Prosopis juliflora and related arboreal species: a monograph, extension manual and database

Including project extension:
Management and utilisation of *Prosopis juliflora*:
a training programme (India)

Project R7295/ZF0086

Final Technical Report

for
Forestry Research Programme (FRP)
Renewable Natural Resources Knowledge Strategy (RNRKS)
Department for International Development (DFID)

NM Pasiecznik and PJC Harris

January 2002

Executive summary

One in ten of the human population may depend principally on *Prosopis* trees as their main source of firewood. *Prosopis juliflora* and related species are now probably the most common trees in the hot arid and semi-arid zones of the world, having been introduced pan-tropically for fuel and fodder in the last two centuries. In the native range Americas, many rural economies rely on *Prosopis* raw materials to supply a booming local trade in processed goods. However, where the species have been introduced, and often from inferior germplasm, into Asia, Africa and Australia, the species are little known, largely under utilised and unmanaged. Here we see how a tree has been introduced, but the indigenous knowledge surrounding its wise management and use, has not. A wealth of literature on the species already exists, but in a variety of languages, journals and conference proceedings, with no global synthesis.

The purpose of the project was to apply new knowledge to problems in forest and tree resource management, via the collation and dissemination of the present state of knowledge of *Prosopis juliflora* and related arboreal species as (1) a scientific monograph, (2) a reference database, and (3) a technical manual, appropriate to the Indian context. These outputs were successfully published, and will benefit small-scale farmers, poor landless families, artisans, traders and small-scale entrepreneurs within the forest/agriculture interface by facilitating an increase in productivity, utilisation and commercialisation of *Prosopis* products. The project will contribute directly to the goal of the Forestry Research Programme, 'livelihoods of poor people improved through sustainably enhanced production and productivity of forest resource systems', and to have an impact in the development goals of DFID as a whole, by improving the human, natural, financial, physical and social capital of the poor in arid and semi-arid zones. The level of impact will be dependent on uptake by target groups, but direct dissemination of outputs was possible during the lifetime of the project via the training programme funded as a project extension. Over 100 trainees were trained in the management and utilisation of *Prosopis juliflora*.

Acknowledgements

The authors wish to thank all project collaborators for the efforts they have all put in at various stages of this project, and without whom, the outputs would not have been possible. Also, to other staff at CAZRI and ICAR in India who played an essential role in the workshops and training programme.

This report is an output from a research project funded by the United Kingdom Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of DFID. (R7295) Forestry Research Programme.

Project team

Lead institute

PJC Harris – project leader
NM Pasiecznik – project co-ordinator
K Cadoret – project administrator

HDRA – the organic organisation
Ryton Organic Gardens
Coventry CV8 3LG
UK
Tel: 024 7630 3517
Fax: 024 7663 9229
Email: npasiecznik@hotmail.com
pjcharris@btopenworld.com
kcadoret@hdra.org.uk

Collaborative institutes

LN Harsh
JC Tewari
Central Arid Zone Research Institute (CAZRI)
Light Industrial Area
Jodhpur 342003
India
lnharsh@cazri.raj.nic.in
jctewari@cazri.raj.nic.in

P Felker
Facultad de Agronomia y Agroindustrias
Universidad Nacional de Santiago del Estero
Av. Belgrano Sud
CP 4200 Santiago del Estero
Argentina
Peter_felker@hotmail.com

G Cruz
Universidad de Piura
Av. Ramon Mugica, Apdo. 353
Piura
Peru
gcruz@udep.edu.pe

LJ Maldonado
Fundacion Produce Nuevo Leon AC
Av. Constitucion 4101, Ote. Col. Fierro
CP 64690 Monterrey
Nuevo Leon
Mexico
lmaldona@prodigy.net.mx

Contents

Background

Prosopis tree species form a major component in dry forests and savannahs in the Americas, and introductions into Africa and Asia have now made *Prosopis* species, principally *P. juliflora*, one of the most widespread trees in the arid and semi-arid zones of the world. Random introductions of poorly documented germplasm into Africa and Asia, coupled with little transference of the technologies whereby it is utilised commercially in its native range, have lead to the under-utilisation of this forest resource. Thorny *Prosopis* shrubs widespread in Africa and India came from the introductions of inferior germplasm, and has lead to a poor appreciation of the genus. In some regions, *Prosopis* has spread from the low rainfall zones in which it was planted, invading water courses, irrigated agricultural land, and adjacent higher rainfall areas. The need for information concerning the relative invasiveness of species, reproductive biology and methods for controlling the spread or eradication has been strongly demanded by many organisations.

Plantations and natural forests of *Prosopis* provide regionally marketable outputs such as timber and charcoal in the USA, honey in Mexico, animal feed in Brazil, gums, fodder and firewood in north-eastern India, timber, charcoal and human foods in South America, and firewood in West Africa. *Prosopis* species are unusual in their importance both as a vital fuel resource for many of the poorest and most disadvantaged rural and peri-urban inhabitants in South Asia and as economically important sources of timber and animal feeds in the Americas. The different experiences of these disparate economic activities need to be evaluated and disseminated, to develop the potential of diversified output from *Prosopis* forests and plantations in the dry zones of the world. Research trials from several continents have identified superior material in terms of growth, pod production, erectness and thornlessness in a range of rainfall and salinity regimes. There is a need for the dissemination of information concerning this material.

The availability of all the information concerning *Prosopis* genetic resources, superior genotypes and methods for genetic improvement will aid researchers in the selection of the species/varieties/clones best suited for the specific environmental and socio-economic needs encountered in the various regions where *Prosopis* is presently an important resource. Information on the real and potential weediness will also be vital if further introductions into areas where *Prosopis* does not presently exist are to be contemplated. Details of the technologies in use, primarily in the native ranges, and the commercialisation of products, would be beneficial in improving the use of *Prosopis* products in regions where they have been introduced. The incorporation of such technologies would then increase the economic activity in these regions. In the long term, this should allow for an increase in the incomes of families living in the many arid and semi-arid areas where *Prosopis* species are widespread, especially where they have been introduced in Africa and Asia.

This project was designed to collate all published and 'grey' literature to produce a monograph, a technical manual appropriate to the cultural, ecological and economic situation of India, and an updateable electronic database. The need for a definitive synthesis of the information available, on the research undertaken in the many aspects of *Prosopis* and technologies presently in use for the processing and commercialisation of *Prosopis* products, has been identified by many governmental and other research organisations. References in journal publications show that there is insufficient transfer of large amounts of information available in different languages. Much time and limited resources have been spent by researchers conducting work that has already been undertaken in other regions, leading to unnecessary duplication of research. In collating global knowledge on *Prosopis*, these syntheses aim to prevent further duplication, and allow for improved identification of future research needs; the database allowing for the rapid location of any further information required by researchers when identifying and/or undergoing research work.

A very extensive body of literature on *Prosopis* already exists, but much exists only as 'grey' literature, in regional or less well known journals, and in many languages. The most comprehensive sources of information on *Prosopis* currently comprise of the published proceedings of national and international conferences. Of most value are those from international conferences, specifically on *Prosopis* species, in Africa, Chile in 1984, Recife, Brazil in 1986, Durham, UK in 1992, Jodhpur, India in 1993 and Washington DC in 1996. Although valuable, each of these is primarily a collection of papers on selected research and development topics and few attempts have been made to synthesise this information into a comprehensive, concise and authoritative monograph. Other publications on *Prosopis* include general information without detail or have been limited to particular geographic areas or topics. Furthermore, there is currently no comprehensive practical field guide which covers the silviculture and utilisation of *Prosopis*. There are many other *Prosopis* programmes in progress covering animal and human nutrition, genetic improvement, molecular taxonomy, nitrogen fixation, timber utilisation and soil amelioration which are providing essential and current information.

Monographs on tree species of wide geographic range and of major commercial and domestic importance are the FRP products for which there is most consistent demand. In India, ICAR supported the establishment of a national *Prosopis* network in 1993 to address a perceived lack of information flow among *Prosopis* researchers. The Ministry of Agriculture in Brazil has received FAO-funding for a Technical Cooperation Programme on *Prosopis* as an economic resource. The demand for information exchange on *Prosopis* has inspired a *Prosopis* e-mail discussion list linking 77 organisations in sixteen countries. The current and potential importance of *Prosopis* species has been highlighted by recent DFID projects in India, Cape Verde and Nigeria.

Project purpose

The purpose is to apply new knowledge to problems in forest and tree resource management, via the collation and dissemination of the present state of knowledge of *Prosopis juliflora* and related arboreal species as a monograph and database, and technical manual, appropriate to the Indian context. This will benefit small-scale farmers, poor landless families, artisans, traders and small-scale entrepreneurs within the forest/agriculture interface by facilitating an increase in productivity, utilisation and commercialisation of *Prosopis* products.

Research activities

The following are the numbered project activities (1-9) as stated in the original funding proposal (RD1), with the addition of activities 10 and 11 which resulted from the training phase (project extension). Each is followed by comments and any unforeseen difficulties that occurred during each.

1. E-mail conference of authors. To further refine format and responsibilities. In addition to regular e-mail contact formal e-mail conferences, as milestones, will be held in months 6 and 12, 15. ***Comments****: regular e-mails proved to be the principal form of communication between collaborators, with 'circulars' and individual contact.* ***Unforeseen difficulties****: there were some difficulties early on in the project in having e-mail contact with all collaborators, one having relocated, others with server problems.*

2. Comprehensive survey of *Prosopis* literature. A comprehensive literature survey of nine months duration will be carried out utilising major international databases, but also by direct approaches to known centres of excellence, networks, research institutes, NGOs, national development groups and individual farmers and businessmen. Co-authors will search and provide hard copies of all grey literature pertaining to *Prosopis* from their region and assist in obtaining locally available published material. ***Comments****: International databases proved to be the single largest source of reference data. All collaborators provided substantial lists of references from their own specific subject area and/or geographic location. Many other researchers and development workers responded positively to requests for information, sending lists, and packages of publications, and who have been gratefully acknowledged in the database and monograph. However, the information request via mail shots which followed, led to very little extra information. Additional references were obtained from reading through reference lists of major publications and reviews.* ***Unforeseen difficulties****: none.*

3. Write monograph. Sufficient information will be available from Month 5 for the preparation of first draft chapters at HDRA. From Month 9, each draft chapter will be distributed to all co-authors for their additions and editing. This process will continue until a final draft is agreed and the complete monograph is ready for external review. Further revision as appropriate, will be undertaken after review. ***Comments****: writing of the first chapters had to wait for collaborators to decide the taxonomic scope of the monograph, and to agree with legume taxonomists' on the geographic range of the selected species. The first drafts of each of the original five chapters were written as planned, one each month.* ***Unforeseen difficulties****: additional time was required between editing stages for the receipt of comments from some project collaborators, and with several re-edits required before external review. Significant further editing was required after the reviews, and after the official end of the project when all co-authors had other responsibilities.*

4. Workshop. A three-day workshop for approximately 40 participants will be held at CAZRI to define the strategy, format, content, style, dissemination pathways, target institutions and ultimate beneficiaries of the technical manual. Participants invited will include authors, and representatives of Indian intermediate users and target institutions, with special emphasis on institutions likely to utilise the technical manual for training and extension. An output of the workshop will be a questionnaire aimed at collecting information on the current utilisation of relevant *Prosopis* species, which will provide base-line data against which the impact of the technical manual could be evaluated. The questionnaire will also obtain the views of a broader range of target institutions on the content and probable uptake and impact of the technical manual. Recipients, identified by the workshop, will include target institutions, likely to utilise the technical manual for training and extension, and representative end users. A further day will be devoted to an executive meeting of authors. ***Comments****: the workshop was conducted to plan, with a range of representatives from Indian target institutions and intermediate users present, and all project collaborators attended. The scope, content and format of the technical manual were discussed and agreed, and the executive meeting of collaborators achieved all objectives (see workshop report, Pasiecznik* et al*, 1999). It was agreed that Dr JC Tewari (CAZRI) would join the team, sharing the responsibilities of LN Harsh.* ***Unforeseen difficulties****: the need to find a date suitable for all collaborators and the host institute lead to the workshop being held some months later than expected. While the questionnaire was drawn up and distributed, there was such a poor response that it was decided that no information could be practically obtained from it.*

5. Construct database. Information gathered in the literature survey will be abstracted and entered onto a database by a half-time secretary/ data processor. ***Comments****: Papyrus reference database software was selected on the grounds of having been developed specifically for references, with in-built error-identification on data entry, and handling software can be installed and distributed free with each data set (where with other reference software, this could have added an extra £2 to the cost of each database. Only the title of each paper was included, as including abstracts would have breached copyright laws of the international database companies. Keywords and keyword-combinations were however individually assigned to the references from an agreed list of 40 to facilitate searching.* ***Unforeseen difficulties****: Data entry, with references obtained from a range of sources, took more time than envisaged. Many of the duplicate references which arose from different sources of data differed by a few characters and could not be identified automatically, which required significant additional time to search and delete manually. Also, individually assigning up to 40 keywords to the final 6500 references also proved time consuming.*

6. Write technical manual. Sufficient information from the literature survey and questionnaire will be available by Month 6 to prepare the first draft of the technical manual at HDRA, following regular exchange of information and ideas between authors, especially Dr LN Harsh. Further revision as appropriate, will be undertaken after review. ***Comments****: the additional project collaborator, Dr JC Tewari, working closely with Dr LN Harsh, was the principal author of the technical manual, based on the format and content agreed at the initial workshop.* ***Unforeseen difficulties****: none.*

7. External review of monograph and manual. The complete draft monograph will be sent to three independent reviewers at least one of whom will be nominated by DFID. The complete draft technical manual will be sent to two independent reviewers in the UK, offering forestry/agroforesty and development/extension expertise. The technical content and applicability of the manual for training and extension will be reviewed by target institutions. ***Comments****: volumes were externally reviewed as planned.* ***Unforeseen difficulties****: none.*

8. Print/ publish outputs. The monograph and technical manual will be ready for printing by Month 15 and printed and proof read by Month 17. The database will be validated and copied. ***Comments****: Both the monograph and database were published by known publishers in the UK, while printing of the technical manual (both English and Hindi versions) were sub-contracted to a local publisher in Jodhpur. Project collaborators were very happy with the quality of the finished publications (see technical manual, Tewari* et al*, 2000, database, Cadoret* et al*, 2001, and monograph, Pasiecznik* et al*, 2001).* ***Unforeseen difficulties****: there were variable delays in the publication of project outputs. The technical manual underwent slight delay due to problems with printing, while with the database there were further delays due to final formatting, but both were published within six months of official project completion. There were unforeseen delays in reaching publication stage of the monograph, due to the difficulties for the eight co-authors to find time for exhaustive re-editing following the official end of the project (see above).*

9. Disseminate outputs. Copies of the outputs will be distributed free of charge to appropriate government agencies, research institutions and NGOs in relevant FRP partner countries. Copies will be distributed to natural resources and forestry advisers, policy makers and practitioners in national and international agencies. Copies will also be available free to individuals and organisations working in countries eligible for British aid. Further copies will be offered for sale to those not eligible for free copies. The arrangements for sale should be agreed as part of the contract negotiation with DFID. The outputs will be advertised widely through the usual publishers' channels and also through established networks, discussion groups and via HDRA and other web sites. ***Comments****: half of all copies published have been disseminated to target institutions (see appendix 2). DFID, ICRAF, FAO and other organisations have provided lists of recipients, as agreed. The remaining half with be distributed following further expected requests to follow subsequent promotion (journal reviews, web-promotion, e-mail shots, through networks, word of mouth etc.). No contract agreement has yet been made with DFID regarding possible sale of project outputs.* ***Unforeseen difficulties****: none.*

10. Conduct training programme planning workshops and initial project maturation meetings. Discuss with identified target institutions and ultimate beneficiaries at the four chosen locations in India, their requirements for content and format of proposed *Prosopis* training programme. ***Comments****: response from intermediate and end users was much higher than expected in three of the four chosen centres, and it was agreed to reduce the proposed training to three and not four sites (see training planning report, Pasiecznik* et al*, 2000).* ***Unforeseen difficulties****: bureaucracy lead to delays in holding the planning workshops.*

11. Conduct training programme. Undertake all activities relating to the training programme, as agree during the planning phase. ***Comments****: all three training programmes were over-subscribed. There was widespread interest from many parties, with extensive press coverage and demand for further training and demonstrations programmes (see training final report, Pasiecznik* et al*, 2001).* ***Unforeseen difficulties****: delays in carrying out the training were caused by bureaucracy and a natural disaster.*

Outputs

***Comments**: All outputs were achieved, as anticipated by the project proposal below, with only minor modification. Project collaborators agreed at the initial workshop that the scope of the monograph should include P. juliflora and P. pallida only, while the database should encompass the whole genus. The monograph was slightly shorter than previewed (162 pp), while the technical manual was more comprehensive (96 pp) due to changes to format and content agreed by collaborators. Also, in addition to the 1000 copies of the technical manual in English, additional time spent by the Indian collaborators and economies in publishing costs allowed for the translation of the technical manual into Hindi, and the publication of 200 copies for use in the training programme project extension.*

Published outputs

(1) Scientific monograph
A monograph on *Prosopis juliflora* and related arboreal species. A monograph (1000 copies x 200 pp) covering all aspects of the species with the greatest potential for improvement, *P. juliflora*, and including species that hybridise with it (including *P. affinis, P. alba*, *P. caldenia*, *P. chilensis*, *P. glandulosa*, *P. laevigata*, *P. nigra*, *P. pallida*, *P. velutina*). Topics covered will include taxonomy, ecology and reproductive biology, utilisation, product processing and marketing, husbandry, pests and diseases, and also, management, control, and environmental impact. *P. tamarugo* (Chile), *P. cineraria* (Asia) and *P. africana* (Africa), the species important in their native range will not be included.
Status: achieved.
PASIECZNIK, N.M., FELKER, P., HARRIS, P.J.C., HARSH, L.N., CRUZ, G., TEWARI, J.C., CADORET, K. AND MALDONADO, L.J. (2001) *The* Prosopis juliflora – Prosopis pallida *Complex: A Monograph*. 162 pp. English. (Book)
ISBN: 0 905343 30 1.
1000 copies published.

(2) Technical manual.
A practical manual (1000 copies x 50 pp) designed for use by farmers, craftsmen, researchers and extension officers in India, with potential value elsewhere. The manual will cover in simple terms, the cultivation, management and processing of selected *Prosopis* species for range of products and uses possibly including animal feedstuffs, timber, honey, gums, fuelwood, charcoal and amenity planting.
Status: achieved
TEWARI, J.C., HARRIS, P.J.C., HARSH, L.N., CADORET, K. AND PASIECZNIK, N.M. (2000) *Managing* Prosopis juliflora *(Vilayati babul) - A Technical Manual*. CAZRI, Jodhpur, India and HDRA, Coventry, UK. 96 pp. [Field]. English and Hindi. (Manual)
ISBN 0 905343 27 1.
1000 copies (in English) and 200 copies (in Hindi) published.

(3) Reference database.
An electronic, searchable and updateable database containing the bibliographic details, with abstracts where possible, of the literature reviewed. This will be available by FTP from HDRA/Coventry University, in disk form (1000 copies), with read only Papyrus reference handling software, and possibly as a CD ROM.
Status: achieved.
CADORET, K, PASIECZNIK, N.M. AND HARRIS, P.J.C. (2000) The Genus *Prosopis* - A Reference Database. CD ROM. 1000 copies. HDRA, Coventry, UK. [Field] (CD ROM)
ISBN 0 905343 28 X.

Unpublished reports

PASIECZNIK, N.M. AND HARRIS, P.J.C. (2001) *Prosopis juliflora* and related arboreal species: a monograph, extension manual and database. Final Technical Report. Internal report to DFID-FRP. Project R7295. HDRA, Coventry, UK. 21 pp.

PASIECZNIK, N.M. TEWARI, J.C. AND HARSH, L.N. (2001) Management and utilisation of *Prosopis* juliflora. Training programme report, May 2001, India. Final Report. Internal report to DFID-FRP. Project R7295. HDRA, Coventry, UK. 56 pp + annex.

PASIECZNIK, N.M. (2000) Management and utilisation of *Prosopis juliflora*. Training programme planning workshop reports. 18 August - 7 September, India. Internal report to DFID-FRP. Project R7295. HDRA, Coventry, UK. 38 pp.

PASIECZNIK, N.M., HARSH, L.N. AND TEWARI, J.C. (1999) *Prosopis*: state of knowledge. Workshop report. 8-11 February 1999, CAZRI, Jodhpur, India. Internal report to DFID-FRP. Project R7295. HDRA, Coventry, UK. 36 pp.

Other dissemination of results

Publications

PASIECZNIK, N.M. (2001) *Prosopis* – management by exploitation, not eradication, required to control weedy invasions. In: ACOTANC 2001, the 9th Australasian Conference on Tree and Nut Crops. Perth, Australia, 13-19 April 2001.

PASIECZNIK, N. (2001) Tree that could bring life to the deserts. *The Organic Way* No. 165. pp. 18-19. HDRA, Coventry, UK. (Newsletter article)

NEELAKANTAN, K.S. (2001) Management and Utilization of *Prosopis juliflora*: Training Manual. Tamil Nadu Agricultural University, Mettupalayam, India. 90 pp.

The media

All three project-related visits to India were covered by local television stations and state newspapers and reported in the workshop and training reports. On a national level, All India Radio covered 'the role of Vilayati babool (*Prosopis juliflora*), in Desert Development (February 1999); the training video was used as an educational film in the nation-wide University Grants Commission Distance Learning Programme Countrywide Classroom Network (October 2000); and the Times of India reported on the final training programme (May 2001).

The internet

Project outputs are detailed and promoted via the HDRA website (www.hdra.org.uk). Discussions are underway to have outputs promoted via links from websites of other organisation and intermediate users. Outputs are to be promoted via selected existing e-mail networks.

Contribution of outputs

Contribution of outputs to DFID's development goals

It has been estimated that up to one-sixth of humanity may depend on *Prosopis* species as their main source of firewood. This project has gathered the global knowledge of the most widespread of these species, detailing the many multiple uses of the tree, and possibilities for improved management and utilisation. Application of such knowledge has the potential to make significant and substantial impact on the livelihoods of poor people living in arid and semi-arid zones, particularly where *Prosopis* are already widespread but under-utilised, notably in India and Africa.

The project outputs are expected to contribute directly to the revised goal of the Forestry Research Programme, "livelihoods of poor people improved through sustainably enhanced production and productivity of forest resource systems", and therefore to have an impact in the development goals of DFID as a whole, by improving the human, natural, financial, physical and social capital of small-scale farmers, poor landless families, artisans, traders and small-scale artisans in the forest/agriculture interface in arid and semi-arid zones.

This can only occur if there is uptake of the information contained within the project publications (outputs). Application of the new knowledge directly to ultimate and intermediate beneficiaries has been a part of the project with the training programme conducted in India. Experiences and feedback from the training programme provide a valuable indicator of the contribution of the project to meeting the above goals, and are detailed in the following sections.

Identified promotion pathways

Six aspects of promotion to target institutions and beneficiaries were identified in the original project proposal, followed by additional comments in italics.

1. Project outputs will be widely advertised via, existing e-mail networks, relevant internet homepages, development publications and the popular scientific press. Copies will be sent for review to relevant journals. Publicity will be sought on BBC World Service, and national and local radio and television in partner countries.
2. HDRA, CAZRI and ICRAF will be the major dissemination centres. Outputs will be posted free of charge to all target institutions identified and to other governmental and educational establishments, research institutions and non-profit making organisations working in countries eligible for British Government aid. The technical manual will be distributed to target institutions in India via CAZRI.
3. The publishers will be responsible for circulation of the outputs for sale to those not eligible for complimentary copies via established wholesale and retail distribution networks.
4. No further stages are required to develop outputs.
5. Baseline data on the utilisation and productivity of *Prosopis* will be included in the monograph and database. Immediate impact of these outputs on research and development activities can be assessed by the frequency of their citation in books, articles and reports. Longer term impact can be assessed by reference to published data, and national and international statistics on the utilisation and productivity of *Prosopis*. HDRA are willing to carry out this impact assessment approximately two or three years after project completion, although this would require a further agreement with DFID.
6. Recipients of the technical manual in India will be requested to return a detailed questionnaire on all aspects of *Prosopis* relevant to their intended beneficiaries. A repeat questionnaire assessment approximately two-three years after project completion would request information on the use of the technical manual and would form the basis of more detailed impact assessment. Again, this would require a further agreement with DFID.

Dissemination of project outputs has been carried out as planned. Already feedback has been received on the monograph and CD-ROM (see appendix 3). While it was stated that 'no further stages are required to develop outputs', it was noted by the project committee, and by FRP, that a training phase that would directly utilise the technical manual, would assist the knowledge in reaching ultimate beneficiaries. It was suggested in 5 and 6 that HDRA could conduct an impact assessment some years after publication of project outputs, but which would require further agreement from DFID. No such discussions have yet taken place.

Training programme

Project R7295 funded a workshop in 1999, which led to the production of a technical manual in 2000, translated into Hindi in 2001. The training programme was originally conceived as a necessary continuation of the work, following the publication of the technical manual (Tewari *et al* 2000). This manual was intended for use in practical training courses to be run in India. The possibility of funding for such courses was suggested by DFID-FRP early in 2000. A proposal was submitted by HDRA for conducting a series of training courses in India in collaboration with existing collaborators in CAZRI, Jodhpur, which was accepted for funding. Planning workshops in 2000 consolidated opinions (see training programme planning report, Pasiecznik *et al*, 2000), leading to the formulation of a training programme held in May

2001. While only 70 trainees were planned and budgeted for, over 100 were trained in the 'Management and utilisation of *Prosopis juliflora*', and more had to be turned away indicating the high demand. The programme comprised three four-day courses, held in Jodhpur (Rajasthan), Bhuj (Gujarat) and Mettupalayam (Tamil Nadu). Trainees were made up from selected target groups, with approximately 30% from NGOs, 20% state foresters, 20% farmers, 20% researchers and 10% from private businesses.

Trainees were very pleased with the training courses, noting that the issue of *Prosopis* was so important, but totally overlooked. Many wanted the space to speak out on what is such a 'hot topic' at present in many states, and this training provided that platform. Others arrived holding many misconceptions as to the negative values of the tree, and were enlightened with displays, demonstrations, food tasting and presentations on the many potential products and simple management practices. The open forum discussions on the first day of each training were generally heated affairs, with the two camps, 'promote' and 'eradicate' airing their views. By the last day however, there were only positive comments, and calls for further training, extension and development to realise the potential of *Prosopis* in revolutionising rural economies in India's dry zones. Several foresters said they would begin to develop economic models for *Prosopis*-based systems in their areas, some farmers and land-owners said they would immediately use some of the management techniques promoted on *Prosopis* on their land with the aim of pod and timber production, and two others placed firm orders for *Prosopis* timber during the programme. Trainers were also more than pleased with the outcome of the training programme, surprised by the overwhelming response, immediate impact and desire for further activities.

The core policy implications arising from the training programme included a range of issues, with immediate recommendations being that a national seminar be held as soon as possible to bring the latest development to the highest level, development of regional and local '*Prosopis* committees, and incorporation of existing knowledge into present extension programmes, with more training courses to be carried out. New appropriate technologies should be demonstrated 'on-farm', with the establishment of selected 'model *Prosopis* villages' in each key state. More detail of present use of *Prosopis* is essential, and possible from existing records. Economic models can then be established and tested in the field, alongside silvicultural systems also essential for the development of the resource. Credit for private enterprise and promotion of farmer co-operatives is needed, and assured markets must be developed through positive press and government intervention. Discussions held with the DDG (NRM) ICAR and Director, CAZRI lead to full support being offered for the development of a larger scale programme based on the results of R7295, to use the global knowledge and local experience collated to maximise the production and utilisation of products from *Prosopis*-based agroforestry systems. These are detailed below (see also training final report, Pasiecznik, 2001).

Project maturation

It was agreed as part of the training extension, that as it would not be feasible to conduct a project maturation workshop with all project collaborators in attendance, these activities would be incorporated as a series of meetings and electronic exchanges into the training programme. Also, the nature of such a 'monograph' project means that assuming the successful publication of outputs, there is less to discuss than with standard research projects. Several comments from project collaborators have already been incorporated into comments on project activities (see earlier). All were very happy with the quality of project publications, and receipt of further requests have indicated a continued demand for outputs.

The following project maturation appraisal by Pratap Narain, Director, CAZRI, provides a good summary of project R7295 from the head of the principal collaborative institute:

- Although only 'inheriting' the collaborative research programme when joining in 1999, very happy with it, but can best comment on the training component, of which we discussed from the initial concept.
- The publications produced so far are of an outstanding quality, a credit to the authors, and to the institutes involved, and in particular the production of a quality technical manual in Hindi, one of the first of its kind. Wider use should be made of the publications, also of the monograph when published.
- Very happy with the use of the CAZRI regional research stations, especially that at Kukma, Bhuj.
- The interest and involvement of many senior foresters in Jodhpur, and widespread press coverage given, even in the Times of India, shows the great importance of this topic, given that it is often treated as a 'dubious' area.
- It is important that CAZRI, as national (and global) experts in the field of *Prosopis* R&D, take a stand in this heated debate, and push forward at all levels a reasoned response to circulating misconceptions.
- Researchers are not trainers. However, the CAZRI extension divisions is at present not up to standard, so in this case, I allowed the training to be organised by the existing project collaborators at CAZRI, with the inclusion of an additional member of staff with extensive extension experience.
- Content with the financial arrangements and organisation from UK end.
- CAZRI wish to put all efforts possible into extending project activities, to maximise use of existing collaboration and look to developing R&D work at Bhuj RRS, rehabilitating the earthquake zone, reversing weedy invasions of *Prosopis* and changing the negative views of this species leading to rural revival.

Statement of CAZRI/ICAR intentions

Discussion with Director, CAZRI, Dr Pratap Narain, on development of R&D at Bhuj RRS (one of the training centres), with potential CAZRI-HDRA collaboration:

- Two options appear open: (a) the first being extension of the training programme only, possibly including development of a *Prosopis* 'model village' for demonstration purposes, and (b) the second being a broader watershed level programme, which would include training and demonstration in *Prosopis* as part of the pro-active development of productive, sustainable, *Prosopis*-based agroforestry systems.
- If training and demonstration only, we may consider a one, two or three year programme for Kutch district only, or including neighbouring parts of Gujarat and/or Rajasthan, or even the whole north-west region of India.
- If a watershed programme, we have already selected one of 1600 ha around Kukma, of which about 600 ha could be selected for active R&D. ICAR offer Rs. 1000/ha for watershed development, which requires supplementing. This project would be multi-disciplinary, involving experts in horticulture, silviculture, extension, soils, hydrology and engineering. *Prosopis* training would form a part of the extension, and R&D on *Prosopis*-based agroforestry systems as part of silviculture. A five year programme is envisaged, possibly three in the first instance.
- There is a need for a pre-project, preliminary 'initiation workshop', for either of the above, and which may decide whether efforts should be concentrated only on certain aspects, preferred by the various stakeholders. This will require a quick 'reconnaissance' survey of population dynamics, maps and regional data available on resources. All possible stakeholders must be involved at this preliminary stage, including CAZRI, village representatives, progressive farmers, local NGOs, local artisans and businessmen, politicians, ecologists, development agencies (local, national and/or international), Forest Department and the State Forest Development Corporation. A two to four day workshop could be held in Bhuj in 2002. The initial estimated cost of carrying out the survey work, workshop, and production of a full funding proposal is £10000.

A specific meeting was called by the Deputy Director General (Natural Resource Management) ICAR, Dr JS Samra on 8th May, following discussions (2) on a future CAZRI-HDRA collaborative project.

- While national, regional, state and district-level R&D has its value, we need geographic focus, and now we have accepted the watershed as the accepted level now.
- The watershed level approach is to be continued into the 10th Five Year Plan (2002-2007), but with a new dimension, that agricultural research will be extended beyond the farm gate, to include full commodity chain analyses, expanding R&D from multi-disciplinary to multi-sectoral.
- First choice for a watershed would be in the Banni region, to which Bhuj is the 'gateway', due to specific social and ecological problems, and that *Prosopis* is the only tree species present and both the cause of, and the solution to, the existing problems.
- Second choice, if political considerations (being close to the Pakistani border) prevent its selection, would be the Kukma watershed surrounding the RRS. Taking on both would be too much work.
- In both, in fact in much of Kutch, there are only two principal plant products – *Prosopis* and grasses, leading to animal production as the main land use activity. But what about small timber, gums, honey etc?
- Develop the production of raw materials for industry, alongside stimuli for these industries, and the whole local economy will see the benefits.
- There is a need to develop silvicultural systems for *Prosopis*-based agroforestry systems, depending on site type, and desired end products, and how to modify systems to maximise production of a variety of products, including understorey grasses.
- There is a need to think holistically, to understand the hydrology under different stand types, different effects on soil, sustainability etc.
- The livelihoods approach is essential, and required from the outset. First find out how are the people living, from where do they obtain their livelihoods. You have hearsay, some local opinions, but concrete, quantitative data is required. What are the sources of income at present for different social groups, e.g. the landless, the small farmer, and what are the on-land and external sources of income?
- What are the commodity chains for each agricultural product, and who are the stakeholders along each chain?
- Also, there are tenure problems, especially in this district, and over 37% of all land is 'unrecorded', such as much of the Rann of Kutch, with no legal owner, i.e. totally common property resource. Other is state, forest or revenue land, some panchyat (village common) land, some private, and clearly land ownership will have a major bearing on management practices.
- A full socio-economic survey is clearly the first stage of any future project.
- ICAR and CAZRI fully support the possibility of further HDRA collaboration on resolving the '*Prosopis* problem' in Kutch, aiding in the rehabilitation of this earthquake-devastated region, and promoting the role of the ICAR via the RRS, Bhuj, in improving and sustaining agricultural productivity. ICAR has sanctioned Rs. 1 crore for the construction of new buildings at the RRS, including administrative block, laboratories and accommodation; also Rs. 11.5 lakh for a run-off pond (in construction), and Rs. 6 lakh for a tube well and pump.
- It was agreed that CAZRI would prepare a 'position paper' on the Banni problem. NM Pasiecznik agreed to draft a pre-concept note on a watershed level project, based on existing information, for circulation and initial discussion in the first instance.

Conclusions

Two 'sets' of recommendations are proposed by the project team and listed below. The first are specific to India, being the principal policy recommendations drawn from the training programme, arrived at from compiling all comments, suggestions and recommendations gathered from trainers and trainees during the three training courses (see training final report, pp 50). The second are global recommendations for further research and development that resulted from the collation of knowledge and production of the monograph and database (see Pasiecznik *et al*, 2001, pp 133-135).

Policy recommendations - India

Policy/institutional

- Hold a national seminar as soon as possible inviting representatives from all stakeholder groups, and top ministers.
- Form national, regional and local *Prosopis* committees to discuss all the issues, with NGOs, farmers, sarpanch, forest officers, ministers, research institutes, private enterprise etc.
- Joint management of roadside trees, - with forestry department paying villagers day rates to thin, single and prune, generating employment and training villagers, and future responsibility could be handed over to willing sarpanch;
- The area under *Prosopis* must be recorded, in village accounts, and in district and state level e.g. through annual seasons and crop report.
- Detail the quantities of charcoal exported from state to state, easily achieved by pooling details from 'certificate of origin' issued by all divisions of the state forest department.
- Recommend state governments to purchase *Prosopis* pod flour for distributing as a subsidised livestock fodder during the extended droughts, with *Prosopis* cheaper and more nutritious than the alternatives, locally available and would stimulate the rural economy and employment generation.

Extension

- Education in the villagers, especially to women and illiterates on the value of the pods as a valuable and healthy animal feed, flour for human foods, wood for timber, gums, honey, etc., become an integral part of all rural extension activities
- Request for more training course to be carried out in the other districts, which NGOs could organise.
- Demonstrate cheap, simple improved kilns for charcoal production and small scale pod processors, which could be made locally, and processing of *Prosopis* wood for furniture making to be strengthened
- Demonstration farms should be established around the district or state, either on state land or preferably with the support of progressive farmers. There is one such farmer nearby, who is beginning to single *Prosopis* on his land.
- Establishment of model *Prosopis* villagers to implement and demonstrate management and utilisation of *Prosopis*.
- Gujarati and Tamil language versions of the technical manual were urgently requested.

Marketing

- Use state forest corporations to promote and market *Prosopis* tree product, and establish a State Forest Development Corporation (SFDC) for Rajasthan
- Farmers co-operatives should be encouraged to increase the collective bargaining power among the producers
- Establish independent funds solely for the purpose of offering credit for commercial *Prosopis* processing, as banks and other lending institutions are unwilling to provide credit to *Prosopis*-based business.
- Create assured markets for *Prosopis* products through positive 'press' and pressure on private enterprise
- Government intervention required to establish suitable industries for tree product processing
- State government to guarantee a market price for an initial period to stimulate management, production and processing of new products such as *Prosopis* timber or pods.

Research

- Fast-growing thornless *Prosopis* should be developed through tree improvement programmes and seed production areas should be established, and supply of quality seeds and seedlings to farmers
- Silvicultural practices need to be developed to obtain optimum rotation ages for maximising volume production
- Develop cheap, simple improved kilns for charcoal production, small scale pod processors, and suitable saw-milling technologies for processing *Prosopis* wood for furniture making
- Develop economic models for *Prosopis*-based land-use systems, for all tree products and associated outputs under different site and market conditions

Research and development recommendation - global

Use of improved genetic material
- Complete, range wide collection of seed, herbarium material, pods and wood
- Full analysis of genetic variation and resolve continuing taxonomic problems
- Identify superior germplasm in terms of pod quality, timber quality, tree form and thornlessness
- Make available genetically improved material of *Prosopis* species

Application of improved management interventions
- Elucidate the effects of selected management interventions on yields of all tree products and economic viability
- Evaluate the effects of management interventions on the environmental (effects on soil salinity, water use etc.)
- Use of different management programmes in controlling weeding invasions
- Development of integrated agroforestry land use systems incorporating *Prosopis*

Development and application of processing technologies
- Undertake ergonomic, technical and economic studies on pod and timber processing technologies for *Prosopis*
- Evaluate and develop suitable technologies for processing *Prosopis* tree products are adapted for village-scale use
- Develop high-technology solutions for extraction of high-value substances from seeds, wood, gums and leaves

Commercialisation of *Prosopis* tree products
- Promote *Prosopis* as low-cost raw material producing high-value products through local processing
- Conduct local surveys to elucidate possible role of *Prosopis* tree products in the regional economy
- Identify 'niche' export markets and promote through trade fairs etc.

Summary

Overcoming researchable constraints
The same four key areas of further research needs that were identified by collaborators during the production of the monograph and database were also noted by target institutions and intermediate users in India: genetic improvement, improved silviculture, better processing technologies, and increased commercialisation. Several project collaborators continue to be involved in research programmes in these areas and are developing further research proposals which aim to overcome these constraints.

Overcoming developmental constraints
It was clear that many suitable technologies are in existence, but need to be applied to the real situation in the field. Those involved in the training programme stressed the need to incorporate new knowledge into existing extension activities, develop further the training with the addition of demonstration farms or villages, and translate technical manual into other local languages. Project collaborators are developing proposals for further training and demonstration activities.

Overcoming commercial constraints
A deeper understanding of these constraints requires an economic research project, looking specifically at *Prosopis* and other arid zone tree species' part in the local economy, and potential for rural development. However, any further development will be greatly enhanced by changes to existing, unfavourable aspects of the policy environment. Several of these changes were suggested by intermediate and end users in India, and will be used for the formation of policy briefs as outputs of this project.

Appendices

Appendix 1. Logframes

Original logframe incorporating training/evaluation project extension

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Goal			
The use of trees within farming systems, including community and farm woodlots, optimised			
Purpose			
Multipurpose tree species with improved performance identified and their use in agroforestry systems promoted			
Outputs			
1. Monograph on *Prosopis juliflora* and related arboreal species	1. Distributed monograph	1. Published monograph	Intermediate users utilise the information in research and development Publication in English is not a constraint
2. Technical manual for India on management of *Prosopis*	2. Distributed technical manual	2. Published technical manual	Target institutions incorporate technical manual into training and extension activities Technologies successfully transferred to ultimate beneficiaries
3. Database of *Prosopis* literature	3. Distributed database by	3. Database	Target institutions have access to suitable technology to use database
4. Training courses on *Prosopis* management and utilisation in India	4. Training courses designed and run	4. 60-80 trainees trained	Common training modules can be agreed
5. Project maturation	5. Final technical report (FTR) submitted and policy briefs produced and circulated	5. FTR and policy briefs	Project collaborators and representatives of governments, target institutions and end users agree to partake in activities
Activities	**Inputs**	**Means of Verification**	**Important Assumptions**
1.1, 2.1, 3.1 E-mail conference of authors to agree format and assign responsibilities reviewed by e-mail at 6 and 12 months	Total Budget: £146904 (incl. VAT) Staff: 60899	1.1, 2.1, 3.1. Agreement on format and responsibilities signed by authors	Access to functioning electronic communications
1.2, 2.2, 3.2 Comprehensive survey of *Prosopis* literature	Overheads: 23601 Capital: 1500	1.2, 2.2, 3.2. Database	Willingness and ability of institutions and individuals to provide required information
1.3 Write monograph	Travel/subsistence: 6325	1.3. Monograph	Information received without undue delay
2.3 Workshop at CAZRI with target Indian institutions and representatives of ultimate beneficiaries to define strategy for technical manual and content of questionnaire	Miscellaneous: 32700 VAT: 21879	2.3. Report of Indian workshop	Active participation by target institutions and representatives of ultimate beneficiaries Workshop reaches a consensus on manual and questionnaire
2.4 Send questionnaire to target Indian institutions		2.4. Collated results of questionnaire	Identification of adequate range and number of intermediate users
3.3 Construct database		3.3. Database	Suitable technology/ software identified and available No conflict with copyright
2.5 Write technical manual		2.5. Technical manual	Information adaptable to a technical format
1.4, 2.6 External review of monograph and manual		4. Reviewers reports on draft manuscripts of Outputs 1 and 2	Agreement of suitable reviewers and timely review
1.5, 2.7, 3.4 Print/publish outputs		1.5, 2.7, 3.4. Outputs 1,2 and 3	Printers conform to contracted

		published	deadlines
1.6, 2.8, 3.5 Disseminate outputs		1.6, 2.8, 3.5. Circulation lists for Outputs 1, 2 and 3	Appropriate recipients identified
4.1, 5.1 Conduct training programme planning workshops and initial project maturation meetings	Total extension budget: 29200 (excl. VAT) UK Staff: 4400 UK Overheads: 2200 Workshops/training: 17800 Travel/subsistence: 4800 + VAT: 5110	4.1, 5.1 Report of training programme planning workshops and initial project maturation meetings	National co-ordinators identify suitable sites and staff for training Common training modules can be agreed All bureaucratic and practical obstacles overcome
5.2 E-mail project evaluation and policy discussions with collaborators		5.2 E-mail discussion document circulated and exchanges between collaborators	Project collaborators agree to partake in additional activities
4.2 Conduct training programme		4.2 Trainees trained	Suitable trainees identified and in attendance
4.3, 5.3 Training and project evaluation workshop undertaken		4.3, 5.3 Final technical report produced and policy briefs distributed	Invitees from relevant authorities attend

Role of *Prosopis* monograph project in revised FRP outputs and activities under newly assigned purposes (Annex 2, DFID-FRP, 2000*)

NARRATIVE	INDICATORS OF ACHIEVEMENT	MEANS OF VERIFICATION	RISKS AND ASSUMPTIONS
PURPOSE New knowledge applied to problems in forest and tree resource management, the resolution of which benefits **small-scale farmers, poor landless families, artisans, traders and small-scale entrepreneurs** within the Forest/Agriculture Interface	-by 2005, increased **financial capital** for target groups through : expanded tree-based employment opportunities ; increased biological and technological productivity ; higher product prices through greater efficiency and effectiveness in the application of labour resources ; and improved availability of subsistence items in land-use systems involving the management of forests and trees -by 2005, increased **sustainable natural capital** for target groups through : reduced variability and risk in production ; and the development of new tree-based production alternatives -by 2005, increased **physical capital** for target groups through :improved information pathways and the production equipment and means by which poor people earn their living -by 2005, increased **social capital** for target groups through :adequate control of access to relevant forest resources ; enhanced institutional capacity ; and an enabling policy environment -by 2005, increased **human capital** for target groups through : enhanced forest management skills ; less destructive tree-product harvesting and improved processing, packaging and marketing capability ; and healthier nutritional use of indigenous tree products	National and local adoption rate surveys National and local socio-economic surveys	Poor people invest benefits to improve choices and options for livelihood strategies
OUTPUTS 1. Strategies developed and promoted to maximise benefits to **small-scale farmers, poor landless families, artisans, traders and small-scale entrepreneurs** accruing from current global issues or generic tools. 2. Knowledge relating to land-use and forest decision making promoted for the benefit of **small-scale farmers, poor landless families, artisans, traders and small-scale entrepreneurs** 3. Strategies for constructive institutional change and reform promoted for **small-scale farmers, poor landless families, artisans, traders and small-scale entrepreneurs** 4. Strategies for improved sustainable livelihoods and income generation for **small-scale farmers, poor landless families, artisans, traders and small-scale entrepreneurs**	2.5 By 2005, monographs and extension manuals prepared on tree species valued by **small-scale farmers, poor landless families, artisans, traders and small-scale entrepreneurs** and promoted	Annual research programme reports External refereeing External P/O reviews Target institutes' reports	Resource managers, producers and processors are able to adopt new technology Enabling cultural, economic, social and political environment exists for widespread application of new knowledge and is not contrary to measures that enhance sustainable livelihoods Capabilities of target institutions radically enhanced
ACTIVITIES 1. Transform previous outputs into formats appropriate to beneficiaries 2. Transform current projects to make their research products more directly useable by beneficiaries 3. Commission new projects which respond more closely to DFID partner country priorities, focus on the very poor, involve stronger partnerships at all stages of the project cycle and include integrally outputs in formats appropriate to beneficiaries 4. Cost-efficient management system put in place			

Appendix 2. Distribution list

The following are the individuals/organisations who have received copies of the monograph and database in December 2001. For recipients of English and Hindi versions of the technical manual, please refer to the training reports (Pasiecznik *et al*, 2000, 2001).

1.	Dr	Brian	Cooper	Biopesticides Project	Antigua
2.	Dr	Carlos A	Carranza	Est. Forestal INTA Villa Dolores	Argentina
3.	Ing	Rubén O	Coirini	Universidad Nacional de Córdoba	Argentina
4.	Dr	Mariano	Cony	IADIZA-CRICYT	Argentina
5.	Dr	Peter	Felker	Universidad Nacional de Santiago del Estero	Argentina
6.	Dr	Mariano	Galera	Universidad Nacional de Cordoba	Argentina
7.	Prof	Juan H	Hunziker	Consejo Nacional de Investigaciones Cientificos	Argentina
8.	Ing	JM	Kozarik	Universidad Nacional de Misiones	Argentina
9.	Ms	Elena	Silnicky	Biblioteca Instituto de Botánica Darwinion (CONICET)	Argentina
10.	Ing	Rolando	Martínez	ITM-FCF-UNSE	Argentina
11.	Dr	Judith	Ochoa	UNSE	Argentina
12.	Dr	Ramon	Palacios	Universidad de Buenos Aires	Argentina
13.	Dr	M	Pia Mom		Argentina
14.	Dr	Beatrice	Saidman	Universidad de Buenos Aires	Argentina
15.	Dr	Anibal	Verga	INTA	Argentina
16.	Dra	G	Verzino	Universidad Nacional de Córdoba	Argentina
17.	Dr	Shane	Campbell	CSIRO	Australia
18.	Mr	Henry	Esbenshade	PGA Inc.	Australia
19.	Ms	Sandy	Lloyd	Agriculture Western Australia	Australia
20.	Mr	Stephen	Midgley	CSIRO-For. & Forest Prods.	Australia
21.	Mr	Barrie	Oldfield	Men Of TheTrees	Australia
22.	Dr	Reiks	Van Klinken	CSIRO-Entomology	Australia
23.	Mr	Noel	Wright	Pilbara Mesquite	Australia
24.	Mr	D	Brown	DFID Bangladesh	Bangladesh
25.	Dr	Z	Hossain	PROSHIKA	Bangladesh
26.	Ms	Bui Thi	Lan	FAO Representative	Bangladesh
27.				Forest Research Institute	Bangladesh
28.	Mr	John	Bazill	DG Development	Belgium
29.	Ms	Elizabeth	Ditchburn	DFID RNR Co-ordinator	Bolivia
30.	Ing	AL	Merida	PROFOR	Bolivia
31.	Ms	Gail	Marzetti	DFID/British Council - Brasilia	Brazil
32.	Mr	Mario	Antonino	International Prosopis Association	Brazil
33.			Biblioteca	SUDENE	Brazil
34.	Mr	Eddie	Edmundson	British Council	Brazil
35.	Dr	VA	Hoeflich	CNPF-EMBRAPA	Brazil
36.	Dr	Paulo Cesar	Lima	EMBRAPA-CPATSA	Brazil
37.	Dr	Mario	Lira	IPA	Brazil
38.	Dr	Jacob	Silva Souta	UFPB	Brazil
39.	Prof	Angela Maria	Vieira Batista	UFRPE	Brazil
40.	Mrs	Tony	Byring	IUCN- W Africa	Burkina Faso
41.	Dr	Denis	Depommier	CIRAD	Burkina Faso
42.	Dr	Jean	Fages	ORSTOM	Burkina Faso
43.	Mr	S	Kambou	Centre National de Semences Forestieres	Burkina Faso
44.	Dr	A	Nikiema	CNSF	Burkina Faso
45.	Dr	Sibin Jean	Ouedraogo	CORAF-Foret	Burkina Faso
46.			Administrator	Int Network of Forests and Communities	Canada
47.	Dr	Joao	Fonseca	DGASP	Cape Verde
48.	Dr	Jose	Levy	INIDA	Cape Verde
49.	Dr	Abel R	Monteiro	INIDA	Cape Verde
50.	Eng	Luisa Emilia	Morais	DGASP	Cape Verde
51.	Dra	M	Vera-Cruz	INIDA	Cape Verde

52.	Mr	Richard	Beales	DFID Caribbean	Carribean
53.	Sr	T	Frisk	Oficina regional de FAO	Chile
54.	Dra	Carmen Sáenz	Hernandez	Facultad de Ciencias Agronómicas	Chile
55.	Dr	Maria-Theresa	Serra	Universidad de Chile	Chile
56.	Ing	CC	Severino	CONAF	Chile
57.	Dr	Zhu	Zhaohua	INBR, Anyuan No.10	China PR
58.	Mr	C	Mantang	Chinese Academy of Forestry	China PR
59.	Ing	LE	Vega	CONIF	Colombia
60.				CIAT	Colombia
61.	Dr	John	Beer	CATIE	Costa Rica
62.	Dr	WS	Vindas	PDCF-SNAC, Ministerio del Ambiente y Energia	Costa Rica
63.	Ing	AR	Sayous	Instituto de Investigaciones Forestales	Cuba
64.	Dr	Lars	Graudel	DANIDA-FSC	Denmark
65.	Lic	AJ	Reynosa	REDCA/SEA-ACT/IICA	Dom Republic
66.	Mr	Juan Carlos	Romero P	RAFE	Ecuador
67.	Mr	Dave	Shishkoff	RAFE	Ecuador
68.	Ing	S	Solano	PRN-CTAF	El Salvador
69.	Mr	EA	Eman	Ministry of Agriculture	Eritrea
70.				DFID Ethiopia	Ethiopia
71.	Dr	Yahya	Bukari	University of Helsinki	Finland
72.	Dr	Mohammed	El Fadl	University of Helsinki	Finland
73.	Dr	Vesa	Kaarakka	University of Helsinki	Finland
74.	Mr	Ronald	Bellefontaine	CIRAD-Foret	France
75.	Mr	Yvon	Dommergues	CNRS	France
76.	Dr	Bernard	Dupuy	CIRAD-Bois et Forets	France
77.	Dr	Helene	Joly	CIRAD-Foret	France
78.	Dr	Henri	Le Houerou	CEFE/CNRS	France
79.	Dr	Bernard	Mallet	CIRAD-Foret	France
80.	Mr	KN	Sanko	Forestry Dept	Gambia
81.	Dr	J	Cobbina	FORIG	Ghana
82.	Ms	Helen	Wedgewood	DFID	Ghana
83.	Ing	JM	Leiva	Universidad de San Carlos	Guatemala
84.	Ing	JA	Quinonez	LUPE	Honduras
85.	Dr	Sarita	Arya	FRI	India
86.	Dr	HM	Behl	NBRI	India
87.	Dr	V	Bhatia	Haryana Forestry Department	India
88.	Dr	NK	Bohra	AFRI	India
89.	Mr	A	Chatterjee	DRCSC	India
90.	Dr	Kevin	Crockford	DFID Rural Development Office	India
91.	Mr	VM	Dama	Hamlai Feeds	India
92.	Prof	MG	Dasthagir	Dept. of Agroforestry	India
93.	Mr	SM	Dave	Dave Import/Export	India
94.	Dr	MC	Desai	GAU- Vet Sci and Aninal Husbandry	India
95.	Dr	Annam	Dilip Kumar	Fortune Bio-Tech Limited	India
96.	Mr	CJSK	Emmanuel	AFRI	India
97.	Dr	VK	Garg	NBRI	India
98.	Dr	VL	Goel	NBRI	India
99.	Mr	S	Gopalakrishnan	Evergreen Environmental Conservation Group	India
100.	Dr	LN	Harsh	CAZRI	India
101.	Dr	NG	Hegde	BAIF	India
102.	Prof	S	Kannaiyan	TN Agricultural University	India
103.	Mr	Ram	Kumar	National Camel Research Centre	India
104.	Dr	MM	Lohia	Trifed	India
105.	Dr	RL	Meena	AFRI	India
106.	Dr	PS	Minhas	CSSRI	India
107.	Dr	Pratap	Narain	CAZRI	India
108.	Dr	KS	Neelakantan	TN Agricultural University	India

109.	Dr	Manish	Pande	Res Foundation for Science, Tech and Education	India
110.	Dr	RS	Paroda	ICAR	India
111.	Dr	PS	Pathak	ICAR	India
112.	Dr	PK	Pramanick	IARI	India
113.	Mr	CP	Ramanathan	Farmer/businessman	India
114.	Dr	Malabika	Ray	ICFRE	India
115.	Dr	JS	Samra	DDG NRM ICAR	India
116.	Prof	BM	Sharma		India
117.	Dr	Ajay	Sharma	Tata Energy Research Institute	India
118.	Dr	BD	Sharma	NRC Arid Horticulture	India
119.	Dr	KC	Shroff	Vivekanand Research and Training Institute	India
120.	Mr		Siddappa	Institute of Forest Genetics and Tree Breeding	India
121.	Dr	Gurbachan	Singh	NRCAF	India
122.	Dr	HP	Singh	CRIDA	India
123.	Dr	SP	Singh	ICFRE	India
124.	Mr	Ram Bir	Singh	IFFCO	India
125.	Mr	RM	Singhal	ICFRE	India
126.	Dr	KR	Solanki	NRCAF	India
127.				Southern Agro Industries Foundation	India
128.	Mr	B	Sridhar	Regional Office, NABARD	India
129.	Dr	R	Sundararaj	Institute of Wood Science and Technology	India
130.	Dr	PM	Talpada	GAU- Animal Nutr Dept	India
131.	Dr	JC	Tewari	CAZRI	India
132.	Dr	P	Tewari	CAZRI	India
133.	Dr	P	Thangavel	Bharathiar University	India
134.	Prof	OP	Toky	HAU-Forestry Dept	India
135.	Dr	OS	Tomar	CSSRI	India
136.	Dr	NK	Tyagi	CSSRI	India
137.	Dr	SN	Tyagi	Forest Dept	India
138.	Dr	S	Uthasamy	TN Agricultural University	India
139.	Dr	SP	Vyas	CAZRI-RRS	India
140.				ICRISAT	India
141.				CARE India	India
142.	Dr		De Malach	Negev Desert Agricultural Experiment Centre	Israel
143.	Dr	Catarina	Batello	FAO	Italy
144.	Dr	Soren	Hald	FAO	Italy
145.	Dr	Christel	Palmberg	FAO	Italy
146.	Dr	Pierre	Sigaud	FAO	Italy
147.	Dr	Katherine	Warner	FAO	Italy
148.	Dr	Ayed	Omary	Mu'tah University	Jordan
149.	Dr	M	Shahbaz	Badia Research and Development Programme	Jordan
150.	Dr	RD	Haller	Baobab Farm Limited	Kenya
151.	Mr	BN	Kigomo	KEFRI	Kenya
152.	Mr	Martin	Leach	DFID Eastern Africa	Kenya
153.	Dr	B	Muok	KEFRI	Kenya
154.	Dr	KA	Mwendwa	KEFRI	Kenya
155.	Mr	EO	Omollo	Ministry of Natural Resources	Kenya
156.	Dr	Tony	Simons	ICRAF	Kenya
157.				ICRISAT Nairobi	Kenya
158.	Mr	Oulathong	Vor Viengkham	Nat. Agriculture and Forestry Research Institute	Lao PDR
159.	Dr	Harry	Potter	DFID Central Africa	Malawi
160.	Mr	Frederick	Ziyabu	Forestry Research Institute	Malawi
161.	Dr	Edouard G	Bonkoungou	AFRENA Programme	Mali
162.	Mr	Pascal	Cuny	Intercooperation	Mali
163.	Mr	Amadou Male	Kouyate	CRRA/ARFP	Mali
164.	Mr	Sidibe	Modibo	Institut d'Economie Rurale	Mali
165.	Mr	Claude	Monnet	IRD	Mali

166.	Ing	Ibrahima	N'Diayz	IER	Mali
167.	Dr	Inamond	Yattara	Universite de Mali	Mali
168.				ICRISAT Bamako	Mali
169.	Mr	B	Diop	Direction l'amenegement et equipment rural	Mauritania
170.	Dr	Paul	Earl	FCB	Mexico
171.	Dr	Carlos	Franco	INIFAP	Mexico
172.	Ing	LJ	Maldonado	Fundacion Produce Nuevo Leon, AC	Mexico
173.	Ing	HH	Mendez	DGRCS	Mexico
174.	Mr	Cristian	Vallejos	Forest Stewardship Council	Mexico
175.		M	Ibrahim	ENDA-Mahgreb	Morocco
176.	Ms	J	Compton	DFID Mozambique	Mozambique
177.	Mr	T	Foy	DFID South Africa Field Office	Namibia
178.	Mr	P	Smit	University of Namibia	Namibia
179.	Mr	WR	Rudder	FAO Representative	Nepal
180.	Mr	HB	Thapa	Department of Forest Research and Survey	Nepal
181.	Ms	Margriet	Berkhout	Agromisa	Netherlands
182.	Dr	Willemine	Brinkman	ETFRN c/o the Tropenbos Foundation	Netherlands
183.	Ms	Irma	Corten	ETC	Netherlands
184.			Library	ETC	Netherlands
185.	Mr	Kees	Sahin		Netherlands
186.	Ing	RC	Sacasa	MARENA	Nicaragua
187.	Mr	ML	Attaou	Direction de l'environment	Niger
188.	Mr	A	Itkam	INRAN	Niger
189.	Mr	A	de Jode	DFID RNR Co-ordinator	Nigeria
190.	Dr	DO	Ladipo	CENRAD	Nigeria
191.	Mr	AM	Aboul-Naga	FAO Representative	Pakistan
192.	Dr	Rafiq	Ahmad	University of Karachi	Pakistan
193.				Pakistan Forest Institute	Pakistan
194.	Ing	H	Bonilla	INRENARE	Panama
195.	Mr	Mark	Hare	CAPAD	Panama
196.	Ing	H	Dominguez	Servicio Forestal Nacional	Paraguay
197.	Dr	L	Alban	Universidade de Piura	Peru
198.	Prof	W	Calderon	Universidade de Piura	Peru
199.	Ing	Gaston	Cruz	Universidade de Piura	Peru
200.	Ing	Manual	de losHeros G	Proyecto Algarrobo-INRENA	Peru
201.	Dr	A	Diaz Celis	CONCYTEC	Peru
202.	Dr	Nora	Grados	Universidade de Piura	Peru
203.	Dr	Nicanor	Ibanez-Herrera	IIDC-La Libertad	Peru
204.			ICRAF	Latin America Regional Programme	Peru
205.	Dr	Carlos	Reynel	Universidad National Agraria	Peru
206.	Ing	AM	Taura	INRENA	Peru
207.	Prof	Maria	Carvalho	Instituto Superior Tecnico	Portugal
208.	Mr	M	Alvarez-Ruiz	University of Puerto Rico	Puerto Rico
209.	Dr	MA	EL-Meleigi	King Saud University	Saudi Arabia
210.	Dr	Dominique	Bauwens	PRONASEF	Senegal
211.	Dr	Pascal	Danthu	CIRAD-Forêt Sénégal	Senegal
212.	Dr	Ousman	Diagne	ISRA	Senegal
213.	Dr	Mamadou	Dione	CNRA/ISRA	Senegal
214.	Dr	Frederic	Do	IRD/ORSTOM	Senegal
215.	Dr	Mamadou	Gueye	IRD	Senegal
216.	Dr	Didier	Lesueur	CIRAD-Foret	Senegal
217.	Dr	Samba Arona	Ndiaye	ISRA-DRPF	Senegal
218.				ENDA Tiers Monde	Senegal
219.	Mr	Tom	Barrett	DFID Southern Africa	South Africa
220.	Dr	Carl	Stoltz	Weed Control Division	South Africa
221.	Dr	Wim	van Averbeke	Technikon Pretoria	South Africa
222.	Dr	Brian	van Wilgen	Working-for-Water Prog. CSIR	South Africa

223.	Prof	Gerrit	van Wyk	Univ. of Stellenbosch	South Africa
224.	Mr	Fritz	von Krosgk	Dept Water Affairs and Forestry	South Africa
225.	Dr	Helmut	Zimmerman	Weeds Research Division	South Africa
226.	Dr	Shafiq	Rehman	College of Agriculture	South Korea
227.	Dr	Lucy	Ramirez	Univ. Publica de Navarra	Spain
228.	Prof	Ranjith	Senaratne	University of Ruhuna	Sri Lanka
229.	Prof	Ranjith	Senaratne	University of Ruhuna	Sri Lanka
230.	Mr	AR	Gorashi	Forest National Corporation	Sudan
231.	Mr	I El Din	Warrag	University of Khartoum	Sudan
232.	Mr	Per	Ekman	IFS	Sweden
233.	Dr	Jelle	Maas	SLU-FTPP Network	Sweden
234.	Dr	M	Bounejmate	ICARDA	Syria
235.	Mr	John	Mtika	National Tree Seed Project	Tanzania
236.	Mr	A	Brahini	Ministere de l'environment et d'eau	Tchad
237.	Mt	T	Moulnang	Dir des Forets et protection de l'environment	Tchad
238.	Dr	S	Appanan	FAO Regional Office	Thailand
239.	Mr	Suksan	Saiwa	Forest Research Office	Thailand
240.	Dr	Clemens	Fehr	GTZ	Uganda
241.	Mr	F	Kahembwe	Forestry Research Institute	Uganda
242.	Dr	Martin	Baker	Int Tree Crops Journal	UK
243.	Mr	David	Beresford-Jones	Cambridge Univeristy	UK
244.	Dr	Peter	Bezkorowajnyj	CAZS-UCNW	UK
245.	Miss	J	Billington		UK
246.	Mr	Chris	Brooke-Harris	HDRA	UK
247.	Prof	Phil	Brookes	IACR-Rothamsted	UK
248.	Dr	Jeff	Burley	Oxford University	UK
249.	Ms	K	Cadoret	HDRA	UK
250.	Dr	Czech	Conroy	NRI	UK
251.			Administrator	Copyright Libraries Agency	UK
252.	Dr	S	Davis	Royal Botanic Gardens	UK
253.	Dr	Roderic	Dutton	University of Durham	UK
254.	Prof	Julian	Evans	T H Huxley School	UK
255.	Prof	C	Garforth	University of Reading	UK
256.	Mr	Alan	Gear	HDRA	UK
257.	Mrs	Sandra	Gibson	ITDG	UK
258.	Dr	John	Hall	SAFS-UCNW	UK
259.	Mr	Steve	Hammet	Hammet printing co.	UK
260.	Dr	Nazmul	Haq	International Centre for Underutilised Crops	UK
261.	Prof	Phil	Harris	HDRA	UK
262.	Dr	Mark	Holderness	CABI	UK
263.	Mr	Ray	Holland	Intermediate Technology Consultants	UK
264.	Dr	John	Hudson	DFID	UK
265.	Dr	Colin	Hughes	Oxford University	UK
266.	Mr	M	James		UK
267.	Dr	Howard	Lee	Wye College	UK
268.			Library	Coventry University	UK
269.			Administrator	IIED	UK
270.			Administrator	NRI	UK
271.			Administrator	CDC	UK
272.	Mr	Duncan	Macqueen	IIED	UK
273.	Miss	Moyo	Oluwatuyi	Centre for Pharmacognosy & Phytotherapy	UK
274.	Dr	John	Palmer	NRIL	UK
275.	Mr	Nick	Pasiecznik	HDRA	UK
276.	Dr	Alan	Pottinger	CNRD	UK
277.	Dr	Hew	Prendegast	RBG	UK
278.	Dr	Robin	Probert	RBG	UK
279.	Dr	Frank	Rosillo-Calle	Kings College London	UK

280.	Mrs	E	Roycroft	HDRA library	UK
281.	Dr	Kate	Schrekenberg	ODI	UK
282.	Dr	Fergus	Sinclair	SAFS-UCNW	UK
283.	Prof	MSJ	Sinmmonds	RBG	UK
284.	Mr	Steve	Smith	Coventry University	UK
285.	Prof	W	Stephens	Cranfield University	UK
286.	Dr	Zwege	Teklehaimanot	SAFS-UCNW	UK
287.			Administrator	The British Library	UK
288.	Dr	Jane	Thornback	UK Tropical Forest Forum	UK
289.	Mr	Oliver	Whaley	Herbareum RGB Kew	UK
290.	Dr	Gerald	Wickens	RBG	UK
291.	Dr	Julia	Wilson	CEH	UK
292.	Dr	Peter	Wood		UK
293.			Main Library	Coventry University	UK
294.	Ing	A	Ligrone	Dirrecion Forestal	Uruguay
295.	Ms	Pippa	Bird	PROFOR, SEED, UNDP Programme on Forests	USA
296.	Dr	S	Bode	Trees for the Future	USA
297.	Dr	James	Brewbaker	University of Hawaii	USA
298.	Dr	JB	Friday	University of Hawaii	USA
299.	Dr	James	Johnson	College of Natural Resources	USA
300.	Prof	PKR	Nair	SFRC	USA
301.	Dr	Robert	Ohm	CKWRI	USA
302.	Mr	Mark	Powell	Winrock International	USA
303.	Dr	Paul	Thiesen	Forestry Consultant	USA
304.	Dr	Sarah	Workman	USDA Nat. Agroforestry Centre	USA
305.	Ms	Julia	Falconer	Rural Development Sector Unit	USA
306.	Mr	Douglas	Lequera	Universidad de los Andes	Venezuela
307.	Mr	Luis Marcano	Gonzalez	Fundarbol	Venezuela
308.	Ing	S	Mendoza	SEFORVEN	Venezuela
309.	Dr		Kha	Forest Science Institute	Vietnam
310.	Mr	John	Hansell	DFID Central Africa	Zimbabwe

Appendix 3. Feedback on monograph and CD-ROM

'I have just received the *Prosopis* book and CD-ROM. Congratulations – they are excellent.' *Prof Jeff Burley, Director, Oxford Forestry Institute,UK.*

'Let me congratulate you, firstly, for producing such an excellent book that perhaps is the most timely one. Wide ranging topics on *Prosopis* are very well concieved and have been very systematically arranged in an impressive manner. This would really inspire many young scientists to further strengthen their research efforts for exploiting *Prosopis* to meet out the fuel wood demands of arid areas.' *Dr PS Minhas, Project coordinator, Central Soil Salinity Research Institute,Karnal, India.*

'This is a much welcome synthesis and compilation of a very difficult subject for whoever is interested in arid and semi arid land forestry, agroforestry and development.' *Dr Henri Noel Le Houerou, France, In Arid Land Land Resources and Management.*

Many thanks for sending the copy of the HDRA monograph – an impressive document. From a quick scan, it highlights numerous points of interest and always in an informative context. I will certainly be drawing from it when I hatch up class exercises for our "Tropical dryland trees" MSc module which runs next March.' *JB Hall, University of Wales, Bangor, UK.*

I just received the documents on *Prosopis* that you kindly sent to me. I glanced through them and was impressed by the ilustrations, the overall presentation and the fantastic amount of precious information.' *Dr Yvon Dommergues, Director of Research, Centre Nationale de Recherches Scientifiques, France.*

'Thank you very much for the beautiful and interesting monograph on the *Prosopis juliflora*.' *Dr Y De Malach, Chief researcher, Desert Agriculture Negev Experimental Center, Israel.*