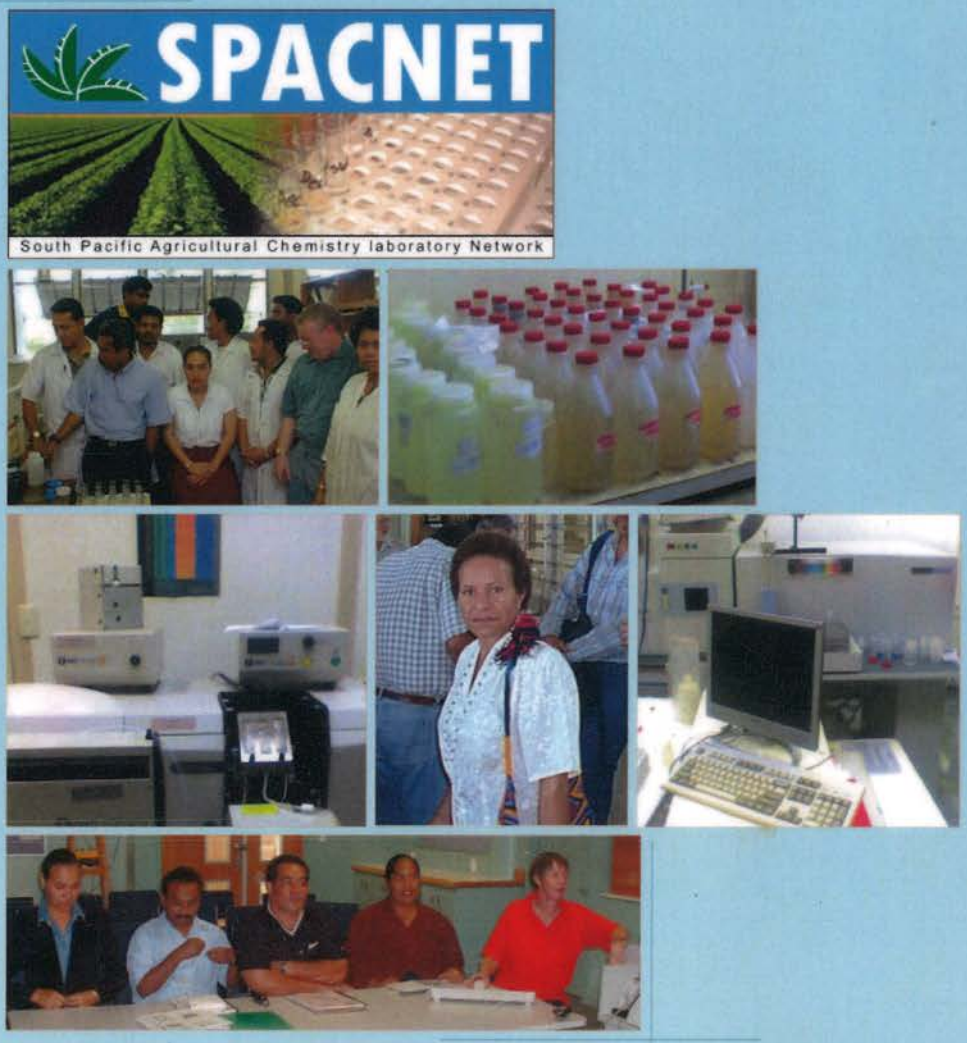
Report on the Status and Needs of the South Pacific Agricultural Chemistry Network (SPACNET) Laboratories

Brian Daly

SPACNET Technical Co-ordinator

South Pacific Agricultural Chemistry Network (SPACNET)

An NZODA Contestable Fund Project



September 2006

Landcare Research New Zealand Ltd
in association with
the Land Resources Division,
Secretariat of the Pacific Community (SPC)

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Landcare Research
Manaaki Whenua

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Abbreviations and Acronyms

ASPAC	Australian Soil and Plant Analysis Council
AusAID	Australian Agency for International Development
CEC	Cation Exchange Capacity
ECL	Environmental Chemistry Laboratory (Landcare Research)
FSC	Fiji Sugar Corporation
GC	Gas Chromatograph
HOAF	Heads of Agriculture and Forestry
HPLC	High Performance Liquid Chromatograph
IANZ	International Accreditation New Zealand
IAS	Institute of Applied Sciences (USP)
IBG	International Business Group
ICP	Inductively Coupled Plasma Spectrometer
IRD	Institut de recherché pour le developpement (Noumea)
KTP	Key Technical Personnel
LRD	Land Resources Division (SPC)
MoRST	Ministry of Research Science and Technology
MoA	Ministry of Agriculture (Fiji)
NAL	National Agricultural Laboratory (PNG)
NARI	National Agricultural Research Institute (PNG)
NATA	National Association of Testing Authorities (Australia)
NZAID	New Zealand Agency for International Development
NZMFAT	New Zealand Ministry of Foreign Affairs and Trade
NZODA	New Zealand Overseas Development Assistance
PNG	Papua New Guinea
QA	Quality Assurance
QC	Quality Control
SPACNET	South Pacific Agricultural Chemistry Laboratory Network
SPC	Secretariat of the Pacific Community
USP	University of the South Pacific

Acknowledgements

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The funding assistance of New Zealand Agency for International Development (NZAID) is gratefully acknowledged.

Management and staff of all the laboratories visited are thanked for their hospitality and willingness to share information.

Executive Summary

The NZODA-funded South Pacific Agricultural Chemistry Laboratory Network (SPACNET) has aimed at assisting seven agricultural chemistry laboratories in four South Pacific countries. Phase one (three years) concentrated on methodology, by providing recommended method manuals and associated training. Phase two (three years) added environmental water analysis methods and concentrated on quality assurance (QA). Phase three has three years NZODA funding with a small contribution from the Secretariat of the Pacific Community (SPC) and is a continuation of the first two phases, in that it will continue the concentration on QA, but carry it to a higher level to assist laboratories to achieve the standards required to become accredited to ISO standard 17025. Also, other areas of analysis, such as food, may be included. At the end of the current funding SPC will institutionalize the network with its Land Resources Division (LRD) activities.

The Solomon Islands laboratory at Dodo Creek was lost to the network when it was destroyed during civil unrest on Guadalcanal in 2001, and the National Agricultural Research Institute (NARI) laboratory in Port Moresby was destroyed by fire in June, 2006. The NARI Laboratory is now being rebuilt.

Following visits to the participating laboratories and the IRD Laboratory in Noumea in April and May, 2006 — the first activity for SPACNET 3 — the following conclusions were reached:

- There is still very strong support for SPACNET, both from the laboratories of the region and their parent organisations.
- Most laboratories have adopted SPACNET methods and used the SPACNET QA manual as a basis for their own.
- Communication within the network is now healthy with e-mail contacts about analytical problems and subcontracting of analyses.
- Only two laboratories have all their activities accredited to ISO 17025; the National Agricultural Laboratory (NAL) at Lae, PNG and the Technical Coordinator's laboratory (Landcare Research in New Zealand). USP's Institute of Applied Sciences (IAS) laboratory in Suva has some food and water methods accredited. The other two laboratories in Fiji, the Institut de recherché pour le developpement (IRD) laboratory in New Caledonia and the NARI PNG laboratory want to accredit some or all of their activities.
- Expansion and updating of the SPACNET method and QA manuals is required due to the recent changes in ISO 17025 and will need to be addressed in the next year by those laboratories that are accredited and immediately by those laboratories wishing to apply for accreditation assessment.
- Sample exchange or proficiency programmes are very important and there was a very enthusiastic response to the offer for SPACNET to enrol the laboratories in the Australasian Soil and Plant Analysis Council (ASPAC) soil and plant proficiency programme. It will also be very useful for Technical Coordinator to regularly monitor performance and target training where needed.
- The value of secondments was recognised, not only to learn directly about the aspect of analyses the secondment has targeted, but also make useful contacts with whom to discuss future problems by e-mail or telephone. A number of potential secondments were identified during the laboratory visits.
- It was agreed that the SPACNET website will replace the newsletters used previously as the main method of communication for the network. This will be a repository for SPACNET manuals and other outputs and will eventually be moved to the SPC website.

- Targeted training courses will again be used and a number of topics were identified. The first of these will follow accreditation-style assessments in those laboratories seeking accreditation using a standard form in each laboratory. The results of this on the four laboratories involved will better define needs. Topics identified to date include: pesticide residue analysis and automated handling of data.

Recommendations

1 Accreditation

Many of the laboratories in the network are aiming at becoming accredited to ISO 17025 or reaching accreditation standard. Two of the laboratories (and the Technical Coordinator's New Zealand laboratory) are currently accredited; and in the case of the Lae, NAL laboratory this is for all its activities. It would be helpful for two Fijian, the Samoan and the Tongan laboratories to have a full accreditation assessment early in the three year programme so that a work programme to address areas where they need help can be established. These assessments can be done using in-country / regional resources which will lower the cost. The IAS laboratory in Suva has a QA Manager (Mereoni Gonelevu) who is now experienced at carrying out internal audits and she could be contracted to spend two days at the MoA laboratory at Koronivia and the Fiji Sugar Research Institute laboratory in Lautoka. For Samoa and probably Tonga the assessment could be carried out by Andrew Poole, an experienced CSIRO Laboratory Manager who is currently resident in Apia. Both auditors would use a standard form which will be adapted from IANZ audit forms and the internal audit forms from the Technical Coordinator's laboratory. Of the other laboratories in the network, the New Caledonia laboratory is also moving toward accreditation, but like all other IRD laboratories world-wide is about to receive assistance from headquarters. The NARI laboratory in PNG will need to regain its accreditation once rebuilt and restocked, but this is probably 12 months or more away.

ACTION: Technical Coordinator prepare a generic laboratory assessment checklist and draft contracts for the IAS laboratory QA Manager to assess the other two Fiji laboratories, and Andrew Poole to assess the Alafua, Samoa and Vaini, Tonga laboratories.

2 Manual Updating

In December 2005 a new version of ISO 17025 was issued. This added a number of new requirements; two new areas are the estimation of uncertainty and the self-appointment of key technical personnel (KTP) rather than externally approved signatories. In addition, there are a large number of minor changes. Therefore the updating of the SPACNET Generic Quality Assurance manual is required urgently as this will facilitate the laboratories' move toward accreditation.

The new ISO 17025 standard requires more information on methods application, validation, and detection limits to be included in the method manuals. The SPACNET Soil, Plant and Water Analysis Manuals will need updating to this standard. In addition a rapid Cation Exchange Capacity (CEC) method for soils was shown to most laboratories and all want it added to the soils section. A number of water method additions, particularly methods for acid-extractable metals, were requested. The updating should be done in year one if time permits.

There was demand from three laboratories for food quality analysis and from two for animal feeds analysis. The need for a SPACNET manual for these two classes of analyses needs further discussion but would be an activity for the second and third years.

ACTIONS:
Technical Coordinator to:

(i) Arrange the immediate updating of the generic QA manual.

(ii) Arrange the updating of the SPACNET Generic Methods Manual to include new methods and make compliant with ISO 17025.

(iii) Have further discussions with laboratories on the need for a generic food analysis manual and an animal feeds analysis manual.

3 Sample Exchange

Sample exchanges are essential to any QA programme. ASPAC runs a soil and a plant proficiency programme, each involving three rounds per year of four samples each time, and has approximately 40 Australasian and SE Asian laboratories participating. The amount of data produced allows a rigorous non-parametric statistical examination of the data, so there is a great degree of confidence in the final median values. There was an enthusiastic response to the offer for SPACNET to meet the cost of enrollment in these programmes rather than run our own. The provision of certificates of proficiency for laboratories that achieve the required standard will be very useful for laboratories where other government departments do not trust their results and use overseas laboratories in preference. It will also be useful for the Technical Coordinator to regularly monitor performance and target training where needed. Laboratories have been informed that they will need to keep submitting results in order to stay enrolled.

ACTION: Enroll six laboratories (3 Fijian; Alafua; Vaini; IRD, Noumea; and NAL, PNG) for the soil and plant exchange programmes starting in September 2006. The NARI Laboratory, PNG will hopefully be ready to join this time next year.

4 Secondments

The use of secondments has been one of the most successful activities in the past for SPACNET. This is because the participants not only learn directly about the aspect of analyses the secondment is aimed at, but also make useful contacts to discuss future problems with, by e-mail or telephone. A number of possible secondments were identified during the laboratory visits. In order of priority these were:

There are three laboratories in the network that use Inductively Coupled Plasma Spectrometer (ICP), a relatively sophisticated and difficult instrument to use. All three laboratories are in the western Pacific and all use the same make and similar models of instrument. The chance for the operators of all three instruments to get together to share experiences and establish a network would be invaluable. This would be best held in the 'neutral' laboratory in New Caledonia. It may be possible to get the Perkin Elmer service engineer to attend for some of the time (at their expense) to discuss and demonstrate preventative maintenance.

Three laboratories requested the chance for their technicians to have training in a busy soils laboratory such as the Fiji laboratory at Koronivia Research Station. These were the Alafua, Lae, and Lautoka laboratories. The Vaini laboratory would also benefit from such a secondment.

Two laboratories wanted technician training for animal feed analysis; Alafua and Lae laboratories.

All laboratories recognised the value of having their technicians exposed to other ways of doing things and even though not having a direct current need wanted to have the chance to add their staff to planned secondments. Placements will be offered to laboratories as they arise and as the budget permits.

ACTIONS:

(i) Arrange secondment for ICP users from Papua New Guinea (2 laboratories) with New Caledonia laboratory.

(ii) Arrange secondment on basic soil analysis at Koronivia Research Station for technicians from Lautoka, Vaini, Alafua, and Lae laboratories.

(iii) If budget allows arrange secondment on animal feed analyses at either the Port Moresby laboratory or at Koronivia Research station.

5 Website

The website will replace the newsletters used previously as the main method of communication for the network. This will be a repository for SPACNET manuals and other outputs and will eventually be moved to the SPC website.

ACTION: Technical Coordinator start the process of updating the website and in particular provide laboratories with a template for putting individual laboratory information onto the site.

6 Targeted Training Courses

With the addition of the accreditation-style assessments to the work programme it is likely that there will be insufficient funds in the first year to carry out any of these. The accreditation assessment exercise will however help clarify the main needs for the courses and certainly will give a good guide to course content for year two.

Three laboratories wanted training in pesticide residue analyses for food. The Koronivia Research Station laboratory has GC and HPLC equipment that would make it possible to run such a course there. The Technical Coordinator needs to find someone suitable to carry out this training.

In three or four laboratories the chance to use the equipment they already have, such as computer controlled instruments and laboratory networks, to automate data capture and handling would greatly improve efficiency and reduce errors. A course on automated data handing options at the Technical Coordinator's laboratory would be useful.

ACTIONS: Technical Coordinator to plan a data handling course, find a suitable resource person to run a pesticide residue analysis course, and identify other areas of need for training following the accreditation assessment exercise and plan these as funds allow.

1. Report on Visits to SPACNET Laboratories in Fiji, Tonga, Samoa, New Caledonia and Papua New Guinea, April and May, 2006

1.1 Introduction

SPACNET links nine laboratories in five countries (PNG, Fiji, Tonga, Samoa, New Zealand) with opportunity to include the IRD laboratory in Noumea. Funding from NZODA for six years (Phases 1 and 2) over an eight-year period achieved a large number of outcomes all aimed at improving the QA at the participating laboratories. These included:

- Survey of all laboratories to establish their capabilities and needs;
- A number of targeted training courses for both Laboratory Managers and technicians on various QA and methodology topics;
- Technician secondments for customised training;
- Provision of recommended methods manuals (two editions) and generic QA (two editions) manuals, safety manuals and interpretation manuals;
- Newsletters and a website for communication both within and outside the network;
- Support for network members to attend international conferences in the region (Laboratory Managers' meetings coordinated with these were possible); and
- The ongoing sample exchange programme.

SPACNET Phase 3 received funding from NZAID, with a small contribution from the SPC, for a further three-year period. SPC will institutionalize the network into its activities at the end of the three year period (2008).

The following implementation activities are proposed:

- Visit each laboratory in the network to conduct an accreditation review. This will include in-depth discussions with laboratory staff to establish priorities for development, training needs, and assistance required to reach accreditation standard. This was completed in the second quarter of 2006.
- Following the needs assessment it is envisaged that a continuation of targeted training courses and secondments will be needed. Likely there will be two targeted training courses (2-week) and three to four 3-week technician secondments a year.
- Sample exchanges are essential to any QA programme. ASPAC run a soil and a plant proficiency programme, involving three rounds per year of four samples each time, and has approximately 40 Australasian and SE Asian laboratories participating. The amount of data produced allows a rigorous non-parametric statistical examination of the data, so there is a great degree of confidence in the final median values. Considerable time and money will be saved in comparison to running our own (internal network) programme in not having to source samples, arrange quarantine issues, chase up data, process data, report back, etc.
- The website will replace the newsletters used for communication in the first six years of the network.

- Laboratory Managers' meetings held every two years to discuss progress and set priorities for the next two years. These will be held in conjunction with international conferences and workshops to maximise the benefits of the travel costs.
- Expansion and updating of the SPACNET method and QA manuals as required.
- Accreditation by an external agency such as IANZ (New Zealand) or NATA (Australia) is the ultimate endorsement of a laboratory's QA system. Accreditation is carried out to the international criteria ISO/IEC 17025:1999 *General Requirements for the Competence of Testing and Calibration Laboratories*. Accreditation makes it easier for the laboratory's results to be legally defensible. Accreditation is expensive and difficult to achieve, but even laboratories not immediately intending to apply for accreditation should be aiming to achieve that standard. The SPACNET network has two laboratories that have nearly all of their activities accredited: the Landcare Research laboratory in New Zealand and one of the PNG labs. One Fiji laboratory has a small part of its activities accredited and is seeking to extend this. The other PNG laboratory has been accredited and is seeking to regain its accreditation, and two Fiji laboratories are interested in working towards accreditation. It is proposed therefore that SPACNET 3 will have a key focus on helping laboratories achieve accreditation standard.

This report describes the outcomes of the meetings and laboratory visits that were undertaken as part of the first activity.

The itinerary and schedule of meetings are given in Annex 1.

1.2 Meetings

1.2.1 Met with Jai Gawander, Research Director, Fiji Sugar Research Centre, 0830-0900, 3 April, and discussed current status and future needs of the laboratory. The Research Centre is about to become independent of (Sugar Research Institute) from July 2006 and will be equally funded by GOF, FSC and the Cane Growers. Sugar as a sector is administered from within the Prime Minister's office. It is expected that the budget for the Centre will be quadrupled, meaning the laboratory should become better resourced. There has been a decline in extension and research work through the Centre in the last few years (see detailed laboratory report) resulting in a declining workload in the laboratory. This trend should quickly reverse and the need for a good quality, preferably accredited, laboratory should become greater than ever. Most of the improvements put in place during the training secondment in June 2004 have been cemented in place but there is still more to do.

A number of qualified new staff have been put in place recently so the laboratory should be able to cope with an increased workload, with some more attention to systems and QA. Jai Gawander was about to resign to stand for parliament (was elected) so the position of a new research director will be advertised.

1.2.2 With Dave Leslie met Siua Halavatau, Team Leader, Crop Production, Land Resources Division of SPC, 0900-1030, 4 April to discuss SPACNET 3. Issues discussed were as follows:

- Dave outlined the funding history for SPACNET and how the Director General of SPC had made a commitment to institutionalise SPACNET into SPC's core programmes in three years' time. This will be under Siua's team.
- Dave explained how we had been successful with an application to an NZAID Contestable Fund programme through the Ministry of Research, Science, and Technology (MoRST) to fund SPACNET for the next three years when SPC's funding support starts. The letter of support (and commitment) from the Director General of SPC had been very important in winning the funding.

- Dave outlined to Siua the previous activities under SPACNET 1 & 2, and the projected activities under 3 (subject to completion of the laboratory visits and an assessment of the laboratory needs).
- Siua explained that his main focus with SPC was to strengthen agricultural extension services in the Pacific region, which he rates overall as very poor throughout the region, particularly in the diagnosis and correction problems with crops. Good quality analytical data (soil and plant) is seen as essential to help get these correct.
- Discussed the possible future location of the SPACNET website on SPC's server. This is likely.
- Under SPC it is possible that Timor Este could become part of the network.

ACTION: Send Siua electronic and hard copies of all SPACNET manuals and other outputs.

1.2.3 Met with Professor Bill Aalbersberg, Director of the Institute of Applied Science, University of the South Pacific (also Associate Dean of the School of Islands and Oceans), 1100-1230, 4 April. Topics discussed included the future of not just the Suva IAS laboratory, but also the Alafua School of Agriculture laboratory in Samoa. USP has a new Vice Chancellor who is determined to increase the amount of research being done by the university. This will increase the workload for the laboratories which has been declining over the last few years. It is important to USP that the laboratories are ready to respond to an increasing workload with good quality data. Bill, as Associate Dean of the School of Islands and Oceans, is also responsible for the School of Agriculture in Samoa and so was very welcoming of anything SPACNET could do to improve quality in the Alafua laboratory. He was also interested in increasing the workload in the Suva IAS laboratory which is now accredited through IANZ for food and water analysis (some targeted training from SPACNET in 2003 contributed to this). However, government departments in the region are not using the IAS laboratory to the extent USP would like, in part because of their prices. Indeed the Fiji MoA plan to set up their own food standards laboratory.

An area of work that needs to be developed for the Alafua laboratory is animal feeds analysis.

1.2.4 Met Mr Jai Kumar, Director of Research, Ministry of Agriculture, 0830-0930, 5 April. He confirmed his support for the Fiji Agricultural Chemistry Laboratory's continued involvement in SPACNET.

One of the main problems currently facing the laboratory is a leaking roof. Jai has received quotes of around $100k to repair.

An area of new demand that they have not yet moved into is pesticide residue testing for organic certification. The laboratory has some of the equipment needed for this work. Also, along with other Pacific Island food exporting countries a food standards laboratory is becoming a priority.

Jai wants a mentor to come to the laboratory for a period of 1 to 3 months as happened at the FSC laboratory in 2004. I explained that this would be outside the budget of the SPACNET programme but would fit the definition of a bilateral in-country training.

ACTION: Send Jai Kumar the NZAID in-country training proposal form to complete.

1.2.5 With Dave Leslie and James Barringer met Kirk Yates, NZAID Manager, NZ High Commission in Fiji, 0830-0930, 6 April. Briefed him on SPACNET history and proposed activities for the next three years.

1.2.6 Met with Andrew Poole (ex Laboratory Manager CSIRO Plant lab, Canberra) and his partner, Amanda Roberts, AusAID Manager in Samoa 1030-1530, 9 April. Andrew was previously a member of the ASPAC executive committee. He is very willing to help where he can with the USP, Alafua laboratory, but it would have to be on a voluntary basis because as the partner of a diplomat he doesn't have a work permit. I briefed Amanda on SPACNET history, achievements and future plans.

1.2.7 Met with David Hunter, Acting Head of School, School of Agriculture and Food Technology, University of the South Pacific, Alafua, 0900-1030, 10 April. Also at the meeting were Dr Mohammed Eaqub, Senior Lecturer in Soil Science, Daya Perera, Laboratory Manager and Philip, laboratory technician. Outlined the proposed objectives for SPACNET 3, the changes made by their laboratory in response to SPACNET 1 & 2. David reaffirmed their support for SPACNET, particularly in view of the proposed rejuvenation of the School's research programme. In addition a new forensic laboratory service has been started to provide a service to Samoa's Police and a food technology laboratory is proposed. There will be common staff in all laboratories and the QA systems that SPACNET is helping develop will be applicable to all the laboratories.

There was discussion on quality of the present laboratory output, and some results for samples that had been analysed in the laboratory and also by Hill Laboratories (the largest private laboratory in New Zealand) were presented by Dr Eaqub. There were some differences and, because of these differences, doubt had been cast on most of the laboratory's soil analysis output. This had affected workload. Was able to explain the differences and pointed out that the Alafua laboratory results were more 'correct' and what was needed for a research client. This was because the method used by the NZ private laboratory is a rapid, narrow ratio extraction method that is suitable for establishing fertiliser needs for farmers, but doesn't quantitatively recover analytes from the type of highly fertile soils presented here. (The next day had a technician in the laboratory repeat the analysis using a version of the rapid method, and the results replicated the NZ laboratory results very well.)

1.2.8 Met with Laisene Samuelu, Assistant CEO Research and Extension, MAF, Alafua lab, 1130-1200, 11 April. This meeting was arranged after looking at the laboratory's workload and clients. It was noted that very little work was now being done for the Ministry of Agriculture and Forestry's Extension Division for farmers. Currently use Hill Laboratories in New Zealand for a small number of analyses. When asked why they were not using the USP laboratory and were using more expensive laboratories in New Zealand, doubts about the quality of the local output were raised. Much of these quality doubts related to the set of results discussed in the previous day's meeting and I was able to assure Laisene that the laboratory data quality is fine and with the improvements envisaged under SPACNET 3 it would become even easier to demonstrate this quality. The desirability of having farmers do soil tests before using fertilisers to avoid wasting expensive fertilisers and polluting the environment was discussed. The Laboratory Manager made a commitment to a rapid turn around for extension samples and hopefully the laboratory will again be able to generate an income stream by doing more of this work.

1.2.9 Met with Dr Jimmie Rodgers, Director-General of Secretariat of the Pacific Communities (SPC), 1345-1415, 5 May. This was a courtesy call. Briefly outlined the activities of the first six years of SPACNET and the proposed activities for the next three. Also, progress and impressions gained from laboratory visits already undertaken in Fiji, Tonga, Samoa and New Caledonia were discussed. Visits have been well received and in most cases the focus on data quality and preparation for accreditation was timely. Dr Rodgers was very supportive and he sees many parallels between SPACNET and other areas SPC is involved in, with all having the aim of network building and bringing people together. He reiterated that he sees SPACNET as a key part of SPC's long-term activities.

To signal the involvement of SPC in SPACNET for the next three years suggested we could include SPC's logo on SPACNET written outputs and a link on the website and this was agreed. Dr Rodgers suggested that the SPACNET generic manuals and other outputs from the first six years be placed on the SPC website.

ACTION: Provide Dr Rodgers with a CD of SPACNET publications. DONE

1.2.10 Met with Dr John Kola, Chairman of National Agricultural Research Institute (NARI) board, 1630-1700, 16 May, Port Moresby. We discussed the SPACNET project and future of the laboratory (positive despite slow progress of rebuilding). Also on behalf of Landcare Research colleagues had an initial discussion with him and Joe Tambe Mangi, Director of Social Research Institute about a possible carbon credits programme that New Zealand could help with. They raised the possibility of a large reafforestation project (up to 50,000 ha) in the Sepik valley that had been cleared for uneconomic grassland and the proposal is to replant in forest (possibly rubber) crops. There are particular difficulties with very poor fertility soils and land tenure issues which make the economics difficult.

ACTION: Provide details of these contacts to Peter Newsome and Craig Trotter. DONE

1.2.11 Met with Dr Raghunath Ghodaki, Director General NARI, 1300-1400, 19 May, Lae. Also at the meeting were Dr Sergie Bang, Director of Research and three programme leaders. Described SPACNET's history and proposed future activities, noting that before the fire the NARI laboratory had been one of the best in the SPACNET network. The options about rebuilding the laboratory were discussed. Pointed out that some level of competition was desirable and that if the NARI laboratory wasn't rebuild there would be no competition for this work in the country. The Lae laboratory based at Unitech operates as a full cost-recovery commercial laboratory and while there would be some short-term economic gains from using this laboratory rather than rebuilding theirs, long-term the NARI research programmes would suffer. This is because there are differences in philosophy and approach in commercial laboratories and research-support laboratories. The latter need to be more responsive to their clients' needs, and assist by developing methodology for new areas of work, plus work with the researchers in developing analytical plans.

Other topics discussed included what were the main equipment items to be purchased first once the laboratory rebuilding is completed, the difference between certification and accreditation and the steps needed to move toward accreditation. Also the future need for a food standards laboratory was mentioned.

1.3 Summary of Laboratory Visits

1.3.1 Central Laboratory, Sugar Cane Research Centre, FSC, Lautoka, Fiji

(i) STATUS

- Personnel. There have been a number of changes of manager since 1996, but the current one has been there for a few years. There are two technicians who have been there for a number of years (one for more than 10) and there are two recent recruitments, both having BSc's in chemistry. The Research Director, who was Laboratory Manager for many years and thus provided some continuity, was resigning to stand for parliament the week of the visit. He was elected so a significant resource of experience has been lost.
- Accommodation. Current laboratory is a little cramped but a new building is planned.
- Equipment. Laboratory is well equipped except a new UV/Vis spectrophotometer is required and an internal computer network is also needed.

- Documentation. Method manual up to date, but work needed on procedures and quality manuals.

(ii) ISSUES

- Need to rebuild client base for soil fertility and plant testing analyses. This will need to be done in conjunction with Research Centre agronomists so that the growers get an integrated service – good quality data, scientifically-based interpretation and recommendation.
- Number of new technical staff with limited experience would benefit from time spent in other soil and plant laboratories.
- Keen to join ASPAC soil and plant proficiency programmes.

(iii) RECOMMENDATIONS

- Laboratory Manager seek assistance from other SPACNET laboratories and beyond for the design of the planned new laboratory.
- Laboratory Manager will need training in laboratory accreditation issues.
- Use QC manager from IAS laboratory to carry out a detailed accreditation-type assessment to provide information to laboratory and SPACNET Technical Coordinator about areas of greatest training needs.

(iv) ACTIONS

- Provide Laboratory Manager with electronic versions of SPACNET and ECL manuals.
- Arrange laboratory assessment by IAS QC manager.
- Include laboratory technicians in training secondments for soil and plant analysis, possibly at Koronivia FACL laboratory.
- Include Laboratory Manager in possible accreditation needs training course.
- Enrol in ASPAC soil and plant proficiency programmes.

1.3.2 Institute of Applied Science lab, USP, Suva

(i) STATUS

- Personnel. There have been some changes of manager since 1996, but the current one has returned after completing a PhD.
- Accommodation. Very good new purpose-built building gives ample space for laboratory activities.
- Equipment. Laboratory is well equipped and much of the equipment is new.
- Documentation. Manuals are up to date

(ii) ISSUES

- Relatively low workload given the number of staff and amount of equipment available. This should improve given USP's renewed focus on research.
- High prices for analyses limit the workload received from the Fiji Government and also other regional governments.
- Number of new technical staff with limited experience would benefit from time spent in other soil and plant laboratories.
- Keen to join ASPAC soil and plant proficiency programmes.
- Because of recent ISO 17025 accreditation, laboratory is a good regional resource for accreditation issues.

(iii) RECOMMENDATIONS

- Laboratory could make efficiencies and lower costs by using automated data acquisition. Most of the equipment would allow this and minimising manual transcription of data will avoid the main source of errors in any laboratory.

- Laboratory should compare costs with other regional laboratories and look to increase workload by lowering prices.

(iv) ACTIONS
- Include laboratory technicians in training secondments for soil and plant analysis, possibly at Koronivia FACL laboratory.
- Enrol in ASPAC soil and plant proficiency programmes.
- Include senior technician in a possible data handling course (at Landcare Research?).
- Send laboratory QA manager a copy of ECL Landcare Research's balance calibration procedure so they can do their own calibrations.
- Send laboratory a copy of the equivalent SPACNET method codes, i.e. Rayment and Higginson.

1.3.3 Fiji Agricultural Chemistry Laboratory, Koronivia Research Station, MoA

(i) STATUS
- Personnel. There has been one change of manager since 1996, but the current one has been there for a few years. The laboratory has appointed a few well-qualified new staff but most analysts are very experienced.
- Accommodation. Current laboratory is large and well designed but needs a new roof.
- Equipment. Laboratory is well equipped with a number of new instruments.
- Documentation. Manuals are not up to date, but will not require a lot of work to rectify this.

(ii) ISSUES
- Need to rebuild client base for soil fertility and plant testing analyses.
- Keen to join ASPAC soil and plant proficiency programmes.
- Need help with pesticide residue analyses in food.

(iii) RECOMMENDATIONS
- Laboratory Manager will need training in laboratory accreditation issues.
- Laboratory could make efficiencies and lower costs by using automated data acquisition. Most of the equipment would allow this and minimising manual transcription of data will avoid the main source of errors in any laboratory.
- Use QC manager from IAS laboratory to carry out a detailed accreditation-type assessment to provide information to laboratory and SPACNET Technical Coordinator about areas of greatest training needs.

(iv) ACTIONS
- Enrol in ASPAC soil and plant proficiency programmes.
- Include senior technician in a possible data handling course (at Landcare Research?).
- Send laboratory QA manager a copy of ECL Landcare Research's balance calibration procedure so they can do their own calibrations.
- Send laboratory a copy of the equivalent SPACNET method codes, i.e. Rayment and Higginson.
- Provide Laboratory Manager with electronic versions of original FACL and ECL manuals.
- Arrange laboratory assessment by IAS QC manager.
- Identify someone who could run a training course for pesticide residue analyses for this and other laboratories.

1.3.4 Chemistry Laboratory, Vaini Research Station, MAF, Tonga

(i) STATUS

- Personnel. One new manager in last nine years. One experienced technician.
- Accommodation. Current laboratory is adequate for current workload.
- Equipment. Laboratory has good basic equipment. Unfortunately most of it is not working.
- Documentation. Method manual is up to date

(ii) ISSUES

- Need to get instruments repaired and/or replaced.
- Laboratory needs operating funds.
- Need to rebuild client base for soil fertility and plant testing analyses.
- One new technician with limited experience would benefit from time spent in another soil and plant laboratories.
- Pesticide residues in food may have to be measured soon.

(iii) RECOMMENDATIONS

- Ministry needs to allocate funds for repairing or replacing equipment.
- Strongly recommended that the proposed food standards laboratory be combined with the soil and plant laboratory and extended to include environmental (particularly water) analyses. This would give a critical mass of analysts and make efficient use of resources.
- Laboratory Manager will need training in laboratory accreditation issues.

(iv) ACTIONS

- Include laboratory technicians in training secondments for soil and plant analysis, possibly at Koronivia FACL laboratory.
- Include this laboratory in possible pesticide residue training course.
- Include this laboratory in possible food analysis training course.
- Arrange visit to laboratory by laboratory consultant in Samoa to carry out accreditation-style assessment to establish and prioritise areas of need to bring the laboratory up to accreditation standard. Although there may be no intention to accredit the soil and plant laboratory the possible food standards laboratory would certainly benefit from this.
- Enrol in ASPAC soil and plant proficiency programmes.

1.3.5 Agricultural Chemistry Laboratory, USP, Alafua, Apia, Samoa

(i) STATUS

- Personnel. There has been one change of manager since 1996, but the current one has been there for a few years. Two of the analysts are experienced.
- Accommodation. Current laboratory is adequate in size and well designed.
- Equipment. Laboratory is reasonably well equipped but needs a new UV/Vis spectrophotometer and bomb calorimeter.
- Documentation. Manuals are not up to date, but will not require a lot of work to rectify this.

(ii) ISSUES

- Keen to join ASPAC soil and plant proficiency programmes.
- Food analyses becoming more important and possibly pesticide residue analyses in food.
- Animal feed analyses also becoming an important part of laboratory workload.

(iii) RECOMMENDATIONS

- USP needs to allocate funds for repairing or replacing equipment.

- Use QC manager from IAS laboratory to carry out a detailed accreditation-type assessment to provide information to laboratory and SPACNET coordinator about areas of greatest training needs.
- Need to rebuild client base for soil fertility and plant testing analyses by continuing recent contact with Extension Division of the Ministry of Agriculture.

(iv) ACTIONS
- Enrol in ASPAC soil and plant proficiency programmes.
- Include laboratory technicians in training secondments for soil and plant analysis, possibly at Koronivia FACL laboratory.
- Include this laboratory in possible pesticide residue training course.
- Include this laboratory in possible food analysis training course.
- Arrange visit to laboratory by laboratory consultant based in Samoa to carry out accreditation-style assessment.
- Arrange for a secondment and sample exchange with Koronivia FACL laboratory for animal feeds analysis training.

1.3.6 Laboratoire des Moyens Analytiques, IRD, Noumea, New Caledonia

(i) STATUS
- Personnel. There have been two changes of manager since 1996, but the current one has been there for a few years. Deputy Manager is now local and the other four technicians are very experienced.
- Accommodation. Very good purpose built laboratory in the main IRD building with ample rooms and space for all activities.
- Equipment. Laboratory is well equipped.
- Documentation. Manuals are up to date.
- Workload has been relatively stable for last few years.

(ii) ISSUES
- Keen to join ASPAC soil and plant proficiency programmes.
- Parent organisation (IRD) wants all its laboratories world-wide to become accredited. Some training will be provided.
- Isolation sometimes causes problems; e.g. no one with whom to discuss ICP-OES problems.
- Will need some sort of formal invitation to join SPACNET.

(iii) RECOMMENDATIONS
- Laboratory Manager / Deputy will need training in laboratory accreditation issues.
- It may be possible to build a client base for soil fertility and plant testing analyses to improve workload.
- Put ICP-OES operator in touch with two similar instrument operators in the two PNG laboratories.

(iv) ACTIONS
- Provide Laboratory Manager with electronic versions of SPACNET and ECL manuals.
- Include Laboratory Manager/ Deputy in possible accreditation needs training course.
- Enrol in ASPAC soil and plant proficiency programmes.
- Arrange secondment of three regional ICP-OES operators, possibly in IRD laboratory.
- Send a letter inviting laboratory to join SPACNET.

1.3.7 National Agricultural Research Institute Lab, Port Moresby, Papua New Guinea

(i) STATUS

- Personnel. There has been no change in senior staff since 1996.
- Accommodation. Laboratory is being rebuilt following a June 2005 fire which destroyed the roof and all the equipment.
- Equipment. All needs to be replaced.
- Documentation. Manuals were up to date and based on SPACNET manuals.

(ii) ISSUES

- Danger in not regaining all previous clients if it takes too long to rebuild and re-equip.
- Accessing funding for re-equipping laboratory is crucial.
- Need to build client base for soil fertility and plant testing analyses.
- Keen to join ASPAC soil and plant proficiency programmes once laboratory rebuilt.
- Food analyses becoming more important and possibly pesticide residue analyses in food.
- Animal feed analyses also becoming an important part of laboratory workload.

(iii) RECOMMENDATIONS

- Laboratory Manager will need training in laboratory accreditation issues.
- Laboratory could make efficiencies and lower costs by using automated data acquisition. Most of the equipment would allow this and minimising manual transcription of data will avoid the main source of errors in any laboratory.
- Laboratory is one of three in network doing animal feeds analyses. A secondment in one of the laboratories would be useful.
- Laboratory is one of three in network using ICP-OES. Getting the three operators together would be mutually beneficial.

(iv) ACTIONS

- Include Laboratory Manager/ Deputy in possible accreditation needs training course.
- Enrol in ASPAC soil and plant proficiency programmes once laboratory becomes active.
- Arrange secondment of three regional ICP-OES operators, possibly in IRD laboratory.
- Include senior technician in a possible data handling course (at Landcare Research?).
- Arrange a secondment to another laboratory doing animal feeds analyses.

1.3.8 National Analysis Lab, University of Technology, Lae, Papua New Guinea

(i) STATUS

- Personnel. The manager in 1996 has retired and been replaced by his deputy. Well trained and qualified senior staff.
- Accommodation. The laboratory has a lot of space and as it carries out environmental work for mining companies has a class 350 clean room.
- Equipment. Laboratory is well equipped, however some instruments are old.
- Documentation. Manuals are up to date as laboratory is accredited

(ii) ISSUES

- Main current issue is that their ICP-OES (more than 50% of laboratory output) is down and the Australian agents will not travel to Lae to repair it because of perceived security problems.
- Keen to join ASPAC soil and plant proficiency programmes.
- Number of new technical staff with limited experience would benefit from time spent in other soil and plant laboratories.
- Sourcing of consumables and equipment is always a problem. Advice from other SPACNET laboratories would be useful.

(iii) RECOMMENDATIONS

- Laboratory is one of three in network using ICP-OES. Getting the three operators together would be mutually beneficial.
- Laboratory could be used to host secondment on environmental analysis and possibly accreditation issues. Has a guest house on campus.

(iv) ACTIONS

- Include laboratory technicians in training secondments for soil and plant analysis, possibly at Koronivia FACL laboratory.
- Enrol in ASPAC soil and plant proficiency programmes once laboratory becomes active.
- Arrange secondment of three regional ICP-OES operators, possibly in IRD laboratory.
- Circulate a questionnaire to laboratories about consumable and equipment suppliers and put the results on the members-only section of the website.

ANNEX 1. Itinerary and schedule of meetings

FIJI, TONGA and SAMOA

Saturday 1 April	1540 - 1845	Fly Palmerston North to Nadi (SJ 435) Stay Raffles Gateway Hotel
Sunday 2 April	1000 - 1500	Preparation for laboratory visits
Monday 3 April	0830 - 0900	Meeting with Jai Gawander, Research Director, FSC Sugar Research Centre, Lautoka
	0900 - 1300	Visit the Sugar Research Centre laboratory, hosted by Jiten Kumar, Laboratory Manager.
	1330 - 1700	Drive Nadi - Suva. Stay at Holiday Inn
Tuesday 4 April	0900 - 1030	Meeting with Dr Siosiua Halavatau, Team Leader, Crop Production, Land Resources Division, SPC, Suva
	1100 - 1230	Met with Professor William Aalbersberg, Director of the Institute of Applied Science, University of the South Pacific (including lunch with Laboratory Manager).
	1230 - 1730	Visit IAS laboratory, hosted by Dr Sereana Kubuabola, Laboratory Manager.
Wednesday 5 April	0830 - 0930	Met Jai Kumar, Director Research and Mili Nawaikula, Principal Research Officer, Koroniva Research Station, MoA
	0930 - 1700	Visit Fiji Agricultural Chemistry laboratory, MoA
Thursday 6 April	0830 - 0930	Met with Kirk Yates, Manager, NZAID, NZ High Commission
	1000 - 1230	Visit MoA Fiji Agricultural Chemistry laboratory, Mili Nawaikula and staff
	1330 - 1630	Road travel to Nadi (Suva to Nadi flight cancelled)
	1830 - 2100	Fly to Tonga (FJ 211). Stay at Fung Sheng Chinatown
Friday 7 April	0830 - 1700	Visit laboratory at Vaini Research Station. Hosted by Dr Viliami Manu and Printer Mafi.

Saturday 8 April	1030 - 1530	Fly Tonga to Suva to Nadi (FJ0210)
	1730 - 1930	Meeting at Raffles Gateway hotel with Jiten Kumar and Abdul Qadir from FSC Sugar Research Centre laboratory to continue discussions about laboratory needs.
Sun 9/ Sat 8	0145 - 0500	Fly Nadi to Apia. (FJ0210) Stay at Pasefika Inn
Sunday 9 April	1030 - 1530	Met with Andrew Poole (ex Laboratory Manager CSIRO Plant laboratory, Canberra) and partner Amanda Roberts, AusAID Manager, Australian High Commission, Samoa.
Monday 10 April	0800 - 1700	Visit University of the South Pacific laboratory at Alafua School of Agriculture and Food Technology. Hosted by David Hunter, acting Head of School and Daya Perera, Laboratory Manager.
Tuesday 11 April	0800 - 1700	Visit University of the South Pacific laboratory at Alafua School of Agriculture and Food Technology. (David Hunter and Daya Perera).
Wed 12 / Thur 13	0700 - 1145	Fly Apia to Auckland (NZ27)
	1425 - 1535	Fly Auckland Palmerston North (NZ 8327)

NEW CALEDONIA

Thursday 4 May	1155 - 1300	Fly Palmerston North to Auckland (NZ 8334)
	1420 - 1630	Fly Auckland to Noumea (NZ 362) Stay at Le Lagon Hotel
Friday 5 May	0830 - 1330	Visit IRD's Laboratoire des Moyens Analytiques. Met with Alain Plenecassagne, Manager, and Leocadie Jamet, senior technician.
	1345 - 1415	Met with Dr Jimmie Rodgers, Director-General of Secretariat of the Pacific Community (SPC).
	1500 - 1600	Made CD of all SPACNET outputs and delivered to Dr Rodgers
Saturday 6 May	0900 - 1300	Work on laboratory status and needs report.
Sunday 7 May	0800 - 1140	Fly Noumea to Auckland (NZ 365)
	1420 - 1525	Fly Auckland to Palmerston North (NZ 5731)

PAPUA NEW GUINEA

Monday 15 May	1600 - 1800	Fly Palmerston North to Brisbane (SJ 333)
	2125 - 2340	Fly Brisbane to Cairns (QF 5888) Stay Acacia Court Hotel
Tuesday 16 May	1200 - 1325	Cairns to Port Moresby (PX 93)
	1600 - 1830	Met with Peter Corbett, Laboratory Manager, NARI laboratory and Veronica Mangi, Deputy Manager. Stay at Lantana Hotel
Wednesday 17May	0800 - 1630	Visit NARI laboratory with Peter Corbett and Veronica Mangi
	1630 - 1700	Met with Dr John Kola, Chairman of NARI board.
Thursday 18 May	0800 - 1030	Visit NARI laboratory
	1200 - 1245	Fly Port Moresby to Lae (PX 102). Met by Ian Walsh, Laboratory Manager, NAL, Unitech,
	1430 - 1730	Visit National Analytical Lab. Stay at Lae International Hotel
Friday 19 May	0800 - 1200	Visit National Analysis laboratory
	1300 - 1400	Visit NARI HQ, and meet with Dr Raghunath Ghodaki, Director General and other staff.
	1640 - 1725	Fly Lae to Port Moresby Stay at Lantana Hotel
Saturday 20 May	0925 - 1050	Fly Port Moresby to Cairns (PX 94)
Sat 20–Sun 28		On leave
Monday 29 May	1245 - 1450	Cairns to Brisbane (QF 649)
	1900 - 0030	Brisbane to Palmerston North (SJ 334)

ANNEX 2. Laboratory Details

Laboratory:	**Central Laboratory, Fiji Sugar Corporation 1997**	**Central Laboratory at the Sugarcane Research Centre of the Fiji Sugar Corporation Ltd – 2006**
Location:	Sugar Research Station, Fiji Sugar Corporation, Lautoka, Fiji	Sugar Research Station, Fiji Sugar Corporation, Lautoka, Fiji
Organisation - External:	Laboratory is part of the Fiji Sugar Corporation Research Centre, which is fully owned and funded by the industry. The Centre also has plant protection, breeding, cane variety selection, agronomy and extension sections. The purpose of the laboratory is to carry out analyses on soils, plants and sugar cane to support the extension work and the research sections.	The Fiji Sugar Corporation is now owned by the Fiji government. The Research Centre will become an independent institution equally funded by the GOF, FSC, and Cane Growers.
Organisation - Internal:	The laboratory is run as one unit.	The laboratory is run as one unit
Laboratory Manager:	Shirley Damuni	Jeetendra Patel
Staff:	Manager, four technicians and six labourers.	Manager, four technicians and four? labourers
Facilities:	The laboratory is small but well designed and occupies approximately 110 m². Sample preparation and sugar juice testing are carried out in a separate building.	The laboratory is small but well designed and occupies approximately 110 m². Sample preparation and sugar juice testing are carried out in a separate building. Possible that the laboratory will soon move to Drasa in 2008.
Equipment:	UV/Vis Spectrophotometer – Hitachi AAS - Shimadzu pH meter EC meter 2 Fume Cupboards 3 Electronic Balances 2 Computers	UV/Vis Spectrophotometer – Hitachi – needs replacement New Varian AAS New Acid fume cupboard Needs new computers and lab network

Laboratory:	Central Laboratory, Fiji Sugar Corporation 1997	Central Laboratory at the Sugarcane Research Centre of the Fiji Sugar Corporation Ltd – 2006
Number of Samples:	1995: Soils - 8892 samples - about 45,000 tests Foliar - 4857 samples - about 24,000 tests 1996 Sugar cane testing - 11,000 samples - 33,000 tests	2005: Soils - 1896 samples Foliar - 877 samples Sugar cane testing - 4207 samples Decline is in advisory samples – now very few - was majority in 1995
Methods:	SOIL: pH - 1:2.5 soil water (or 1 M KCl) suspension, short stir. C - Walkley - Black. N - Kjeldahl digestion (Cu catalyst) followed by steam distillation. Exchangeable Ca, Mg, K & Na – acetic acid extr, Al - exchangeable - KCl extraction followed by titration Available P - modified Truog (0.01M H_2SO_4) PLANTS: N - Kjeldahl digestion (Se catalyst) - no nitrate pretreatment, Nessler colorimetric finish. P - nitric / perchloric digestion followed by Murphy-Riley determination K - nitric / perchloric digestion followed by AAS determination Ca - as for K Mg - as for K Traces (Fe, Mn, Cu, Zn) - as for K	Most methods have been modernised as per SPACNET manual – ammonium acetate now use instead of acetic acid.
Quality Assurance:	Good method manual. Uses internal QC sample with each batch and every 10th sample is replicated. No external sample exchanges.	Method manual updated recently and reflects what is been done. Still using QC samples and some sample exchanges with other SPACNET laboratories.

Laboratory:	Central Laboratory, Fiji Sugar Corporation 1997	Central Laboratory at the Sugarcane Research Centre of the Fiji Sugar Corporation Ltd – 2006
Strengths:	Very busy laboratory with well trained staff. Soil and plant data used to make fertiliser recommendations using a computer. This means that there will always be a demand for the laboratory's services Laboratory is funded from Research Centre's funds which come from a levy on growers, so operating funds should not be a problem	Much less work than previously but still a busy laboratory. Future funding assured through new Sugar Research Institute funding, including Euro 11 m from the EUI. Planned re-instatement of advisory services should rebuild workload
Weaknesses:	Cramped space considering the increase in workload in the last few years. Laboratory has only one professional chemist, which makes it vulnerable without fully documented procedures manuals. Some of the methods and equipment are not suitable for the very large workload in the laboratory. For example an automated colorimetric analyser with computer acquisition of data for P and N measurements would considerably speed up these analyses.	Still in relatively cramped space, but new building planned. Data handling and reporting needs automating for efficiency and QC reasons. Procedures manuals are not completed and with the turnover of staff (including Laboratory Managers) this means a high risk of losing valuable undocumented experience.

Laboratory:	**Institute of Applied Sciences Analytical Services laboratory, University of the South Pacific, Suva 1997**	**Institute of Applied Sciences Analytical Services laboratory, University of the South Pacific, Suva 2006**
Location:	Institute of Applied Sciences, The University of the South Pacific, PO Box 1168, Suva, Fiji.	Institute of Applied Sciences, The University of the South Pacific, PO Box 1168, Suva, Fiji.
Organisation - External:	The laboratory is part of the Institute of Applied Sciences (IAS), which is the consulting arm of the School of Pure and Applied Sciences of the University of the South Pacific. The laboratory provides support to USP's teaching and research programmes and a consultancy service for other clients both in Fiji and the region. Its work has changed focus over the last few years and now only small numbers of soils and plants are analysed with waters and sediments sampled for environmental pollution and monitoring programmes making up the bulk of the laboratory's workload.	The laboratory is part of the Institute of Applied Sciences (IAS), which is the consulting arm of the School of Pure and Applied Sciences of the University of the South Pacific. The laboratory provides support to USP's teaching and research programmes and a consultancy service for other clients both in Fiji and the region. Maim focus is environmental analyses particularly water, but food, animal feed, soil and plant are still important.
Organisation - Internal:	Run as one unit.	Run as one unit.
Laboratory Manager:	Sereana Kubuabola, Manager Analytical Services	Dr Sereana Kubuabola, Manager Analytical Services Replaced Kishore Chand two years ago after completing a PhD.
Staff:	Manager, Chief Technician, five technicians	Same
Facilities:	Very spacious, but old (1940) buildings which are this year being replaced by a new building	New purpose built laboratory building which are a big improvement on old air force hangars previously occupied.
Equipment:	UV/Vis Spectro - Perkin Elmer Lambda 20 3 x AAS - Perkin Elmer flame and graphite furnace – pH meters EC meters HPLC GC	Well equipped laboratory. Perkin Elmer lamda 35 UV/Vis Spectrophotometer 2 HPLC 2 Perkin Elmer GC New Shimadzu GFAAS Old PE GFAAS – still used. Old PE FAAS – still used New Lachat FIA for water analysis

Laboratory:	**Institute of Applied Sciences Analytical Services laboratory, University of the South Pacific, Suva 1997**	**Institute of Applied Sciences Analytical Services laboratory, University of the South Pacific, Suva 2006**
Number of Samples:	1996: Total - 1,745 samples for about 5,500 tests Soils and sediments - 34 samples Food / Feeds - 471 samples Water - 1,194 samples	2005: Total – 2722 samples for 10248 tests. This includes micro, chem, effluent, water, food, and miscellaneous (which includes soil and plant).
Soil and Plant Methods:	SOILS pH - 1:2.5 soil water (or 1 M KCl) suspension, 1 hour shake C - Walkley - Black with titration finish N - Kjeldahl digestion (Se or Cu catalyst) followed by steam distillation. Exchangeable Ca, Mg, K & Na - leaching with 1 M ammonium acetate, 1:50 ratio CEC - leaching method, alcohol wash following bases extraction, then NaCl leaching and steam distillation determination of the ammonium ions. Available P - Olsen - manual Murphy-Riley finish. Available P - Truog - manual Murphy-Riley finish. P retention - Saunders method. P - total - sodium carbonate fusion with manual Murphy-Riley finish. Exchangeable Al - 1 M KCl extraction, titration finish DPTA extractable trace metals, AAS finish SO4 - phosphate extractable. Particle Size - hexametaphosphate shaking dispersion followed by hydrometer	Very similar methods with some updating from the SPACNET method manuals.
Quality Assurance:	Use internal reference samples. Laboratory is seeking NATA accreditation for its environmental monitoring work so a lot of effort is going into up-grading laboratory manuals.	Laboratory is now IANZ accredited for food and water analyses. Hence the method and procedures manuals for these types of analyses plus the overall QA manual are first class. This is also true for equipment calibration and documentation.

Laboratory:	**Institute of Applied Sciences Analytical Services laboratory, University of the South Pacific, Suva** **1997**	**Institute of Applied Sciences Analytical Services laboratory, University of the South Pacific, Suva** **2006**
Strengths:	Well trained senior staff and experienced technicians. Good backup from university departments. Good equipment. About to have new laboratory building. NATA accreditation of environmental work will have spin-off benefits for other areas of analyses.	Still true Still true Still true Have very good purpose built building. Accreditation through IANZ to ISO 17025 assures the laboratory's clients of the quality of the analytical results.
Weaknesses:	Only a small number of soils and no plants analysed in 1996. It is difficult to maintain continuity of skills for technicians with such a small workload. This low number of samples makes it very important for the laboratory to participate in sample exchange programmes	Still only a small number of soil and plant samples which make it hard to retain skills in this area. High prices for analyses limit the workload received from the Fiji Government and also other regional governments.

Laboratory:	Fiji Agricultural Chemistry Laboratory, 1997	Fiji Agricultural Chemistry Laboratory 2006
Location:	Research Division, Koronivia Research Station, Ministry of Agriculture, Fisheries, Forests and ALTA, PO Box 77, Nausori, Fiji.	Research Division, Koronivia Research Station, Ministry of Agriculture, PO Box 77, Nausori, Fiji
Organisation - External:	The laboratory is part of the chemistry section of the Research Division of MAFFA. Its function is to provide an analytical service to farmers, extension officers, other sections of the Research Division such as Agronomy and Land-use, and other parts of the Ministry, such as Animal Health and Production.	The laboratory is part of the chemistry section of the Research Division of MoA. Its function is to provide an analytical service to farmers, extension officers, other sections of the Research Division such as Agronomy, and other parts of the Ministry, such as Animal Health and Production
Organisation - Internal:	The laboratory is split into the Agricultural Chemistry section lead by a Research Officer, and the Government Analyst section, also lead by a Research Officer, which provides a food analytical service for the Health Ministry and a forensic analytical service for the Police. Although there is considerable sharing of facilities, staff and equipment between the sections, the remainder of this description applies to the Agricultural Chemistry section only	The laboratory is split into the Agricultural Chemistry section lead by a Senior Research Officer (SRO), and the Government Analyst Section, also lead by a Research Officer, which provides a food analytical service for the Health Ministry and a forensic analytical service for the Police. Although there is considerable sharing of facilities, staff and equipment between the sections, the remainder of this description applies to the Agricultural Chemistry Section only
Laboratory Manager:	Josua Wainiqolo, Principal Research Officer.	Miliakere Nawaikula, Principal Research Officer.
Staff:	Research Officer in charge of section with nine technicians and two laboratory assistants. Most of the technicians have many years experience and have gained the Fiji Institute of Technology Laboratory Technician certificate.	New SRO in charge of Agricultural Chemistry Section, Apaitia Vakacego. Most technicians have many years experience. Some have upgraded qualifications by doing degrees at USP.
Facilities:	Large purpose-built building (1970's). Air-conditioners were installed in the laboratories and a chemical store and preparation rooms were built in 1992 with the assistance of New Zealand aid.	Large purpose-built building (1970's). Some maintenance is now required particularly a new roof and fume cupboards.
Equipment:	UV/Vis Spectro - Perkin Elmer Lambda 2 – new UV/Vis Spectro - Perkin Elmer Lambda 20 - 10 yrs AAS - Perkin Elmer 1100, flame - 13 yrs	Some new equipment: Varian HPLC Varian GC

Laboratory:	Fiji Agricultural Chemistry Laboratory, 1997	Fiji Agricultural Chemistry Laboratory 2006
	AAS - Varian SpectraAA5, flame - 4 yrs 2 pH meters 2 EC meters 3 Fume Cupboards 5 Electronic Balances Computers: 4 x stand alone 286, 386 and 486	pH meter dilutor Calorimeter
Number of Samples:	1996: Soils - 2,812 samples - 29,101 tests Foliar - 1,947 samples - 19,357 tests Feeds - 1,097 samples - 10,230 tests Other agricultural samples - 1,237 - 2,382 tests Total agricultural chemistry: 7,093 samples - 61,070 tests	2005: Soils, Plants, Animal feeds: 2,316 samples, 24,909 tests
Soil and Plant Methods:	SOILS: pH - 1:5 soil water (or 1 M KCl) suspension, 1 hour shake EC - 1:5 soil water suspension, one hour shake. C - Walkley - Black with titration finish. N - Kjeldahl digestion (Cu catalyst) followed by steam distillation Exchangeable Ca, Mg, K & Na - leaching or shaking with 1 M ammonium acetate, 1:50 ratio CEC - leaching method, alcohol wash following bases extraction, then NaCl leaching and steam distillation determination of the ammonium ions. Available P - Olsen - manual Murphy-Riley finish. P retention - Saunders method Exchangeable Al - 1 M KCl extraction, titration finish. B -hot water extraction followed by azomethine-H determination S - phosphate resin extractabled followed by Ba sulphate turbidimetric determination DPTA extractable trace metals, AAS finish.	Same methods as before although some new animal feeds methods added.

Laboratory:	Fiji Agricultural Chemistry Laboratory, 1997	Fiji Agricultural Chemistry Laboratory 2006
	Particle Size - hexametaphosphate shaking dispersion followed by 4-point sieve and 4-point pipette measurement of grading curve. PLANTS: N - Kjeldahl digestion (Cu catalyst) with sulpho-salicylic acid nitrate pretreatment followed by steam distillation. P - Kjeldahl digest followed by manual Murphy-Riley K - Kjeldahl digest followed by AAS determination Ca - dry ashing followed by AAS. Traces (Fe, Mn, Cu, Zn) - as for Ca B - ashing followed by azomethine-H determination S - digestion and ashing with Mg nitrate followed by Ba sulphate turbidimetric determination. Cl - hot water extraction followed by titration	
Quality Assurance:	Fully documented QA system with methods, procedures, training, computer techniques, balance calibration etc. Has in-house soil and plant check samples run with every batch. Analyses in a batch where the QC sample is outside 1.6 SDs are repeated Part of the International soil and plant exchange programme run from Wageningen with generally excellent results.	Manuals out of date- electronic copies lost on a computer hard disc that died. Some QC sample results charted – others not. Limited automated capture of data with a lot of transcription of data. All laboratory files now written weekly to CD for backup.
Strengths:	Well trained staff. Most staff were trained on-the-job for three years (1991-1994) by a New Zealand consultant Good facilities and good basic equipment. Fully developed soil fertility testing service which is leading to a large increase in sample through-put, and will ensure on-going demand for the laboratory's services	Well trained staff. Most staff were trained on-the-job for three years (1991-1994) by a New Zealand consultant Commitment by management to achieve accreditation standard. Soil fertility service needs to be rebuilt following decline after political and funding problems; this will assure laboratory's future.

Laboratory:	Fiji Agricultural Chemistry Laboratory, 1997	Fiji Agricultural Chemistry Laboratory 2006
Weaknesses:	Lack of operating funds. Laboratory is very dependant on overseas funded programmes to provide a lot of the basic operating funds for chemicals and maintenance. At least one of these programmes is ending this year which will leave a gap in the laboratory funding. There has been a large increase in soil fertility testing for farmers which to date has been provided free. It would provide a good income stream for the laboratory if a small charge was made for this service now that the farmers have become convinced of its usefulness. It will have to be made possible for the laboratory to retain these earnings to be used for operating costs. Computers have become an integral part of the laboratory's operations, but the computers are badly in need of up-grading The main AAS, which is the instrument used to produce more than half the laboratory output is 13 years old and starting to give problems. The backup instrument is a very basic one and not suitable to be the main instrument. A new mid-range instrument is needed.	Lack of operating funds. Capital spending on equipment has been good, but the building needs a $100k new roof. Isolation from networks – laboratory seems to struggle to keep an e-mail service operating.

Laboratory:	Tonga MAF Analytical Laboratory – 1997	Tonga MAF Analytical Laboratory - 2006
Location:	Vaini Research Station, Ministry of Agriculture and Forestry, PO Box 14, Nuku'alofa, Kingdom of Tonga	Vaini Research Station, Ministry of Agriculture, Forestry and Fisheries, PO Box 14, Nuku'alofa, Kingdom of Tonga
Organisation - External:	The laboratory is part of the Plant Nutrition, Soil & Water Section of the Research Division which is one of eight divisions of the Ministry of Agriculture and Forestry.	The laboratory is part of the Plant Nutrition, Soil & Water Section of the Research Division which is one of eight divisions of the Ministry of Agriculture, Forestry and Fisheries.
Organisation - Internal:	Run as one unit.	Run as one unit
Laboratory Manager:	Viliami Manu, Principal Soil Scientist	Vunivesi Minoneti. Previous manager is now at HQ but still has an interest in the laboratory.
Staff:	Manager and a soil scientist (who has an office in the laboratory) both have other duties in addition to their laboratory input. There is one technician, another on study leave, and a laboratory assistant.	Manager, two technicians
Facilities:	Purpose designed building (early 1980's). Has one large room with smaller instrument room and preparation/oven room; a total space of about 90 m^2.	Same
Equipment:	AAS - Pye Unicam SP9 - 13 yrs Vis Spectrophotometer - Pye SP6 - 13 yrs UV/Vis Spectro - Milton Roy Spectronic 501- new pH meter - Philips Pu 9420 - 13 yrs pH meter - TPS Moisture meter - Ohaus 2 x Ovens Muffle Furnace - Gallenkamp Steam Distillation unit - Buchi 316 4 Electronic Balances 1 Fume Cupboard 2 x Computers (486 & Mac IIci	AAS Varian SpectraAA 50B - not working Two UV/Vis spectros – not working pH meter - TPS Oven – works 2 working balances Digestion block – not working Centrifuge – OK RO water system – not working Distillation water system - OK
Number of Samples:	1996: Soils - 467 samples - about 3,500 tests Plants - 134 samples - about 1,000 tests	Very few soil and plant analyses done in last two years due to lack of operational equipment. Some water analyses done using hospital UV/Vis

Laboratory:	Tonga MAF Analytical Laboratory – 1997	Tonga MAF Analytical Laboratory - 2006
Soil and Plant Methods:	SOILS: pH - 1:2.5 soil water (or 1 M KCl) suspension, stir and leave overnight N - Kjeldahl digestion (Cu catalyst) followed by steam distillation. Exchangeable Ca, Mg, K & Na - shaking with 1 M ammonium acetate, 1:25 ratio. Available P - Bondorff - manual Murphy-Riley finish. PLANTS: N - Kjeldahl digestion (Cu catalyst) with sulpho-salicylic acid nitrate pretreatment followed by steam distillation. P - Kjeldahl digest followed by manual Murphy-Riley. K - Kjeldahl digest followed by AAS determination Ca - dry ashing followed by AAS. Mg - as for Ca Traces (Fe, Mn, Cu, Zn) - as for Ca	Same methods as before
Quality Assurance:	Method manual not updated since 1984. No QA manual. No evidence of QC samples or external sample exchanges	Method manual recently updated, based on SPACNET manual. Equipment and operating manuals also up to date.
Strengths:	Good building. Demand for analytical service is strong from both Research and Extension Fertiliser imports into Tonga are running at about 3000 T / year and 75% of this is used for squash growing at relatively high rates. It is probable that much of it is unnecessary. In addition concerns are being expressed about the environmental impacts of excessive amounts of agricultural inputs (Professor John Morrison, University of Wollongong; pers comm). An efficient soil fertility assessment service would enable farmers to tailor fertiliser programmes to their actual needs and not just use heavy blanket standard recommendations. This would save them money and reduce contamination of ground water by excess leached nutrients. The Ministry is moving into cost recovery policies so that is likely that the laboratory would be able to retain future earnings to use for operating costs.	Good building still. Still is an unfulfilled demand for soil fertility analyses to rationalise fertiliser use and prevent on-going environmental pollution. Previous manager (Dr Viliami Manua) has been tasked with looking into a food standards laboratory by the Ministry. Made strong representations that it would be desirable to combine this with soil fertility, plant nutrition and environmental laboratories. This would make efficient use of resources and create a laboratory of a size that would have more chance of survival. Dr Manu has returned to Vaini Research Station as Deputy Director, Research

Laboratory:	Tonga MAF Analytical Laboratory – 1997	Tonga MAF Analytical Laboratory - 2006
Weaknesses:	Lack of operating funds. A possible way of addressing this was discussed above. Lack of trained technicians. This means that there is a lack of practical skills in the laboratory, as shown by the fact that the major instruments were not maintained. This practical training is gained from technician courses, on-the-job training, or secondments to larger laboratories. The scientists in the laboratory have very good theoretical skills but have not had the opportunity to develop practical skills. Method manual needs up dating. No QA programme or manual.	Lack of operating funds. Inoperable equipment means that very few samples have been analysed in last two years. Viability of laboratory must be in question.

Laboratory:	**USP Alafua Agricultural Chemistry Laboratory, Apia, Western Samoa – 1997**	**USP Alafua Agricultural Chemistry Laboratory, Apia, Western Samoa - 2006**
Location:	School of Agriculture, USP Alafua Campus, Private Mail Bag, Apia, Western Samoa	School of Agriculture, Food and Technology, USP Alafua Campus, Private Mail Bag, Apia, Western Samoa
Organisation - External:	The laboratory is part of the Soil Science department of the University of the South Pacific's School of Agriculture.	The laboratory is part of the Soil Science department of the University of the South Pacific's School of Agriculture, Food and Technology.
Organisation - Internal:	Run as one unit.	Run as one unit.
Laboratory Manager:	Dr Loku Yapa, Senior Lecturer and head of Soil Science	Daya Perera, Senior Technician
Staff:	Manager (who has other duties), Senior technician position is vacant, three technicians or technical assistants.	Manager, 2 technicians and 2 technical assistants
Facilities:	Large building of approximately 160 m^2 split into a main laboratory 0f about 70 m^2, a smaller laboratory or preparation area of about 50 m^2, plus a number of other rooms and offices.	Same
Equipment:	AAS - Perkin Elmer 2380 - 10 yrs Vis Spectrophotometer - Spectronic 20- 10 yrs pH meter - Orion 811 pH meter - EDT RE357 EC meter - Cole-Palmer 4 x Ovens Muffle Furnace – Gallenkamp 4 Electronic Balances 2 Fume Cupboard 2 x Computers (2 x 486 & 286)	AAS PE 200 1 year old Old spectronic UV/Vis – not working pH meter – Orion - old but working EC meter - new Parr Bomb calorimeter - working but very old 5 balances Muffle furnace – new Manual distillation equipment for N 2 Fume Cupboard 2 x Computers
Number of Samples:	1996: not known, but low due to loss of Chief Technician and AAS being out of action for many months. Workload generated from USP varies a lot depending on students' thesis projects.	2004: Soil - 197 samples, about 2000 tests Plant - 56, about 550 tests Feeds - 154 samples, about 1050 tests

Laboratory:	USP Alafua Agricultural Chemistry Laboratory, Apia, Western Samoa – 1997	USP Alafua Agricultural Chemistry Laboratory, Apia, Western Samoa - 2006
Soil and Plant Methods:	SOILS: pH - 1:1 soil water (or 1 M KCl) suspension, one hour. Exchangeable Al - 1 M KCl extraction, titration finish C - Walkley - Black with titration finish N - Kjeldahl digestion (Cu & Se catalyst) followed by steam distillation. Exchangeable Ca, Mg, K & Na - leaching or shaking with 1 M ammonium acetate, 1:10 ratio. CEC - leaching method, alcohol wash following bases extraction, then NaCl leaching and steam distillation determination of the ammonium ions. Available P - modified Truog (0.01M H_2SO_4) PLANTS: N - Kjeldahl digestion (Cu & Se catalyst) (no nitrate pretreatment) followed by steam distillation. P - nitric / perchloric digestion followed by Murphy-Riley determination K - nitric / perchloric digestion followed by AAS determination Ca - as for K Mg - as for K Traces (Fe, Mn, Cu, Zn) - as for K	Similar but have switched to SPACNET methods and ceased using perchloric acid digestions (safety reasons).
Quality Assurance:	Soils method manual not updated since 1970's. No QA manual. No evidence of QC samples or external sample exchanges	Using SPACNET methods manual and QC manual. Needs to be rewritten to suit this laboratory. Using QC samples but not charting results. Have carried out some sample exchanges with outside laboratories.

Laboratory:	USP Alafua Agricultural Chemistry Laboratory, Apia, Western Samoa – 1997	USP Alafua Agricultural Chemistry Laboratory, Apia, Western Samoa - 2006
Strengths:	Good building except for fume cupboards. Demand for an analytical service (which they are prepared to pay for) is strong from both Research and Extension divisions of the Ministry of Agriculture, Forests, Fisheries and Meteorology (MAFFM). Fertiliser usage is increasing in Western Samoa. The Director of Extension said farmers wanted access to reliable, quick and not too expensive soil fertility service. Such a service would have to include interpretation and advice to be useful however. The researchers need the service to optimise their agronomic trials. The provision of such a service would fill in the gaps in the laboratory's workload and justify the acquisition of improved equipment.	Good building with fume cupboard now rebuilt. Stable staff. Reasonable base load of work which has the potential to be greatly enhanced with the rejuvenation of USP's research programme and the provision of a soil fertility and plant nutrition service to the Samoan Ministry of Agriculture.

Laboratory:	**Laboratoire d'Analyses du Centre ORSTOM - 1997**	**Laboratoire des Moyens Analytiques, IRD, Noumea, Nouvelle-Caledonie 2006**
Location:	Laboratoire d'Analyses, ORSTOM, BP A5, Nouméa Cedex, Nouvelle Calédonie	IRD, BP A5, Nouméa Cedex, Nouvelle Calédonie
Organisation - External:	The laboratory is part of the ORSTOM (L'Institut français de recherche scientifique pour le développement en coopération) centre in Noumea which has a total staff of 165. It provides a service to the research sections of the organisation, particularly the Agronomy and Soils section.	The laboratory is part of the IRD (Institut de recherche pour le développement) centre in Noumea. It provides a service to the research sections of the organisation, particularly the Agronomy and Soils section.
Organisation - Internal:	The laboratory is run as one unit.	
Laboratory Manager:	Dr Jean Louis Duprey	M. Alain Plenecassagne
Staff:	10 staff: scientist manager and deputy manager who are from France, and eight technicians from New Caledonia.	Manager, senior technician and 4? Other staff.
Facilities:	Very good purpose built laboratory in the main ORSTOM building with ample rooms and space for all activities. Plenty of fume cupboards, reticulated pure water, and all air-conditioned. Sample preparation carried out in a detached building some distance from laboratory.	Very good purpose built laboratory in the main IRD building with ample rooms and space for all activities. Plenty of fume cupboards, reticulated pure water, and all air-conditioned.
Equipment:	AAS - Varian Spectra, flame - 9 yrs 3 x AutoAnalysers - 3 to 27 yrs Buchi 430 Digester - 6 yrs Buchi 323 Distillation apparatus - 6 yrs 3 x pH meters Titrator - Metrohm 682 Conductivity meter - Metrohm 660 4 Fume Cupboards 4 Electronic Balances Computers - 5 x 486's some attached to instruments	AAS Spectra AA-300 – good ICP PW 3300DV - good Microwave Digestor 3 x AutoAnalysers x pH meters Titrator - Metrohm 682 Conductivity meter - Metrohm 660 4 Fume Cupboards 4 Electronic Balances Many computers

Laboratory:	Laboratoire d'Analyses du Centre ORSTOM - 1997	Laboratoire des Moyens Analytiques, IRD, Noumea, Nouvelle-Caledonie 2006
Number of Samples:	1995: 3070 samples involving 36,140 tests. 56% soils, 29% plants, 14% waters.	Laboratory averages about 40,000 tests per year. 2005: lower than average at 22500.
Methods:	SOIL: pH - 1:2.5 soil water (or 1 M KCl) suspension, short stir. C - Walkley - Black. N - Kjeldahl digestion (Cu catalyst) followed by steam distillation Exchangeable Ca, Mg, K & Na - NH4Cl method of Tucker CEC - NH4Cl method of Tucker Al - exchangeable - KCl extraction followed by titration. Available P - Olsen with Dabin modification (NH4F) - autoanalyser finish. Total Elements - nitric / perchloric digest followed by AAS. PLANTS: N - Kjeldahl digestion (Cu catalyst, sulpho-salicylic acid) followed by steam distillation or autoanalyser finish. P - nitric / perchloric digestion followed by autoanalyser determination. K - nitric / perchloric digestion followed by AAS determination Ca - as for K Mg - as for K Traces (Fe, Mn, Cu, Zn) - as for K	Same methods except all metal analyses now by ICP-OES
Quality Assurance:	Good method manuals, well developed computerised sample registration system, calculation and results handling. Sample exchanges with other ORSTOM laboratories.	Good method manuals, well developed computerised sample registration system, calculation and results handling. Sample exchanges with other IRD laboratories.

Laboratory:	Laboratoire d'Analyses du Centre ORSTOM - 1997	Laboratoire des Moyens Analytiques, IRD, Noumea, Nouvelle-Caledonie 2006
Strengths:	Very experienced staff. Technical staff range from 9 to 36 years experience. Well resourced laboratory in terms of facilities and equipment.	Very experienced staff. Well resourced laboratory in terms of facilities and equipment. Laboratory client base has expanded and now includes other French Pacific territories, other research organisations, and local university as well as IRD researchers.
Weaknesses:	Laboratory is very reliant on a small client base. Most of the work is soil characterisation from the agro-pedology section. Very little soil fertility / plant testing work done even though fertiliser is used by farmers. The provision of such a service would widen the laboratories client base and lead to more efficient fertiliser use. Limited contact with other laboratories in the region. This is partly a language problem.	Still little soil fertility / plant testing work done even though fertiliser is used by farmers. Has been limited contact with other laboratories in the region at least partly because of language. However current manager speaks some English and deputy manager has excellent English.

Laboratory:	National Agricultural Chemistry Laboratory (NACL) 1997	National Agricultural Research Institute Laboratory (NARI), Port Moresby, Papua New Guinea - 2006
Location **- mail**	Kilakila, Port Moresby, Papua New Guinea Department of Agriculture and Livestock, PO Box 417, Konedobu, NCD, Papua New Guinea	Kilakila, Port Moresby, Papua New Guinea PO Box 417, Konedobu, NCD, Papua New Guinea
Organisation - External	Department of Agriculture and Livestock has three divisions, Technical Services, Field Services and General Services (Admin). Technical Services is divided into Research and Agricultural Protection. Research has Land Use, Crop Research and Livestock Research Sections. Agricultural Protection sections are Quarantine and the NACL. A major part of NACL's workload comes from the Research Division. A major restructuring of agricultural research in PNG is about to be undertaken and this will involve NACL. This is discussed below.	Now part of the National Agriculture Research Institute which has its HQ in Lae.
Organisation - Internal:	NACL is run as three sections; Soil and Plant, Rubber and Natural Products. The natural products section analyses food, waters, and other natural products.	Same
Laboratory Manager:	Peter Corbett, Chief Agricultural Chemist	Peter Corbett, Chief Agricultural Chemist
Staff:	Two Scientific Officers (SO), two Senior Technical Officers (STO), and two Technical Officers (TO) in the Soil and Plant Section. Food and Natural Products have one SO and one STO, while Rubber has one STO and one Technical trainee. There are also two labourers for sample preparation, cleaning etc.	Deputy Manager / QC manager plus 3 other technical staff.
Facilities:	The laboratory is housed in a modern purpose designed building built in 1986 with the assistance of New Zealand aid. There are two general laboratory areas, the smaller one for natural products and a very large laboratory for soil and plant testing. In addition there is a large instrument room, two rooms, each with three fume cupboards, a wash-up room, soil and plant preparation rooms, and a number of other special purpose rooms. The instrument room and the two main laboratories are air-conditioned. There is an external chemical and sample store.	In June 2005 the laboratory building had the roof burnt off in a fire that started with solvents stored in a fridge. All of the laboratory equipment was damaged or destroyed by smoke or water damage. Laboratory Manager has managed to get EU funding to replace the roof (done) and rebuild interior. He will then try and source funding for new equipment.

Laboratory:	National Agricultural Chemistry Laboratory (NACL) 1997	National Agricultural Research Institute Laboratory (NARI), Port Moresby, Papua New Guinea - 2006
Equipment:	The laboratory has recently received a large amount of new equipment purchased with Australian aid. Included in the overall package are installation and training trips for the instrument operators. C, N & S Analyser - LECO CNS2000 - new UV/Vis Spectrophotometer - Varian/Cory 1C - new AAS - Varian SpectraAA200, graphite furnace - new AAS - Varian SpectraAA200, flame - new AAS - Varian SpectraAA200, hydride generator - new HPLC - Varian - new (for pesticide residues) HPLC - Waters - (for cocoa work) GC - Varian Star 3400 CX Microwave Digester - CEM MDS 6 Fume Cupboards 7 Electronic Balances Computers 4 x 486's attached to new instruments 4 x stand alone 486 or pentiums 1 x 486 with old Xenix operating system	All equipment will need replacing including an ICP-OES which had become the main instrument used in the laboratory for metals analyses, particularly environmental analyses.
Number of Samples:	1996: 35% from DAL, 65% commercial and farmers. 1847 soils 671 plants 20 natural products 2623 rubber 49 water These samples resulted in approximately 40,000 tests.	2004: 2126 samples, 14,533 tests with leaf> water> soil> food. Rubber analyses which previously made up a large part of the laboratories workload ceased a couple of years ago. Factory has reopened and this work should restart.

Laboratory:	National Agricultural Chemistry Laboratory (NACL) 1997	National Agricultural Research Institute Laboratory (NARI), Port Moresby, Papua New Guinea - 2006
Soil and Plant Methods:	SOIL: pH - 1:5 soil water (or 1 M KCl) suspension, 1 hour shake. EC - 1:5 soil water suspension, one hour shake. C - Walkley - Black (changing to LECO CNS2000). N - Kjeldahl digestion (Se catalyst) followed by steam distillation (changing to LECO CNS2000) Exchangeable Ca, Mg, K & Na - leaching with 1 M ammonium acetate, 1:10 ratio. CEC - leaching method, alcohol wash following bases extraction, then NaCl leaching and steam distillation determination of the ammonium ions. Available P - Olsen - manual Murphy-Riley finish. P retention - Saunders method. Exchangeable Al - 1 M KCl extraction, AAS determination. Particle Size - hexametaphosphate shaking dispersion followed by 2-point hydrometer estimation of sand and clay. PLANTS: N - Kjeldahl digestion (Se catalyst) followed by steam distillation, no nitrate pretreatment, (changing to LECO CNS2000). P - nitric / perchloric digestion followed by vanado/molybdate determination. K - nitric / perchloric digestion followed by AAS determination Ca - as for K Mg - as for K Traces (Fe, Mn, Cu, Zn) - as for K B - ashing followed by azomethine-H determination S - digestion and ashing with Mg nitrate followed by Ba sulphate gravimetric determination.	Similar and a number of environmental methods (such as total metals) added and an ICP finish instead of AAS..

Laboratory:	National Agricultural Chemistry Laboratory (NACL) 1997	National Agricultural Research Institute Laboratory (NARI), Port Moresby, Papua New Guinea - 2006
Quality Assurance:	Laboratory is accredited through PNGLAS (Papua New Guinea Laboratory Accreditation Scheme) which is supported by NATA in Australia. PNGLAS carries out accreditation inspections to NZ or Australian standards and ensures that laboratory quality control systems, equipment calibration, staff training etc are meeting the criteria of good laboratory practice. The laboratory has a good in-house quality control system with internal reference samples run with every batch of analyses. Control charts are used to keep track of precision and accuracy. Participation in external sample exchanges occurs with generally good results. Staff are experienced and well trained.	Laboratory will need help to regain its accreditation to PNGLAS which it lost before the fire because of workload issues prevented it from staying up to date with documentation.
Strengths:	Good building with some modifications and extensions needed for expanding and changing work. Excellent equipment, most of which is new. Good QA program with very full QA manual which documents all of the laboratories activities. This arises from the laboratory accreditation. Experienced Laboratory Manager (who is following on from a very experienced manager). Stable and well trained scientific staff and technicians (most technicians have done a technicians course at Lae polytech). Well founded methods which are mostly based on regionally (and internationally) accepted methods such as Blakemore et al, 1987) and Rayment and Higginson, 1992).	Experienced staff. When (and if) the laboratory is rebuilt and equipped it will be well resourced for the next 10 years. Has been accredited before so knows what is required and is mostly compliant.
Weaknesses:	Chronic shortage of operating funds restricts laboratory output. The laboratory currently does not charge for its services, but unless clients can provide chemicals and other operating necessities it is unlikely that their samples will be analysed. It is expected that the placement of the laboratory into the new National Agricultural Research Institute this year will solve these under funding problems. The Institute will be a Quango with the ability to run its own finances. This will give the laboratory the chance to carry out cost recovery for	Funds are always short, however laboratory now keeps its own income which gives flexibility. Danger in not regaining all previous clients if it takes too long to rebuild and re-equip.

Laboratory:	National Agricultural Chemistry Laboratory (NACL) 1997	National Agricultural Research Institute Laboratory (NARI), Port Moresby, Papua New Guinea - 2006
	analyses and use the income to finance laboratory costs. Despite training opportunities mainly in Australia, laboratory staff feel isolated from other soil chemists and agricultural analysts. QA manual needs up-dating; current edition is dated 1991. Historic slow sample turn-a-round time. This makes it difficult to run a soil fertility advisory service (a needed service and one of the best ways to maintain an income stream). The installation of a large amount of new equipment has begun to improve turn-a-round times and an improvement in the availability of operating funds should complete the process. The laboratory has the equipment, staff and systems in place to give a very rapid and accurate service	

Laboratory:	National Analysis Laboratory (NAL) – 1997	National Analysis Laboratory (NAL) - 2006
Location physical:	University of Technology, Lae, Papua New Guinea	University of Technology, Lae, Papua New Guinea
- mail:	PNG University of Technology, PO Box 79, Lae, Morobe, Papua New Guinea	PNG University of Technology, PO Box 79, Lae, Morobe, Papua New Guinea
Organisation - External:	The laboratory is a self-funding, fully commercial part of Unitech Development & Consultancy Ltd, which is the commercial arm of the PNG University of Technology.	The laboratory is a self-funding, fully commercial part of Unitech Development & Consultancy Ltd, which is the commercial arm of the PNG University of Technology.
Organisation - Internal:	NAL is run as three sections; General Analysis, Trace Metal Analysis and Pathology. Soil and Plant analysis are carried out in the General Analysis section.	
Laboratory Manager:	Fred Grieshaber, Chief Chemist.	Ian Walsh, Chief Chemist (was previously Deputy Manager).
Staff:	Total staff of 14 most of whom have tertiary degrees in science.	Similar
Facilities:	The laboratory has a lot of space and as it carries out a lot of environmental work for mining companies it has a class 350 clean room with a graphite furnace AAS. Part of the laboratory is an old university teaching laboratory and there are plans to replace this with a new building in the next year or so.	The laboratory has a lot of space and as it carries out environmental work for mining companies it has a class 350 clean room.
Equipment:	AAS - Varian SpectraAA40, graphite furnace - 4 yrs AAS - Varian SpectraAA20+, flame - 5 yrs AAS - Perkin Elmer 3100, flame with FIAS - 7 yrs. 2 x Kjeldahl distillation unit, Buchi TOC analyser - OI 700 - 4 yrs 3 Fume Cupboards 7 Electronic Balances Computers -8 x miscellaneous Apples	Perkin Elmer 3100 ICP-OES – 6 years - not currently working AAS - Varian SpectraAA20+, flame - 15 yrs GFAAS - Perkin Elmer & Varian – 13 & 15 years GBC hydride AAS UV / Vis Spectro – Varian – not working 3 Fume Cupboards 7 Electronic Balances Computers - many

Laboratory:	National Analysis Laboratory (NAL) – 1997	National Analysis Laboratory (NAL) - 2006
Number of Samples:	1996: 6500 samples in 920 jobs for whole laboratory These samples resulted in approximately 60,000 tests. 60% samples were waters, 30% were stock feed. The remaining 10% were soils, plants, sediments, fish etc.	2004:
Soil and Plant Methods:	SOIL: pH - 1:5 soil water (or 1 M KCl) suspension, ½ hour shake EC - 1:5 soil water suspension. C - Walkley - Black. N - Kjeldahl digestion (Se catalyst) followed by steam distillation. Exchangeable Ca, Mg, K & Na - leaching with 1 M ammonium acetate 1:10 ratio. CEC - leaching method, alcohol wash following bases extraction, then NaCl leaching and steam distillation determination of the ammonium ions Available P - Olsen - manual Murphy-Riley finish. PLANTS: N - Kjeldahl digestion (Se catalyst) followed by steam distillation, no nitrate pretreatment. P - nitric / perchloric digestion followed by vanado/molybdate determination. K - nitric / perchloric digestion followed by AAS determination Ca - as for K Mg - as for K Traces (Fe, Mn, Cu, Zn) - as for K	Similar plus water and environmental sample methods

Laboratory:	National Analysis Laboratory (NAL) – 1997	National Analysis Laboratory (NAL) - 2006
Quality Assurance:	Laboratory is accredited through PNGLAS (Papua New Guinea Laboratory Accreditation Scheme) which is supported by NATA in Australia. PNGLAS carries out accreditation inspections to NZ or Australian standards and ensures that laboratory quality control systems, equipment calibration, staff training etc are meeting the criteria of good laboratory practice. The laboratory is also a member of ASPAC (Australian Soil and Plant Analysis Council) and through good performance in this groups sample exchange program is accredited to carry out EC, pH, Carbon, Olsen-P, and Exchangeable Mg, K & Na on soils; and N, K, S, Ca, Mg, Cu, Fe, Mn & Zn on plants. The laboratory has an in-house quality control system with internal reference samples run with every batch of analyses. Control charts are used to keep track of precision and accuracy Staff are experienced and well trained.	Laboratory is still accredited to ISO 17025 through PNGLAS (Papua New Guinea Laboratory Accreditation Scheme) which is supported by NATA in Australia.
Strengths:	Very experienced Laboratory Manager. Stable and well trained scientific staff and technicians. Good building with some modifications and extensions needed for expanding and changing work. Good equipment, most of which is less than 5 years old. Good QA program with very full QA manual which documents all of the laboratories activities. This arises from the laboratory accreditation. Fully commercial laboratory so does not suffer from the common Pacific laboratory problem of shortage of operating funds. Most methods are well founded and are based on regionally (and internationally) accepted methods such as Blakemore et al, 1987) and Rayment and Higginson, 1992).	Very experienced Laboratory Manager. Stable and well trained scientific staff and technicians. Good building As required by accreditation the laboratory has fully developed QA program. Fully commercial laboratory and is self funding.

Laboratory:	National Analysis Laboratory (NAL) – 1997	National Analysis Laboratory (NAL) - 2006
Weaknesses:	In terms of soil and plant analyses, the laboratory does not carry out large numbers. This makes continuity of analysts' skills a potential problem. Some methods could be improved particularly for plant analyses and exchangeable bases.	Isolation (and reputation for violence of area) is preventing the repair of the ICP-OES, which normally produces a large proportion of the laboratory results. Other equipment is aging.

Laboratory:	National Analytical Laboratory, Solomon Islands - 1997	National Analytical Laboratory, Solomon Islands - 2006
Location - physical:	Dodo Creek Research Station, Ministry of Agriculture and Fisheries, Solomon Islands	
Location - mail:	Ministry of Agriculture and Fisheries, PO Box G13, Honiara, Solomon Islands	
Organisation	The laboratory is part of the Research Division of the Ministry of Agriculture and Fisheries.	
Laboratory Manager:	Fred Peter, Research Officer	Fred Peter, Research Officer
Staff:	The laboratory staff currently consists of an analyst with 10 years experience who at the time of the visit was on maternity leave, and a Research Officer who also has other duties.	
Facilities:	The laboratory has purpose built-building with approximately 180 square metres of space spread over six rooms. Some of the rooms are air-conditioned, but not all of these are working. The most pressing problem with the facilities are that the two fume cupboards have both collapsed (because of water leaks causing the particle board walls to disintegrate). These will need to be replaced before any plant analyses or soil N analyses can be carried out.	The laboratory was destroyed during civil unrest in 2001 and still has not been rebuilt.
Equipment:	Vis Spectrophotometer - Spectronic – old AAS - Varian SpectraAA20, flame - 5+ yrs - not working Flame Photometer - Corning. Kjeldahl distillation unit, Kjeltec 1026. 2 x pH meter - Pye Unicam 291 – old 2 Electronic Balances Computers – none	All equipment destroyed
Number of Samples:	1996: 22 samples - analyses not completed. Lab was analysing 1000's of samples in the 1980's. 1992 – 426 1993 – 288	

Laboratory:	National Analytical Laboratory, Solomon Islands - 1997	National Analytical Laboratory, Solomon Islands - 2006
Soil and Plant Methods:	SOIL: pH - 1:2.5 soil water. EC - 1:2.5 soil water suspension. ½ hour shake then overnight standing. C - Walkley - Black. N - Kjeldahl digestion - complicated digestion followed by a manual colorimetric measurement of ammonium Exchangeable Ca, Mg, K & Na - leachings with an alcohol:ammonium acetate reagent CEC - complicated leaching method with three more leachings following bases extraction. CEC measured by AAS determination of Na Available P - Olsen uses 2 hour shake cf. normal; ½ hour. Total P - Nitric / Sulphuric digestion. Probably gives low results. Total K - Nitric / Perchloric digestion. Dangerous in current fume cupboards. Limited usefulness of results. DPTA extractable trace metals. - method OK but some doubt as to usefulness - i.e. how to interpret results PLANTS: N - Kjeldahl digestion - good method with nitrate inclusion, followed by steam distillation. K -Kjeldahl digest P Ca -Kjeldahl digest Mg - Kjeldahl digest Traces (Fe, Mn, Cu, Zn), acid digestion	Methods were changed to SPACNET recommended methods following training of Laboratory Manager.
Quality Assurance:	Laboratory is not currently operating so difficult to judge, however the only manual seen was a methods manual. This was written with the help of a British volunteer who worked in the laboratory until 1992. The methods are mostly based on older British and Dutch methods most of which give good results, but many are unnecessarily complicated. There are simpler, but just as accurate methods in use in other	SPACNET QA manual was adopted

Laboratory:	National Analytical Laboratory, Solomon Islands - 1997	National Analytical Laboratory, Solomon Islands - 2006
	laboratories of the region.	
Strengths:	Good building with some urgent repairs needed to fume cupboards. Strong commitment from the Director Research to keep the laboratory operational Demand from 170 Extension Officers and more than 10 Research Agronomists for an analytical service	
Weaknesses:	Lack of trained staff. The person designated to be in charge of the laboratory has no previous experience in a chemistry laboratory. Aging and inadequate equipment Lack of QA manuals and systems. Current method manual needs updating with simpler and more relevant methods	

Laboratory:	**Vanuatu Department of Agriculture and Horticulture, Port Vila, (no current laboratory) – 1997**	**Vanuatu Department of Agriculture and Horticulture, Port Vila, (no current laboratory) 2006**
Location:	Department of Agriculture and Horticulture, Private Mail Bag 040, Port Vila, Vanuatu	
Need for a Laboratory:	Discussions concerning the need for a laboratory were held with the Director of Agriculture, Steven Kalsakau, Jeffery Lahva, IBSRAM cooperator, Charles Rogers, Director, Farm Support Association, and James Wasi, Principal Agricultural Extension Officer. The consensus seemed to be that a laboratory was not required yet for the following reasons. There is only a very small amount of fertiliser being used in the whole country to date, therefore little or no demand for a soil testing service. There is some agronomic research being carried out (PRAP and IBSRAM), but this is mostly regionally funded and as long as funds are included in the budgets, analyses can be purchased from a laboratory in the region. This scenario however requires at least sample preparation facilities for particularly plant samples. These need to be dried, and preferably ground soon after sampling to prevent spoilage.	No progress on developing a laboratory.
Facilities:	A 16 square meter room was located on the research station containing some equipment left over from the now completed pasture improvement program.	
Equipment:	Large fan oven (40-70°C). This is suitable to dry soils at the low temperature and plants at the higher. Kubati hammer mill - for plant grinding. Freezer - useful for freezing excess plant samples prior to preparation. Small oven (240°C) - suitable for soil water contents at 105°C.	
Equipment Needed:	A simple water purification system, pH meter and EC meter would allow the measurement of useful but simple to measure soil properties for the cost of a $2000 - $3000.	

Laboratory:	Vanuatu Department of Agriculture and Horticulture, Port Vila, (no current laboratory) – 1997	Vanuatu Department of Agriculture and Horticulture, Port Vila, (no current laboratory) 2006
Strengths:	The strength of such a proposed preparation and simple measurement laboratory is that it is appropriate for the current needs of the department. It would be capable of expansion in future using the models developed in other countries of the region if demand rises. This would happen if the use of fertiliser for cash cropping increased dramatically making the optimisation of this fertiliser use more important. The other scenario where a better developed laboratory would be needed would be if more in-country funded agronomic research was carried out.	
Weaknesses:	The isolation of the probably one staff needed for the laboratory would need to be addressed by training and on-going contact with a laboratory in a larger country of the region. Even for a very simple level laboratory such as that proposed, QA is important. A method and procedures manual would be required.	