

Promoting Uptake of Research Outputs from the Livestock Production Programme High Potential Production System



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PRODUCTION SYSTEM LOGICAL FRAMEWORK - HIGH POTENTIAL SYSTEMS (INCLUDING PERI-URBAN INTENSIVE SYSTEM)			
NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPO ASSUM
GOAL To maintain or improve productivity through improved animal health and welfare, increased productivity and improved sustainability of livestock production systems.	In improved animal health and welfare indicators - cost reduction (disease control) - reduction by 10% between 2007 and 2012 - impact of improved herd management - by 20% between 2007 and 2012	national surveillance systems and data sets - FGD project reports - evaluation of FGDs - national reports to support programme - 2007 - 2012	
PI (Pillar 1) To improve the performance of livestock in high potential and production intensive farming systems (Core Livestock or Livestock) improved	In 2007 to 2012 increased mean value per piglet raised - output of animal products increased by 20% - productivity index improved by 15% - milk production increased by 20%	regularity of output information - national production data sets - evaluation of livestock production programmes - research programme reports - monitoring system baseline data	Research and Development, marketing and promotion, farm visits, local workshops, and development of technologies tools
OU (OU 1) To improve the productivity of the core sector of livestock production (livestock) and associated	Techniques adopted to increase efficiency of core sector of livestock production by 20% - herd conversion efficiency of improved livestock kept by core sector farmers demonstrably improved by 15% by 2012	Research programme reports Reports of core livestock Research project reports Extension agency or producer group reports	Target setting Monitoring of productivity 2012

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Executive Summary

This document summarises an analysis of progress along uptake pathways by the research outputs of the **High Potential Production System (HPPS)** of the Department for International Development's **Livestock Production Research Programme (LPP)**. Some general background to the current **Renewable Natural Resources Knowledge Strategy (RNRKS)** and the LPP and its HPPS has also been provided

The current status of research projects directed at the delivery of outputs under the **High Potential Production System** has been summarised allowing an assessment of the relevance of their **geographical foci** and general balance in relation to the outputs specified for the system within the RNRKS to be made. These would appear, on the whole, to be **perfectly satisfactory**. A more detailed analysis of the published outputs of the HPPS and related projects has suggested a number of activities that will be required in order to improve their contribution to generating developmental impact. These are included in the recommendations made below. Several limitations to the more widespread dissemination – beyond national agricultural research systems – of the research outputs of the HPPS have also been discussed. In particular, the importance of a systematic approach to ensuring research outputs are made optimum use of in generating impacts at the programme purpose level has been stressed. The final section of the report uses this more general synthesis of information to examine progress along a defined uptake pathway on a project-by-project and output-by-output basis.

It may be concluded from this study that past and current HPPS projects form an effective basis for generating a substantial, developmental impact. However, careful consideration of the most appropriate packaging of research outputs will be needed in order to realise this. Some suggestions regarding the first steps in this process are also included amongst the recommendations.

Recommendations

General

1. Page 10 - The current profile of HPPS projects suggests a need to prioritise project identification and implementation for the delivery of HPPS outputs 3 (*improved storage*) and 5 (*crop-livestock integration*) and for activities relating to the improvement of the nutritive value of feeds under output 1 (*techniques for nutritive value improvement*).
2. Page 11 - In view of possible blockages in the transfer of information via traditional published media, the value of the *Kenya – Tanzania Link Project (R6776)* as a prototype for encouraging south – south communication amongst LPP projects and thereby providing a wider springboard for effective dissemination should be considered.
3. Page 14 - the production of outputs appropriate to the end-user in the extension and farming communities needs more detailed assessment. This should focus on

the extent to which existing published material could be packaged in alternative forms and, perhaps, on the need for the programme to support a formal series of extension type publications. An evaluation of the extent to which this type of output currently goes unreported is also likely to be of value.

4. Page 15 - research managers might profitably explore, with scientific publishers, means of ensuring that outputs published in key journals are disseminated more widely in developing countries.
5. Page 17 - a *systematic* approach to generating impact from research outputs at the purpose level is required. It is recommended that further consideration and wider discussion amongst stakeholders should be initiated. The main issues to be addressed are likely to be: selection of appropriate dissemination media, scope of impact required, field monitoring of uptake and the identification of appropriate sources of funding. A co-operative approach between research and bilateral programmes is likely to be of importance in relation to the last point.

Specific to Outputs

6. Page 20 - Future work directed at output 1 probably still requires a re-focusing of effort away from the development and refinement of nutritive value assessment techniques and onto their *application in making feeds of improved nutritive value available*. A brief strategy outlining how this might be achieved and where it would be most likely to generate impact may be of value unless this is immediately apparent from other, current LPP activities.
7. Page 21 - The potentially high degree of synergy amongst projects directed at output 2 and with projects directed at other outputs (notably output 4) could probably be exploited more effectively. An LPP sponsored workshop on the assessment, availability and utilisation of feed resources, with a particular focus on impact generation could offer widespread benefits to researchers funded by the programme.
8. Page 21 - A strategy for commissioning projects to address output 1.3 is required. As an initial step, a survey of the relative importance of storage losses in compromising feed supplies amongst the LPP-HPPS target countries should be commissioned so that a phased set of projects aimed at tackling the problem can be implemented.
9. Page 22 - As the research directed at output 4 is essentially integrating in nature, there is a need with this, more than any other output, to ensure that activities are properly co-ordinated. The workshop proposed in the recommendation that relates to output 2 could assist in this. In addition, it is suggested that a series of "stock-taking" exercises relating to key themes (e.g. nutrition – reproduction interactions, feed resource planning, optimising husbandry practices) would allow the most promising areas for impact generation to be prioritised for wider promotion and dissemination.
10. Page 22 - In addressing output 5 for the HPPS, it is particularly important that full advantage should be taken of the cross-cutting links with other LPP production systems. This is particularly relevant to the issue of the impact of livestock on soil fertility. It is suggested that a brief but more detailed review of current and likely future outputs in this area is undertaken before future commitments under HPPS are decided.

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Appendix 3: Published Outputs from the HPPS and Assessment of their Potential for Targeted Impact Amongst End User Groups.

List of Abbreviations

DFID	Department for International Development
IARC	International Agricultural Research Centre
FAIPS	Forest-agriculture Interface (and Hillside) Production System
FAM	Feed – animal - manure
FTR	Final technical report
HPPS	High Potential (including Peri-urban Interface Production System
LPP	Livestock Production Programme
NARS	National Agricultural Research System
NRIL	Natural Resources International Limited
ODA	Overseas Development Administration
RNRKS	Renewable Natural Resources Knowledge Strategy
RNRRS	Renewable Natural Resources Research Strategy
RNRs	Renewable natural resources
SAPS	Semi-arid Production System

Background

Objectives of the RNRRS / RNRKS

The original Renewable Natural Resources Research Strategy (RNRRS) was published in 1994 and implemented in 1995 by the Overseas Development Administration¹ (ODA). In general terms, it was designed to improve the cost-effectiveness, quality, relevance and, thereby, developmental impact of research in the renewable natural resources (RNRs) sector. Specifically, the RNRRS reflected a requirement that ODA-funded research should be targeted more effectively on the needs and opportunities of users and managers of RNRs in developing countries. In outline, the research conducted would generate impact as it would:

- demonstrably, be demand-led; that is responsive to the needs of end-users in developing countries;
- generate products (research project outputs) that meet the needs of end users in ODA's target population groups and countries;
- when research outputs were applied in the field, result in improved performance or production from the components of RNR systems;
- by the application of research outputs across the RNRRS in an integrated fashion, lead to improved productivity of target RNR systems as a whole.

The RNRRS documentation specified that its component research should be implemented over seven "production systems"

- Semi-arid,
- High potential,
- Hillside,
- Tropical moist forest;
- Forest-agriculture inter-face,
- Land-water interface;
- Peri-urban interface.

And within 12, broadly disciplinary programmes

- Crop Protection Programme
- Crop Post-Harvest Programme
- Plant Sciences Programme
- Forestry Programme
- Animal Health Programme
- Livestock Production Programme
- Aquaculture Programme
- Fisheries Management Programme
- Fish Genetics Programme
- Fish Post-Harvest Programme

¹ - the Department for International Development's (DFID's) precursor department.

- Flexibility Fund

Moreover, research conducted within each programme should encompass social and economic constraints upon productivity as well as technical ones.

More recently, in 1998, the RNRRS has matured into the Renewable Natural Resources Knowledge Strategy (RNRKS). Whilst operating in substantially the same fashion as the RNRRS, the RNRKS takes account of a much reinforced emphasis on poverty alleviation specified by the 1997 Government white paper on international development. Most importantly, restated outputs, purposes and goals at the strategy level take account of this change in emphasis:

- **Outputs:** creation and promotion / dissemination of new knowledge relevant to economically and environmentally sustainable development *leading to a demonstrable impact.*
- **Purpose:** benefits to poor people generated by the application of this knowledge.
- **Goal:** livelihoods of poor people improved through sustainably enhanced production and productivity.

These statements encapsulate the over-arching objectives of the RNRKS. Therefore, research programme managers will, where necessary, have to re-align their project portfolios to ensure that these are generating impact in terms of sustainable livelihoods for the poor rather than with the narrower focus of improved productivity and productive potential. Of course, improvements in the latter often generate improvements in the former so many current research activities, initiated under the RNRRS, continue to be of relevance.

Notwithstanding these evolutionary aspects of the RNRKS programmes and their management, the key requirement remains that research should be conducted with a focus on pre-defined impacts amongst the members of a specified target group. Moreover, this impact should ultimately contribute to the generation of tangible improvements in the livelihoods of poor people. Thus, clearly specified uptake pathways for individual research projects are needed in order for their potential and actual impacts at this strategy goal level to be assessed.

This document presents a snapshot of the status of research conducted under the High Potential Production System (HPPS) of the Livestock Production Programme (LPP) in terms of current progress along uptake pathways. Attention is drawn to a number of significant issues and recommendations are made to assist in improving the generation and monitoring of impacts attributable to activities commissioned by the LPP within the HPPS.

The High Potential Production System of the LPP

The HPPS is one of four RNRKS production systems for which the LPP is contracted to deliver research outputs:

- Semi-arid (SAPS);
- High potential (including production issues related to the peri-urban interface) ;
- Forest-agriculture inter-face (including hillsides; FATPS);
- Peri-urban interface (principally marketing of livestock products);

The 1994 research strategy document defines high potential production systems as:

"... found in regions characterised by amenable climate (temperature, rainfall), supplemented by irrigation where rainfall is erratic or unfavourable and fertile soils with no inherent structural or physico-chemical constraints. RNR based economic growth is often focused in the high potential systems and these regions offer opportunities for improving rural employment."

From this relatively exclusive statement, the following, working definition appears to have evolved and is applied currently:

High Potential Production Systems are found in areas where relatively few climatic and resource limitations apply to primary production. Temperatures are equable and rainfall for crop and fodder production, if inadequate, may be supplemented by irrigation. Soils are likely to be fertile but intensification will require careful attention to strategies to avoid their degradation

High potential systems tend, because of the relatively few basic resource constraints, to offer the widest range of production options to RNR managers. Technologies developed for conditions under which resource limitations are greater (i.e. SAPS and FAIPS) may also be applied and, indeed, may be even more effective when used in higher potential areas. Thus, when considering uptake pathways for the HPPS it is particularly important to include a consideration of relevant outputs of projects designed principally for other production systems.

The current logical framework for the HPPS of the LPP is attached at Appendix 1

Outputs of the High Potential Production System

The contracted outputs for the LPP-HPPS are summarised in Table 1 and described briefly below.

Output 1. Techniques for improving the nutritive value of feeds for livestock production developed and promoted.

This output acknowledges that, even in the HPPS, nutrition is still, often the first limiting constraint on performance (provided that major diseases are under control). Assessing the quality of tropical feeds is generally a more complex process than the same task for the less variable feed resources used in industrialised countries. Therefore, much of the past research focused on this output has, necessarily, been directed at the development of appropriate laboratory techniques for nutritive value assessment. Future work is more likely to move towards the application of these and

existing techniques to assess the outcomes of improved forage crop husbandry; varietal selection and physical and chemical techniques for improving the quality of available forages.

Table 1: The five outputs required of the LPP-HPPS in order to support the attainment of the programme purpose.

Programme Purpose

HPPS 1: Performance of livestock in high potential and pen-urban intensive farming systems (crop - livestock or livestock) improved;

Output 1: Techniques for improving the nutritive value of feeds for livestock production developed and promoted.

Output 2: Strategies to improve the seasonal availability of livestock feeds in high potential areas developed and promoted.

Output 3: Improved technologies and strategies for fodder crop and crop residue storage developed and promoted

Output 4: Improved strategies for animal husbandry and nutrition in the livestock production system and in crop / livestock systems in high potential and pen-urban areas developed and promoted.

Output 5: Livestock management strategies for improving the integration of crops and livestock in mixed farming systems developed and promoted.

Output 2: Strategies to improve the seasonal availability of livestock feeds in high potential areas developed and promoted.

Like output 1, output 2 is also directed at enhancing the supply of nutrients to livestock managed in high potential areas. In this case, research projects are directed at improving the quantity rather than the quality of available feeds. Method development is also required to achieve this. In particular, suitable techniques for assessing the availability of feed resources in a dynamic manner so that seasonal effects can be accounted for are needed. These techniques will and, in fact, are already beginning to allow the identification of major seasonal constraints on feed supply in study systems. This will ultimately allow the development of feed production and management strategies and also, where appropriate, the promotion of feed marketing to allow the availability of feed resources to be better matched with the needs of livestock at critical times of the year.

Output 3: Improved technologies and strategies for fodder crop and crop residue storage developed and promoted.

Output 3 addresses a further consequence of uneven seasonal distributions in the availability of feeds. At certain times of the year, feeds such as crop residues may be available in excess of the capacity of associated livestock to consume them. However, during storage, serious losses may occur as a result of infestation by pests or

pathogens. As a result, the quantity and quality of stored feed is reduced further restricting the supply of nutrients to animals. Also relevant to output 3 is the development of simple and acceptable technologies for conserving forages. Appropriate research will seek to augment farmers' existing storage practices with readily applicable methods that will, again, promote an improved match of available feed resources and the needs of livestock.

Output 4: Improved strategies for animal husbandry and nutrition in the livestock production system and in crop / livestock systems in high potential and peri-urban areas developed and promoted.

This output recognises that improvements to nutrition applied in isolation will not always be sufficient to generate an improvement in performance. Thus, the research conducted under output 4 will, in general terms, attempt to place nutritional and other component interventions in the context of the broader management strategies for livestock holdings. In particular, the importance of the now, well-documented interactions of nutritional status with other the other factors, such as health, fertility and environment, that influence the overall performance of the livestock holding will be addressed. This knowledge will then be applied to the development of optimum combinations of feeding and husbandry strategies to improve animal performance.

Output 5: Livestock management strategies for improving the integration of crops and livestock in mixed farming systems developed and promoted.

In many systems, livestock interact intimately with other components of the farming system and cannot, therefore, be managed in isolation. For example, even in high potential areas, the need for effective conservation of nutrients via the feed – animal – manure (FAM) pathway is often critical for the continued functioning of many mixed farming systems. Under these circumstances, the ability of livestock to generate adequate quantities of good quality manure compost may be as important an aspect of their performance as their milk or meat production capabilities. Therefore, in the case of mixed farming systems, the potential impacts on soil fertility, crop production and the general sustainability of the systems will be addressed under output 5. It is anticipated that, due to the inherent complexities of mixed farming systems, appropriate systems simulation modelling techniques will need to be applied in support of the delivery of this output.

The Current State of Play

The Projects

Table 2 lists current and completed LPP projects that can be expected to contribute to the delivery of the outputs specified by the RNRRS / RNRKS for the LPP-IPPS. These projects can be divided into three categories:

- projects commissioned directly to contribute towards the delivery of specified HPPS research outputs (HPPS Projects);
- LPP projects commissioned under other production systems (SAPS, FAIPS) that are likely to generate outputs that will also be applicable in high potential production systems (cross-linked Projects);
- Projects commissioned before the widespread adoption of the RNRRS as a framework for managing ODA-funded research in 1995 (pre RNRRS 1995 projects).

Table 2: Current and completed projects addressing the delivery of outputs required of the LPP High Potential Production System.

R number	Short title	Output addressed	Participatory element	Country focus	Start date	End date	FTR available
HPPS Projects							
R6340	Interactions between high and low quality forages (gas production).	1.1	✓		01/04/95	31/03/96	✓
R???	High quality forage supplements	1.2	✗	Zimbabwe			✗
R5690	Strategies for the allocation of seasonally varying feed resources.	1.2	✓	Nepal	01/04/93	31/03/95	✓
R6153	Adoption of planted forages for smallholder dairying in Kenya	1.2	✗	Kenya	01/10/94	31/12/96	✗
R6610	Introduction of fodder legumes.	1.2	✓✓	Bangladesh	01/04/96	31/03/99	
R6619	Sustainable utilisation of forages: husbandry.	1.2	✓✓	Tanzania	01/04/96	31/03/99	
R6262	Practical dairy feed rationing system.	1.4	✓✓	Bolivia / Tanzania	01/04/95	31/03/99	
R6358	Effects of nutrition on health and productivity of N'Dama cows.	1.4	✓	Gambia	01/08/95	31/03/96	✓
R6359	Feeding strategies for improved reproduction	1.4	✓	Tanzania	01/04/95	31/03/99	
R6775	Evaluation and improvement of feeding strategies.	1.4	✓	Kenya	01/10/96	30/09/00	
R6776	Kenya - Tanzania link project.	1.4	✗	Tanzania / Kenya	01/08/96	31/03/00	
R6954	Dietary tannins	1.4	✗	India	01/04/97	31/03/99	
Other LPP projects with potential impacts in the HPPS							
R6138 ⁵	Forages for smallholder milk production	1.2	✗	Zimbabwe	01/11/84	30/08/96	
R6339 ⁵	Straw supplementation with legumes	1.2	✓✓	Bangladesh	01/07/95	31/03/99	
R6993 ⁶	Stovers in Zimbabwe	1.2	✓	Zimbabwe	01/10/97	30/09/00	
R7010 ⁵	High quality silage from adapted forage	1.2	✓✓	Zimbabwe	01/04/97	31/03/00	

Table 2: Current and completed projects addressing the delivery of outputs required of the LPP High Potential Production System

R number	Short title	Output addressed	Participatory element	Country focus	Start date	End date	FTR available
R6955 ^S	Reproductive performance of crossbreeds	1.4	✓✓	Zimbabwe	01/04/97	30/09/00	
R6283 ^F	Implications of livestock for soil fertility.	1.5	x	Kenya	01/04/85	31/03/88	✓
<i>Projects Initiated before the Adoption of the RMRRS</i>							
R4338	Evaluation of cereal crop residues	1.1	✓		01/04/90	31/03/92	✓
R5180	Development of improved methods for estimating nutritive value.	1.1	x		01/04/92	31/03/97	✓
R5176	Use of tropical feeds in non-ruminant rations.	1.2	x		01/04/92	31/03/95	✓
R5183	Modelling livestock production and feeding systems.	1.2	x	Nepal	01/04/92	31/03/95	✓
R5181	Effects of storage of fibrous feeds.	1.3	x	Zimbabwe / India	01/04/92	31/03/95	✓
R5180	Effects of supplements on smallholder goat production.	1.4	x	Swaziland	01/04/90	31/12/94	✓ ¹
R5182	Role of nutrition in mediating post-partum anaestrus	1.4	x		01/04/92	31/03/93	✓ ³
R5689	Optimal use of scarce supplements	1.4	✓	Kenya	01/04/93	31/12/95	✓ ⁴
R5690	Milk production from the indigenous Malawi goat.	1.4	x	Malawi	01/08/93	30/09/95	✓

x - No participatory activities

✓ - participatory diagnostics

✓✓ - full participation of stakeholders

^S - addressing SAIPS Purpose 1

^F - addressing FAIPS Purpose 1

1 - In draft form

2 - extent of participation not clear

3 - literature review

4 - Ph.D. thesis

The analysis presented in this review is based on an evaluation of the outputs of the HPPS and related projects listed in Table 2.

Coverage of Outputs by Current and Completed Projects

From Table 2, it is clear that progress towards the delivery of outputs under the HPPS has been uneven. There are three areas in which this is particularly apparent:

- Activities directed specifically at output 3 (*improved storage*) have been very limited to date.
- Output 5 (*crop-livestock integration*) has yet to receive any attention under the HPPS.
- Substantial progress has been made on the method development aspects covered by output 1 (*techniques for nutritive value improvement*). However, these have yet to be widely applied in support of projects to improve the nutritive value of available feeds

There are likely to be a number of reasons for these irregularities:

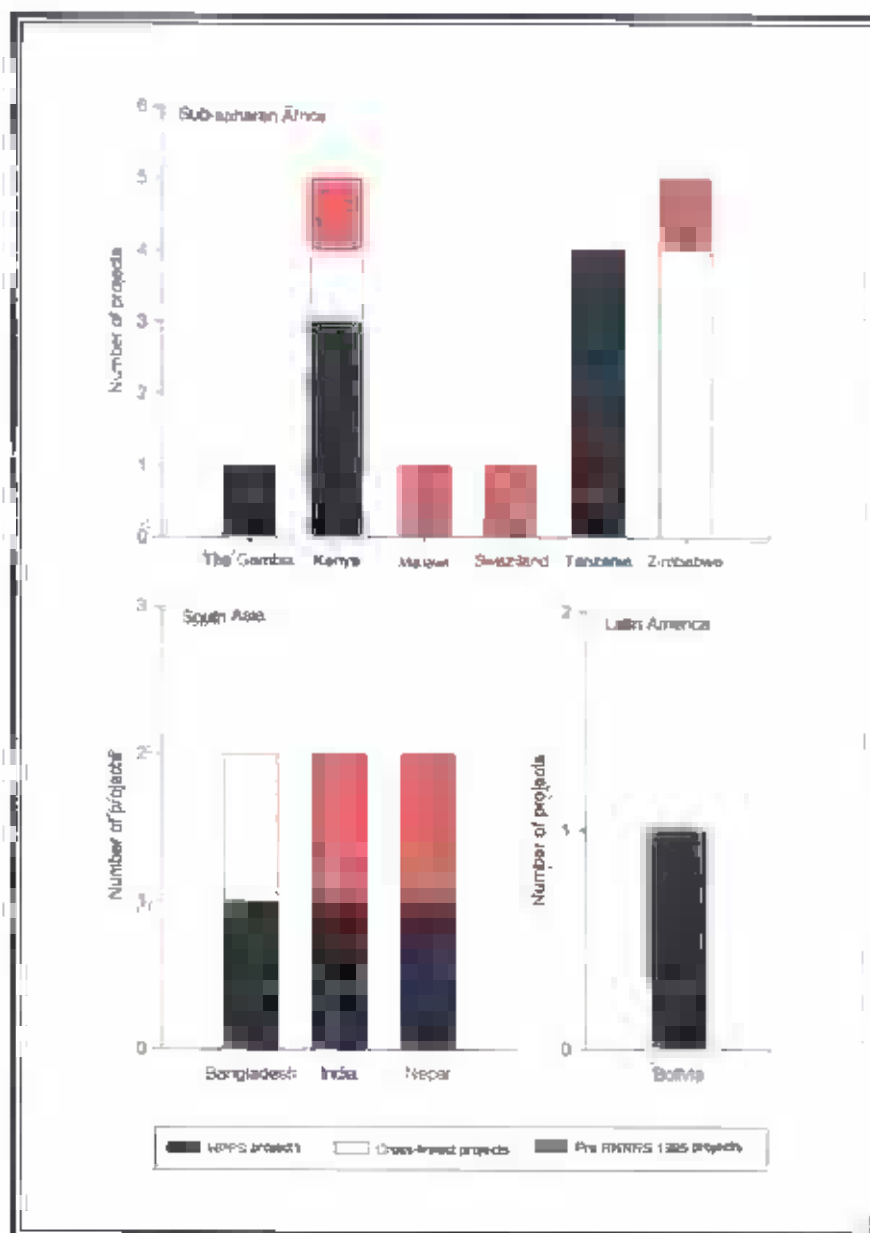
- Over the ten-year period covered by this review, successive research managers have had to track a series of gradual (and some more drastic) changes in research priorities. These have affected the relevance of activities targeting some outputs more than others.
- Some of the specified outputs require inputs from disciplines in which researchers have more established track records in the delivery of research products to DFID. Viewed at this point in time, these will appear to have had a head start on outputs that have required the more recent establishment of new disciplinary research foci and institutional linkages with DFID research managers and target groups.
- The relevance of research directed at some of the outputs is often strongly dependent on a specified geographical focus. This can significantly affect the amount of time and effort required to establish functional linkages with target groups in-country.
- Activities directed at the delivery of one output may depend upon the generation of research results by activities conducted under another. Where this is the case, a staged approach will clearly be required.
- Some of the outputs that appear to be receiving relatively little attention currently are in fact being addressed by component activities of other projects, the main focus of which is on other outputs. Current work on silage and crop residue utilisation in Zimbabwe offers an example of this in relation to output 3 (improved storage).

Thus, whilst there is a risk to the complete delivery of outputs 1, 3 and 5 if they are not prioritised in the near future, this is not seen as a critical difficulty for the programme manager at present. This view is confirmed by reference to the timeframes for the delivery of the HPPS outputs (Appendix 2) that were included in

the successful bid document produced by Natural Resources International Limited (NRIL) in 1997.

Recommendation: *The current profile of HPPS projects suggests a need to prioritise project identification and implementation for the delivery of HPPS outputs 3 (improved storage) and 5 (crop-livestock integration) and for activities relating to the improvement of the nutritive value of feeds under output 1 (techniques for nutritive value improvement).*

Figure 1: The geographical distribution of HPPS, cross-linked and pre-RNRRS 1995 projects.



Geographical focus

Figure 1 summarises the principal geographical foci of the HPPS and related projects.

The overall balance of projects amongst continents reflects DfID's emphasis on the poorer countries of sub-Saharan Africa and South Asia effectively. Africa, in particular has been, and continues to be, well represented in the HPPS' portfolio of projects. More localised priorities in Latin America have been catered for by the activities of project R6282 (*Practical Dairy Feed Rationing System*) in Bolivia.

In Africa, the main thrust of projects commissioned by the HPPS has been in East Africa – Kenya and Tanzania. This is in line with the country priorities outlined by the RNRKS and is desirable as similarities in culture, production systems and environments in the two countries mean that benefits are likely to accrue from synergy amongst project activities in each. Furthermore, the geographical proximity of the two countries raises the possibility of the LPP stimulating genuine exchanges of information and experiences amongst national programme researchers for a relatively small operational outlay. This could occur on an *ad hoc* basis but has also, to an extent, been formalised in the activities of project R6776 (*Kenya – Tanzania Link Project*). This project provides for regular interchanges between two complementary projects R6619 (*Sustainable Utilisation of Forages: Hushandry*) and R6775 (*Evaluation and Improvement of Feeding Strategies*) with a view to documenting shared and contrasting experiences when the two projects have been completed.

Recommendation: *In view of possible blockages in the transfer of information via traditional published media (see page 17), the value of the Kenya – Tanzania Link Project (R6776) as a prototype for encouraging south – south communication amongst LPP projects and thereby providing a wider springboard for effective dissemination should be considered.*

The three current projects in South Asia do not appear to have the critical mass or degree of complementarity required for the effective replication of this kind of approach. However, it may be possible and worthwhile to establish similar linkages with projects in other LPP production systems or with projects funded by other RNRKS programmes.

An Assessment of Published Outputs

In the past, research commissioned by DfID – both under the RNRKS and previously – has been assessed mainly on the basis of tangible outputs produced in the form of research papers, technical reports and bulletins and other printed material. These have obvious value for reviewing the scientific quality of the research conducted. They also represent an important pathway for the wider publicity of research results, serving to draw attention to the achievements of researchers beyond their immediate target groups and countries. However, the extent to which this type of publication has generated a demonstrable impact amongst end-users – particularly in the case of more

applied or “systems-based” studies whose end-users would normally lie firmly in the extension and farming communities – has not always been so clear.

In this section, the published outputs of the HPPS (listed in Appendix 3) have been summarised by publication type (Table 3). A preliminary assessment has also been made of the likely consumers of this material and, therefore, its potential to generate developmental impact.

Table 3: Classification of RNRRS project publications according to type.

Publication type	Description
A	Papers in refereed journals, book chapters, edited international conference proceedings or bulletins (published or accepted for publication).
B	Scientific abstracts, oral presentations, posters, non-edited conference proceedings
C	Internal Reports.
D	Newsletters, technical leaflets, lecture presentations.
E	Ph D. Theses
F	M.Phil / M.Sc. Theses.
G	Miscellaneous (e.g. radio / TV programmes, videos, oral presentations to non-scientific audiences).
H	Computer software (including databases)

Types of Publication

Figure 2 summarises LPP publications likely to be of relevance to the delivery of HPPS outputs specified at the research programme level. These have been classified according to the type of publication and have also been distinguished according to the type of project that has produced them.

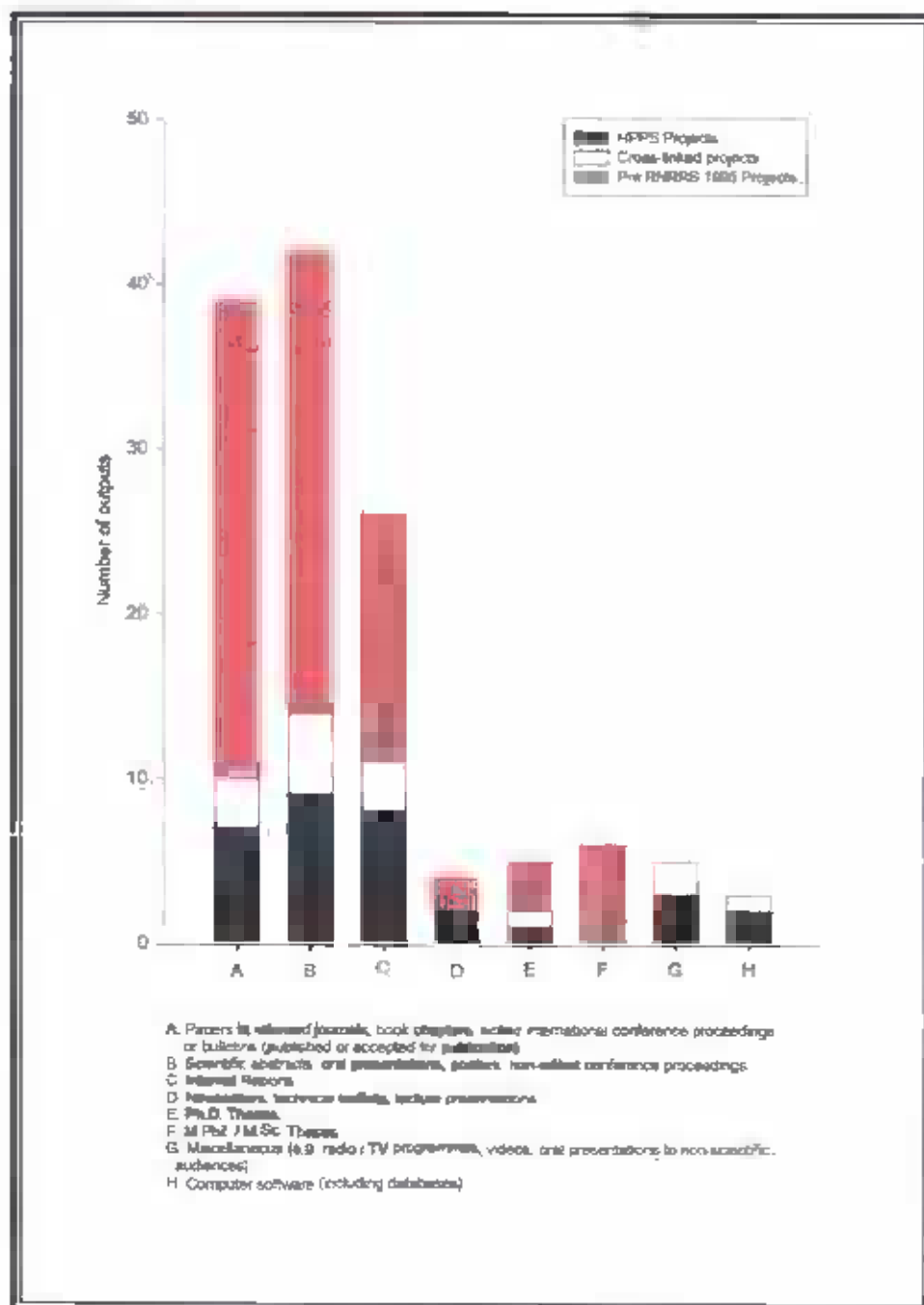
It is apparent that the vast majority of reported publications are essentially traditional, research publications falling into the refereed journal, conference presentation or institutional report categories. There are likely to be a number of reasons for this concentration of effort.

- Internal institutional reporting requirements,
- Pressure on academics to maintain a strong record of peer reviewed publications to support departmental assessments;
- A past emphasis from DfID itself on the importance of refereed publications with less kudos attached to more informal publications for the ultimate end-user.

There is little doubt that these publications represent considerable benefits in terms of the generation of knowledge to underpin the efforts of other researchers and that this

can, ultimately, be put good use in support of the goals of the RNRKS. However, in many cases, this type of publication also forms a considerable repository of knowledge that could be packaged to be more accessible to end-users and thereby contribute substantially to improving the impact of the strategy. The imbalance evident in Figure 2 suggests that this is either not being done or that such outputs are not being adequately reported.

Figure 2: *The distribution of published LPP outputs relevant to the HPPS amongst publication types.*



This sample is small but there is some evidence from Figure 2 of movement in this direction with outputs of type G starting to appear amongst the HPPS projects commissioned since 1995. While maintaining the production of scientific publications this trend needs to be encouraged as research activities become more adaptive, generating outputs that will be more directly useable by farmers and extensionists

Recommendation: the production of outputs appropriate to the end-user in the extension and farming communities needs more detailed assessment. This should focus on the repackaging of existing research outputs in alternative forms. An evaluation of the extent to which this type of output currently goes unreported is also likely to be of value.

The Potential Impact of Published Outputs

Table 4 suggests a scheme for assessing the likely impact domains of published outputs from the HPPS. It is stressed that, *at this stage, this scheme is being used to assess the likely impacts of the actual published material and not the information that it contains.* As suggested above, alternative packaging of research results could lead to a somewhat different picture emerging.

Table 4: Individual and Institutional categories likely to benefit from LPP-HPPS research outputs.

Category	Description
A	Donors
B	Strategic researchers in developed countries
C	Strategic researchers in IARCs (includes national institutions working overseas)
D	Applied researchers in IARCs (includes national institutions working overseas)
E	Applied researchers in NARS
F	Training (institutions and individuals)
G	Planners at national / regional levels
H	National extension and other technical support services
I	Agro-industry
J	Commercial farmers (only limited subsistence activities)
K	Smallholders (largely subsistence based)
L	Landless or land-poor

This scheme tries to account for the likely penetration of the publication medium as well as its target audience. For example, a publication in Animal Science may well be relevant to researchers in the NARS but will have no impact if their institution cannot afford a subscription. This problem has already been highlighted by Morton (1997). in

his survey of the circulation of some key journals (see Table 5) The circulation figures for developing countries would probably appear even less encouraging if the proportion of these entering the IARCs were to be accounted for separately. Access to these by NARS researchers may be limited.

Table 5: *The circulation of some key journals in which HPPS research outputs might be publishable (from Morton, 1997).*

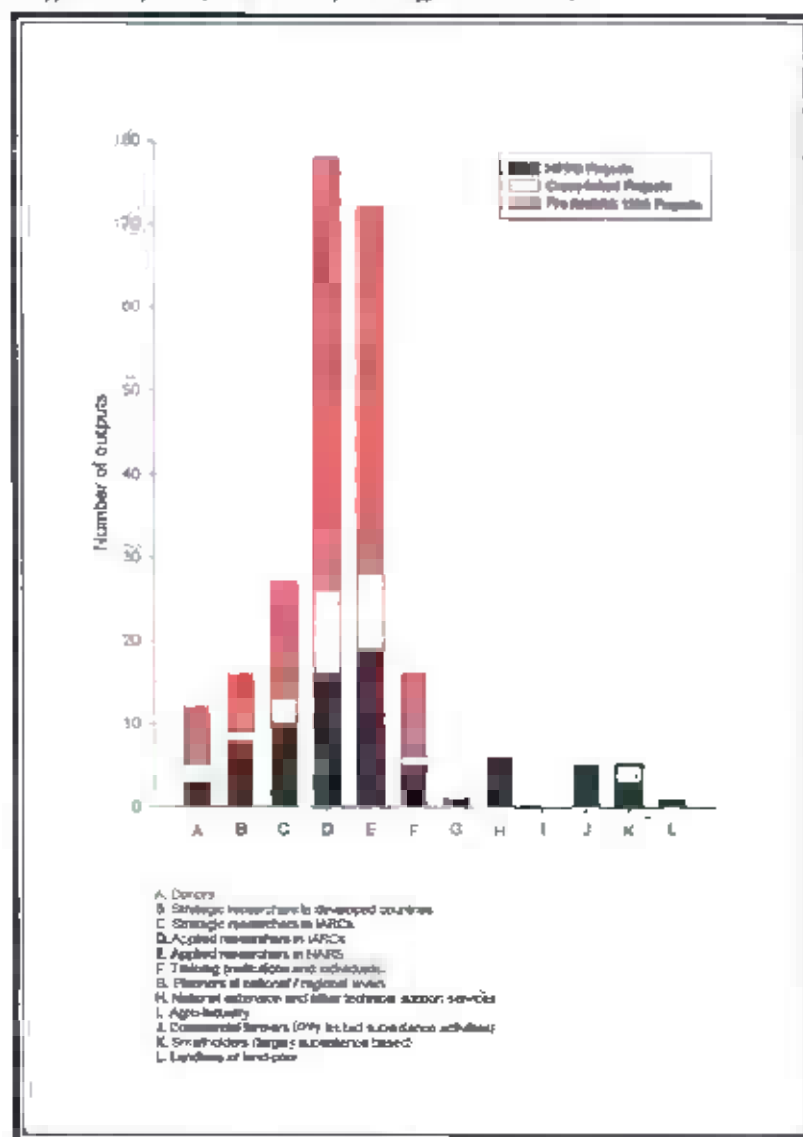
Journal	Circulation	Circulation in developing countries	Non-research readership
Agricultural Systems	600	200	No
Agriculture, Ecosystems and Environment	500	30	A small number
Animal Science	2000	100	3-400
Annals of Tropical Medicine and Parasitology	804	112	Includes reviews read by many policy makers
British Poultry Science	700	150-200	An appreciable number among poultry advisers, poultry company employees and poultry nutritionists in the feedstuffs area
Experimental Agriculture	Not known	Not known	
Journal for Farming Systems Research/Extension	150-200, but may shortly increase fourfold	120-160, increase is likely to be within developing countries	Many readers move back and forth among research, extension and administration
Journal of Animal Science	5000 hard copies + 50,000 visits to electronic version on the Internet	1623 ASAS members outside USA, but few in developing countries	
Livestock Production Science	700	140	Policy-makers and people in industry
Mycopathologia	Not known	Not known	Few
Tropical Animal Health and Production	300	150.	Difficult to say, but target audience includes extensionists and field veterinarians
Tropical Science	300	150	c.50% in developing countries, almost 100% in other countries

There is clearly a need to ensure that published research outputs penetrate as widely as possible amongst researchers in developing countries. Many institutions within the NARS now have access to internet e-mail if not to the world wide web. However, attempts to disseminate outputs originally published in scientific journals via this medium are likely to run into problems of copyright. Some journals do offer reduced

subscription rates for *bona fide* institutions in developing countries but these are often limited in number and may still be a unacceptable burden on diminutive library budgets.

Recommendation: *research managers might profitably explore, with scientific publishers, means of ensuring that outputs published in key journals are disseminated more widely in developing countries.*

Figure 3: *Assessment of the Impact Domains of HPPS Outputs. (N.B. This refers to the current outputs themselves and not the material described by them. These might, if packaged differently, impact at a quite different level).*



In Figure 3, the impact domain scheme of Table 4 has been applied to the HPPS and related projects for the individual outputs summarised in Appendix 3. This is, necessarily, a somewhat subjective process but it is to be hoped that it is at least

reasonably representative when applied across the 130 outputs assessed during the course of this review.

The main messages from Figure 3 are:

- The extent of impacts of HPPS research amongst applied researchers would appear to be very promising with 68% and 55% of outputs expected to penetrate this group in the IARCs and NARS respectively;
- The contribution made by NARS scientists receiving training during the course of HPPS projects is represented by a relatively small proportion of the outputs (14%). Nevertheless, it should not be underestimated as, provided these staff are retained, it represents a long-term penetration;
- Penetration beyond the institutional level of the NARS is more difficult to assess. However, there is little evidence in the information available to indicate that this has occurred to any great extent. To date, dissemination into the extension and farming communities is very much dependent on uptake pathways that are, effectively, outside the control of LPP management. It must be suspected therefore that much, potentially valuable material, is not making the impact that it could.

The third of these messages is clearly the one that requires the most immediate consideration. It is possible to take one of two positions here:

- The research outputs generated are meeting the requirements of the RNRKS. They are effectively reaching national programmes that can now use them to generate further outputs that will be transferred, via the extension services, into the field;
- The outputs are reaching the national programmes but they are likely to be more effective in generating impact if their penetration into local extension services and, possibly onto farms, could, in some generally acceptable way, be encouraged actively by the research programme;

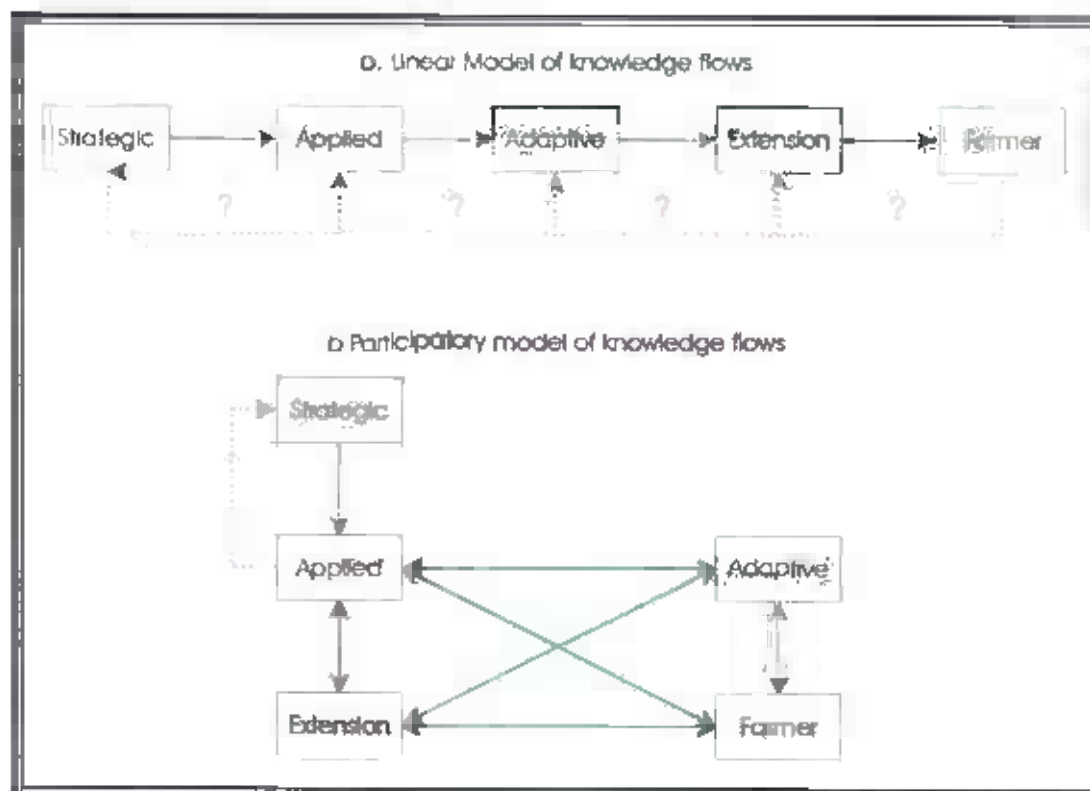
It would appear to this author that the logical framework structure of the RNRKS suggests that the latter position is more in keeping with the spirit of the strategy. If this is the case, shepherding research impact up the step from the output level to the purpose level – making, essentially, a move from the first to the second of these positions – comes, at least partly within the ambit of the research manager.

Recommendation: *a systematic approach to generating impact from research outputs at the purpose level is required. It is recommended that further consideration and wider discussion amongst stakeholders should be initiated. The main issues to be addressed are likely to be: selection of appropriate dissemination media, scope of impact required, field monitoring of uptake and the identification of appropriate sources of funding. A co-operative approach between research and bilateral programmes is likely to be of importance in relation to the last point.*

Farmer Participation and its Implications for Impact.

A detailed consideration of the potential benefits and shortcomings of participatory research methods in promoting the use of research outputs is beyond the scope of this document. However, the much wider application of the participatory paradigm has been a feature of all the RNRKS programmes in recent years and this has, without doubt, influenced promotion pathways for the research and uptake of innovations based on the research by farmers. Figure 4 compares a traditional, linear model of the flow of knowledge generated by research with one of the many possible arrangements that might be found in participatory research projects.

Figure 4: A comparison of knowledge flows between a linear and a participatory model of research uptake.



In relation to generating impact from the research, the most important features of the participatory model – provided that it has been applied effectively – are that:

- The key information flows are two-way. Therefore the cumulative distortions of information that can occur at each node in the linear model are minimised;
- The direct involvement of farmers and extension services allows proper consideration of their needs, objectives and the limitations that they may face when formulating the project's activities;

Effectively, this analysis assesses the extent to which the outputs of the research (see Appendix 3) have been applied in order to meet the system purpose:

“Performance of livestock in high potential and peri-urban farming systems (crop – livestock or livestock) improved”

This is clearly the key step in assuring that the research programmes in general achieve developmental impact. Where it is successfully negotiated, techniques, technologies and strategies developed and tested under at least partially controlled conditions may be expected to become or contribute positively to the day-to-day management practices of farmers.

Output 1: Techniques for improving the nutritive value of feeds for livestock, production developed and promoted.

Progress on the uptake pathway for HPPS purpose 1, output 1 is summarised in Table 7.

As stated above (see page 3) the work directed at this output has focused largely on the development of methods for assessing nutritive value. This may be regarded as a success with the widespread adoption of the head space gas technique (developed and refined with LPP funding) in a number of laboratories within the NARS. Work directed at the development of techniques for actually improving the nutritive value of feeds on farms has not yet reached the stage of generating widespread impact; although it may be possible to observe some benefits in the field from the work on straw feeding (excess feeding and chopping).

Recommendation: Future work directed at output 1 probably will require a re-focusing of effort away from the development and refinement of nutritive value assessment techniques and onto their application in making feeds of improved nutritive value available. A brief strategy outlining how this might be achieved and where it would be most likely to generate impact may be of value unless this is immediately apparent from other, current LPP activities.

Output 2: Strategies to improve the seasonal availability of livestock feeds in high potential areas developed and promoted.

Progress on the uptake pathway for HPPS purpose 1, output 2 is summarised in Table 8.

A solid base of research oriented outputs has now been built up under output 2. These have focussed on both the development of methods for the evaluation of seasonal constraints on the supply of nutrients to livestock and on the development of component technologies for alleviating these. There would appear to have been some

attempts by individual projects (notably R6610 and R7010) to take some of the research outputs and package them for extension services and farmers. The wider adoption of the outputs of the projects directed at improving seasonal fodder supplies will be enhanced if this approach can be adopted more widely. To date there has not been widespread adoption outside the research community of the methodological innovations in the assessment of seasonality in feed resources. To some extent this is understandable as these are, in many ways, research tools. Future projects are expected to consider the extent to which similar methods might be made available to extension services. A possible, general shortcoming in the research directed at this output is a lack of integration between the methodological projects and those directed at the development of interventions.

Recommendation: *The potentially high degree of synergy amongst projects directed at output 2 and with projects directed at other outputs (notably output 4) could probably be exploited more effectively. An LPP sponsored workshop on the assessment, availability and utilisation of feed resources, with a particular focus on impact generation could offer widespread benefits to researchers funded by the programme.*

Output 3: Improved technologies and strategies for fodder crop and crop residue storage developed and promoted

Progress on the uptake pathway for HPPS purpose 1, output 3 is summarised in Table 9.

The generation of impact relating to this output has, necessarily, been very limited due to the lack of research activities conducted under it.

Recommendation: *A strategy for commissioning projects to address output 1.3 is required. As an initial step, a survey of the relative importance of storage losses in compromising feed supplies amongst the HPPS target countries should be commissioned so that a phased set of projects aimed at tackling the problem can be implemented.*

Output 4: Improved strategies for animal husbandry and nutrition in the livestock production system and in crop / livestock systems in high potential and peri-urban areas developed and promoted

Progress on the uptake pathway for HPPS purpose 1, output 4 is summarised in Table 10.

Progress along uptake pathways for output 4 is variable. In general, this type of work did not attract a large proportion of available funding before the implementation of the RNRRS. It also requires that interactions between different factors influencing livestock performance and, in some cases, with other system components should be:

considered. Thus, a long-term commitment is needed before meaningful results may be obtained. Potentially, therefore, there may be difficulties in driving this kind of work far enough along the uptake pathway to generate broad-based developmental impacts during the life of the strategy. There are a number of positive indicators though from the work conducted to date. Where the research is able to focus on specific problems with well-defined impacts, it would appear that considerable progress may be made. Indications from R6282 and R6775 are already very promising and R6954 should be well integrated with activities directed at output 1.

Recommendation: As the research directed at output 4 is essentially integrating in nature, there is a need with this, more than any other output, to ensure that activities are properly co-ordinated. The workshop proposed in the recommendation that relates to output 2 could assist in this. In addition, it is suggested that a series of "stock-taking" exercises relating to key themes (e.g. nutrition-reproduction interactions, feed resource planning, optimising husbandry practices) would allow the most promising areas for impact generation to be prioritised for wider promotion and dissemination.

Output 5: Livestock management strategies for improving the integration of crops and livestock in mixed farming systems developed and promoted

Progress on the uptake pathway for HPPS purpose 1, output 5 is summarised in Table 11.

To date, no work directed at this output has been undertaken under the HPPS. However, the most significant aspect of the impact of livestock on crop production in high potential systems, i.e. the impact on soil fertility, has received detailed attention in the past – notably from R6283 – and it is possible that the outputs of this project will underpin future work in the FAIPs. The outputs of R6283 itself were directed largely at the research community and are unlikely to generate extension material without further work. However, they do appear likely to form a strong basis for further, more adaptive, research that, if properly designed, could either provide tools for the extension services in high potential areas or generate interventions that could form a basis for recommendations to farmers.

The need, specified in the LPP logical framework, for modelling tools to assist in this area appears to be adequately addressed by other projects funded by the LPP.

Recommendation: In addressing output 5 for the HPPS, it is particularly important that full advantage should be taken of the cross-cutting links with other LPP production systems. This is particularly relevant to the issue of the impact of livestock on soil fertility. It is suggested that a brief but more detailed review of current and likely future outputs in this area is undertaken before future commitments under HPPS are decided.

Table 11: Progress on uptake pathway for Purpose 1 – Output 5.

Livestock management strategies for improving the integration of crops and livestock in mixed farming systems developed and promoted

Project	Completed	Progress on Uptake Pathway							
		A	B	C	D	E	F	G	H
Code	Short title								

HPPS Projects

None commissioned to date.

Other LPP projects with potential impacts in HPPS

R6283F Implications of livestock for soil fertility.

2



Reference

Morton, J.F. (1997) *A Note on Scientific Journals and Dissemination for Scientific Research*. NRI Social Sciences Group Unpublished Note.

Appendix 1: Production System Logical Framework - High Potential Systems (including peri-urban interface system)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
GOAL:			
Livelihoods of poor people improved through sustainably enhanced supply and value of animal products and improved contribution of livestock to crop production.	In targeted NRD core and niche countries: - real value of livestock sector increased by 10% between 2005 and 2010, - output of national herd increased by 20% between 2005 and 2015	- national agricultural surveys and statistics; - FAO annual reports, - evaluation of RNRSS - national reports to regional organisations	
PURPOSE 1:			
1. Benefits for poor people generated by enhancing the performance of livestock in high potential and peri-urban intensive farming systems (Crop-livestock or Livestock) improved	By 2007 in two nominated areas where primary demand exists: - outputs of animal products increased by 20%; - productivity index increased by 15%; - milk production increased by 20%.	- reports of target institutions - national production statistics, - evaluation of livestock production programme, - research programme reports, - monitoring against baseline data	- climatic conditions remain favourable, - enabling environment (policies, institutions, markets, incentives) for widespread adoption of new technologies and strategies exists.
OUTPUT 1:			
1.1. <u>Techniques for improving the nutritive value of feeds for livestock production developed and promoted</u>	Techniques adopted by contact farmers in two core or niche countries by 2005 - Feed conversion efficiency of ruminant livestock kept by contact farmers demonstrably improved by 10% by 2005 Techniques incorporated into extension recommendations in two core or niche countries by 2004	Research programme reports. Reports of target institutions. Research project reports. Extension agency or producer group reports. Research programme reports Reports of target institutions.	Target institutions invest resources in uptake and application of research products.
ACTIVITIES:			
1.1.1 Refinement of analytical methods for assessing the components of nutritive value	Refined methods for predicting energy and nitrogen supply and the effects of anti-nutritive factors available to NARS and CG centres by 1999	Research project publications. Annual reports of NARS and CG centres	NARS and CG centres continue to invest in nutrition research.
1.1.2 Validation of appropriate combinations of analytical methods for assessing the nutritive value of a) fodder crops and b) crop residues	Validated recommendations on appropriate combinations of analytical methods (including rationing systems) available to NARS and CG centres by 2000	Research project publications. Annual reports of NARS and CG centres	NARS and CG centres continue to invest in nutrition research
1.1.3 Identification of the principal opportunities to increase the nutritive value of fodder crops and crop residues.	Principal opportunities identified and their effects quantified in two contrasting HP production systems by 2002.	Research project reports	Appropriate collaborative links with NARS can be developed and maintained to facilitate research.
1.1.4. Development of improved crop husbandry methods for improving the nutritive value of fodder crops and crop residues.	Improved crop husbandry methods for the two systems studied under 1.1.3, adopted by contact farmers by 2005	Research project reports and publications Producer group reports.	Crop husbandry methods for alleviation of limiting factors identified in 1.1.3, prove to be researchable Contact farmers willing to participate in research process can be identified.
1.1.5 Development of physical and chemical techniques, applied post-harvest, for improving nutritive value or reducing levels of toxins	Post-harvest processing techniques for the two systems in 1.1.3 incorporated into extension recommendations by 2004	Research project reports and publications Extension agency reports	Post-harvest treatments for opportunities identified in 1.1.3, prove to be researchable NGOs and government extension services willing and able to take

NARRATIVE SUMMARY	OBJECTIVELY-VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
OUTPUT 2:			
1.2. Strategies to improve the seasonal availability of livestock feeds in high potential areas developed and promoted	Strategies adopted by contact farmers in two core or niche countries by 2005 - seasonal feed deficits reduced by 20%	Extension agency, NGO and producer group reports. Research programme reports	Target institutions invest resources in uptake and application of research products
ACTIVITIES:			
1.2.1. Development of participatory and quantitative methods for analysing seasonal constraints on nutritional status	Two alternative methods available to scientists in developing countries by 1999	Research project reports and publications. Annual reports of NARS.	Representative research sites can be identified NARS continue to invest in livestock systems research
1.2.2. Identification of the major seasonal nutritional constraints on livestock productivity	Seasonal nutritional constraints identified in two HP systems by 1999	Research project reports	Seasonal constraints in study systems can be evaluated by available (including newly developed) methods.
1.2.3. Testing of component interventions to improve fodder supply during specific periods of feed shortage	Component interventions to alleviate constraints identified by 1.2.2. tested by 2003	Research project reports and publications	Suitable research sites and collaborators can be identified Seasonal constraints identified in 1.2.2. prove to be researchable Environmental conditions allow research to be conducted effectively
1.2.4. Development of year-round feed management strategies for improved livestock productivity and economic performance	Year-round feed management strategies in use by contact farmers by 2005	Research project reports and publications Producer group reports.	Suitable research sites and collaborators can be identified Environmental conditions allow research to be conducted effectively. Contact farmers willing to participate in the research process can be identified
1.2.5. Evaluation and enhancement of the role of fodder marketing in alleviating seasonal feed shortages	Improved fodder marketing strategies for the two systems studied in 1.2.2. presented to policy makers by 2001.	Research project reports Policy documents relating to selected HP systems	Suitable research sites and collaborators can be identified Policy makers retain an interest in fodder marketing issues
1.2.6. Development of herd management strategies for matching nutrient demands with the availability of feed resources	Improved herd management strategies in use by contact farmers by 2004.	Research project reports and publications. Producer group reports.	Suitable research sites and collaborators can be identified Contact farmers willing to participate in the research process can be identified
OUTPUT 3:			
1.3. Improved technologies and strategies for fodder crop and crop residue storage developed and promoted.	Improvements adopted by 20% of farmers in study systems by 2004.	Research programme reports Extension agency reports.	Target institutions invest resources in uptake and application of research products. Interventions promoted by extension services
ACTIVITIES:			
1.3.1. Evaluation of the extent and principal causes of storage losses	Study of storage losses in two HP systems initiated by 1998	Research project reports	Suitable research sites and collaborators can be identified
1.3.2. Evaluation of the adequacy and limitations of storage methods practised by farmers	Comparative study of farmers' practices in four contrasting situations initiated by 1998	Research project reports	Suitable research sites and collaborators can be identified Farmers existing storage practices can be usefully evaluated

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
ACTIVITIES:			
1.3.3. Identification and testing of interventions aimed at reducing storage losses	Improved storage methods incorporated into extension recommendations by 2002.	Research project reports and publications, Extension literature relating to the selected systems	Causes of storage losses identified in 1.3.1. prove to be researchable Extension services prioritise problems and willing to take up research results
OUTPUT 4			
1.4. Improved strategies for animal husbandry and nutrition in the intensive livestock production system and in crop/livestock systems in high potential and peri-urban areas developed and promoted	Improved husbandry and nutrition strategies in use by 20% of farmers in two study systems by 2005.	Research programme reports Extension service reports	No major changes in economic and social conditions between problem identification and development of strategies. Strategies taken up and promoted by extension services
ACTIVITIES:			
1.4.1. Development of factual feeding interventions to optimise the interactions of nutrition with reproductive activity and health status	Interactions characterised by 2000 and factual interventions developed by 2002.	Research project reports and publications.	Suitable research sites and collaborators can be identified Practicable feeding interventions can be formulated for the system under study
1.4.2. Evaluation of the effects of different animal husbandry strategies on livestock performance.	Effects of important alternate husbandry strategies evaluated by 2002.	Research project reports and publications	Links between husbandry strategies selected and overall performance can be established
1.4.3. Development of feeding strategies that optimise the use of available feeds and supplements.	Feeding strategies for 1 fodder crop and 1 crop residue based system developed by 2005	Research project reports and publications.	Suitable research sites and collaborators can be identified, Effective farmer participation in research can be obtained
1.4.4. Development of simulation models to evaluate optimum combinations of feeding and husbandry strategies for improved livestock performance	Models developed and tested by 2004 and recommendations disseminated to extension services by 2005	Research project reports and publications, Extension literature.	Outputs of other activities and information from other sources adequate for the construction of practical, working models Government extension services and NGOs willing and able to take up research results.
NEW OUTPUT 5:			
1.5. Livestock management strategies for improving the integration of crops and livestock in mixed farming systems developed and promoted	Improved strategies in use by contact farmers by 2005	Research programme reports. Producer group reports	Target farmers invest resources in uptake and application of research products Interventions promoted by extension services
ACTIVITIES:			
1.5.1. Development of management strategies for optimising the role of livestock in promoting effective nutrient cycling	Management strategies in use by contact farmers by 2002	Research project reports and publications. Producer group reports.	Contact farmers willing to participate in the research process can be identified.
1.5.2. Evaluation of other crop (including horticulture) -livestock interactions and the potential for improving integration in mixed systems.	Crop -livestock interactions evaluated and their quantitative effects measured in one representative HP system by 1999	Research project reports and publications.	Suitable research sites and collaborators can be identified Adequate quantitative techniques available for reliable results to be obtained

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
ACTIVITIES:			
1.5.3. Development of management models for planning optimum resource use efficiency and whole-farm productivity in crop-livestock systems.	Models tested and strategies for field-testing devised by 2001.	Research project reports and publications.	Information from 1.5.1 and 1.5.2. adequate for the construction of reliable working models.
1.5.4. Testing of strategies for optimum resource use efficiency and whole-farm productivity.	Strategies indicated by modeling activities tested on-farm and in use by contact farmers by 2005.	Research project reports and publications. Producer group reports.	Contact farmers willing to participate in the research process can be identified.

Shading indicates text drawn from the RNRRS (1995 - 2005) document. The use of italics indicates where this text has been modified. Normal text on a clear background indicates new text. Emboldened text indicates prescribed outputs to be addressed in this call for concept notes.

Appendix 3: *Published Outputs from the HPPS and Assessment of their Potential for Targeted Impact Amongst End User Groups.*

Publication Categories

Publication type	Description
A.	Papers in refereed journals, book chapters, edited international conference proceedings or bulletins (published or accepted for publication)
B.	Scientific abstracts , oral presentations, posters, non-edited conference proceedings.
C.	Internal Reports
D.	Newsletters, technical leaflets, lecture presentations.
E.	Ph.D. Theses
F.	M.Phil. / M.Sc. Theses
G.	Miscellaneous (e.g. radio / TV programmes, videos, oral presentations to non-scientific audiences).
H.	Computer software (including databases)

Categories of Likely, Direct Beneficiaries

Category	Description
A.	Donors
B.	Strategic researchers in developed countries
C.	Strategic researchers in IARCs (includes national institutions working overseas)
D.	Applied researchers in IARCs (includes national institutions working overseas)
E.	Applied researchers in NARS
F.	Training (institutions and individuals)
G.	Planners at national / regional levels
H.	National extension and other technical support services
I.	Agro-industry
J.	Commercial farmers (only limited subsistence activities)
K.	Smallholders (largely subsistence based)
L.	Landless or land-poor

NOTE: *These categories have been used in relation to the published outputs themselves. The material (interventions, techniques and technologies) described in a particular publication might impact at a quite different level if packaged in a different form.*

R Number	Output	Citation	Publication category	Likely beneficiaries
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HPPS Projects

R6340	1	Wood, C.D., Murray, A.H., Moss, A.R. and Givens, D.I. (1997) Use of the gas production technique to investigate responses of supplementing low quality forages: 1. <i>In vitro</i> interactions. In: BSAS In vitro Meeting? . 14.	B	D,E
	2	Murray, A.H., Moss, A.R., Wood, C.D., Givens, D.I., and Gill, M. (1997) Use of the gas production technique to investigate responses of supplementing low quality forages: 2. <i>In vitro</i> interactions and comparisons with <i>in vivo</i> parameters. In. BSAS In vitro Meeting? . 64.	B	D,E
	3	Givens, D.I. (1996) <i>An Evaluation of the Gas Production Technique for Identifying Digestive Interaction Between High and Low Quality Forages</i> . ADAS Feed Evaluation and Nutritional Services. Unpublished Contract Report. 10pp.	C	A
R77??	1	Manyuchi, B., De B Hovell, F.D., Ndlovu, L.R., Topps, J.H. and Tigere, A. (1996) Feeding napier hay as supplement to sheep given poor quality natural pasture hay. effects of level of napier hay supplement and inclusion of urea in the basal diet on intake and digestibility <i>Animal Feed Science and Technology</i> , 63 123 - 135.	A	D,E
	2	Manyuchi, B., De B Hovell, F.D., Ndlovu, L.R., Topps, J.H. and Tigere, A. (1994) Effect of napier or groundnut hay as supplements to sheep consuming poor quality natural pasture hay. <i>Proceedings of the British Society of Animal Science, Winter Meeting, Scarborough</i> . 21 - 23 March, 1994. Paper no 77.	B	D,E
	3	Manyuchi, B. (1994) <i>High Quality Forages as Supplements to Low Quality Forages for Ruminants</i> . Unpublished Ph.D Thesis, University of Aberdeen. 77?pp.	E	D,E,F

R Number	Output	Citation	Publication category	Likely beneficiaries
R5690	1	Thorne, P. J. and Herrero, M. (1998) The role of livestock in natural resources management. In: <i>Food, Lands and Livelihoods. Proceedings of an International Conference held at the KARI Conference Centre, Nairobi, Kenya, 27 - 30 January, 1998</i> BSAS Occasional Publication no. 21, Edinburgh, UK. British Society of Animal Science. 87 - 94. (part funding under R6282)	A	B, C, D, E
	2	Thorne, P. J., Tanner, J.C. and Guring, H.B. (1998) Patterns in the provision of feed resources for stall-fed ruminant livestock in the Nepal Himalaya. In: <i>Food, Lands and Livelihoods: Setting Agendas for Animal Science. International Conference held at the KARI Conference Centre, Nairobi, Kenya, 27 - 30 January, 1998</i> . 153 - 154.	B	B, C, D, E
	3	Thorne, P. J. (1993) Report on a Visit to Nepal to Initiate a Collaborative Study of seasonal Feed resources Availability with the Pakhrbas Agricultural Centre 19 April - 4 June, 1993 Unpublished Report, R2009 (S), Chatham, UK. Natural Resources Institute. 84 pp.	C	F
	4	Thorne, P. J. (1993) Report on a Visit to Nepal to Monitor the Progress of a Collaborative Study of Seasonal Feed Resources Allocation with the Pakhrbas Agricultural Centre 19 April - 4 June, 1993. Unpublished Report, R2072 (S), Chatham, UK, Natural Resources Institute. 58 pp.	C	F
	5	Thorne, P. J. Studies of Seasonal Feed Availability and Allocation to Mixed Species Livestock Holdings on Smallholder Farms in Nepal. Seminar presented to Tropical Agriculture M.Sc Students, Wye College.	D	F
	6	Thorne, P. J., Tanner, J.C. and Guring, H.B. (1999) The characterisation of feed resources in crop-livestock systems and its implications for the development of improved feeding strategies - a case study from Nepal. <i>Agricultural Systems</i> . (in review).	A	D, E

R Number	Output	Citation	Publication category	Likely beneficiaries
	7	Thorne, P.J (1995) . <i>Feeding Strategies in Smallholder, Crop-livestock Systems A Case Study from Nepal</i> Final Technical Report on Project R5183. Chatham, UK, Natural Resources Institute. 53pp.	C	A
R6153	1	Seminars by Drs Hannover, Staal, Tanner and Thorpe at KARI's RRC Embu, 3rd April, 1997 to KARI, Ministry of Agriculture, Livestock Development and Marketing and private sector dairy staff.	D	E,G
	2	Thorpe, W. et al, 1997. Characterisation of dairy systems supplying the Nairobi milk market: a pilot cross-sectional survey in Kiambu District KARI/ILRI Collaborative Dairy Project Working Document. (C)	C	D,E
R6610		No dissemination outputs recorded yet		
R6619	1	Massawe, N.F., Owen, E., Mtenga, L.A., Romney, D.L, and Holden, S. Developing sustainable forage utilisation to increase profitable milk production on smallholder farms in Tanzania: approach using Participatory Rural Appraisal (PRA). <i>Proceedings of the 23rd Scientific Conference Tanzania Society of Animal Production 23 (1996), 1997, 23-31.</i>	B	E
	2	Massawe, N.F., Owen, E., Mtenga, L.A., Ashley, S.D., Holden, S. and Romney, D.L. (1998) Identified constraints to improving forage utilisation for milk production in three locations of Tanzania: Approach towards participatory livestock research. In: Food, Lands and Livelihoods. Setting Research Agendas for Animal Science. Conference held at KARI, Conference Centre, Nairobi, Kenya 27- 30 January, 1998. Page 98 - 99.	B	B,C,D,E

R Number	Output	Citation	Publication category	Likely beneficiaries
R6282	1	Dijkstra, J., France, J., Neal, H.D., St. C., Assis, A.G., O.F.Aroeira, J.M. and Campos. (1996) Simulation of digestion in cattle fed sugarcane model development. <i>Journal of Agricultural Science (Cambridge)</i> , 127 231 - 246.	A	C,D,E
	2	Dijkstra, J., France, J., Assis, A.G., Neal, H.D., St. C., Campos, D.F., and Aroeira, J.M. (1996) Simulation of digestion in cattle fed sugarcane: prediction of nutrient supply for milk production with locally available supplements <i>Journal of Agricultural Science (Cambridge)</i> , 127: 247 - 260	A	C,D,E
	3	Thorne, P.J., Sinclair, F.L. and Walker, D.H. (1997) Using local knowledge of the feeding value of tree fodder to predict outcomes of different supplementation strategies <i>Agroforestry Forum</i> , 8 (2): 45 - 49.	A	B,C
	4	Thorne, P.J. (1997) <i>Summary of Cattle Performance on Dairy Farms in the Santa Cruz Area, Bolivia</i> . Unpublished NRI Report, NRI, Chatham, UK 145 pp.	C	H,J,K
	5	Thorne, P.J. (1998) <i>DRASTIC. A Dairy Rationing System for the Tropics. Evaluation Version for Windows 3.1</i> . Natural Resources Institute, Chatham, United Kingdom, 40pp.	H	H,J
	6	Thorne, P.J. (1998) <i>DRASTIC. Un Sistema de Racionamiento para Vacas Lecheras Tropicales. Version de Evaluacion para Windows 3.1</i> . Natural Resources Institute, Chatham, United Kingdom, 40pp	H	H,J
	7	Thorne, P.J. and Herrero, M. (1998) The role of livestock in natural resources management. In: <i>Food, Lands and Livelihoods. Proceedings of an International Conference held at the KARI Conference Centre, Nairobi, Kenya, 27 - 30 January, 1998</i> . BSAS Occasional Publication no. 21. Edinburgh, UK. British Society of Animal Science, 87 - 94. (part funding under R5690)	A	B,C,D,E
	8	Dissemination Workshop. Santa Cruz, Bolivia, 24 - 25 November, 1998. Demonstration and use of DRASTIC with dairy co-operative technical staff and farmers (35 participants).	G	H,J,K

R Number	Output	Citation	Publication category	Likely beneficiaries
R6358	9	Dissemination Workshop, Trinidad, Bolivia, 27 - 28 November, 1998 Demonstration and use of DRASTIC with dairy co-operative technical staff, farmers and university-level students (80 participants).	G	H, J
R6359	10	Dissemination Workshop, Tanga, Tanzania, 6 - 8 January, 1998 Demonstration and use of DRASTIC with dairy development project technical staff, NARS scientists, government extension staff and farmers (c. 90 participants).	G	A, H, J, K, L
R6358		No dissemination outputs recorded yet.		
R6359	1	Msangi, B.S., Bryant, M.J., Dijkman, J.T. and Thorne, P.J. (1998) Characteristics of small scale dairying in urban, sub-urban and peri-urban areas of coastal Tanzania In: <i>Food, Lands and Livelihoods. Setting Research Agendas for Animal Science. Conference held at KARI, Conference Centre, Nairobi, Kenya 27- 30 January, 1998.</i> Page 9.	B	B, C, D, E
R6775	1	Romney D, Tanner J, Chui J, Kenyanji M, Morton J, Ndegwa P (1997). Feed utilisation options for smallholder dairy farmers. In <i>Food, Lands and Livelihoods. Setting Research Agendas for Animal Science.</i> Conference held at KARI, Conference Centre, Nairobi, Kenya 27- 30 January, 1998 Page 43	B	B, C, D, E
R6775	2	KARI/McFARNILRI (December 1996) Feeding Strategies for Smallholder Dairying in Kiambu District: Draft report of a PRA focusing on feeding practices.	C	F, H
R6776	1	Morton, J., Ashley, S., Romney, D. and Mfenga, L. (1998). Farmer Participatory Research in Livestock Production: Themes from a Workshop in Arusha. (in prep)	C	E

R Number	Output	Citation	Publication category	Likely beneficiaries
R6954	1	Butler, N.L., Dawson, J.M., Wakelin, D. and Buttery, P.J. (1998) Effect of dietary tannin protein level on the susceptibility of sheep to parasitic infection. <i>Proceedings of the British Society of Animal Science, 1998</i> . 97.	B	B, C, D, E
<i>Other LPP Projects with Potential Impacts in the HPPS</i>				
R6138		No dissemination outputs recorded yet.		
R6339		No dissemination outputs recorded yet.		
R6993	1	Wood, C.D. (1997/1998) Three visit reports (Internal NRI Reports).	C	A
	2	Wood, C.D. and Nube, S. (1997) Project planning and implementation of LPP project on cereal stovers. <i>Proceedings of the First DFID / DRSS Workshop, Matopos, October 1997</i> (LPP publication).	B	D, E
R7010	1	Titterton, M. and Mhere, O. (1997) Project planning and implementation of LPP project on high quality silage from adapted forages. <i>Proceedings of the First DFID / DRSS Workshop, Matopos, October 1997</i> .	B	D, E
	2	Local radio interview presenting the project, its objectives and results under the topic of forage conservation for livestock feeding	G	K
	3	Field day for local farmers interested in dairying with over sixty attendees	G	K
R5181	1	Wareing, P.W., Phillips, S., Panigrahi, S. and Noubé, S. (1995) The effect of storage on the mycoflora of maize and sorghum stover in Zimbabwe. <i>Mycopathologia</i> (in review?).	A	D, E

R Number	Output	Citation	Publication category	Likely beneficiaries
	2	Phillips, S.I., Wareing, P.W., Dutta, A., Panigrahi, S. and Medlock, V. (1995) The incidence of mycoflora, aflatoxin and zearalenone in dairy feed and forage samples from Eastern India and Bangladesh. <i>Mycopathologia (in review?)</i> .	A	C,D,E
	3	Jones, B.D. (1993) <i>The Effects of Mycotoxins in Ruminants with Particular Reference to the 'Carry Over' of Mycotoxins and Mycotoxin Metabolites from Naturally Contaminated Feed to the Milk of Lactating Cows</i> . Chatham, UK, Natural Resources Institute. Unpublished Report.	C	D
R6955	1	Ball, P.J.H. (1997) Proceedings of the First DFID / DRSS Workshop, Matopos, October 1997.	B	D,E
R6283	1	Cadisch G., de Oliveira, O.C., Cantarutti, R., Carvalho, E., and Urquiaga, S. (1997). The role of legume quality on soil carbon dynamics in savanna ecosystems In & quot; <i>Carbon and Nutrient Dynamics in Natural and Agricultural Tropical Ecosystems & quot;</i> . (L. Bergstrom and H. Kirchman, eds.), pp.47-70. CAB International, Wallingford	A	C,D,E
	2	Kimani, S.K., Gathua, K.W., Mugane, P.G. and Cadisch, G. (1997) Effects of phosphorus and manure application on bean yield in the central Kenya Highlands. <i>Paper presented at the First All Africa Crop Science Congress. 13-17 January, 1997 at the University of Pretoria, Harfield, South Africa.</i>	B	D,E
	3	Delve, R.J., Tanner, J.C., Kimani, S.K., Giller, K.E., Cadisch, G. and Thome, P.J. (1998) The effects of feed nitrogen and polyphenol levels on the fate of ingested nitrogen in steers and their implications for nitrogen cycling in mixed farming systems. In: <i>Food, Lands and Livelihoods. Setting Agendas for Animal Science. 27-30 January, KARI Conference Centre Nairobi, Kenya.</i> p87	B	B,C,D,E
	4	Delve, R.J. (1998). <i>The Effects of Livestock Feeding Management on Soil Fertility.</i>	E	F

R Number	Output	Citation	Publication category	Likely beneficiaries
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Unpublished Ph.D. Thesis Wye College, University of London.

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| 45 | Thorne, P. J. and Cadisch, G. (1998) ANORAC. <i>Allocation of Nitrogen in Organic Resources for Animals and Crops</i> . Natural Resources Institute, Chatham, United Kingdom 45pp. | H | D,E |
| 6 | Thorne, P. J., Dolve, R. J., Cadisch, G., Tanner, J. C., Giller, K. E., Kimani, S. K., Thorpe, W. and Thomas, D. (1998) Implications of Livestock Feeding Management for Long-term Soil Fertility in Smallholder Mixed Farming Systems. Final Technical Report on Project R6283 Chatham, UK. Natural Resources Institute. 68pp. | C | A |

Projects Initiated before the Adoption of the RNRRS

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|-------|---|--|---|-----|
| R4338 | 1 | Mueller-Harvey, I., McAllan, A. B., Theodorou, M. K. and Beever D.E (1988) Phenolics in fibrous crop residues and plants and their effects on the digestion and utilisation of carbohydrates and proteins in ruminants. In: Reed J.D., Capper, B.S. and Neate P. J.(Eds). <i>Plant breeding and the nutritive value of crop residues</i> Proceedings of a workshop held at ILCA, Addis Ababa, Ethiopia, 7- 10 December 1987. ILCA, Addis Ababa, 97-132 | A | D,E |
| | 2 | Mueller-Harvey, I and Blackwell, P M S. (1988) Polyphenolics in sorghum crop residues. <i>Bulletin de Liaison no. 14 du Groupe Polyphenolics</i> , Narbonne, France. <i>Compte-rendu des Journees Internationales d'Etude et de l'Assemblee Generale</i> , University Brock Street, Catherine's, Ontario, Canada 16-19 August 1988. (Abstract). | B | B |

R Number	Output Citation	Publication category	Likely beneficiaries
3	Mueller-Harvey, I. (1989) Identification and importance of polyphenolic compounds in crop residues. In: <i>Physico-chemical characterisation of plant residues for industrial and feed use</i> (A. Chesson and E.R. Orskov, Eds) Elsevier Applied Science, London, pp 88-109.	A	B
4	Aboud, A.A., Reed, J.D., Owen, E. & McAllan, A.B. (1990). Feeding sorghum stover to Ethiopian sheep: effect of stover variety and amount offered on growth, intake and selection. <i>Animal Production</i> , 50, 593 (Abstract)	B	C,D
5	Mueller-Harvey, I., Dhanoa, M.S. and Barnes, R.J. (1990). NIRS of sorghum crop residues. In: <i>Third international Conference on Near Infrared Spectroscopy</i> . Brussels, Belgium, 25-29 June.	B	B
6	Mueller-Harvey, I. and Blackwell, P.M.S. (1991) An improved HPLC post-column derivitisation procedure for the UV-Vis spectroscopic characterisation of phenolic compounds. <i>Phytochemical Analysis</i> , 2, 38-42	A	B
7	Aboud, A. A (1991). <i>Strategies for the Utilization of Sorghum Stover as Feed for Cattle, Sheep and Goats</i> . PhD Thesis, University of Reading.	E	E,F
8	Osafa, E.L.K., Owen, E., Aboud, A.A.O., Said, A.N., Gill, E.M. & McAllan, A.B (1991). Feeding sorghum stover to Ethiopian sheep. Effect of chopping and amount offered on growth, intake and selection. <i>Animal Production</i> . (in press).	A	C,D
9	Aboud, A.A., Owen, E., Reed, J.D., Said, A.N. & McAllan, A.B (1991) Feeding sorghum stover to Ethiopian goats and sheep. Effect of the amount offered on growth, intake and selection. <i>Animal Production</i> , (in press).	A	C,D
10	Mueller-Harvey, I. and Blackwell, P.M.S. (1991). An improved post column derivitisation procedure using shift reagents for the UV-Vis spectroscopy of phenolic compounds in plant extracts. <i>XVth international conference Groupe Polyphenols</i> . Universite Louis Pasteur. Strasbourg. France 9-11 July.	B	B

R Number	Output Citation	Publication category	Likely beneficiaries
11	Mueller-Harvey, I., Dhanoa, M.S., Blackwell, P.M.S. and Reed, J.D. (1991). Cluster analysis of HPLC data and in vitro digestibilities to describe varietal differences between sorghum crop residues and their responses to different sites. COST 84bis workshop proceedings. Reggio Emilia, Italy.	B	B
12	Mueller-Harvey, I. and McAllan, A.B. (1991). Tannins - their biochemistry and nutritional properties. In: <i>Advances in Plant Cell Biochemistry and Biotechnology</i> (I. M. Morrison, ed). JAI Press Ltd, London (in press).	A	B
13	Mueller-Harvey, I. and Dhanoa, M.S. (1991). Cluster analysis of HPLC-chromatograms to describe varietal differences between sorghum crop residues and their responses to different sites. <i>J. Sci. Food Agric.</i> (in press).	A	C,D,E
14	Mueller-Harvey, I. and Reed, J.D. (1991). Phenolic compounds and their relationship to in vitro digestibility of sorghum leaves from bird and non-bird resistant varieties. <i>J. Sci. Food Agric.</i> (in press).	A	C,D,E
15	Theodorou, M.K., Williams B.A., Brooks, A., Dhanoa, M.S., McAllan, A.B. and Gill, M. (1991). Estimation of kinetic parameters associated with the digestibility of tropical forages using a new in vitro technique. In: <i>Animal Production in Developing Countries</i> , eds. M. Gill, E. Owen, G.E. Pollott and T.L.J. Lawrence. Occasional Publication No. 16, British Society of Animal Production. 224 - 225.	B	C,D
16	Mueller-Harvey, I., Dhanoa, M.S., McAllan, A.B. and Reed, J.D. (1991) Variations in the phenolic components of sorghum crop residues related to varietal and environmental differences. In: <i>Animal Production in Developing Countries</i> , eds. M. Gill, E. Owen, G.E. Pollott and T.L.J. Lawrence. Occasional Publication No. 16, British Society of Animal Production. 218 - 219	B	C,D,E
17	Mueller-Harvey, I., Reed, J.D., Dhanoa, M.S. & McAllan, A.B. (1991). Phenolic compounds and their relationship to in vitro digestibility of sorghum leaves of bird resistant and non bird resistant varieties. In: <i>Animal Production in Developing</i>	B	C,D,E

R Number	Output Citation	Publication category	Likely beneficiaries
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Countries. eds. M. Gill, E. Owen, G.E. Pollott and T.L.J. Lawrence. Occasional Publication No. 16, British Society of Animal Production. 220 - 221

18 Khazaal, K., Mueller-Harvey, I., McAllan, A.B., Osafo, E.L.K., Owen, E. & Said, A.N. (1991) Effects of harvesting at different stages of growth and long term storage on the phenolic composition of sorghum stover. In: Animal Production in Developing Countries. eds. M. Gill, E. Owen, G.E. Pollott and T.L.J. Lawrence. Occasional Publication No. 16, British Society of Animal Production 210 - 211

19 Osafo, E.L.K., Owen, E., Said, A.N., Gill, E.M. & McAllan, A.B. (1991). Sorghum stover as ruminant feed in Ethiopia: Effect of cultivar, site of growth, pre-harvest leaf stripping and storage on yield and morphology In: Animal Production in Developing Countries. eds. M. Gill, E. Owen, G.E. Pollott and T.L.J. Lawrence. Occasional Publication No. 16, British Society of Animal Production. 188 - 199.

20 Osafo, E.L.K., Owen, E., Said, A.N., Gill E.M. & McAllan, A.B. (1991). Feeding sorghum stover to Ethiopian sheep and cattle: Effect of chopping and amount offered on intake and selection. In: Animal Production in Developing Countries. eds. M. Gill, E. Owen, G.E. Pollott and T.L.J. Lawrence. Occasional Publication No. 16, British Society of Animal Production 204 - 205

21 Aboud, A.A.O., Owen, E., Reed, J.D., Said A.N. & McAllan, A.B. (1991). Feeding sorghum stover to Ethiopian goats and sheep: Effects of amount offered on intake, selection and performance. In: Animal Production in Developing Countries. eds. M. Gill, E. Owen, G.E. Pollott and T.L.J. Lawrence. Occasional Publication No. 16, British Society of Animal Production. 202 - 203

22 Anon. (1991) Evaluation of Cereal Crop Residues: Influence of Species, Variety and Environment on Nutritive Value. Final Technical Report on Project X0093 [4338]. Hurley, UK, AFRC Institute of Grassland and Environmental Research.

R Number	Output	Citation	Publication category	Likely beneficiaries
7	Wood, C.D., Tiwari, B.N., Plumb, V.E., Powell, C.J., Roberts, B.T. and Gill, M. (1995) Differences in protein precipitation activity of extractable tannins, crude protein and ash contents of leaf samples from Nepalese fodder trees. <i>Tropical Science</i> , 35: 376 - 385.	A	D,E	
8	Wood, C.D., Tiwari, B.N., Plumb, V.E., Powell, C.J., Roberts, B.T., Sirimane, V.D., Rossiter, J.T. and Gill, M. (1994) Interspecies differences and variability with time of protein precipitation activity of extractable tannins, crude protein, ash and dry matter contents of leaves from 13 species of Nepalese fodder trees. <i>Journal of Chemical Ecology</i> , 20: 3149 - 3162.	A	D,E	
9	Sampath, K.T., Wood, C.D. and Prasad, C.S. (1993) Effect of sources and levels of nitrogen supplements on <i>in vitro</i> fermentation of untreated and 5% urea treated finger Millet straw (<i>Eleusine coracana</i>). <i>Proc VI Anim. Nutr. Res Workers' Conf., Bhubaneswar</i> , abstract No 309. 151 - 152	B	D,E	
10	Prasad, C.S., Sampath, K.T. and Wood, C.D. (1993) Evaluation of untreated and urea treated finger millet straw (<i>Eleusine coracana</i>) at different levels of concentrate supplementation using <i>in vitro</i> gas production techniques. <i>Proc. VI Anim. Nutr. Res Workers' Conf., Bhubaneswar</i> . abstract No 310. 152	B	D,E	
11	Wood, C.D. and Plumb, V.E. (1994) Total phenols and protein precipitation assay as indicators of the inhibitory effects of phenols on rumen microorganisms. <i>Animal Production</i> , 58: 445 (abstr.)	B	C,D,E	
12	Wood, C.D., Gillet, C., Rosales, M. and Green, S. (1995) Relationships between <i>in vitro</i> gas production characteristics and composition of tree leaf fodders from Bolivia, West Africa and Colombia. <i>Animal Science</i> , 60: 541 (abstr.)	B	D,E	
13	Wood, C.D. and Plumb, V.E. (1995) Evaluation of assays for phenolic compounds on the basis of <i>in vitro</i> gas production by rumen micro-organisms. <i>Animal Feed Science and Technology</i> , 56: 195-206.	A	C,D,E	

R Number	Output	Citation	Publication category	Likely beneficiaries
14	Murray, A.H., Daálkhajjav, D. and Wood, C.D. (1996) Rumen degradability of Mongolian pastures: a comparison of in situ and in vitro gas production techniques <i>Animal Science</i> , 62, 684 (abstr.).	B	D,E	
15	Wood, C.D. and Manyuchi, B. (In press) Use of an in vitro gas production method to investigate interactions between veld hay and Napier hay or groundnut hay supplements. <i>Animal Feed Science and Technology</i> .	A	D,E	
16	Powell, C. (undated) <i>To determine the effect of supplementation of barley straw with lucerne hay, meadow hay, rye hay and timothy hay on gas production during in vitro fermentation</i> . Chatham, UK, Natural Resources Institute. Unpublished Internal Report.	C	D	
17	Powell C. (undated) <i>To determine the effect of the in vitro fermentation technique on the fibre fraction of five samples of temperate hay and straw</i> . Chatham, UK, Natural Resources Institute. Unpublished Internal Report.	C	D	
18	Wood, C.D. (1996) <i>Effects of tannins in ruminant nutrition</i> . Chatham, UK, Natural Resources Institute. Unpublished Internal Report.	C	D	
19	Wood, C.D. and Mathewman, R.W. (1996) <i>Feed samples from NW India: Report on initial evaluation</i> . Chatham, UK, Natural Resources Institute. Unpublished Internal Report.	C	D	
20	Anon <i>Note on a workshop held at Pakhnbas Agricultural Centre, Nepal, 25 - 29 March 1996</i> Chatham, UK, Natural Resources Institute. Unpublished Internal Report.	C	D,E	
21	Wood, C.D., Tborne, P.J., Romney, D.L. and Rosales, M. (1997) <i>Techniques for evaluating ruminant feeds in less developed countries, with particular reference to the potential use of in vitro gas production methods</i> . Chatham, UK, Natural Resources Institute. Unpublished Internal Report.	C	D	
22	Wood, C.D. and Murray, A.H. (1997) <i>Characterisation of Costa Rican feed samples</i>	C	D	

R Number	Output Citation	Publication category	Likely beneficiaries
	'using the gas production method. Chatham, UK, Natural Resources Institute. Unpublished Internal Report.		
23	Cedano, F. (1996) Use of in vitro gas production technique for predicting in vivo apparent digestibility and voluntary intake of feedstuffs for sheep Unpublished M.Sc. Thesis, University of Reading.	F	E,F
24	Rosales, M. (1996) In vitro assessment of the nutritive value of mixtures of leaves from tropical fodder trees Unpublished D. Phil. Thesis, University of Oxford.	E	E,F
25	Vargas, J.E. (1995) Evaluation of the fermentation characteristics of five provenances of <i>Gliricidia sepium</i> by in vitro gas production technique. Unpublished M.Sc. Thesis, Wye College, University of London.	F	E,F
26	Avomyo, F. (1995) An evaluation of the gas production technique in determining interactive effects between ruminant feed mixtures. Unpublished M.Sc. Thesis, Wye College, University of London.	E	E,F
27	Robinson, A. (1993) In vitro rumen fermentation studies: standardisation of the Hurley method and comparison with and between earlier procedures. Unpublished Honours Thesis, Wye College, University of London	F	F
28	Clark, M. (1994) An investigation into the ranking of tree leaf species as food supplements for ruminants using modified procedures of the pressure transducer technique. Unpublished Honours Thesis, Wye College, University of London.	F	F
29	Goodenough, L. (1996) Detection of anti-nutritive compounds found in leaves by TLC and fungal inhibition. Unpublished Honours Thesis, Wye College, University of London.	F	F
30	Gill, M., Bennison, J. and Wood, C.D. (1996) The selection of trees for fodder. In: <i>Advances in Agroforestry. Proceedings of a British Council Short Course, University of Wales, Bangor 29 March - 10 April 1992.</i> Manchester, UK, The British Council. p 65 - 73.	D	E,F

R Number	Output Citation	Publication category	Likely beneficiaries
31	Wood, C.D (1995) <i>Feed evaluation: Recent developments</i> Summary of presentation given to LSAAC, February 1995	D	
32	Wood, C D and Manyuchi, B. (1996) Use of an in vitro gas production method to investigate interactions between veld hay and napier hay or groundnut hay supplements. <i>Poster Presented at a Conference on Evaluation of Forages for Ruminants in the Tropics held in Zimbabwe.</i>	B	E
33	Arinendariz, I.R., Cadish, G., Giller, K.E. and Wood, C.D. (1996) Nitrogen mineralisation in soils and in vitro rumen fermentation parameters as affected by chemical composition of tree fodders. <i>Poster Presented at an International Conference Entitled "Driven by Nature", Wye College, University of London, UK</i>	B	C,D,E
34	<i>Workshop on fodder tree quality held at Pakhribas Agricultural Centre, Nepal, 25 - 29 March 1996</i>	B	D,E
35	Wood, C.D. (1997) <i>Development of Improved Methods for Estimating the Nutritive Value of Tropical Forages.</i> Final Technical Report on Project R5180 Chatham, UK, Natural Resources Institute. 58pp	C	A
R5178	1 Panigrahi, S. (1992) Effects of treating cottonseed meal with a solution of ferrous sulphate for the prevention of brown yolk discoloration. <i>Animal Feed Science and Technology, 38: 89-103.</i>	A	D
2	Panigrahi, S. (1992) Effects of different copra meals and amino acid supplementation on broiler chick growth. <i>British Poultry Science, 33: 683-687.</i>	A	D
3	Panigrahi, S. (1992) Energy deficit-induced behaviour changes in broiler chicks fed copra meal-based diets. <i>Proceedings of the World's Poultry Science Congress, 20-24 September, 1992, Amsterdam, The Netherlands, Volume 3, pp 503-507.</i>	B	E
4	Panigrahi, S., S. Phillips, Plumb, V.E. and Watson, A.J. (1992) Evaluation of the nutritive value of yellow rice in rats and broiler chicks. <i>British Journal of Nutrition,</i>	A	D

R Number	Output Citation	Publication category	Likely beneficiaries
	68: 573-582.		
5	Panigrahi, S., Rickard, J., O'Brien G.M. and Gay, C. (1992) Effects of different rates of drying cassava root on its toxicity to broiler chicks <i>British Poultry Science</i> , 33: 1025-1042.	A	D
6	Panigrahi, S. and Plumb, V.E. (1995) Effects on dietary phosphorus of treating cottonseed meal with crystalline ferrous sulphate for the prevention of brown yolk discoloration. <i>British Poultry Science</i> (in press)	A	D
7	Panigrahi, S. (1995) The potential for small-scale oilseed expelling in conjunction with poultry production in developing countries. <i>World's Poultry Science Journal</i> , Vol 50 (July 1995 issue): 1-6.	A	D,E
8	Panigrahi, S. (1995) A review of the potential for using cassava root meal in poultry diets. <i>Proceedings of a the international Symposium on Tropical Tuber Crops (ISOTUC) 6-9 November 1993. Abstracts published by Indian Society for Root Crops, Central Tuber Crops Research Institute, Sreekarayam, Thiruvananthapuram, India</i> (in press).	B	E
9	Thorne, P.J. (1993) A physical and financial appraisal of a feeding system using combinations of low-nutrient-dense and concentrated feeds for growing pigs in the Solomon Islands. <i>Tropical Agriculture (Trinidad)</i> , 70: 78 - 82.	A	E
10	Thorne, P.J. (1992) Developing the use of local feed resources for pigs and poultry in Kiribati. <i>World Animal Review</i> , 72: 20 - 25	A	E
11	Thorne, P.J. (1992) Amino-acid composition and aspects of protein quality in expeller copra meals for pig feeding. <i>Tropical Science</i> , 32: 145 - 151.	A	D,E
12	Thorne, P.J. (1992) Alternatives to imported compound feeds for growing pigs in the Solomon Islands. <i>Tropical Agriculture (Trinidad)</i> , 69: 141 - 144.	A	E

R Number	Output	Citation	Publication category	Likely beneficiaries
13		Panigrahi, S. (1995) The Use of Tropical Feeds in Non-ruminant Rations, with Particular Reference to Poultry Production. Final Technical Report on Project R5178. Chatham, UK, Natural Resources Institute. 55pp.	C	A
R5183	1	Thorne, P. J. (1995) Modelling the effects of livestock on nutrient flows in mixed crop-livestock systems. In: <i>Livestock and Sustainable Nutrient Cycling in Mixed Farming Systems of Sub-Saharan Africa</i> . Proceedings of an International Conference held in Addis Ababa, Ethiopia, 22 - 26 November, 1993 eds. J.M Powell, S. Fernandez-Rivera, T.O. Williams and C. Renard. Addis Ababa, Ethiopia, International Livestock Centre for Africa. 493 - 508	A	D,E
	2	Thorne, P. J. (1995) FRAME: A simulation of the consequences of farmers' decisions on the allocation of limited feed resources in mixed species livestock holdings. <i>Vth International Symposium on Herbivore Nutrition</i> , 11 - 15 September, 1995, Clermont Ferrand, France.	B	D
	3	Thorne, P. J. (1994) Modeling Livestock Feed Availability and Allocation to Improve Seasonal Feed Supplies and Feeding Systems. Chatham, UK Natural Resources Institute. 82 pp.	C	A
	4	Thorne, P. J. (1995) A Simulation Model of the Consequences of Feed Allocation Decisions in Mixed Species Livestock Holdings (FRAME). Final Technical Report on Project R5183. Chatham, UK, Natural Resources Institute. 159pp.	C	A
R5190	1	Ogwang, B.H and Xaba, B. (1997) The effect of feeding agro-industrial by-products on weight gain and body condition of draft oxen in Swaziland. <i>Paper Presented to a Meeting of the African Feed Resources Network (No other details available)</i> .	B	D,E
	2	Ogwang, B.H. (1996) <i>Effect of Supplements of Crop Residues or Agro-industrial By-products on the Performance of Smallholder Goat Production in Swaziland.</i>	C	A

R Number	Output	Citation	Publication category	Likely beneficiaries
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Unpublished Final Technical Report (Draft) on Project R5190. University of Swaziland, Luyengo, Swaziland. 18pp.