng, Mafeteng, Tsakholo, Teyateyaneng, Leribe, and Mokhotlong. The initial focus of research at these experiment stations was on testing imported agricultural technologies and assessing their suitability for the commercial production systems in Lesotho.

Lesotho gained its political independence from the United Kingdom in 1966. In prior years most of the agricultural research was conducted by expatriate researchers assisted, in most cases, by national workers trained to the diploma level. Research was mainly carried out as donor-funded projects for which the Government of Lesotho paid the salaries of the local staff but made only minimal contributions to the local operating costs. Prior to 1979 local research appears to have had little impact on agricultural production and conservation endeavors due in large part to a failure to focus on the key problems facing the majority of farmers in Lesotho and the generally poor state of the country's agricultural research infrastructure (Namane 1991).

In 1979 the Agricultural Experiment Station in Maseru and the 11 substations administered by this station were brought together as the Agricultural Research Division (ARD) under the Deputy Permanent Secretary Technical (DPS Technical). In 1981 MACM was restructured into two departments; the Department of Technical Services (DTS) and the Department of Extension and Development (DED). This latter department was renamed the Department of Field Services (DFS) in 1985. DTS took charge of the technical departments which included livestock, crops, research, conservation, and the Lesotho Agricultural College (LAC). DED was responsible for disseminating information, extending technologies to farmers, and managing the District Agricultural Officers.

In 1985 MACM was reorganized into five departments —administration, technical services (including ARD), crop services, livestock services, and field services— and was again restructured in 1987. This time the Department of Technical Services was divided into a Department of Economics and Marketing, which mainly had an advisory role to the minister, and a Department of Conservation and Forestry, while ARD was attached to DFS.

In the late 1970s the focus of agricultural research increasingly shifted from testing imported technologies for use on cash-crop farms towards an on-farm research mode of operation. This shift in focus coincided with the initiation of a Farming Systems Research (FSR) project, which was set up in 1979 with substantial financial assistance from USAID. The initial objective of the FSR project was to establish a Farming Systems Research Unit within ARD. In the years that followed this objective was broadened to strengthening ARD's entire research program. During the course of the FSR project, three research stations were established at Nyakosoba, Siloe, and Mokhotlong.

1 The material presented in this section draws largely from SADCC and DEVRES (1985), ISNAR (1989) and Namane (1991).

The FSR project ended in 1986 and was followed by the Lesotho Agricultural Production and Institutional Support (LAPIS) project. The LAPIS project consisted of a research component at ARD, a training component at the Lesotho Agricultural College (LAC), and a production component under DFS/Extension of MACM, which worked closely with the Department of Crops Services and to a lesser extent with the Department of Livestock Services. The three components together sought to identify and develop agricultural practices to increase agricultural production and enhance the employment prospects for small-scale farmers. The research component of the LAPIS project built on the foundation of the FSR project and aimed to increase the research capabilities of ARD to develop and extend technologies to farmers. An additional objective of the project was to strengthen ARD's farming-systems research unit. The LAPIS project took a different approach from the FSR project because of the high rate of failure of experiments launched during the latter project. More emphasis was given to on-station work and institutional building than to the establishment of prototype areas as under the FSR project. The production component of the LAPIS project focused mainly on vegetables, small-scale irrigation systems, fruit trees, and range management. The project ended in March 1993. From 1979 to 1993 most of ARD's capital investments (such as buildings and a modest amount of equipment including tractors and other vehicles needed for field research) were funded by USAID. Also the Food and Agriculture Organization (FAO) supported ARD financially during the late 1970s and throughout the 1980s.

Forestry research was initiated with the establishment of the Forestry Research Section (FRS). This section was formed in 1979 when an expatriate researcher was assigned to the Lesotho Woodlot Project (LWP). LWP was founded six years earlier to serve as the Central Forest Authority and was administered by the Forestry Department of MACM. Research focused on species and provenance trials, fertilizer application, nursery research, forestry inventory, monitoring pests and diseases, and some seed collection. LWP ended in 1987. Its activities were continued by a newly established Division of Forestry. A National Tree Seed Centre was established by the Division of Forestry in 1988.

Diploma level education in the agricultural sciences is provided by the Lesotho Agricultural College (LAC). LAC was established in 1955. Its programs are authorized by the National University of Lesotho (NUL), but the college is administratively and financially controlled by MACM. NUL was established in 1945 as the Pius XII College. In 1964 it became a campus of the newly established University of Basutholand, Bechuanaland, and Swaziland (UBBS). After independence of the three countries in 1966 the university was renamed the University of Botswana, Lesotho, and Swaziland (UBLS). UBLS was funded equally by the three governments, but had little presence in Botswana or Swaziland during 1964-70. The main campus of UBLS at this time, the Roma campus, was in Lesotho. In the early 1970s two additional campuses were established, one in Botswana at Gaborone, the other in Swaziland at Kwaluseni. In 1975 the Government of Lesotho detached the Roma campus from UBLS and established the National University of Lesotho (NUL). Because the Faculty of Agriculture for UBLS was located at Kwaluseni in Swaziland, NUL created its own Faculty of Agriculture which became operational in 1991.

2.2 Present Structure

As background to a description of the present structure of Lesotho's agricultural research system this section begins with a brief overview of contemporary developments in the country's agricultural sector. Cropping conditions in Lesotho are not particularly good: the soil fertility is low, the land faces severe erosion problems, and the rainfall is erratic. About 76% of the country's area is classed as suitable for agriculture. Only 14% of this agricultural land is cropped, the remaining 86% is pastureland. Agricultural households in Lesotho rely heavily on off-farm sources of income, mostly outside the country. About 45% of the male labor force works in South Africa and most of the agricultural work is done by women.

The Agricultural Research Division (ARD) conducts almost all the country's agricultural research. The division is part of the Department of Field Services of the Ministry of Agriculture, Cooperatives and Marketing (MACM) (see appendix 3). ARD is headquartered in Maseru and has 10 sub/field stations: one in the mountain foothills, three in the mountains, and six in the southern lowlands. In addition, three research sites were established during the FSR project, one in each of the major agroecological zones of Lesotho. The two research sites at Nyakosoba (mountain foothills) and at Siloe (southern lowlands) operate as regional stations. The third research site at Mokhotlong (mountains) is apparently closed, while one of the three field stations in the mountains has been upgraded to the status of a regional station. A fourth regional station was established at Mahobong, Leribe (northern lowlands). The station at Maseru is the only station with laboratories and other research facilities, as well as the only station permanently staffed with researchers. The other field stations are staffed by caretakers and lack buildings (other than accommodation for the caretakers) and equipment. The regional stations have facilities for scientists and are reportedly to be staffed with scientists in the near future. ARD's research mandate includes agronomy, horticulture and fruit trees, livestock, range and fodder crops, soils, plant protection, human nutrition, rural sociology, and seed testing. Some extension work is also conducted. Crop research at ARD seeks to test and release new crop varieties as well as investigate improve crop management practices such as the timing and method of planting, row spacing, and planting density. Limited livestock research is conducted and focuses on applied animal nutrition research. With only 26 research staff in 1991 ARD confronts a problem which besets most small NARS namely ensuring its research program and staff do not get overly fragmented. ARD's organizational structure is presented in diagrammatic form in appendix 3.

Agricultural research in Lesotho has always been heavily project driven in terms of funding and program orientation. During the 1980s and the early 1990s operational support for programs, the capital funds for buildings and equipment for field research, and the training costs of research staff were provided almost entirely by donors, with USAID being the major source of funds.

Although ARD conducts most of the country's agricultural research there are a few other institutes that engage in a limited amount of agricultural research. The Department of Livestock of MACM conducts some research on small game, dairy, fisheries, poultry, and range management. Forestry research is conducted by the Forestry Research Section (FRS) of the Division of Forestry within the Department of Conservation and Forestry of MACM.

The Institute of Southern African Studies (ISAS) of NUL conducts some research on the marketing of agricultural products such as grains, livestock, and vegetables. Because of lack of data ISAS is not included in the data report of this brief.

Table 2: *Overview of Present Structure of NARS, 1991*

Institutional category	Supervising agency	Executing agency		Research focus	Staffed research sites[a]	Number of researchers			
		Name	Acronym			National	Expats	Total	FTEs
Government	Ministry of Agriculture, Cooperatives, and Marketing	Department of Field Services, Agricultural Research Division	ARD	crops, livestock, agronomy	15 (1)	20	6	26	26
		Department of Conservation and Forestry, Division of Forestry, Forestry Research Section	FRS	forestry	1 (1)	1	0	1	1
Academic	National University of Lesotho	Faculty of Agriculture	FA/NUL		1 (1)	na	na	5	0.5
Total					*17 (3)*	*na*	*na*	*32*	27.5

Source: 1249 and 1489.
[a] Staffed with researchers and/or technicians. Bracketed sites are permanently staffed with researchers.

The Lesotho Agricultural College (LAC) provides instruction in seven programs at the diploma and certificate level at its two campuses at Maseru and Leribe, respectively. LAC is administered by the Department of Administration of MACM. Current teaching staff consist of four MSc and 18 BSc. In addition to its training responsibilities, LAC also attempts to conduct some applied research in cooperation with ARD. However, only a very limited amount of time is spent on agricultural research and no relevant personnel and expenditure data were available for inclusion in this report.

In 1991 the Faculty of Agriculture (FA/NUL) was established at the National University of Lesotho. The faculty has 20 established posts, but only five were filled during the faculty's first academic year. In the college year 1992/93 the Faculty of Agriculture had a teaching staff of 11, of whom five were nationals and six were expatriates. With the faculty still in its infancy, staff at FA/NUL do not spend much time doing agricultural research.

3. NARS Statistics

In the absence of any questionnaire responses the data reported here are based on the secondary sources cited at the conclusion of this report and personal communication with Dr. T. Namane of ARD.

3.1 Long-Term Development

In the early 1960s Lesotho employed only 4 full-time equivalent researchers per million economically active agricultural population, compared with the contemporary sub-Saharan African average of 15. In spite of the subsequent rapid growth in the number of researchers per million economically active agricultural population to 32 in 1981-85, this ratio was still lower than the corresponding regional average of 42 researchers (Pardey, Roseboom and Anderson 1991). Most recently (1992) this intensity ratio grew to 36 researchers per million economically active agricultural population, which is still below the regional average.

For the period 1961-92 the number of full-time equivalent researchers and expenditures grew at an annual rate of 10.1% and 7.1%, respectively. These growth rates are substantially higher than the corresponding annual rates of 6.8% and 4.7%, respectively, for sub-Saharan Africa during the period 1961-85.

During the first 25 years (1961-85) the number of researchers and expenditures grew at a approximately the same rate. More recently, however, total expenditures declined substantially in real terms while the number of researchers has continued to grow as the system has increasingly became staffed with national scientists.

In the early 1960s agricultural research expenditures expressed as a percentage of agricultural GDP averaged 0.14%, compared with a sub-Saharan African weighted average of 0.26%. This research intensity ratio reached 1.08% in the mid-1980s, which is more than two times the regional weighted average but still modest when compared with other small countries in sub-Saharan Africa.

Table 3: *NARS Researcher and Expenditure Series, 1961-92*

	'61-65	'66-70	'71-75	'76-80	'81-85	'86-90	1991	1992	growth rate[a]
Researchers (FTEs)	2.0	4.6	9.2	13.4	19.0	25.5	27.5	24.1	10.1
Expenditures (millions 1985 Maloti per year)	0.143	0.339	0.668	0.872	1.079	0.859	0.899	0.952	7.1
Expenditures (millions 1985 PPP[b] dollars per year)	0.496	1.178	2.322	3.031	3.750	2.985	3.123	3.309	7.1
Expenditures per research-er (thousand 1985 PPP[b] dollars per year)	248	256	253	226	198	117	114	137	-2.7
Economically active agricultural population (millions)	0.46	0.48	0.51	0.55	0.60	0.64	0.67	0.67	1.4
Researchers per million economically active agricultural population	4.4	9.6	18.0	24.3	31.8	39.8	41.3	35.8	8.5
AgGDP (million 1985 PPP[b] dollars)	758	514	485	504	346	4178	354	284	-2.3
Expenditures as a % of AgGDP	0.14	0.48	0.71	0.76	1.08	0.72	1.05	1.43	6.5

Source: See appendices 5 and 6.
Note: Table includes data for ARD, FRS, and the Faculty of Agriculture of NUL. ARD's expenditures include MACM funds and USAID contributions through FSR and LAPIS projects. FAO funds and those from other donors are excluded because no detailed information was available.
[a] Least squares annual growth rates for the 1961-1992 period.
[b] For information about "PPP dollars" see appendix 2.

3.2 Human Resources

Degree and Nationality Status of Researchers

Detailed information on the educational status of ARD and FSR research personnel are presented in table 4. Prior to political independence in 1966, the two (full-time equivalent) researchers working in Lesotho were expatriates. Throughout the 1980s and the early 1990s most of the expatriates were employed through USAID's LAPIS project and its predecessor the FSR project. During the period 1966-85 ARD had no national researchers with a PhD degree. In 1991, two full-time equivalent researchers with a PhD degree were employed at the institute. During 1966-85 less than one-third of ARD's national staff had a postgraduate degree. As part of the FRS and LAPIS projects many nationals were sent to universities in other countries to do postgraduate studies. During 1988/89 for example, 14 nationals were sent abroad for training. In 1991 a total of 7 PhD, 11 MSc, and 15 BSc graduates were trained abroad. However, ARD had to contend with the inevitable turnover in its small cadre of professional staff, with 13 nationals on the professional staff leaving the division since 1979.

FRS is a small section and its national staff are only trained to the BSc level.

Gender

ARD employs a higher proportion of female researchers compared with other African NARS. In 1988 around one third of ARD's national scientific staff were female. No information on female expatriate staff was available.

Table 4: *Educational and Nationality Status of Researchers*

Institutional category	Researcher status	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90	1991[a]
				(full-time equivalents)				
ARD	PhD	0	0	0	0	0	0.5	2.0
	MSc	0	0	0.2	1.4	3.1	7.6	6.0
	BSc	0	1.2	3.5	4.7	5.9	7.9	12.0
	Subtotal	0	1.2	3.7	6.1	9.0	16.0	20.0
	Expat	2.0	3.4	5.4	7.3	8.5	7.4	6.0
	Total	*2.0*	*4.6*	*9.2*	*13.4*	*17.5*	*23.4*	26.0
FRS	PhD	—	—	—	—	0	0	0
	MSc	—	—	—	—	0	0	0
	BSc	—	—	—	—	0.5	1.4	1.0
	Subtotal	—	—	—	—	0.5	1.4	1.0
	Expat	—	—	—	—	1.0	0.7	0
	Total	—	—	—	—	*1.5*	*2.1*	*1.0*
Total	PhD	0	0	0	0	0	0.5	2.0
	MSc	0	0	0.2	1.4	3.1	7.6	6.0
	BSc	0	1.2	4.3	5.3	6.4	9.3	13.0
	Subtotal	0	1.2	4.5	6.7	9.5	17.4	21.0
	Expat	2.0	3.4	5.0	6.9	9.5	8.1	6.0
	Total	*2.0*	*4.6*	*9.2*	*13.4*	*19.0*	*25.5*	*27.0*

Source: See appendix 6.
[a] Data for 1991 excludes FA/NUL.

Staff Composition

The number of ARD's technical support staff decreased from 28 in 1984 to 11 in 1991 (table 5). The number of researchers increased substantially during this period with a consequent collapse in the ratio of technical support staff per researcher from 3.1 in 1984 to 0.4 in 1991.

Data on "other" support staff were only available for 1984 when the ratio of "other" support staff per researcher was 2.3.

Table 5: *Staffing Structure ARD*

Staff category	1984	1987	1988	1989	1991
			(number of personnel)		
Research	9	16	15	17	25
Support					
Technical	28	11	14	11	11
Other	21	na	na	na	na
Subtotal	49	na	na	na	na
Total	*58*	*na*	*na*	*na*	*na*

Source: 0004, 1220, 1224, 1225, 1229, and 1249.

3.3 Financial Resources

Expenditures

Table 6 provides a breakdown of ARD's expenditures by source and spending category. USAID contributions accounted for 23-26% of ARD's total expenditures, except for 1985, the last year of the FSR project, when they accounted for 39%. Most of ARD's capital investments were funded by USAID through the FSR project (1979-86) and the LAPIS project (1986-93).

Table 6: *Breakdown of ARD's Expenditures by Cost Category and Source of Funding*

Institute	Cost category	1985	1986	1987	1988	1989	1990	1991	1992
					(percentages)				
MACM	Salaries	49.0	64.7	57.9	63.5	61.8	57.8	67.2	62.1
	Operating	12.5	9.5	16.1	12.3	13.1	16.3	9.9	15.2
	Subtotal	61.5	74.2	74.0	75.7	74.9	73.9	77.1	77.4
USAID contributions[a]		38.5	25.8	26.0	24.3	25.1	26.1	22.9	22.6
Total		*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: 1220, 1488, and 1489.
[a] USAID expenditures per year are derived by dividing the total project expenditures by the duration of each project in years (i.e., the FSR project from 1979 to 1986 and the Agricultural Research Component of the LAPIS project from 1986 to 1993). The total project expenditures include funds for long-term training.

FAO and other donors provided additional funds for research projects in Lesotho. A considerable amount of equipment has also been provided in kind over the past 10-15 years. For example, FAO purchased the laboratory equipment for the Seed Testing Laboratory in the late 1970s and replaced some of the old equipment in ARD's Seed Testing Laboratory in 1993. The resources made available by these other projects and gifts are not included in the data presented here.

3.4 Research Focus

An overview of the research orientation of Lesotho's NARS is presented in table 7. In 1989 about 22% of the researchers worked on crop research and 17% on livestock research. Forestry and natural resources research received equal attention (5.6%). About one half of the total research effort went to research that could not readily be allocated to a particular commodity. This is mainly farming systems research.

Table 7: *Research Focus, 1989* [a]

Research Focus	ARD	FRS[b]	Total FTE	Total Share
		(full-time equivalents)		*%*
Crop	4	0	4	22.2
Livestock	3	0	3	16.7
Forestry	0	1	1	5.6
Natural Resources	1	0	1	5.6
Other	9	0	9	50.0
Total	*17*	*1*	*18*	*100*

Source: 1220 and 1230.
[a] Includes only national research staff.
[b] FRS data for 1990.

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This bibliography comprises three different sets of references. The "references" section relates to references cited in the text, the "data sources" to references from which data have been extracted to construct the time series (see appendices 5 and 6), and "other references" to references that have been consulted in the process of data collection but not used explicitly.

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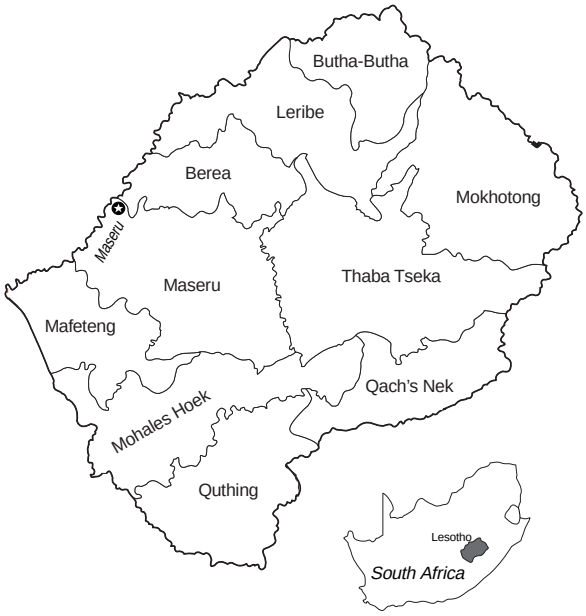
Appendix 1: Country background information



Geography

Area: 3.0 million ha
Location: enclave within the east central part of the Republic of South Africa.

Agroecological features: about two-thirds of the total land area is mountainous (more than 3,000 m above sea level). The terrain gradually descends westward to a foothill region, and farther west to a fertile and densely populated lowland region. Four major zones are distinguished: the Lowlands, the Foothills, the Mountains, and the Orange River Valley. Lesotho has a temperate subtropical climate. Precipitation, usually concentrated in torrential thunderstorms, averages about 711 mm annually, with less rainfall in the southern part of the country (dry lowlands). There are frequent frosts in the winter, and hail is a frequent summer hazard. Soils are of basaltic origin. The mountain soils are thin but rich and the lowlands are characterized by red soils of sandstone origin. Erosion is the principal factor limiting the continued productivity of Lesotho's soils.

Population

Total (1991): 1.8 million
Annual growth rate (1981-90)[a]: 2.8%
Literacy (1990): 78%
Life expectancy (1991): 56 years

Economy *(values reported in 1985 PPP dollars)*

Gross Domestic Product (1991): 2,798 million dollars
Per capita GDP (1991): 1,543 dollars
Agricultural GDP (1991): 372 million dollars
Share of agriculture in GDP (1991): 13.3%

Annual growth rates (1981-90)[a]
GDP: 4.7%
GDP per capita: 1.8%
AgGDP: 3.3%

Trade *(values reported in current dollars)*

Net surplus total trade (1991): -575 million dollars
Net surplus agricultural trade (1991): -133 million dollars
Percentage of agricultural imports in total imports: 23.4%
Percentage of agricultural exports in total exports: 26.3%
Major agricultural import commodities (1992)[b]: bovine cattle (14%), refined sugar (11%), maize (10%), pigs (8%) and poultry meat (7%)
Major agricultural export commodities (1992)[b]: greasy wool (84%), flour wheat (13%) and bovine cattle (3%)

Agriculture

Agricultural land (1990): 2.3 million ha
Annual growth rate (1981-90)[a]: 0.2%
Percentage arable: 13.8%
Percentage permanent crop: 0.0%
Percentage permanent pastures: 86.2%

Economically active agricultural population (1991): 0.7 million
Annual growth rate (1981-90)[a]: 1.3%
Percentage in total economically active population: 78.9%

Fertilizer use per ha arable land (1990): 14.4 kg
Annual growth rate (1981-90)[a]: -1.3%

Major crops (in decreasing order of value of production): maize, wheat, dry beans, sorghum and dry peas

Sources: Europa Publications (1992), FAO (1993), and World Bank (1993).
[a] Least squares growth rate.
[b] Bracketed percentages represent value share of the respective total.

Appendix 2: Definitions and concepts

NARS

The construction of quantitative and internationally comparable expenditure, personnel, and related measures of a national agricultural research system (NARS) requires a precise idea of what, in fact, is being measured. Since the term NARS is subject to a variety of interpretations, it is necessary to define rather precisely the NARS concept used here. Our approach adheres, wherever possible, to the internationally accepted statistical procedures and definitions developed by the OECD and UNESCO for compiling R&D statistics (OECD 1981 and UNESCO 1984). For statistical purposes a NARS is defined in terms of the following characteristics:

(a) *National*. The concept of a "national" system used in this report refers to domestically targeted research activities funded and/or executed by the *public* sector of a particular country. A relatively broad concept of the public sector is taken to include government, semi-public, and academic research institutes. However, private, for-profit research as well as the research activities of supranational research agencies that are not executed through national institutes are excluded. Also excluded is research undertaken by short-term development projects.

(b) *Agricultural*. Agricultural research, as defined here, includes crop, livestock, forestry, and fisheries research, as well as research on agricultural inputs, the natural resource base, and socio-economic aspects of primary agricultural production. It excludes, where possible, research concerning the off-farm storage and processing of agricultural products, commonly referred to as post-harvest research and food-processing research. This delineation corresponds with the national accounts definition of the agricultural sector.

(c) *Research*. Research is often performed in conjunction with other activities such as extension, education, and production. To the extent possible, research activities (in terms of expenditures and staff) are differentiated from these other activities. However, if non-research activities were an integral part of an institute's research activities and accounted for less than 20% of the resources of the institute, it was expedient to classify all the activities of the institute as being research-related.

Full-Time Equivalent (FTE)

A full-time equivalent researcher year is taken to be a person who holds a full-time position as a researcher during the whole year. Adjustments to full-time equivalents have only been made when: (a) a research position was part-time; (b) a research position was not filled for the whole year; and (c) if the position explicitly involved tasks other than agricultural research. In the latter case an estimate was made of the time spent on agricultural research. No adjustments were made, however, for vacation or sick leave nor for time spent on administration, meetings, travel or other activities that form part of the normal duties required to support a research endeavor. Following this line of reasoning, professional staff in management positions were classified as researchers.

The degree status of researchers is determined on the following basis: 3-4 years full-time university education (BSc), 5-6 years (MSc), and more than 6 years plus doctorate thesis (PhD).

Expatriate Researcher Costs

Many expatriate researchers working on donor-supported projects in NARSs are paid their salaries and living expenses directly by the donor agency. All (or some substantial fraction) of these costs do not get included in the financial reports of the agricultural research organizations. To calculate these *implicit* costs we took the average cost per researcher in 1985 to be 120,000 "1985 PPP dollars" and backcast this figure using the rate of change in real personnel costs per FTE researcher in the US state agricultural experiment station system. This extrapolation procedure makes the assumption that the personnel-cost trend for US researchers is a reasonable proxy of the trend in real costs of internationally recruited staff working in NARSs. Unless otherwise stated FTE expatriate researchers have been costed at $80,000 "1985 PPP dollars" per researcher for the 1961-65 period, $85,000 per researcher for 1966-70, $90,000 per researcher for 1971-75, $110,000 per researcher for 1976-80, and $120,000 per researcher for 1981-91.

Deflators and Exchange Rates

All expenditure figures were first compiled in current local currency units (appendix 5). In order to facilitate comparisons over time and across countries these figures are deflated with a local GDP deflator to base year 1985, and then converted to a common currency (US dollars) using the 1985 Purchasing Power Parity (PPP) over GDP. PPPs are synthetic exchange rates that attempt to reflect the purchasing power of a country's currency. The PPPs used here are derived from the Penn World Table (Mark 5), which is based on the benchmark studies of the International Comparison Project (Summers and Heston 1991). For additional information on currency conversion methods in this context see Pardey, Roseboom, and Craig (1992).

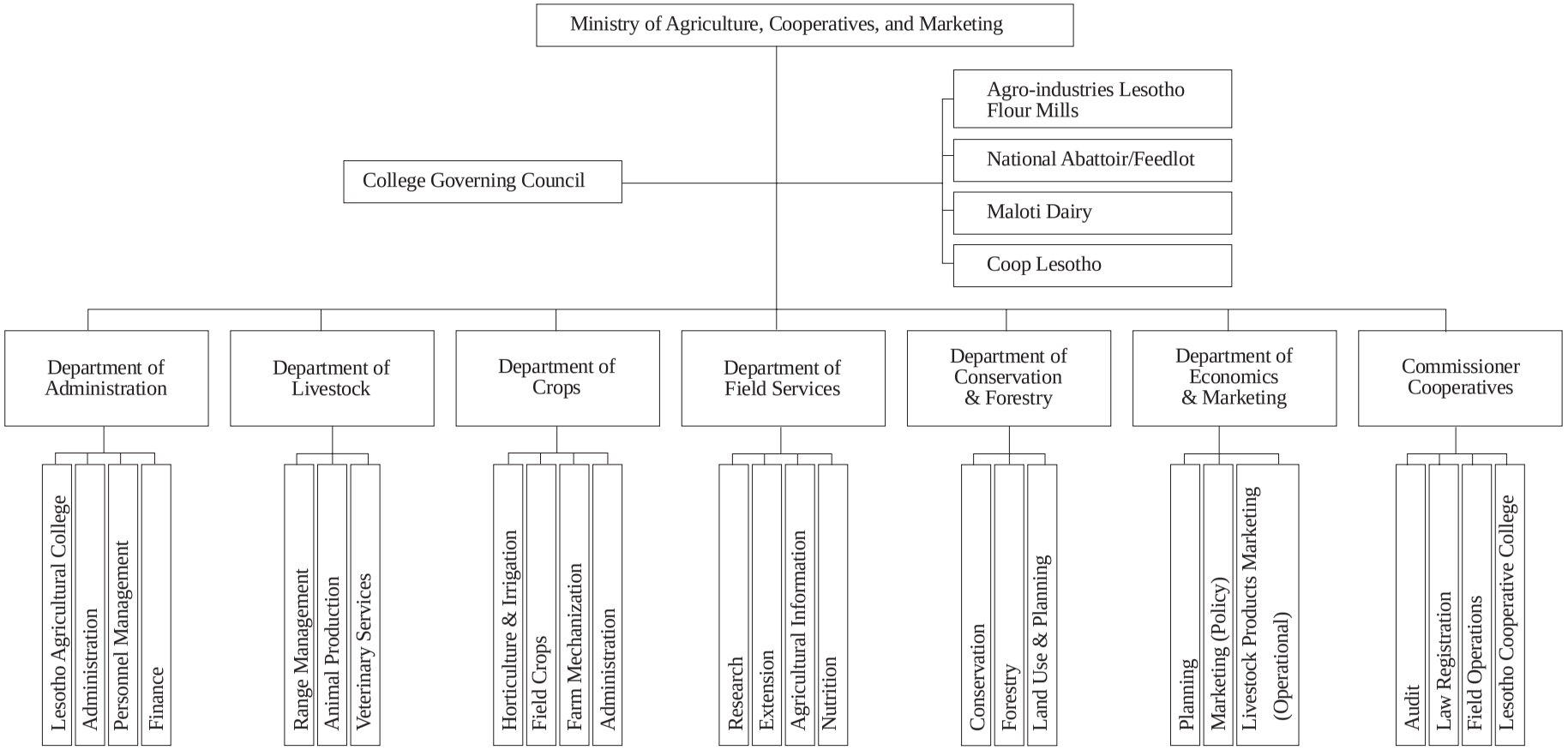
Nomenclature for tables in text

A zero indicates an actual observation of zero, a dash indicates an observation is not relevant (due to institutional mergers, closures, and so on), while “na” indicates an observation that is not available.

In the text we note any marked deviations from these data compilation norms and include points of clarification if warranted.

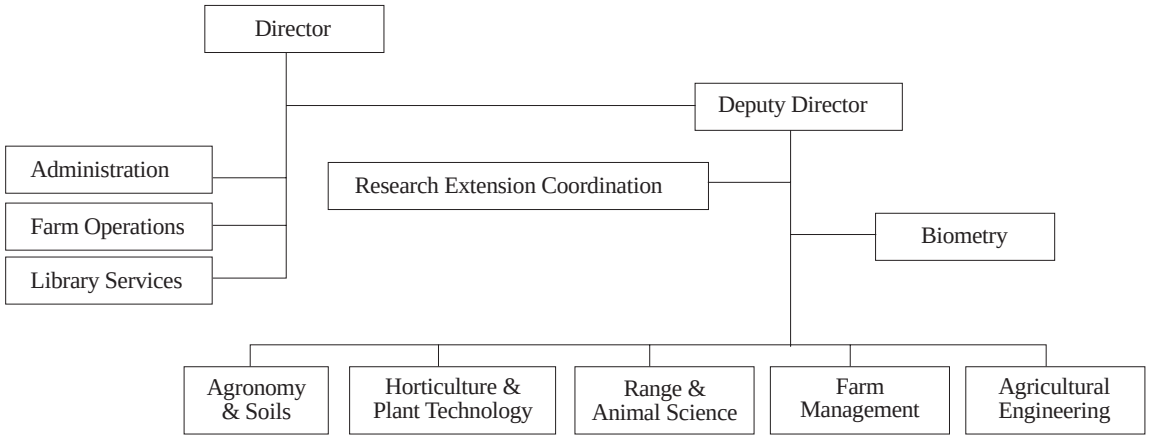
Appendix 3: Organizational charts of the agricultural research institutes

Ministry of Agriculture, Cooperatives, and Marketing (MACM), 1993



Appendix 3: Organizational charts of the agricultural research institutes (contd.)

Agricultural Research Division (ARD), 1989



Appendix 4: Addresses of the agricultural research institutes

Director
Agricultural Research Division
P.O. Box 829
Maseru, 100
LESOTHO

Chief Forestry Officer
Forestry Division
P.O. Box 180
Roma
LESOTHO

Dean
Faculty of Agriculture
National University of Lesotho
P.O. Box 180
Roma
LESOTHO

Appendix 5: Researcher and research expenditure totals, 1961-92

Total Number of FTE Researchers

Category	Name institute	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Public	ARD	1	*1.5*	*2.0*	*2.5*	3	3	*3.8*	*4.6*	*5.4*	*6.2*	7	*8.1*	10	*10.0*	*10.8*	*11.6*
	FRS	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Academic	FA/NUL	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL		1.0	1.5	2.0	2.5	3.0	3.0	3.8	4.6	5.4	6.2	7.0	8.1	10.0	10.0	10.8	11.6
Sources:		10				286	10					589		16			
Category	Name institute	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Public	ARD	*12.4*	*13.2*	*14.0*	*14.8*	*15.6*	*16.4*	*17.2*	18	*20.1*	*22.2*	*24.2*	23	23	*24.5*	26	*22.0*
	FRS	—	—	—	1	*1.2*	*1.3*	*1.5*	*1.7*	*1.8*	2	*2.5*	3	*2.0*	1	*1.0*	*1.0*
Academic	FA/NUL	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.5	1.1
TOTAL		12.4	13.2	14.0	15.8	16.8	17.7	18.7	19.7	21.9	24.2	26.8	26.0	25.0	25.5	27.5	
Sources:					976				4		976	1229	1224;1225	1220	1230	1249; 999	999

Note: Italicized figures represent data that are either constructed or interpolated.

Total Research Expenditures — Currency: million Maloti

Category	Name institute	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Public	ARD	*0.013*	*0.023*	*0.030*	*0.037*	*0.044*	0.044	*0.065*	*0.074*	*0.092*	*0.112*	0.115	*0.152*	*0.193*	*0.190*	*0.263*	*0.289*
	FRS	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Academic	FA/NUL	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total (current Maloti)		0.013	0.023	0.030	0.037	0.044	0.044	0.065	0.074	0.092	0.112	0.115	0.152	0.193	0.190	0.263	0.289
GDP deflator (1985=100)		18.69	21.51	20.96	20.92	20.42	20.65	23.81	21.88	23.03	23.95	21.66	25.17	26.46	26.61	34.72	36.30
Total (constant 1985 Maloti)		0.071	0.107	0.143	0.178	0.214	0.214	0.274	0.337	0.401	0.466	0.533	0.604	0.731	0.715	0.756	0.795
Total (constant 1985 PPP dollars)		0.248	0.372	0.495	0.619	0.743	0.743	0.954	1.171	1.392	1.620	1.852	2.101	2.542	2.485	2.629	2.764
Sources:							589					589					
Category	Name institute	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Public	ARD	*0.324*	*0.394*	*0.418*	*0.521*	*0.608*	*0.683*	0.801	0.879	1.108	0.796	0.892	1.144	1.248	1.340	1.681	1.927
	FRS	—	—	—	*0.025*	*0.033*	*0.040*	*0.050*	0.058	*0.090*	*0.131*	*0.211*	*0.341*	*0.285*	0.175	*0.207*	*0.280*
Academic	FA/NUL	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*0.032*	*0.096*
Total (current Maloti)		0.324	0.394	0.418	0.546	0.641	0.722	0.850	0.938	1.198	0.927	1.103	1.485	1.533	1.515	1.921	2.303
GDP deflator (1985=100)		39.01	45.47	46.57	56.26	63.84	69.86	80.11	85.56	100.00	114.11	128.84	154.12	173.95	194.05	213.76	241.92
Total (constant 1985 Maloti)		0.831	0.865	0.897	0.971	1.004	1.034	1.062	1.096	1.198	0.812	0.856	0.964	0.882	0.781	0.899	0.952
Total (constant 1985 PPP dollars)		2.890	3.008	3.118	3.375	3.490	3.595	3.690	3.810	4.166	2.824	2.975	3.350	3.064	2.714	3.123	3.309
Sources:				1220	1220	1220	1220	1220	1220/1489; 976	1220/1489	1488/1489	1488/1489	1488/1489	1488/1489	1488/1489; 1230	1488/1489	1488/1489

Note: Italicized figures present data that are either constructed or interpolated.

Appendix 6: Research staff development by institute, 1961 9

Agricultural Research Division (ARD)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	
Nationals																	
PhD	0	*0*	*0*	*0*	0	0	*0*	*0*	*0*	*0*	0	*0*	*0*	*0*	*0*	*0*	
MSc	0	*0*	*0*	*0*	0	0	*0*	*0*	*0*	*0*	0	*0.0*	*0*	*0.3*	*0.5*	*0.8*	
BSc	0	*0*	*0*	*0*	0	0	*0.6*	*1.2*	*1.8*	*2.4*	3	*3.2*	*3.5*	*3.7*	*3.9*	*4.2*	
Subtotal	0	*0*	*0*	*0*	0	0	*0.6*	*1.2*	*1.8*	*2.4*	3	*3.2*	*3.5*	*4.0*	*4.5*	*5.0*	
Expatriates	1	*1.5*	*2.0*	*2.5*	3	3	*3.2*	*3.4*	*3.6*	*3.8*	4	*4.9*	*5.7*	*6.0*	*6.3*	*6.6*	
Total	1	*1.5*	*2.0*	*2.5*	3	3	*3.8*	*4.6*	*5.4*	*6.2*	7	*8.1*	10	*10.0*	*10.8*	*11.6*	
Source:	10				286	10					589		16				
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Nationals																	
PhD	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	*0*	*0*	0	0	1	*1.5*	2	*1.0*	0
MSc	*1.1*	*1.4*	*1.6*	*1.9*	*2.2*	*2.5*	*2.7*	3	*5.3*	*7.7*	10	7	7	*6.5*	6	*5.0*	4
BSc	*4.4*	*4.6*	*4.9*	*5.1*	*5.3*	*5.5*	*5.8*	6	*6.0*	*6.0*	6	8	9	*10.5*	12	*10.0*	8
Subtotal	*5.5*	*6.0*	*6.5*	*7.0*	*7.5*	*8.0*	*8.5*	9	*11.3*	*13.7*	16	15	17	*18.5*	20	*16.0*	12
Expatriates	*6.9*	*7.2*	*7.5*	*7.8*	*8.1*	*8.4*	*8.7*	9	*8.8*	*8.5*	*8.2*	8	6	*6.0*	6	*6.0*	
Total	*12.4*	*13.2*	*14.0*	*14.8*	*15.6*	*16.4*	*17.2*	18	*20.1*	*22.2*	*24.2*	23	23	*24.5*	26	*22.0*	
Source:								4			1229	1224	1220		1249		999

Note: Italicized figures represent data that are either constructed or interpolated.

Forestry Research Section (FRS)

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD				0	*0*	*0*	*0*	*0*	*0*	0	*0*	0	0	0	*0*	*0*
MSc				0	*0*	*0*	*0*	*0*	*0*	0	*0*	0	0	0	*0*	*0*
BSc				0	*0.2*	*0.3*	*0.5*	*0.7*	*0.8*	1	*1.5*	2	1.5	1	*1.0*	*1.0*
Subtotal				0	*0.2*	*0.3*	*0.5*	*0.7*	*0.8*	1	*1.5*	2	1.5	1	*1.0*	*1.0*
Expatriates				1	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	1	*1.0*	1	0.5	0	*0*	*0*
Total	—	—	—	1	*1.2*	*1.3*	*1.5*	*1.7*	*1.8*	2	*2.5*	3	2.0	1	*1.0*	*1.0*
Source:				976						976		1225		1230		

Note: Italicized figures represent data that are either constructed or interpolated.

Faculty of Agriculture, National University of Lesotho (FA/)

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD																
MSc																
BSc																
Subtotal																
Expatriates																
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	11
Ag Research															0.5	1.1
Source:															999	999

Note: Italicized figures represent data that are either constructed or interpolated. Faculty time spent on research has been estimated at 10%.

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