

Report of a Review of the PestNet Network

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Content of the Report

Executive summary and Recommendations

1. Introduction

- 1.1. The History of PestNet**
- 1.2. The Pest Net email service**
- 1.3. The PestNet website**
- 1.4. The Review of PestNet**
 - 1.4.1. *Feedback on PestNet***
 - 1.4.2. *Analysis of PestNet Services***

2. Use and value of PestNet

- 2.1. Introduction**
- 2.2. Use and Value of the PestNet email service**
- 2.3. Use of the PestNet website**
 - 2.3.1. *PestNet use statistics***
 - 2.3.2. *Statistics on the use of fact sheets accessed via the Pest***
- 2.4. Feedback from PestNet Users, Contributors and Others**
 - 2.4.1. *Summary***
 - 2.4.2. *Respondents' Feedback on the Impact and Value of PestNet***

3. Suggestions for improving PestNet

- 3.1. Introduction**
- 3.2. Current constraints to PestNet operation**
- 3.3. Potential improvements in the way PestNet services are delivered**
- 3.4. Improve the ability of PestNet to meet users' requests**
- 3.5. The taxonomic problem and potential for greater use of specialists to improve the PestNet service**
- 3.6. Strategic options**
- 3.7. Scope of PestNet (regional/global)**
- 3.8. Funding issues**
- 3.9. Collaboration and partnership options**
- 3.10. Other ideas on future strategies**

4. Future Options for PestNet and Recommendations

- 4.1 Introduction**
- 4.2 Funding strategy**
- 4.3. The scale of PestNet in the future; Regional or Global**
- 4.4. The email service and ways in which it can be improved**
- 4.5. Ways in which the PestNet website can provide additional support to the email system**
- 4.6. How other plant protection sites and services could complement PestNet activities**

Appendices:

- **Appendix 1: Terms of Reference**
- **Appendix 2: PestNet initiatives in the Caribbean and Africa and a proposal regarding Latin and South America (Spanish translations)**

Executive Summary and Recommendations

Summary:

PestNet was established in December 1999 as an email network, initially aimed at plant protection workers in the Pacific Islands. The aim was to enable workers in remote situations, without access to identification or other support, to post queries about pest, disease and other plant protection issues on the network and for those able to provide answers to do so through the email network. PestNet services, including the email network and a dedicated website, are free.

In May 2012, Professor Geoff Norton at The University of Queensland was invited to review PestNet, with the aim of (a) assessing the impact and value of PestNet; (b) investigating what opportunities and constraints there might be to the future of PestNet; and (c) determining how PestNet might be improved. The full Terms of Reference are provided in Appendix 1.

With limited funding and time to conduct the review, there was little alternative than to conduct the review as a desk study. Thus the main data gathering exercise involved requests to PestNet users for feedback on the three main aims of the review summarised above. Analyses were also made of the activity of the email correspondence and of the use of the PestNet website and linked Pest Fact sheets. The extent and quality of the feedback received from PestNet users, as well as other interested parties, was extremely valuable and many contributors provided additional feedback when specific requests were made, particularly regarding future options and recommendations.

Analysis of the information flow through the PestNet network and feedback from a range of PestNet participants indicates that PestNet provides a unique and valuable service, particularly for the South Pacific and Asia. Given that this service is provided with very little occasional funding, it undoubtedly provides great value for money. Further, while there are a number of other agencies providing online pest information and diagnostic services for plant protection, the particular format and service provided by PestNet is uniquely different. It is primarily problem driven: requests for identification, diagnostic and other information regarding specific plant protection problems is the *raison d'être* for PestNet, involving the active participation of a community of plant protection experts and practitioners. The popularity of PestNet is indicated by the increase over the past 14 years to over 1,300 direct participants and, indirectly, to many more subsequent beneficiaries.

During the 14 year period that PestNet has been operating, the situation has changed on several counts. In the first place, the decline in expertise available for identifying and diagnosing plant pest and disease problems has continued. Second, there have been many developments in communication technology as well as other technologies, such as image databases, that provide additional resources for identification and diagnostics. A third factor is that many of the key people who established PestNet 14 years ago are still those who

moderate and facilitate the operation of PestNet and they do this primarily on a voluntary basis with very limited funding. While this has worked well in the past, there are questions about the future sustainability of PestNet. It is for these reasons that this review was initiated and that it is apposite that recommendations regarding the future of PestNet be considered and explored.

Recommendations:

The future strategy for PestNet will be determined by circumstances and decisions made by PestNet management as well as by decisions made by those in funding agencies and in organisations which could potentially provide complementary services. Therefore, the following recommendations are conditional on these other factors and, together with the other sections of this report, at least provide background information, a systematic framework, a number of options, and a working document for developing a future strategy.

There are six issues that are addressed in Section 4 of this report, leading to the series of recommendations concerning the future of PestNet reproduced below:

Recommendation 1:

Funding to support new technology and future management strategies

It is recommended that one or more funding agencies are approached to support specific one-off projects to upgrade PestNet communication technology and to facilitate the development of future PestNet management arrangements, as discussed in other recommendations in this report.

Recommendation 2:

The scale of PestNet in the future: Regional or Global

It is recommended that the main focus of PestNet in the immediate future should be on improving both the efficiency and sustainability of the email and online services to the Pacific Islands, SE Asia and Asia. PestNet services for other regions should be added as and when there is increased interest; willing “managers” and/or collaborators; committed regional moderators; experts who agree to contribute; and where any extra funding required is available.

Recommendation 3:

The email service and ways in which it can be improved

- *The feasibility and cost of developing a smartphone app for improving the metadata included with requests for management, ID and diagnostic assistance should be explored.*
- *Ways of increasing the number, involvement, and breadth of disciplines represented in the PestNet expert panel should be investigated, including approaches to institutions or scientific societies. Structuring the email service to allow expert contributors to choose to receive news items rather than general email queries should be explored as a means of encouraging their participation in PestNet’s expert panel.*
- *If the number of participants and scope of the email services and operations provided by PestNet are to increase, the feasibility of replacing the current Yahoo system should be examined.*

Recommendation 4:

Ways in which the PestNet website can provide additional support to the email system

- *It is recommended that a more obvious, step-by-step guide is developed and publicised via email and on the home page of the website, indicating the various options available when seeking assistance, particularly through the PestNet website but also through other relevant information sources on other, linked sites.*
- *A more detailed analysis should be made of the PestNet website using Google Analytics to assess current use of the various sections of the website and particularly the summaries section.*
- *Associated with the suggestion to develop an app for submitting queries and images to the PestNet server, consideration should be given to the development of an online “Summaries” database to automate the recording process for initial queries and responses as much as possible.*
- *Once the pest fact sheet app has been developed, the extent to which it is being used should be assessed and the potential for including other regionally appropriate extension material in an app should be explored, including accessing the summaries on the PestNet website.*
- *Consideration should also be given to the potential role that Facebook, Twitter or other social media systems could play as a component of PestNet communication.*

Recommendation 5:

How other plant protection sites and services could complement PestNet activities

It is recommended that the potential for cooperation with organisations and agencies such as CABI, ARDN, various CG Centres, PILN, SPC, Bugwood, APHIS-ITP, PaDIL, IAPPS, etc. should be explored to assess the pros and cons of developing stronger links. The initial aim would be to make the various “clients” serviced by these organisations aware of the PestNet email request service, website and fact sheet app provided by PestNet and to provide PestNet “clients” with additional information sources.

Recommendation 6:

Management of PestNet, succession planning and sustainability issues

A succession and future management plan should be developed as a matter of urgency, involving a meeting of PestNet moderators to address the replacement of retiring moderators with new volunteers; to seek funding for a full or part-time moderator if volunteers are not forthcoming; to explore collaboration with other organisations to assist in managing PestNet activities; or devise other options.

Acknowledgements:

I am extremely grateful to the many PestNet users and contributors who generously gave of their time to respond to the initial request for feedback, and in many case, responded to subsequent requests for information. A list of all respondents can be found in Table 1.2 in the Introduction. However, special mention should be made of the following moderators who provided valuable background information on PestNet and made many other contributions to this report: Grahame Jackson; Bob Macfarlane; Wilco Liebrechts; Guy Mathurin;; Banpot Napompeth; Charles Ssekye; George Wall.

1. Introduction

1.1. The History of PestNet

PestNet was established in December 1999 as an email network, aimed at providing rapid advice and information on crop protection. It started as a service for the Pacific when two developments came together: the widespread use of emails and the explosion of digital photography. Together they formed the basis for PestNet to evolve into a pest control, advisory and pest identification service. Scientists, practitioners and growers could easily send information to PestNet about a possible pest or other crop problem they detected and for which they needed advice and/or identification. Another important factor for PestNet success was the willingness of people who had worked in the Pacific and who had years of experience to be involved.

Of the Pacific's many countries and territories, only a few had and still have a well-functioning plant protection service. Most countries are too small to afford a plant protection service and, as a consequence, pest incursions could go unnoticed until it was too late to undertake eradication efforts. By the time a specialist from the SPC (Secretariat of the Pacific Community) or from some other agency visited the site, the crop and the pest had often long gone but the problem remained unresolved.

1.2. The PestNet email service

PestNet was established to address this specific problem by providing an email service to bring quick management advice and information on identification and diagnostics to practitioners in the Pacific, in particular those in remote areas. PestNet started with e-groups and, when that system was taken over by Yahoo groups, a smooth transition occurred to that service. The "Welcome" email from the Yahoo PestNet email network is shown in Box 1.1 below. However, it was not until a PestNet subscriber realized that photos

Box 1.1. Welcome email from PestNet

Hello,
The moderator of the pestnet group has approved your request for membership. Complete your Yahoo! Groups account:

Your email address has been added to the email list of a Yahoo! Group.
To gain access to all of your group's web features (previous messages, photos, files, calendar, etc.) and easier control of your message delivery options, we highly recommend that you complete your account by connecting your email address to Yahoo account. It is easy and free. Please visit:
<http://groups.yahoo.com/convacct?email=xxxxxx&list=pestnet>

Here are a few key tips to get you started:

- * To learn more about the pestnet group, please visit - <http://groups.yahoo.com/group/pestnet>
- * To post a message to this group, send email to - pestnet@yahoogroups.com
- * To contact the moderator of this group, send email to - pestnet-owner@yahoogroups.com
- * To unsubscribe from this group, send email to - pestnet-unsubscribe@yahoogroups.com

Thank you for choosing Yahoo! Groups as your email group service.
Regards,
Yahoo! Groups Customer Care

Your use of Yahoo! Groups is subject to <http://docs.yahoo.com/info/terms/>

could be attached to emails that PestNet really took off, since this improved the ability to identify and diagnose crop problems and so greatly enhanced the usefulness and impact of the PestNet network.

PestNet then rapidly expanded to service requests from South East Asia and a separate service was subsequently established for the Caribbean in 2003: later, the original service was extended to Africa. Now PestNet is open to anyone who has a question or wants to share information on issues about plant protection and quarantine. Emails submitted by PestNet members first go to 6 moderators, one of which will then either validate the email as a genuine request, or reject the email as unintelligible. In the past very few messages have had to be refused. The main reasons for refusal have been 1) advertising of services, 2) unclear English, 3) poorly phrased questions, 4) huge photos, 5) out-of-office responses.

The PestNet email service is free to members, which include staff from government and non-government organisations, universities, and the private sector, as well as farmers, advisors and students. Any organisation, group or individual can join: all they need is access to email. PestNet now has more than 1200 members in over 80 countries; the number of email requests and responses reported on the PestNet Network per month since 1999 are shown in Table 1.1.

Table 1.1. PestNet email message history

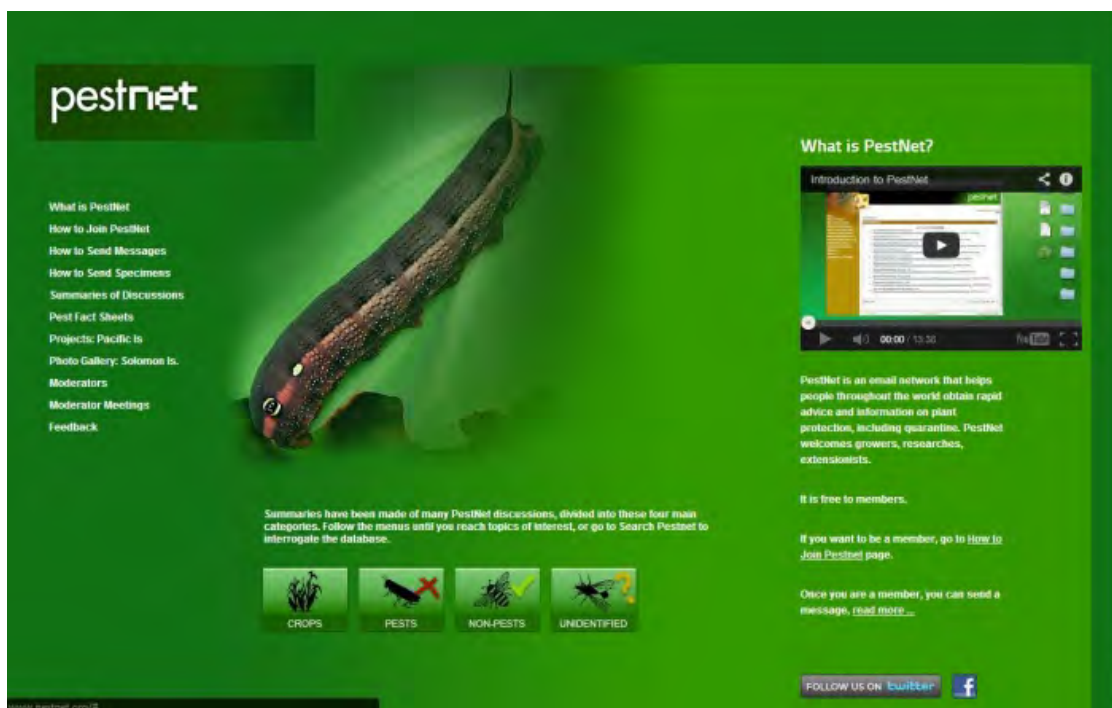
(Number of messages sent from December 1999 to July 2013)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	91	63	64	49	63	65	39					
2012	116	73	71	80	48	62	81	84	68	55	90	24
2011	60	78	90	57	114	100	65	34	70	85	62	96
2010	73	53	64	67	37	103	98	79	92	133	44	51
2009	50	64	101	62	67	66	83	106	73	71	55	83
2008	77	69	49	29	65	74	85	47	55	96	106	52
2007	38	34	93	55	73	48	40	48	38	73	51	32
2006	112	47	92	94	77	65	66	34	65	87	72	28
2005	71	59	133	76	82	107	42	82	77	65	74	59
2004	41	84	84	48	43	43	38	43	78	47	77	46
2003	38	40	50	31	28	62	56	40	25	42	42	67
2002	60	54	35	33	37	37	25	94	55	36	205	51
2001	43	31	14	30	19	46	43	42	22	20	47	57
2000	27	16	43	31	31	39	37	24	28	44	31	29
1999												1

1.3. The PestNet website

To provide additional support to the PestNet email service a dedicated website (www.pestnet.org) – has been developed. The main features of the website include:

- How to join and send messages
- Summaries of email discussions, and
- Pest Fact Sheets and images



Both the summaries and the fact sheets provide material that can be referenced by moderators in responses to email requests as well as providing resources that PestNet members can refer to initially before sending an email request.

1.4. The Review of PestNet

In May 2012, Professor Geoff Norton at The University of Queensland was invited to review PestNet. The full Terms of Reference for the review are provided in Appendix 1, and can be summarised as follows:

- Assess the impact and value of PestNet to users
- Determine how the current services provided by PestNet might be improved, and
- Investigate what opportunities and constraints there might be for the future of PestNet

The limited time and funds available for this review prohibited any detailed field work to assess the use and impact of PestNet in the South Pacific or Southeast Asia or to conduct field surveys to identify ways in which PestNet might be improved. Therefore the approach and process used to gather information for the review consisted of two main activities:

- Requesting feedback and comments from those involved in the PestNet network, as well as other interested parties, in response to the three main terms of reference

- Analysing activity associated with the PestNet email service, the PestNet website, and associated Pest fact sheets.

1.4.1. Feedback on PestNet

To obtain feedback from those involved in PestNet, both as users as well as contributors, a general request was sent via the PestNet network to all PestNet members seeking their thoughts on the impact and value of PestNet and on how PestNet activities could be improved. The initial email requesting this information is shown in Box 1.2 below.

Box 1.2. Initial email to PestNet users and contributors requesting feedback

Dear Members

I know these days we get all kinds of requests to give our opinions on this or that, to fill in forms, to give feedback, etc. And I know how time consuming this is. But **this** request is very important! We have got funds from ACIAR, the Australian Centre for International Agricultural Research for a PestNet evaluation.

I know that many of you have helped PestNet over the months and years, and we are very grateful. I know too that many have taken advantage of PestNet's services, and we hope they have been of use. But really we have no idea if we have been of use or not! So we want some evidence that PestNet is doing the right thing, and ideas from you on how we can improve.

The evaluation is being done by Geoff Norton - details below. Geoff has asked me to put out this email, to introduce him, and to ask for your help.

Very briefly, the terms of reference of the PestNet evaluation include:

- Assessing the impact and value of PestNet to users
- How the current services provided by PestNet might be improved, and
- What opportunities and constraints there might be for the future of PestNet

Since it is not possible to visit the many users of PestNet in different parts of the world, Geoff is relying on emails, Skype and other forms of communication to source information on the above issues. He will be contacting individuals associated with the operation of PestNet later. However, at this initial stage of the evaluation, he would be grateful for any feedback you can provide regarding PestNet activities, particularly any comments on the three issues listed above. Please email your comments to Geoff at G.Norton@uq.edu.au.

Regards

Grahame Jackson
[Chair PestNet]

Sent on behalf of:

Professor Geoff Norton

moderators, members and other interested parties (such as taxonomists who were occasionally asked to identify specific pests) to provide feedback on more specific aspects of PestNet, and particularly on the opportunities and constraints for the future of PestNet. For this purpose, several one-on-one Skype discussion sessions were organised with particular

participants. A full list of those responding to these requests is provided in Table 1.2 below: comments made by these correspondents on the first term of reference is provided in Section 2.4 , feedback on the other two terms of reference are provided in sections the 3.2 to 3.10.

List of those who have contributed to the Review of PestNet

A – H	J - M	N – W
Alan Anderson	Kong Luen Heong	Banpot Napompeth
Sheryl Backhouse	Grahame Jackson	Ian Naumann
Adamid Beltran	Greg Johnson	Mike Pearson
Jan Breithaupt	Elio Jovicich	Richard Piper
Dave Britton	Potineni Kalidas	Kim Pullen
Fred Brooks	Ruth Kerruish	Giacomo Rambaldi
Gerry Cassis	Jill Key	Rod Randell
Tim Chancellor	Gerrit van de Klashorst	David Rentz
Matthew Cock	Birte Komolong	Soetikno S Sastroutomo
Roger Day	Lastus Kuniata	Posa Skelton
Charles Dewhurst	Tuulima Laiti	Charles Sseyewa
Dick Drew	Wilco Liebrechts	Takena
Konrad Englberger	Wai Hong Loke	Peter Walton
Mark Ero	Lum Keng Yeang	Rowan Ward
Javier Franco	Guy Mathurin	Gillian Watson
Driekie Fourie	Bob McFarlane	John Wightman
Mike Furlong	Joe Miles	
Dagmar Hanold	Laurence Mound	
“Short” Heinrichs		

1.4.2. Analysis of PestNet Services

To obtain evidence of the information flow across the PestNet network, email correspondence was monitored for a one month period and analysed for their content and purpose.

Information about the use of the PestNet website was obtained from Google Statistics and similar data was obtained regarding visitation to the Pest Fact sheet site. Details concerning the analysis of the email correspondence over the one month period are provided in Section 2.2 and statistics concerning the use of the PestNet website and of the linked Pest Fact Sheets are provided in Section 2.3.

2. Use and Value of PestNet

2.1. Introduction:

The continuous level of activity of the PestNet network since its establishment in 1999 (see Table 1.1.) and the current membership of over 1200 members in over 80 countries indicates that PestNet has made and continues to make a valuable contribution to plant protection and quarantine in the Pacific, SE Asia and other regions.

Further information indicating the use and value of PestNet was obtained in three ways:

- Monitoring and recording email activity through the PestNet network for the period of a month;
- Reviewing statistics regarding use of the PestNet website and of the linked pest fact sheets
- Obtaining feedback from PestNet users and contributors and from other interested parties regarding the use and value of PestNet

2.2. Use and Value of the PestNet email service

The main channel of communication through the PestNet network is the email service. As mentioned above, the number and content of emails submitted to the PestNet network during the period 6 May – 6 June 2013 was monitored and recorded. Details concerning the specific topics covered are shown in Table 2.1., together with details concerning the number of responses, if any, on that topic.

On the basis of the brief snapshot of email activity shown in Table 2.1., the functions performed by the PestNet email service can be summarised as follows:

- Request and provide information and advice on pest and disease identification and diagnosis (largely based on digital images attached to emails)
- Alert members to new incursions, threats or to a change in pest status in the Pacific Islands, Southeast Asia and other developing countries
- Provide details and links to recent topical articles and references and facilitate information exchange and discussions between scientists and plant protection practitioners in Pacific Island and Southeast Asian countries
- Respond to enquiries and discussions on pesticides, pests, crops losses, IPM, and generally on good pest management (including biological, cultural, and chemical controls), quarantine interceptions and crop husbandry practices
- Circulate newsletters, notices and announcements on workshops, seminars, symposia and conferences
- In some circumstances, facilitate literature searches for Pacific Island and Southeast Asian countries.

Table 2.1. PestNet email topics over the period 6 May – 6 June 2013

<p>Identification and Diagnostic requests (total emails 45)</p> <p>Insect on Guava - 1 response</p> <p>Mango trees infested – 3 responses</p> <p>Pest infested tricosanthes dioica - 2 responses</p> <p>Shade tolerant groundcover - 1 response</p> <p>Fungus attacking whitefly - 6 responses</p> <p>Nuisance beetle - 2 responses</p> <p>Armyworm outbreak – 3 responses</p> <p>Disease of Gerbera – 1 response</p> <p>Bolitotherus – No reply</p> <p>Pest on banana (Maldives) – No reply</p> <p>Fly on indigenous tree spp – 3 responses</p> <p>Fusarium on oil palm - 1 response</p> <p>Papaya – rain and roundup - 9 responses</p> <p>Pest Status/alert (total emails 5)</p> <p>Erythrina Gall Wasp - 1 response</p> <p>Non-indigenous insect Heteropsylla – 1 response</p> <p>Stewart's wilt, maize</p> <p>Other information requests (total emails 16)</p> <p>Management</p> <p>Banana varieties resistant to Fusarium oxysporum</p> <p>Yellow Crazy Ant Population Suppression and Eradication – 7 responses</p> <p>New mealy bug in Seychelles – control options</p> <p>Status of Expertise</p> <p>Request for details of practicing plant pathologists in the Pacific Islands - 4 responses</p> <p>Call for expressions of interest</p> <p>Consultant required for desktop review of Vanuatu’s invasive spp</p>	<p>Details on specific references (total emails 36)</p> <p>Patented phage therapy for fire blight</p> <p>Rice blast research</p> <p>Insect bacteria and symbiosis</p> <p>GM Cassava and virus diseases</p> <p>Bee decline and Neonicotinoids - 3 responses</p> <p>Evolution of insect resistance to Bt crops</p> <p>Biopesticide from cassava - 3 responses</p> <p>Aerial sprays in forestry endangered wildlife</p> <p>Nematodes Encapsulated Battle Corn Pests</p> <p>Red rape petals curb oilseed pests</p> <p>GM wilt-resistant bananas</p> <p>PNG coconut killing disease difficult to cure</p> <p>Solving global food insecurity – Insects - 1 response</p> <p>Surveys for banana diseases East Africa</p> <p>Leaf rust coffee</p> <p>Invasive plant disease vector management</p> <p>Biocontrol coconut pests</p> <p>Nematode resistant wheat</p> <p>Unknown disease on exotic ornamental</p> <p>Hazardous pesticides meeting in Europe</p> <p>Fungi provide early warning for plants</p> <p>Issues with Biocontrol – 1 reply</p> <p>Black rot disease of cabbages - 1 reply</p> <p>Undiagnosed disease of snake bean</p> <p>Yellow canopy syndrome in sugarcane</p> <p>Witches broom cocoa</p> <p>Brown streak cassava</p> <p>Notification of other information sources (total emails 4)</p> <p>Pacific Invasives Learning Network (Newsletter)</p> <p>Flat mite ID tool released (Newsletter)</p> <p>International Plant pathology (Newsletter)</p> <p>Australian fruit flies (New poster)</p>
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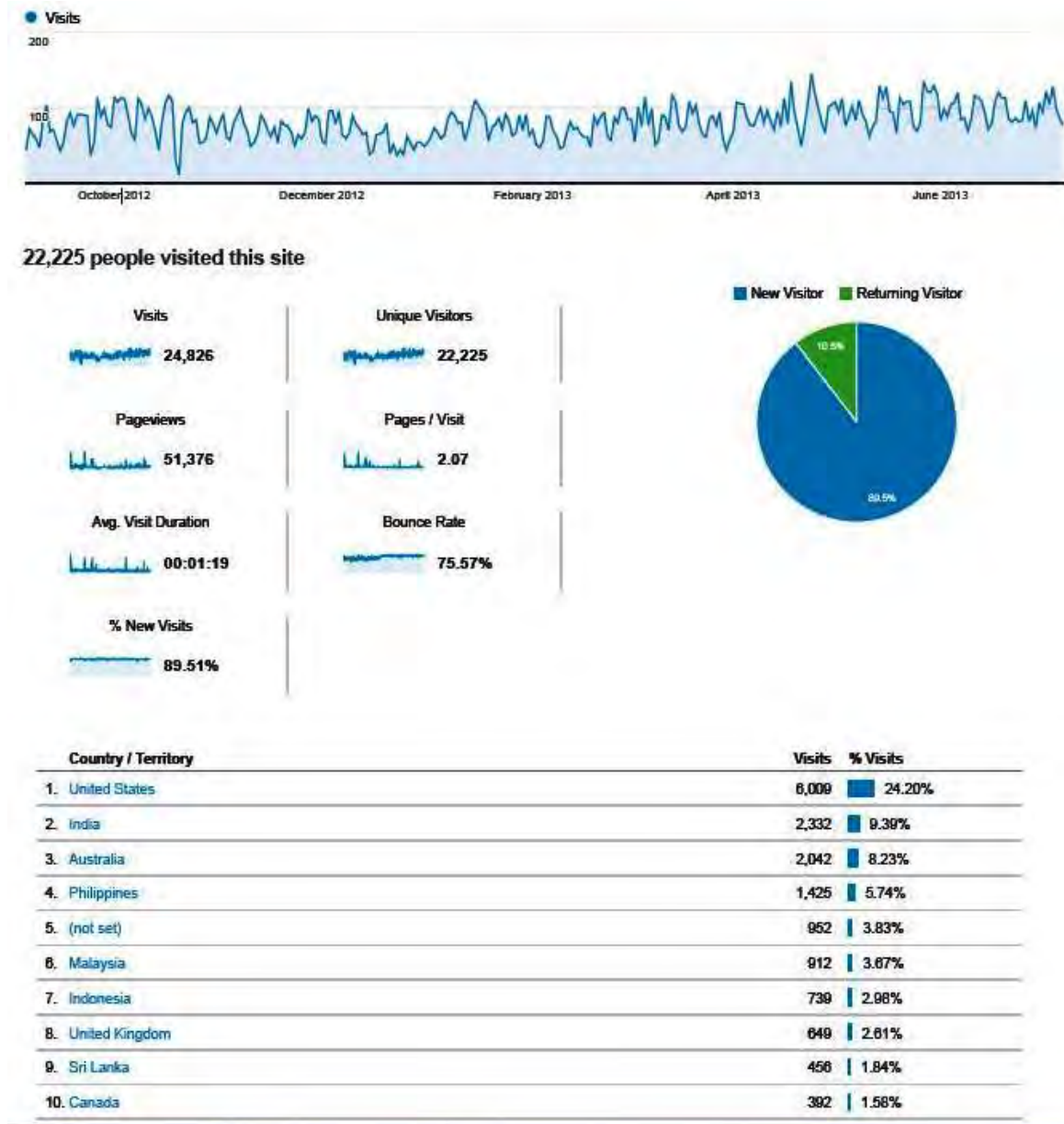
2.3. Use of the PestNet website

An indication of the extent to which the PestNet website is being used was obtained by accessing details of visitations to the website, using Google Analytics, and to the Pest Fact Sheets, which are accessed via the PestNet website from www.terracircle.org, using statistics from www.issuu.com.

2.3.1. PestNet use statistics

The Google Analytics report for the period October 2012 – June 2013 shows there were over 22,000 visits to the PestNet website, with an average duration of 1.19 minutes per visit. While visitors from the US amounted to almost 25% of the visits, and Australia 8%, an equivalent number of visits were in total from India, Philippines, Malaysia, Indonesia and Sri Lanka. It is worth noting that 10% of visits were return visits and that around 7% of the total visits were via smartphones, a figure which is likely to increase in the future.

Fig. 2.1. PestNet website - Google Analytics Report: October 2012 – June 2013



2.3.2. Statistics on the use of fact sheets accessed via the PestNet site

Visitors to the PestNet website can access fact sheets on specific pest problems, via the TerraCircle web site. There are 101 fact sheets prepared for use by farmers and 101 fact sheets prepared for use by extension agents. The fact sheets can either be viewed online or they can all be downloaded as PDF files. The statistics shown in Table 2.2 indicate the extent to which these fact sheets have been accessed online over the 6 months from 11 January to 11 July 2013. Details on the number of times the fact sheets were downloaded were not available at the time of writing this report.

Table 2.2. Information on Fact Sheet usage on the PestNet website

	Number of times a document is displayed	No of visitors who spent "significant" time in the fact sheet section	Av Time Spent in the fact sheet section
Jun 11 - Jul 11			
Farmer Fact Sheets	33	10	6:03
Extension Fact Sheets	65	4	0:48
May 11 - Jun 11			
Farmer Fact Sheets	41	8	0:24
Extension Fact Sheets	79	12	0:34
Apr 11 - May 11			
Farmer Fact Sheets	17	5	0:40
Extension Fact Sheets	84	9	1:38
Mar 11 - Apr 11			
Farmer Fact Sheets	129	21	1:07
Extension Fact Sheets	216	73	2:22
Feb 11 - Mar 11			
Farmer Fact Sheets	25	6	1:34
Extension Fact Sheets	72	7	1:00
Jan 11 - Feb 11			
Farmer Fact Sheets	45	6	1:58
Extension Fact Sheets	87	4	1:20

2.4. Feedback from PestNet Users, Contributors and Others

While details concerning the activity of the email service and website indicate the level of PestNet use, it is the personal experience of PestNet users and contributors that is likely to provide more useful evidence of the value and impact of PestNet. As described in the Introduction (Section 1.4.1), a general request was sent via the PestNet network to all PestNet members seeking their thoughts on the impact and value of PestNet to users, as well as requesting feedback on the other two terms of reference.

2.4.1. Summary

The following eight points summarise the opinions of those PestNet users and contributors who responded to the request for their views on the use and value of PestNet:

1. **Free and open Network** - Perhaps the most important value of PestNet is that it is free and open to all to ask questions and to comment.
2. **PestNet is very much a grass roots network** – It is a user-based network where expert opinion is sought on problems that face practitioners and their advisors. Many emails either raise or are in response to requests for specific help in managing a pest situation, in helping identification and diagnosis, or obtaining other plant protection information.
3. **PestNet is a Professional network** – It provides a forum for exchange of information about plant protection issues in the region and facilitates the development of new professional contacts.
4. **Regional information source** - PestNet provides feedback to regional specialists on the distribution and movement of pests: it helps them keep a finger on the pulse.
5. **Funds for taxonomy have been cut back globally** – therefore either expertise for taxonomic identification is not available or it is prohibitively expensive, particularly in developing countries. Through PestNet, it is possible for an isolated pest manager to catch the eye of, or get referred to, specialists around the world who he or she would not normally know about.
6. **Rapid identification, diagnostic and control advice** – is a major strength of PestNet. While PestNet has not been used as much for disease diagnosis as for insect pest identification, requests for advice on disease issues is increasing. The problem of diagnosing symptoms is part of the problem.
7. **A source of new information** – Moderators and other PestNet members use the network to make users aware of new scientific developments or new incidences of pests and diseases in specific regions.
8. **The value of PestNet goes well beyond its members** – Information via PestNet emails is often relayed to others – such as members of an industry group (e.g. tropical horticulture groups in Australia with 300 members). PestNet also provides a

valuable extension and training service, providing useful information to many “non-active” participants who still read the emails.

2.4.2. Respondents’ Feedback on the Impact and Value of PestNet

It is the particular experience of individual respondents, however, which gives a more in-depth and meaningful understanding of the many and various ways in which PestNet adds value to its users. The following quotations, which are in no particular order, are from those PestNet users and contributors who emailed responses to the request for their feedback on the first of the three principal terms of reference – namely: “Assessing the impact and value of PestNet to users”. This feedback is reported verbatim, except where editing was necessary to maintain the anonymity of the respondents; a condition that was given to all respondents. Where the respondent made several points, these have all been included in the same section; each section (respondent’s response) being separated by a line.

“I have had little direct experience of the impact of PestNet on users. However, the impression for other practitioners such as myself, who have had a good deal experience with PestNet, is that it is targeted very much towards to the user, both in terms of content and expression. The material is clearly designed for ease of use, such that it can cater for a broad range of beneficiaries. I have been particularly impressed by the 'Flipping Books' and the content of the fact sheets. I have indeed made professional contacts through questions and comments coming in. Perhaps the most important value of PestNet is that it is free and open to all to ask questions and to comment.”

“PestNet is a true network - I have indeed made professional contacts through questions and comments coming in. Perhaps the most important value of PestNet is that it is free and open to all to ask questions and to comment.

Why is PestNet important? Answer: because Governments in developed countries have cut back on support to Museums that provide id services, so that the array of specialists (whose expertise could often be accessed gratis) has diminished when it comes to potentially new or obscure problems. Through PestNet, it is possible for an isolated pest manager to catch the eye of, or get referred to, specialists around the world to whom he or she would not normally know about.

Agriculturalists in many LDCs just do not have access to the cash to pay for ids, and libraries and comprehensive reference collections are a dream, even at national Centres. The same goes for pest management issues. The vast pool of experience that can be accessed will bring forward helpful advice and comment, from a range of perspectives. Solutions to problems are found - even if it is by consensus!

I suspect that the converse is also true - specialists who look at global issues are also able to make new contacts and extend their knowledge of the distribution and movement of pests via PestNet. I know this is true because I have done it.

As in all fields of research, tremendous advances are being made in understanding and managing pests - Grahame's ability to search them out and report them is a service that I, among others, appreciate and which could easily be taken for granted.

This is why I am a firm supporter of PestNet. *If it did not exist, someone would have to invent it.* CABI et al can offer similar services - but I do not detect the same degree of user friendliness and focus.”

“The summaries of messages are useful. It is interesting to follow a complete discussion thread on a topic, but this is not always that easy as the emails are sometimes de-linked from each other. Perhaps this is due to the way some people reply to emails. I registered through Yahoo Groups, using my Google login. This works most of the time, but there do seem to be some gremlins as several times I have not been able to access the page I have been seeking.”

“I am involved in sub-tropical horticultural groups in Australia with over 300 members +partners. The PestNet forum is invaluable to all and I pass on information that is appropriate to the groups.”

“I have been an unabashed fan of PestNet from its earliest days. I routinely recommend it during the course of my capacity building projects in south-east Asia and encourage people to assist when they can.”

“I’m a comparatively new member of Pest Net (+/- 12 months) and haven’t contributed anything to date but have monitored fairly closely the communication between the members. My primary interest is in anything (plant pest) in the SE Asia area that could be the next threat to Australia via natural pathways, so my focus is on PNG, East Timor, Indonesia and Solomon Island, plus to a lesser extent the Pacific Islands.

Pest Net probably accounts for 50% + of the emails I receive daily but I don’t mind the influx at this stage because it is relevant to my work and it’s the coal face. I’m a firm believer that the highest risks and timely responses will come from those on the front line.

So in short, I think Pest Net is a great initiative that directly helps me keep my finger on the pulse of the places where I can’t be. And I don’t personally know how it can be

improved. They've managed to get the scientific community regularly communicating and exchanging professional advice with each other which is what makes it the success I believe it is."

"I have been a fan of PestNet since I first became aware of it. I have seen how it has grown in network and topic coverage, and has continued to grow as a promptly responding source of reliable advice to scientists and extension personnel as well as some farmers, in many countries, especially the Pacific.

Diagnostic and control advice is a strength, with many pest experts offering quick and insightful responses to queries usually accompanied by photos of the pest and the damage. It has been good to see the advisory advice/ inputs of Pacific Island scientists growing so they have been moving from recipients to providers of expert advice.

The requests for/ provision of diagnostic and control advice for plant diseases has not been as great or as extensive as the requests for advice on pests and weeds, but this too is growing. A challenge is that sometimes advice is difficult because symptoms can have a variety of causes and some sort of diagnostic test or isolation is needed.

I probably make comment on Pest Net myself perhaps 3 or 4 times a year - usually in relation to a disease I am familiar with. I also occasionally use PestNet to publicise an event of relevance to members or to send on information to the convenors that may be worth distributing. I also appreciate the way in which the convenors send our news and information and scientific findings of interest to the Pest net members."

"It is really useful for plant protection people all over the Globe in identifying the new pests as well as sharing the information. Only drawback is, it is unable to accommodate large pixel pictures. If something is done in this regard it will be useful to upload the pictures without any editing."

"As an entomologist, I find PestNet a valuable resource for:

- becoming aware of the existence and movement of plant pests and diseases around the world
- assisting with advice and identifications of plant problems
- networking with scientists, discovering their specialties, and getting a sense of personality
- But as a tool for scientists (especially in smaller countries) to gather information and advice I think PestNet is extremely valuable."

“PestNet’s major impact is the connection of people/experts worldwide, enhancing discussions and assisting each other in plant production/protection related matters; PestNet helps establishing networks and strengthens collaboration via information exchange.”

“PestNet is very valuable to the people who need the most scientific support – those who farm (or serve as agricultural advisors) in small countries that lack their own scientific experts. It is also valuable to the experts who monitor it, because it provides early warnings about the development of new pest problems and where they are present, before they spread widely.”

“It is very impressive as now PestNet became global

Great help for getting quick and yet reliable ID of pests & diseases (mostly insect pests)

Great communication tool for plant protection/quarantine officers and pest taxonomists”

“I think the main value of PestNet is as a forum where people with pest / disease problems without diagnostic / control advice available locally, or funds to purchase such expertise, can seek advice from experts elsewhere in the world for free.

[Critics of PestNet]... thought that the discussions among specialists on PestNet about the diagnosis would confuse the person posting the message, and therefore be contra-effective (communication exchanges between specialists discussing a specific problem and providing a diagnostic advisory based on data (incl. photos) provided were always posted on PestNet). It must be said however that, although ID and advice was always presented as tentative, where identification of a pest was followed up later with taxonomic institutions, the tentative ID agreed by specialists and provided online through PestNet has always been confirmed as the correct one.

The value of PestNet to its users is evidenced by the large number of subscribers – today exactly 1300 – who reside in over 80 countries in the world (the exact number is difficult to determine as many use ‘common’ email service providers – yahoo, gmail, etc.). Its usefulness to our subscribers is tested rather by the number of ‘unsubscriptions’ from our service, which are very, very few – indicating that people do appreciate our service. But many of the 1300 subscribers never post a query, nor contribute to discussions. Yet, they don’t unsubscribe. To shed some light on this phenomenon perhaps my experience in [one of the smaller islands] will help here. On a visit there some 12 or so years ago I noticed a large pile of A4 paper printouts on the shelf behind me, and noticed they were PestNet messages. Upon enquiring about this (and even saying that the messages were available on the web) they responded that they wanted to keep abreast with all plant protection issues in the Pacific that were discussed on PestNet. Yet, they never contributed, and to my

knowledge, never have. But the messages are read, and we expect that they have provided information and helped raise awareness.

This above highlights an area where PestNet's impact has not been measured, and probably will be difficult to do so anyway: extension and training services. The high number of non-contributing specialists (email addresses) can be interpreted as interested parties who read our messages, and gain information that can help in pest management, quarantine alertness, etc. This area is probably an area where PestNet can significantly develop, and enhance, its impact much further, particularly if we become accessible to farmers."

"For me personally, PestNet has served me well and I hope it's the same with other users. And that's why I had been a PestNet member/user for quite sometimes now and will not quit any time soon. I received, learned and many times downloaded a lot of very useful technical information thru PestNet. I commend the work of the moderators in particular, the Chair Dr. Grahame Jackson for his part in making available to PestNetters a lot of useful information and the many research work done in many parts of the world. PestNet is most valuable and will continue to be, in places where technical expertise and resources are lacking. Samoa is a case in point though it's a shame that many of us here do not 'exploit' this service fully when we could."

"My initial reaction is that PestNet seems to work pretty well and I'm not aware of any obvious problems. As someone who worked extensively in the Pacific at a time free access to information and expert advice was often not available, or at best very slow, it would have been great to have had access to something like PestNet."

"I believe that all users ranging from lay people and medium level technicians interested in insect pests, diseases and weeds to the highly qualified and globally recognized authorities benefit greatly from participating and exchanging their knowledge through PestNet. The greatest impact is with extension agents who are advising farmers in their respective region. PestNet is a "handy" tool to help them and the information obtained is highly valuable. In many instances PestNet also has a high impact on academic, technical as well as scientific know-hows for the users. PestNet does have a tangible and intangible impact and value to the users at different levels from the somewhat less technical level to the highly technical level."

"From my point of view PestNet is a really valuable tool for those of us who are/were on the ground dealing with pest related concerns. There is a wide readership, and advice is typically very relevant, although sometimes identifications may be incorrect or there is out of date advice. Those issues are addressed on the site, but generally we, the users, are aware of the shortcomings.

PestNet has been hugely valuable even to get one on to the 'right track' to follow up on issues. The availability of PestNetters is also excellent for making contact with those workers who used to be in the (mainly) Pacific area and who have huge knowledge banks that they are willing to share.

A directory of PestNet contacts by discipline would be useful, I don't know about confidentiality issues, but pest workers are not likely to be over sensitive to such issues. I think that Pestnet is a really useful tool that also makes one aware of all the things happening out there.”

“I have been a member of PestNet for a long while now, and have been finding it to be a useful tool for interacting and seeking information/specialist advice on pest and disease issues. I have always advocated for colleagues in PNG to sign on. The way in which the forum is managed at present to me is good.”

“I am pleased with the success of PestNet and hope it continues.”

“I cannot think of anything to improve the services, except to find a way to get faster internet service to the recipients and members. PestNet is absolutely wonderful! It is where I usually turn for answers, and I know it is the first choice for many people in the Pacific - and now all over the world. So my recommendation is simple: PestNet should keep doing what it is doing so well already.”

“I guess the impact lies in the dissemination of certain pest and disease outbreaks around the globe or its indications and is quite relevant to know even though its occurrences is outside of the Pacific Oceania Region, including at times mitigation options and taxonomic verifications that is relevant to Biosecurity and Plant Protection and interaction with relevant experienced experts and links, research and documents.”

“I'm more of a spectator as far as PestNet is concerned, rather than a user, but from what I can see, it seems the service has proved to be very useful to many people in the region. In many ways, it is a pioneer in the use of IT in support of plant protection. And the volunteer nature of PestNet makes it both admirable and sustainable“.

“I think PestNet is a wonderful service and am a relatively regular contributor in both ways - seeking assistance and providing assistance. I must admit I have not really used the Online part of the service.

I do not know a great deal about how it actually operates but ...I consider it a very useful way of keeping in contact with other plant protection personnel. In a number of instances, I have developed contacts outside of the PestNet forum by responding privately to a posting. The email address of people who post things on PestNet is useful as it allows a response without having to load PestNet up with banter.”

“I think that the present way in which PestNet works is very commendable considering the financial resources on which it operates. That is mainly the result of the efforts of Grahame. For now it is a repository of information on plant health and it also helps farmers and technical officers make rapid tentative diagnostic identifications which are very important, especially in countries and areas who do not have the expertise based locally. Farmers in the Caribbean are increasingly in need of the rapid identification service and information on plant pests and diseases. They are also in need of information and training on plant pests and diseases, integrated pest management and alternatives to pesticides.

Given the fact that more and more people are turning to the internet and social media for information, I think this is an opportunity for PestNet to be of greater service as a forum and source of information for these topics. This can be achieved with partnerships with other agencies once the main themes are not lost.”

“My engagement with PestNet started fairly late (2008) when I was [a] coordinator for [a] Pacific Islands Network in Taxonomy. At the time I was promoting the building of taxonomic capacity for Pacific islanders. PestNet with all the taxonomists and experts being members provided a useful point of contact for making contacts and seeking help. My current role continues to rely on PestNet for sourcing information relevant to the Pacific Islands invasive species teams.”

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3. Suggestions for Improving PestNet

3.1. Introduction:

When PestNet users and contributors were asked for feedback, they were asked to comment on three areas:

- The impact and value of PestNet to users
- How the current services provided by PestNet might be improved, and
- What opportunities and constraints there might be for the future of PestNet

Feedback on impact and value has already been considered in the previous chapter. In this chapter, suggestions on improvements and the opportunities and constraints for the future of PestNet are discussed. Although there was an implicit suggestion that these two topics address shorter and longer term issues respectively, the feedback received did not always comply with this idea. Consequently, the feedback from both requests has been combined and presented under the following topics, starting with existing problems and issues (3.2 to 3.5), followed by more strategic, long term issues (3.6 to 3.10). Summaries of the specific issues regarding each topic that are covered by contributors' comments are followed by the verbatim feedback.

3.2. Current constraints to PestNet operation

Physical constraints – e.g. bandwidth

- My one suggestion would be to keep it simple - just emails and descriptive, diagnostic images when necessary. Grahame and you know that if you want to continue to reach many of the islands, band width is a big consideration.

Funding and moderator constraints

- Major constraint is no funding - Grahame Jackson is to be congratulated for the enormous amount of effort he puts in to PestNet.
- The constraints to extending the service are normal - additional people would be needed, especially to move the archives around and money would be required to pay them and someone or a team would need to maintain direction and quality control.
- I doubt v much if Grahame and Co can devote more time to what they do - they do an awful lot already - that to me is the issue - to maintain the status quo or go up a notch or two. How much would it cost and who will pay?
- Many times we've talked about the potential to develop interactive services that can be used by farmers directly, but every time we've failed in attracting funds. We're in the Pacific away from where much of the action is; a bunch of volunteers with no funds to go to meetings and conferences to identify and commit partners to developing a joint initiative, and it seems that the world is not considering that something good can come out of the Pacific that can help Africa in particular.

- Perhaps our major constraint – and concern – is that we revolve around one person who near-single-handedly made PestNet what it is today: Grahame. Although PestNet is a Fiji-registered NGO with a board, [decisions are made by very few people]. In short, [PestNet does not] have a broad operational base, and our succession-planning is non-existent. These would be key areas we must focus on, but it's difficult to do so as volunteers with virtually no funds.
- I worry most that PestNet depends on a few individuals. It would be good to encourage a few more moderators or assistant moderators into the fold.

Lack of younger recruits to the PestNet network

- My impression is that most of the contributors to PestNet from outside the Pacific Islands (e.g. Australia and New Zealand) are, quite understandably, people who have previously worked in the Pacific Islands. While these people are an important resource, because of their (often long) experience in a particular subject area and specific experience working in the Pacific. A question I would ask is to what extent are younger people, with access to good information resources and a working knowledge of new technologies, being recruited into the PestNet community. Is this a potential problem, and if so what should/could be done about it?

Organisational constraints to more active involvement of some contributors

- There is a problem with the almost public nature of the discourse, and some organisations are very wary of being exposed to any criticism by their employee's use of "social media"... and would not like the disclosure of any sensitive information. I recently had my wrist slapped for providing identification advice and simultaneously mentioning my occupation and employer, but am free to contribute to PestNet as a private citizen. I find this regrettable, but can appreciate the political sensitivities. This obviously stymies my ability to post many queries, in case of retribution. Information is often best communicated directly and confidentially with experienced scientists.
- For some reason I understand too that [some staff in government organisations have] had difficulty accessing PestNet - yet many of these folk wished to be on it.

Restrictions on disclosure – e.g. management advice

- Constraints on people giving advice: certain types of advice may be excluded (that could be in a disclaimer), e.g. especially pesticide advice because you are dealing with legislation in different countries. Some organic advice may also not be applicable in another country. It is a tricky one because the person seeking advice wants to know how to fix something.

Critical role of those seeking identification and other services

- To me it is also difficult to improve the current service. The PestNet moderators are relatively "passive" as opposed to the question askers who are relatively "active". What will happen with a supposed scenario when there is no question posted and to be moderated? Or, at times, we used to witness only one question asker from a particular country posting so many questions, relevant and irrelevant.

What do we do to solve or improve that situation? PestNet has no practical mechanism to moderate its own activities and consequently its services.

Other constraints

- PestNet is attempting to recruit additional moderators and to cover additional geographical regions and is also considering the choice of language pertaining to non-English speaking regions. In a situation like that the constraint on the language will be enormous if not confusing and eventually “boring”. To me an expansion along that line will be more or less like the development of BioNET INTERNATIONAL and its expansion to so many regional LOOPS. Most of them are relatively active in the beginning when the budget was there but also most of them are fading out and become moribund.
Personally, I believe that what we are doing with PestNet now is quite satisfactory according to its nature and function.
- One of the obvious constraints with PestNet is communication in English from the non-English speaking countries. However, there is no obvious solution to overcome this constraint.
- Future constraints I can think of are:
 1. Internet access difficulties in some of the Pacific countries
 2. Movement or reshuffling of local or national biosecurity or quarantine officers, where every 2 - 3 years, there is a need to train new staff.

3.3. Potential improvements in the way PestNet services are delivered:

Provide frequent explanations to users of the different services provided by PestNet and improve ease of access and navigation to these services.

- The upfront part of the PestNet website is fine - but accessing the store of information lurking in the background is not so easy. The first gateway is accessing the website if you have lost the link. It is in small letters under Grahame's address: www.PestNet.org ; www.ediblearoids.org ; www.terracircle.org.au
Its name not too difficult to guess or Google, but...Grahame's email could be more up front.

Explore ways to filter emails to better match users' interests and to provide better advice

- One possible improvement, if it is technically possible and practical, is to use key words to filter the emails sent to individuals, such that individuals could opt to receive all emails or just those on specific topics. I don't see this as a major problem at present but it might become one if the volume of emails continues to grow.
- I guess the only improvement for me personally would be a way of filtering the incoming emails to just those relating to pests/diseases found in SE Asia and pacific region. This could perhaps be done via a requirement for contributors to nominate

which world region their query/contribution is in relation to, and users having the ability to select those regions they want to receive and 'block' incoming emails from those world regions they don't want. I'm conscious though that as soon as you start putting requirements on contributors above and beyond just drafting and sending an email, you also run the risk of some opting not to use the facility.

- I think it could be improved perhaps if people had a template for enquiries - so often someone puts up a post but only provides meagre details of symptoms or other relevant information.

Improving the quality of information provided (e.g. images) by those requesting assistance

- The quality of images sometimes leaves much to be desired. From time to time I am asked to provide training in macro- and micro-photography, so more assistance in this respect from the PestNet website or capacity building programs such as the ones I run might help.
- Definite identification of disease or insect specimens using photos still a limitation many times a lot of guess work and often requiring submission of actual specimens with some of the problems or queries presented requiring urgent solutions. I do not have a workable/cheap solution how to resolve this but it's a constraint that needs improving.

Consider alternative, technical ways of delivering PestNet communications, including a different platform, the use of SMS, geo-platform, and remote microscopy.

- Not sure whether PestNet could accommodate this but it could provide from time to time specific information for example how to reduce pictures or large documents for sending or even how/where to search for the right information on the web and so forth. Many beginner and lay scientists in less developed countries/situations lack understanding of these issues which jeopardises their utilization of PestNet.
- PestNet is very active and appears to be going strong. However, I understand that the current yahoo arrangement seems to have caused some problems for some of [the members of my organisation] not being able to join. So for improvement of PestNet perhaps find a stable platform that can support the service that yahoo is currently doing. Perhaps do it through Google groups – or perhaps find space on SPC or even on SPREP (or such an organisation) where they can host the discussion/network group.
- I can see the advantages of using a system based on emails, especially as more and more people are now using mobile phones through which they can access messages. I suppose there are likely to be cost implications, but there may be value in building in an SMS service for specific applications. One might be to incorporate an app such as the Lucid system as a first stage in the identification process (for those cropping systems where they are currently available). Another could be alerts about outbreaks which are considered likely to move to neighbouring countries.
- We would like to reach out to a range of users but especially farmers. With smart phones we know that we can respond directly to farmers' problems. This will come, but how do we do it? What are the options? Texts to PestNet, texts to volunteers in

each country to relay the messages by computer and save costs?

- Looking forward I'd like to suggest considering what I think would represent a fundamental advancement in the services offered by PestNet - adding the spatial dimension to available data, hence adding a geo-platform.
- The only suggestion I would like to make (of course with limited knowledge on the use of the technology), is possibility of using the remote microscopy technology for the identification pest and diseases through the network. Whether, the technology can be located at nominated organizations within different countries to link up with specialists overseas for the identification of pests and diseases that needed identification. I am not really sure whether it will work or not but just a suggestion. Otherwise, it is good the way it is for me.

Outline response strategy after new outbreak identified

- One improvement could be to outline a summarised Response Strategy after a new outbreak has been identified. Such a strategy could refer workers in the outbreak area to specialists in Australia, New Zealand etc. in addition to initial emergency response procedures.

3.4. Improve the ability of PestNet to meet users' requests:

Encouraging users, both practitioners and specialists, to send in and respond to requests

- Unfortunately, the open nature of the dialogue and cultural habits mean that many of the people in SE Asia who read the postings would not dream of asking a question nor would they feel bold enough to offer an answer. More active engagement by SE Asians would be a good thing. It would improve the service to users.

Determining the specific plant protection problems users have difficulty getting information for.

- I have looked for my special interests under crops and pests on the [PestNet] website (i.e., insect pests that live in the soil, legume and oil and fibre crops) and did not find them although I realize that what is in there reflects the questions asked.
- Below is a list of some of the pests we have problems with in SE Qld. I haven't had the chance to go through all the answers on the forum and collate updated answers to the pests but major problems are the Fruit Piercing Moth and Fruit Spotting Bug. We have answers to fruit fly but it would be nice if we could get someone to collate updated answers and have the most recent answers first when you are searching. eg If I click on Pests, then put Mealybugs in the search engine, I get 8 pages of info but not in date order. Is it possible to have someone update the website so if someone is looking for an answer, they don't have to click on each single answer x 8 pages say for the mealybug.

28 spotted ladybird; Aphids; Carpophilus Beetle; Citrus Bugs; Citrus gall wasp; Citrus Leafminer; Clearwing Moth – Lepidoptera; Crusader bug & other bugs; Elephant Weevil; Erinose mite; Fig leaf beetle; Fruit Fly; Fruit Piercing Moth; Fruit Spotting Bug; Fruit Sucking Moth, Grasshoppers; Green Planthopper; Harlequin bug; Longicorn beetle; Macadamia flower caterpillar; Lychee flower caterpillar; Macadamia Nutborer; Mealy Bug as well as Cryptolaemus, the Mealybug predator; Mites; Peach Tip Moth - Oriental Fruit Moth; Psyllids; Scale; Slugs and snails; Thrips; Weevils; Yellow Peach Moth.

Improving self-help through the PestNet website

- Mostly I don't see that PestNet needs improving, unless the organizers want to improve the systems behind the scenes. I haven't checked it out, but I get the impression that the organizers have developed 'libraries' of pest and disease pictures and control advice that users can browse in search of answers to their own problems. If that is not the case, then that might be a good direction to go in. It would save the experts having to answer the same question repeatedly.

3.5. The taxonomic problem and potential for greater use of specialists to improve the PestNet service:

Taxonomic issues for pest identification

- Getting identifications of [certain pests] is clearly a problem around the world, due to the very few people available with anything other than local experience. The lack of anyone now with USDA at Beltsville or with BMNH London, on thrips, coccids and whitefly leaves a great hole in the international information system, particularly as it is now so difficult to get any information out of those collections without visiting. Currently the "management" answer is to photograph everything in collections - but I do not know of any evidence that such imaging is actually increasing the output of taxonomic knowledge. To me, it feels like the emperor's new clothes.

Increase the number of identification specialists available to PestNet users

- It would be very valuable to have access to more expert taxonomic advice, as it is becoming increasingly difficult for workers to send material out of their countries for identification-more red-tape and shipping costs (e.g in PNG there are 4 separate forms + specimens have to be SEEN by someone in the Dept of Environment and Conservation, can't be done using a web-cam, as no computer!) before any permit is issued and **paid for**. This is a huge problem for workers not in the Capital. Taxonomists are also getting thinner on the ground!
- The PestNet Forum may establish a list of plant pest taxonomists who are members of PestNet (details contact) for each subject (e.g. mealy bugs, scale insect, fruit fly, etc.). This list shall be provided to the users of the PestNet then they can contact directly to the relevant taxonomist when necessary.

Need for more diagnostic help on diseases

- There is also a need for diagnostic help for symptoms of diseased plants and plant products (e.g. we need expert advice through images of symptom of plant disease)
- Assistance is needed for diagnosis of symptoms associated with diseased plants and plant products: we need expert advice through images of symptom of plant disease.

Develop agreements with relevant institutions with taxonomic expertise

- Since specialist taxonomists are few and far between, their availability for PestNet enquiries is very limited. Already there are several taxonomists who are only used when a moderator relays a query to them due to a lack of response or because there is uncertainty about an ID or diagnosis. One way to do this is to develop agreements with institutions having appropriate expertise – many of which like to encourage and play a valuable role in the region.

Issues regarding the availability of expert identifiers

- The balance between people who need and those who give is critical. We don't know anything about that. That's why we started the "Associates": people with an expertise who are not necessarily members, and who will be flicked an email to help with IDs occasionally. I have only done entomologists. We need weed experts and pathologists
- I am not up on the site as an "expert", but sit on the benches for when problems are not readily solved by others who are on the site. Usually what happens is Grahame will forward an enquiry to me. I have not seen very many since I agreed with Grahame to take on this role, maybe three to four enquiries. This is ok, as like many of us, I am often stretched for time, and we are always dealing with local public enquiries and research enquiries here as it stands, so I would not like to see a great increase in enquiries.
- As far as I can see the service is working very well. One enquiry that was forwarded to me had been pretty much already answered in a very professional and competent way by another person, and I really couldn't put more in than what they had contributed!
- Since I don't see what the actual volume of enquiries to the site really is, I don't think I can add too much more to your review. I know that these sorts of involvement are looked on favourably by the senior admin here at the Museum, as we like to think we have a valuable role in the region, so I am happy to continue with things as they are.
- As an author of three monographs on [a specific pest] of the tropical South Pacific region, I take an ongoing interest in problems and distributions of this pest in that region. This is why I like to see PestNet messages.
I do not regard myself as committed to providing a regular identification service for PestNet – that would be against the terms of my contract with the organisation I work for. However, I monitor the pest problems discussed on PestNet as a way of keeping my finger on the pulse of the pests moving around out there, which benefits [my organisation]. If I can help with a comment or two, I provide it but if I am too busy at the time then I will not comment, as my paid work takes first priority. Of course I like to help if I am able.
The same applies regarding provision of identifications; if I feel it is in [my organisation's] and my research interests, then I may choose to contact a PestNet 'customer' privately and offer to identify a sample. However if I am busy with [my

organisation's] business at a particular time, then I may not offer to help. There is no official commitment between me and PestNet and that is the way I want to keep it.

- [Issues concerning feedback from experts and other issues]:
 - a/- [Provide] contact details of taxonomists for each group of plant pests;
 - b/- The time for providing response/feedback from experts;
 - c/- Can the new users receiving feedback/response from experts if he/she raises his/her issue ?
 - d/- PestNet members in Vietnam or among ASEAN region and Moderators can be met together at interval time (2 or 3 years) for knowledge sharing ?

3.6. Strategic options

Background and strategic issues influencing future PestNet options

1. If we do nothing will PestNet slowly die? My thought is that there will always be a need for a free Q&A forum like PestNet but if for any reason we go days or weeks without messages then members will forget about the service and it will die. Problem is if no questions come in for a few days then a moderator needs to be pumping news items into the system if nothing else but to keep PestNet in the eye of members. Grahame is doing this at present but not sure how long he will be willing to keep doing it. No one else seems to have the time or inclination to do it.
2. Are new services needed to keep PestNet alive? New services will require further commitment by the moderators; Grahame cannot be expected to continue to shoulder the lion share of the work. I am not clear whether the other moderators have the time or inclination to do any additional work. If we stay unchanged then perhaps Q.1) applies.
3. Can we automate the mentoring process? Very few messages have had to be refused. The main reasons for refusal are: 1) advertising of services, 2) unclear English, 3) poorly phrased questions, 4) huge photos, 5) Out-of-office responses. With reasons 2) – 4) we get into correspondence with the member and help them improve their message but this is time consuming for the moderators (currently mostly Grahame). Message types 1) and 5) are not released but there are few of these. We have never had abuse and few cases of spam. Based on our track record we could just release all messages automatically and have a system of removal of messages if anything unfortunate gets through. This would remove some of the workload from the moderators but run the risk of alienating some members if poor messages get through.
4. Are the summaries on the website useful? It would be good to interrogate the site statistics and see how many times the site and especially the summaries have been accessed per month/week. The summaries are a lot of work, mostly for Grahame, but I am unclear how much they are used. Grahame has been paid a small amount to

draft the summaries but it is uncertain how long PestNet will be able to continue to do this.

5. Can we improve frequency of website access by improved Google/Bing/Yahoo searches? This is possible but I have no idea how to go about it. Only a search on the name PestNet finds it but other similarly named sites are also listed; searches of pest names do not find PestNet.

- The informal system should work with minimal organizational input, apart from moderation to ensure that the messages posted are genuine, relevant and beneficial in nature.

The PestNet system is a victim of its own success. From being aimed at supporting Pacific Island agriculture, apparently it now serves much of the developing tropical world (although Africa largely seems to have not become aware of PestNet yet). This demonstrates the widespread need for such support, but has probably made running the system unduly arduous.

- PestNet – I feel has two major audiences: one - the government (especially agriculture and trade sectors) and the second – academic (universities, etc). The latter audience is probably there to share research ideas-opportunities-results-resources – but also to offer expert advice. Opportunities for PestNet to grow are probably found in Universities and Regional Organisations, whereas justification and support for PestNet can be strengthened through government sectors.
- One of the big issues PestNet faces is that of succession planning. Too many things in the Pacific can fall into a heap once the key committed individual is removed. Sad to say. An idea that occurs to me is to co-opt PestNet national contacts (maybe you already do this) and from among which those with the greatest commitment and ability can be groomed for succession

3.7. Scope of PestNet (regional/global) – *making PestNet more of a global service has generally been difficult.*

- We thought that different parts of the world would have their own Pestnet; this would get around language differences. We tried that in November 2003, starting Cari-PestNet, and then went after assistance to start Afri-PestNet. Both have been challenges. Recently, [an offer to translate Spanish emails has been made] but as yet we have not thought how to let people know the service exists .We don't know which countries are members as we don't keep a database.
- We want more people to join from all sectors: government to private, from university lecturer to students, farmers to retailers. I think more industry people would be useful as long as they did not use Pestnet to advertise their wares. School children doing projects (helping farmers and acting as middle persons) would be wonderful - but how to arrange it?

- Internationality - this all started as a Pacific Service that led on to Asia...and the (developing) world. Is this sustainable? Does or can PestNet take this on fully. Talk of a Spanish section indicates it can = if Spanish is OK what next? Portuguese, Thai, Vietnamese...Mandarin

If we approach AusAID for \$\$ for an international service, they may say 'not our patch'. Not sure who else there may be, certainly not much in the private sector. Gates Foundation perhaps?

3.8. Funding issues

A range of ideas on the pros and cons of increased funding, including potential sources

- One of the challenges for PestNet will be the impact of the aid policies, guidelines and funding in the Pacific region. In addition, there may be additional aid donors that may offer more opportunities but also may involve more investment in establishing networks. Although PestNet has an exhaustive network of collaborators and beneficiaries, the challenge for it will be to maintain these, and this will have cost imposts to consider.
- We need to be clear on what requires funding, are we talking about permanent or even part time personnel. Activities [such as developing collaborative ventures] would certainly require at least part time personnel. Or do you intend that moderation remain voluntary in which case succession planning is essential. If moderation is to be voluntary then the only cost is the hosting of the website which is tiny and unlikely to be covered by a donor unless other issues are attached to make the amount more substantial, i.e. worth the effort to fund. Few donors like to fund small projects, <\$100K pa. Unfortunately having paid staff and a consequent larger budget brings complexity and formality into the mix as would closer association with other organisations. Current strengths are, as you mention, simplicity and informality, it would be a shame to loose these.
- I don't know what the financial situation is for PestNet, but presumably like most services there are financial constraints. My main hope would be that sufficient medium to long term funding could be obtained to continue PestNet as a free and cooperative enterprise. I believe PestNet meets a very important need for agricultural researchers and advisors, especially in countries with limited access to the information resources many of us take for granted. I don't know if it's possible to put a \$ value on the service PestNet provides, given that much of it would be in the form of preventing or reducing crop losses, but I suspect it's very good value for money.
- Ideas from the group regarding future funding for PestNet were:
 - A small charge for posting a question or an identification request.
 - A small charge for searching PestNet archives (see below).

- A system of fees based on user usage: x requests per year before user pays for subsequent requests.
 - A small charge for contacting an expert through PestNet.
 - Above charges should only apply to companies and government departments.
 - Development of “Pest Face”. Donor submits images to PestNet library, the image donor and PestNet moderator then decide on a fee to access the images (funds to go to PestNet but possible that image provider would require some remuneration).
 - Changing the site provider to Google and then advertising on the site.
- Fund raising activities - the idea is to have fund raising activities at events (such as ACIAR project field days and regional meetings) where PestNet users and beneficiaries meet. PestNet could also be promoted at these events. Possible forms of fundraising could be collection (from individuals) or institutional contributions.
 - Can't help much with this, but the plant clinic I operated with volunteers for 25 years (still operates) has a member of staff who was allowed to work for so many hours a week on the clinic. Not sure on Graham Jackson's arrangements.
 - Some of the search engines and websites require subscribing to access them. Can PestNet work out a system where individual “PestNetters”, agricultural institutions, and others can link up and access these websites for searching detailed information? Of course everyone must pay a subscription for this. Just a thought.
 - I think that ACIAR should support/fund the service - it delivers great benefit to a widely scattered audience, since correct diagnosis is often the key to sourcing correct control advice.
 - If we approach AusAID for \$\$ for an international service, they may say 'not our patch'. Not sure who else there may be, certainly not much in the private sector. Gates Foundation perhaps?
 - What I can suggest is that reference could be made to some CBD initiatives such as the GTI (Global Taxonomy Initiative) supported by GEF and which may be relevant to PestNet objectives especially in terms of possible sources of future support.

3.9. Collaboration and partnership options

There are a number of suggestions for working in collaboration with other services

- I think that attempts should be made to link to other [existing services] in such a way that when a request comes in it is cross referenced with the linking sites and the person directed to where the answer lies. Similar to what happens now but bringing in other sites to provide greater coverage.

A number of suggested sites to link to have been proposed, as follows:

ASEAN Regional Diagnostic Network (ARDN)

- In collaboration with the south-east Asian NPPOs we are working to develop an ASEAN Regional Diagnostic Network (ARDN). Mostly, this would be designed to facilitate the sending of specimens and samples, via a clearing house (in the CABI labs in Malaysia). ARDN would protect confidentiality if required, so it could handle sensitive biosecurity identifications if necessary. It is more or less hard-wired to NPPOs. Although some people might want to send only images, I don't see that ARDN creates any conflict with PestNet. In fact, I sometimes talk about how PestNet could refer some things to ARDN and the ARDN website could refer people to PestNet as a potentially quicker way of getting what they want. I would be happy to hear from you again when ideas are formulated, in the event that we can assist in any way.

CABI – Plantwise

- It seems to me that PestNet is occupying somewhat similar territory to CABI's 'Plantwise'. Of course, Plantwise currently operates in a relatively small number of countries. But the Expert Identification Service is free to 'eligible members' in over 80 countries. Plantwise does not make available responses to enquiries in the same way as PestNet. However, it does produce fact sheets which include the type of information posted in PestNet's message summaries. I wonder if there is scope for links to relevant Plantwise fact sheets to be added to PestNet.
- Recently, CABI's Plant Clinic service has addressed some of the same needs [as PestNet], and probably collaboration with this should be explored.

Pacific Invasives Learning Network - PILN

- It would be great to find out more about PestNet moderation and the resources needed to ensure its existence and growth. I think if we become aware of these – then we are able to find ways to support them. PILN, in its infancy, included PestNet as a means for getting information for invasive species workers. By including PestNet in our work plans – we are in a better position to raise funds to implement our work plans (including PestNet). Perhaps the moderator can visit us and familiarise him/herself with us so that we can build up the trust/and brainstorm together for future funding opportunities.

Melanesian Agricultural Information System (MAIS)

- Link up with the ([MAIS](#)) for bibliographic data, educational and extension materials and information about projects and activities in Melanesia. I'm thinking that if an individual wanted to delve deeper than the basic information, that MAIS provides a pathway. The component on projects and activities will go live later this year, and I'm also looking to capturing and indexing image libraries, to enhance the knowledge base. No matter what you decide to do I will put a link from MAIS to PestNet.

Potential for other linkages to support PestNet users

- Links to other free-available tools or databases should be established, for instance:
for Pest reporting – International Plant Protection Convention (IPPC; <https://www.ippc.int>);
for Pest Diagnosis – collaborate with Australia on high quality and free accessible diagnostic tools;
for Recording of information resources (species information, pictures, references) – EcoPort (www.ecoport.org ; see above project information);
for Connection to experts in particular fields of plant protection (entomology , phytopathology, virology, etc.) - International Society for Pest Information (ISPI; <http://www.pestinfo.org>); many more official databases could be linked and regional hubs could be established, e.g. through BioNet-loops: <http://www.bionet-intl.org/opencms/opencms/index1.jsp>)...;
- The PestNet related website could be improved for easier pest/disease references

Include PestNet sessions in training courses

- Some introductory taxonomic training courses already include brief sessions on PestNet. There is considerable potential for increasing the links between training courses and PestNet – with PestNet providing an ongoing training and decision support component to trainees.

Other suggestions on collaboration

- Link up to other countries (I don't know the member list of PestNet) but it could maybe be linked up with other educational institutions, with extension diagnostic services in the US, and other countries.
- One thing I wonder about at times is whether I as a private business should rightly "advertise" my products (mostly information posters) via a posting although the mediators have always allowed this, I assume based on their value judgements. I think there are many products that Pestnet clients might be interested in yet do not know they exist - maybe PestNet could come up with some way of making these people aware of such products. In particular I am thinking of products such as biological control agents , bio-insecticides, insect traps and pheromones.

3.10. Other ideas on future strategies

- How to organise all that info that has been exchanged? - Does it exist as an entity? and if yes in what form? - the solutions to problems, new technology, etc. fact sheets, and so on. have it accessible to the folks who need it. The concept of a kind of PestNet Wiki comes to mind - where a key word or two is/are entered and the/a data base is searched for 'mentions'. The more formal idea of a true wiki is less attractive as a first step because the guy in the field may not know what he is looking for beyond ' banana pest'. and of course the concept as whole does not help with new pests. It would take a whole lot of writing and editing to simulate a Wikipedia.

No brainer: stage 1 - identify the problem: stage 2 - say what we know about it?
But maintaining the ability to respond internationally to the 'hey guys, what is this thing on my gerberas' issue must surely remain high on the agenda.

CAB Direct is I guess the ultimate service, but it is not free. 15 pounds pa converts to a lot of Rs or Dong.

The constraints to extending the service are normal - additional people would be needed, especially to move the archives around and money would be required to pay them and someone or a team would need to maintain direction and quality control.

I doubt v much if Grahame and Co can devote more time to what they do - they do an awful lot already - that to me is the issue - to maintain the status quo or go up a notch or two. How much would it cost and who will pay?

Not sure how much of all this is useful - in summary, I am a firm supporter of PestNet and I am willing to help with its on-going development although my physical facilities and time are limited.

- Opportunities – include:
 - (i) Continuing to gain more enquirers, advisors with disease control expertise
 - (ii) Development of self-help data bases
 - (iii) Growing their collection of pictures of pests, diseases and pathogens
- Increase the language range to access the countries likely to benefit from PestNet.
- Maybe PestNet might look at the possibility of publishing compendia based on the summaries although it may be wiser to stay electronic online only. If publication were considered then copyright and other permissions would be needed for making pictures and opinions available. Personally I think such developments would be a step too far, and incur more costs and liabilities than they are worth.
My message is keep it simple / informal, keep it free, and keep it online.
- Options
 - a). to provide web-based training on ID (remote microscopy), IPM, GAP, etc.
 - b). to compile database of taxonomic experts and members of PestNet
 - c). to produce/compile relevant multimedia tools related to ID (diagnostics) and plant protection
 - d). to compile Image Library of pest and diseases (with authoritative ID) of major crops in the Pacific and SE Asian countries

The only constraint is FUNDING availability for PestNet to implement additional tasks.

- In terms of how the current services of PestNet can be improved in the future, I am thinking of:
 1. Building the capacity or training biosecurity or quarantine officers in taking good photo and putting it in a proper form or file type that is clear to be read by PestNet expert group. Also [improving] their skills to describe the

symptoms and taking samples.

2. For PestNet to create more like sub-region group. This is to help this sub group, for example, Pacific PestNet to share knowledge, experience, information, that are relevant and match or suit to their conditions.

3. For PestNet to think of translations to local language, especially with important or major disease outbreak incidence of any pests and diseases that need to be understood by local farmers in villages.

- For future opportunities, I can say that there will be wider reach out about PestNet due to increase in communications technology in the Pacific. Also there will be strong network with emerging experts on plant diseases and pests, high utilisation rate of information from PestNet on disease outbreak in the mainstream media such as newsletter, radio, etc., strong collaboration with international networks, societies of phytopathology.
- Opportunities might arise in the future where relevant dissemination of information can trigger early response to incursion of pests and diseases, it's prevention of spreading, it's containment and treatment, it's partnership with certain international organizations and agencies dealing with pests and diseases diagnosis and management options, been readily accessible benefiting all countries in terms of market access and trade facilitation in obtaining pest and disease of concern relevant to the proposed trade, link to invasive species and its agencies, a forum where heads of quarantine and research can exchange pest and disease information, how it can be marketed and be a one stop shop for everything regarding pest and disease and relation to trade, market access, tariffs, non tariffs, markets, pest risk analysis tool kit, management options, link to trade statistics, links to academic research institutions, internships, specific and general online courses inter-related to plant protection and biosecurity (whether free or paid for), synchronized and compatible with other related websites like CABI, Pestlist databases, a forum for plant pest disease clinic specifically for farmers, growers that might want to seek for verification of plant symptoms and its mitigation options, how it can be user friendly, Constraints could be the cost of its maintenance, how credible and authenticated pest and disease information is, it's relevance and usage by members.

PestNet could be improved by having a taxonomic toolkit within its web page where members can access:

- help to identify certain pests and diseases for capacity building
- a possible inventory list of all pests and diseases per region or to country level that have been received over the past years; their categorization, based on severity or economic importance
- awareness of materials like pest alert with brief information that can be utilized by concerned countries for awareness purposes at its border with easy printing accessibility.
- GIS & GPS of economic pests and diseases per region around the globe and its association with mitigation options, different entry pathways,
- reference catalogue pertaining to literature review, journals, publications, reports,

- a link to relevant and related ISPM Standards/protocols in Plant Protection and Biosecurity,
- a video chat interface (not sure) between one and a group, a link to licensed chemical distributors, laboratories, relevant inspection kit & equipment distributors, post-harvest facilities, equipment, biocontrol agent platform database,
- links to relevant donor agencies etc.

4. Future Options for PestNet and Recommendations

4.1 Introduction:

It is evident from the analysis and feedback received from PestNet users and contributors presented in earlier sections of this report that the PestNet experiment has been highly successful and made a significant contribution to providing valuable pest control, quarantine, identification, diagnostic and other information of direct value to those at the sharp end of crop protection decision making.

Given the overwhelming positive feedback from those who have been involved in PestNet, if it no longer existed it would be sorely missed, particularly by those in remote and isolated regions, who value the free Q&A forum it provides, but also by those who value PestNet for its ability to keep them informed of developments in the field.

However, the success of PestNet and the way in which it operates raises issues about its future. The increase in participants and requests for assistance in identifications and for other information has put a strain on the volunteer moderators and while the development of the web site, with email summaries and fact sheets, has increased the opportunities for participants to find answers to their problems online, it is not clear that this has so far reduced the flow of email requests.

A number of participants have commented on the key role that Grahame Jackson plays in maintaining the email activity and web site development. Indeed, given Grahame's critical role as the PestNet "champion", feedback I've received from some contributors is that unless something is done regarding succession strategy in the next couple of years, PestNet is likely to slowly die.

Regarding the future, several commentators think that the unique feature of PestNet – simple, informal and free – needs to be maintained. On the other hand, other commentators suggest that PestNet faces a quandary: as one respondent puts it "If PestNet is to survive it likely needs more secure people or at least better funded people, but that needs money and or links to large organisations which brings complexity and formality". Nevertheless, the view of many respondents and of this reviewer is that various options for the future of PestNet should be explored and while there is a danger that simplicity and informality could suffer if increased funding and/or collaboration is achieved, this is not sufficient reason to ignore the potential for exploring both aspects in the future.

With this proviso, the following section addresses issues that should be considered in determining the best strategy for PestNet in the future. These future options are based on my analysis and on the many comments and suggestions provided to me by those who use or contribute to PestNet or who are concerned about the future of PestNet, as reported earlier. A draft of preliminary recommendations was sent to those who had responded to the earlier request for feedback, resulting in additional ideas and suggestions.

An important issue for the future concerns the role of volunteer moderators, and particularly Grahame Jackson, in keeping PestNet operational. Since some of these volunteers are close to retiring or have other commitments, there is some urgency for addressing this issue. These management issues are dealt with further in section 4.7 below

but clearly will have a major influence on any future PestNet strategy, as will future decisions made by PestNet moderators and by those in funding agencies and in organisations which could potentially provide complementary services.

Therefore, the following recommendations are conditional on these other factors and, together with the other sections of this report, at least provide background information, a systematic framework, a number of options, and a working document for developing a future strategy.

There are six issues that are addressed in making recommendations on the future of PestNet:

- Funding strategy
- The scale of PestNet in the future – whether it should be regional or global
- The email service and ways in which it might be improved
- Ways in which the PestNet website can provide additional support to the email service
- How other plant protection sites and services might complement PestNet
- Management of PestNet, succession planning and sustainability issues

4.2 Funding strategy

Whatever future activities described below are to be implemented, particularly those taking advantage of new software technologies, it would seem that some initial funding at least will be required. There are several funding strategies that could be considered, including grants from a single organisation or a consortium of donor organisations, including those concerned with agricultural, biosecurity and environmental issues; a fee for service model; selective online advertising; or an arrangement where an existing “crop protection officer” has a defined part-time role to contribute to PestNet. These and several other possibilities were suggested in section 3.6 of this report.

Recommendation 1: Funding to support new technology and future management strategies

It is recommended that one or more funding agencies are approached to support specific one-off projects to upgrade PestNet communication technology and to facilitate the development of future PestNet management arrangements, as discussed in other recommendations in this report.

4.3. The scale of PestNet in the future; Regional or Global

Over the years PestNet has grown from a service primarily aimed at meeting the needs of plant protection in remote islands in the Pacific to one which attempts to service enquiries from Asia, Africa and the Caribbean. Therefore, a critical question is what should be the strategy in the future? Should PestNet become a global service or should it maintain its focus on queries from specific regions but with expert contributions from a global pool of expertise, much as it is at present? Attempts to set up regional PestNet centres in Africa and the Caribbean, as described in Appendix 2 to this report, have met with limited success.

Recommendation 2: The scale of PestNet in the future: Regional or Global

It is recommended that the main focus of PestNet in the immediate future should be on improving both the efficiency and sustainability of the email and online services to the Pacific Islands, SE Asia and Asia. PestNet services for other regions should be added as and when there is increased interest; willing “managers” and/or collaborators; committed regional moderators; experts who agree to contribute; and where any extra funding required is available.

4.4. The email service and ways in which it can be improved

The email service is the most valuable feature of PestNet as indicated from the overwhelming support from both users and contributors to PestNet. There are several ways in which the efficiency of the email service might be improved:

4.4.1. Improving the quality of the email queries sent to PestNet

Several correspondents mentioned the need for improved images and for better metadata associated with these images, indicating the region, crop details, etc. While a previous attempt to get users to use a request template was largely ignored, it would be worth exploring the possibility of developing a menu driven template that also ensures image attachments are automatically resized to an optimal resolution. Since smartphones are now widely available, this technology could possibly provide the most accessible way of achieving this. An app developed for use by those who request management, ID and diagnostic assistance and which includes drop down menus such as the country and the crop concerned, recent weather conditions, etc. would mean that certain critical metadata associated with the query would need to be completed before the request could be sent. The image of the pest or disorder could be taken with the smartphone and attached to the app and emailed to the list server.

It has also been suggested that online courses to improve the quality of photographs taken by those who are requesting identification or diagnostic advice should also be re-considered.

4.4.2. Expand the expert Panels for identification and diagnostics

As well as depending on voluntary moderators, the PestNet email service also depends on the active and voluntary involvement of experienced practitioners and scientists. The informal panel of entomological taxonomists set up by PestNet provides one way of tapping into the declining international pool of taxonomic expertise. Currently, many of these taxonomists are only used when a moderator relays a query to them due to a previous lack of response to the initial request or because there is uncertainty about an ID or diagnosis.

One way to recruit experts might be to develop agreements with institutions or scientific societies having appropriate expertise – some of which are likely to encourage the limited involvement of staff in playing a valuable role in contributing to pest management in developing countries.

Feedback from contributors suggest that another way of increasing the pool of PestNet experts is to recognise that some experts sympathetic to the objectives of PestNet have unsubscribed to the email service due to the large number of ID and diagnostic emails they receive. Since these experts are likely to be interested in continuing to receive news items

from PestNet, it would be worth exploring the possibility of separating the email service into a news item and diagnostic item service and allowing users to choose which service(s) they wish to subscribe to. Those experts choosing the news item service could then be invited to join a panel of experts to be contacted only when appropriate. Such a development may also help in expanding this panel to include plant pathologists and weed scientists, as already planned.

4.4.3. Improve the networking software

Several correspondents suggested that the current Yahoo networking platform used by PestNet is restrictive and that some emails from the Yahoo server are blocked as junk mail. The transfer to alternative systems, such as Google, might be considered, as well as the possibility of developing a customised platform. The feasibility, cost and advantages of such a change would need to be examined closely.

Recommendation 3: The email service and ways in which it can be improved

- ***The feasibility and cost of developing a smartphone app for improving the metadata included with requests for management, ID and diagnostic assistance should be explored.***
- ***Ways of increasing the number, involvement, and breadth of disciplines represented in the PestNet expert panel should be investigated, including approaches to institutions or scientific societies. Structuring the email service to allow expert contributors to choose to receive news items rather than general email queries should be explored as a means of encouraging their participation in PestNet's expert panel.***
- ***If the number of participants and scope of the email services and operations provided by PestNet are to increase, the feasibility of replacing the current Yahoo system should be examined.***

4.5. Ways in which the PestNet website can provide additional support to the email system

The PestNet website provides an online presence for the PestNet network and is a source of additional information to meet the issues users might have in pest identification and diagnostics. Gradual improvements have been made to the site since it was first launched as funds became available, including summaries of email requests on specific problems, email responses and images, and the posting of over 100 pest fact sheets for extension and for farmers' that can be viewed online or downloaded.

Several ways in which the use and value of the PestNet site could be improved are suggested as well as ways of reducing the effort required to maintain and manage the website.

4.5.1. Improve the various ways in which users can use PestNet resources to identify and diagnose their problems.

Several comments made by contributors indicated users are not fully aware of the various options they could use to find answers to their queries apart from the email service. One simple improvement that should be made is to make it more obvious that there are various

options users can take in seeking ID and diagnostic help by providing a step-by-step guide. This might start with going to the Summaries section and browsing to see if records exist of previous correspondence and images on the specific problem of concern, searching through the PestNet online fact sheets, linking to other sites providing ID and diagnostic help, and finally, using the PestNet email service.

The PestNet Summaries section constitutes a valuable resource on specific pest topics: to date more than 10,000 messages have been summarised, CTA having given support to PestNet to summarise the first 6000 messages. However, it is not clear how much these summaries are accessed by users. Further enquiries through Google Analytics should give a better indication of their use, although the use of summaries by PestNet moderators should not be ignored. Since considerable (voluntary) effort is required to incorporate new topics raised through email correspondence, how to improve the efficiency of capturing, navigating and searching the summary information should be explored. One way of doing this would be through the development of an online summaries database that would automatically store initial email messages; subsequent correspondence in response to that initial query would be directly recorded in the database. While some editing of such summaries would be necessary it should require far less effort to maintain this service than at present. If the option of using a smartphone template to send a query to PestNet, as suggested in section 4.4.1, is implemented, this should improve the metadata provided with the initial query and reduce the editing required.

Consideration should also be given to the potential for using other social media technologies such as Facebook and Twitter, to see whether this form of communication could serve a useful role in PestNet communication.

4.5.2. Focus more on providing an online extension system

While help with pest and disease identification, diagnostics and management has been the main role of PestNet to date, in recent years increased focus has been placed on providing extension material, in the form of pest and disease fact sheets for extension officers and farmers. Viewed or downloaded online, this initiative could be further developed to provide other extension material that is designed for the particular circumstances in developing countries.

The widespread availability of smartphones could also be used to deliver fact sheets to users – enabling them to browse or search for fact sheets relevant to specific crop pests and disorders. A PestNet fact sheet app is already being developed allowing extension agents and farmers to download the app free to Android and iOS phones and tablets. Once this app is released some form of assessment should be made of the value of this type of delivery and whether further development of this or other fact sheet apps would be worth developing.

Recommendation 4: Ways in which the PestNet website can provide additional support to the email system

- ***It is recommended that a more obvious, step-by-step guide is developed and publicised via email and on the home page of the website, indicating the various options available when seeking assistance, particularly through the PestNet website but also***

through other relevant information sources on other, linked sites.

- *A more detailed analysis should be made of the PestNet website using Google Analytics to assess current use of the various sections of the website and particularly the summaries section.*
- *Associated with the suggestion to develop an app for submitting queries and images to the PestNet server, consideration should be given to the development of an online “Summaries” database to automate the recording process for initial queries and responses as much as possible.*
- *Once the pest fact sheet app has been developed, the extent to which it is being used should be assessed and the potential for including other regionally appropriate extension material in an app should be explored, including accessing the summaries on the PestNet website.*
- *Consideration should also be given to the potential role that Facebook, Twitter or other social media systems could play as a component of PestNet communication.*

4.6. How other plant protection sites and services could complement PestNet activities

A number of PestNet users have pointed out that since PestNet was established, a number of online and other identification and diagnostic services have been developed that could potentially complement PestNet activity. Since a number of these other services supply resource material to assist in the ID/diagnostic process or provide other relevant information on pests and their management, they could support PestNet activities as well as benefit from the feedback provided by the demand side focus of the PestNet network. The websites and activities that could most usefully complement PestNet are described below:

- Several correspondents have noted that PestNet occupies similar territory to CABI’s ‘Plantwise’ project, consisting of in-field diagnostic clinics as well as an online Knowledgebank. The Plantwise service currently operates in a relatively small number of countries but the expert Knowledgebank Service is free to ‘eligible members’ in over 80 countries. While Plantwise does not make available responses to enquiries in the same way as PestNet, it does produce fact sheets which include the type of information posted in PestNet’s message summaries. There is already some sharing of fact sheets between CABI-Plantwise and PestNet and perhaps there is scope for greater cooperation, ranging from easier access to CABI’s fact sheets by PestNet users to closer collaboration between CABI-Plantwise and PestNet that provides a more comprehensive response to the needs of users of both systems.
- It has been suggested that the proposed ASEAN Regional Diagnostic Network (ARDN), involving the Southeast Asian National Plant Protection Organisations and the Australian Government could also be a useful ally. ARDN is designed to facilitate the sending of specimens and samples, via a clearing house (in the CABI labs in Malaysia) and Dr

Neumann has suggested that PestNet could refer some queries to ARDN and the ARDN website could refer people to PestNet as a potentially quicker way of getting what they want.

- A number of CGIAR Agricultural Research Centres, such as IRRI, CIP and IITA, have developed online Knowledge Databases, providing diagnostic and other information for their mandated crops. The potential for making users of these CG Centre systems aware of the PestNet facility and for Centre staff to become involved in responding to email requests could be of mutual benefit to the Centres and to PestNet.
- It would be desirable to explore how plans for future PestNet developments can best fit with and complement the activities and the needs of regional organisations in the Pacific, such as SPC and PILN, and with other regional organisations in SE Asia.
- A number of other pest and disease image databases and diagnostic tools exist, such as the various image databases at the Bugwood site, the APHIS ID-Source site, PaDIL, etc.; there are other sites, such as the International Plant Protection Convention (IPPC) site that provides useful resources for pest reporting. It is suggested that a module on the PestNet website that provides annotated links to these other sites would complement the PestNet service.

Recommendation 5: How other plant protection sites and services could complement PestNet activities

It is recommended that the potential for cooperation with organisations and agencies such as CABI, ARDN, various CG Centres, PILN, SPC, Bugwood, APHIS-ITP, PaDIL, IAPPS, etc. should be explored to assess the pros and cons of developing stronger links. The initial aim would be to make the various “clients” serviced by these organisations aware of the PestNet email request service, website and fact sheet app provided by PestNet and to provide PestNet “clients” with additional information sources.

4.7. Management of PestNet, succession planning and sustainability issues

As reported in the introduction to this section, a number of those involved in PestNet believe that unless action is taken soon to develop a succession strategy for the current moderators of PestNet, there is a distinct possibility that PestNet will fade away. Unless this issue is addressed with some urgency, the value of any improvements achieved in the short term may be lost in the longer term.

As the main champion of PestNet since its inception, Grahame Jackson has clearly done a tremendous job and continues to do so. While I believe he has no immediate plans to reduce his input to PestNet, it would be imprudent not to explore suitable candidates who might replace him and indeed replace other moderators when they do decide to step down.

Apart from reducing the effort required to manage PestNet activities, through some of the proposals detailed above, there are likely to be several ways in which the issue of future management of PestNet could be addressed, including the following:

- Recruit new volunteer moderators and agree on specific roles that each moderator should play

- Seek funding for a full or part-time moderator
- Approach an organisation active in the plant protection field to provide a % of the FTE of one of their staff to help manage PestNet operations.
- Collaborate with other organisations to address specific aspects of PestNet activities and so utilise their staff to assist PestNet management.

Recommendation 6: Management of PestNet, succession planning and sustainability issues

A succession and future management plan should be developed as a matter of urgency, involving a meeting of PestNet moderators to address the replacement of retiring moderators with new volunteers; to seek funding for a full or part-time moderator if volunteers are not forthcoming; to explore collaboration with other organisations to assist in managing PestNet activities; or devise other options.

Appendix 1: Terms of Reference

CONTEXT

A not-for-profit organisation, Pacific PestNet, was registered with the Registrar of Titles under the Charitable Trust Act (Fiji).

The objectives of the organisation are to:

- Promote the exchange of information on plant protection and quarantine between Fiji, the Pacific region and countries elsewhere;
- Promote access to information on plant protection and quarantine by Fiji and the Pacific region; and
- Provide assistance on matters concerning plant protection and quarantine.

The name was changed at an annual general meeting to Pestnet, and the organisation extended its reach to Asian countries with support from the Australian Government's Department of Agriculture, Fisheries and Forestry, and AusAID. Later, PestNet accepted members worldwide. In November 2003, PestNet was invited by The Technical Centre for Agricultural and Rural Cooperation (CTA) to help set up a similar organisation for the Caribbean – CariPestNet.

PestNet is described on its website (www.pestnet.org) as:

[...] an email network that helps people worldwide obtain rapid advice and information on crop protection, including the identification and management of plant pests. It started as a service for the Pacific, rapidly expanded to South East Asia, set up a separate service for the Caribbean, and now welcomes anyone interested in crop protection anywhere in the world. It's free to members.

The purpose of PestNet is described on its website, as follows:

Plant pests – insects, pathogens and weeds – are always present, damaging crops grown for home consumption, domestic markets or for export. New pests can spread from country to country and threaten agricultural production and biodiversity.

If growers and plant health professionals in the region are to manage pest problems and protect their rural industries, they need access to specialist scientific and technical advice on the identification and management of plant pests. And they need it quickly and cheaply. PestNet, with hundreds of members worldwide, can help them.

Membership of PestNet is described on its website as being open to any organisation, group or individual. Membership is stated as comprising people from government and non-government organisations, universities, the private sector, farmers and students.

PestNet's activities are described on its website as covering a range of topics. These include pest identifications from digital images, pest outbreak alerts, pest management (biological, cultural, and chemical), and quarantine interceptions.

In 2012, 21 PestNet Associates were identified; they are taxonomists on insects and mites who comment on emails sent to them. Not all Associates are PestNet members. A similar list

of plant pathologists and weed experts is to be set up. In the same year, members from South America and elsewhere were encouraged to send emails in Spanish if that was more convenient to them.

PURPOSE

As PestNet has been in operation for 12 years, it is necessary to undertake an evaluation of its objectives, methods of operation and matters of coverage for PestNet to remain relevant.

EVALUATION

Methodology

Interviews with individual moderators of PestNet:

1. Grahame Jackson, Chair, Australia - gjackson@zip.com.au
2. Wilco Liebregts, Secretary, Treasurer, Fiji - ecoconsult@connect.com.fj
3. Bob Macfarlane, New Zealand - scapanes@gmail.com
4. Guy Mathurin, Caribbean moderator, St Lucia - guy.mathurin@gmail.com
5. Charles Ssekeyewa, Africa moderator, Uganda - cssekeyewa@gmail.com
6. George Wall, Spanish translator, Guam - gwall@uguam.uog.edu
7. Banpot Napompeth, Asia moderator, Thailand - agrban@ku.ac.th

Desk research:

- PestNet constitution
- PestNet website
- Minutes of meetings (on the website)
- Engagement with Cari-PestNet (<http://pets.groups.yahoo.com/group/caripestnet/>); Ron Barrow, CABI, Trinidad, is the moderator (ronniebarrow1@gmail.com)
- Level of participation – questionnaire to representative sample of PestNet members from different regions – Pacific, South Asia, East Asia, Africa, Europe, South America, North America (governments, NGOs, universities, private sector, farmers, students) – (pestnet@yahoogroups.com)
- Discussion with Giacomo Rambaldi, CTA, The Netherlands – (Rambaldi@cta.int)
- Discussion with Ian Naumann, DAFF, Canberra - (Ian.Naumann@daff.gov.au)
- Discussion with SPC LRD; Inoke Ratukalou, Director, and head of plant protection Tony Ganaua (tonyg@spc.int), plant pathologist, and entomologist Maclean Vagalo (macleanV@spc.in).
- Discussions with FAO. Four members are from FAO, with two active: Jan Breithaupt (Jan.Breithaupt@fao.org), and David Nowell (Dave.nowell@fao.org). Vili Fuavao, Sub-regional Representative for Pacific Islands supported a PestNet TCP project in 2006 (ViliA.Fuavao@FIELD.FAO.ORG).

Questions

1. Has PestNet met its objectives? If no, what should be the objectives?
2. How efficiently and effectively has PestNet carried out its activities?
3. Does PestNet remain relevant today and, if no, what needs to be done to achieve relevance into the future?
4. How well is the day-to-day business of PestNet conducted? What improvements can be made?
5. Should PestNet strive to attract funding and, if yes, what would be the key priorities?

6. What does the future of PestNet look like?

Duration

Preparation x 2 work days
Interviews x 5 work days
Briefing and debriefing x 2 work days
Writing report x 6 work days
TOTAL = 15 work days (3 weeks, including weekends)

The final report should be submitted within 30 days of execution of the contract for this evaluation.

Remuneration

A fee of \$10,000 (inclusive of travel) is payable for the evaluation. Payment will be made within 21 days of receiving a report that meets the requirements of these terms of reference.

Travel

The evaluation will commence with a meeting between the consultant and the Chair, PestNet requiring travel from Brisbane to Sydney. Costs are included in the fee stated above.

_____ date

Geoff Norton
Professor
University of Queensland

_____ date

Grahame Jackson
Chair Pestnet

Appendix 2: PestNet initiatives in the Caribbean and Africa and a proposal regarding Latin and South America (Spanish translations)

As mentioned in Section 4 of this report - which considers Future Options for PestNet and Recommendations - a number of initiatives have been taken to expand the range of PestNet users, initially to the Caribbean and subsequently to Africa. A proposal also arose during the course of this review to provide a Spanish translation service for potential PestNet users in Latin and South America. Brief summaries of these initiatives are provided below.

Caribbean project

In 2003, a Caribbean version of CariPestNet was established as a separate system, with funding from CTA. Since then over 800 email messages have been recorded. However, the most recent posting on CariPestNet was in August 2013 and there has been no response to emails from the Moderator of CariPestNet when asked for details concerning the current status and plans for CariPestNet. One of the current PestNet moderators is based in the Caribbean and he is actively involved in supporting PestNet activities.

African project

The extension of the original PestNet service to Africa has met with limited success: there is an active moderator based in East Africa and there have been a number of emails originating from African users. However, there have been a number of constraints to getting PestNet more widely used in Africa.

Limited internet access is one reason, but that is diminishing and the possibility of using mobile phones for PestNet communication could overcome this problem. The lack of experience in using IT to address practical plant protection problems is another issue, and scientists are thought to be more likely to use PestNet in Africa than extension agents but this is also changing, particularly amongst the younger and/or more educated groups. Language would be another constraint, particularly in French speaking African countries.

South American (Spanish) PestNet

In response to the request for comments from users of PestNet on its value and future potential, a conversation occurred between several contributors regarding the possibility of establishing a Latin American version of PestNet or at least to allow Spanish speaking users to send their requests to PestNet in Spanish and to have responses translated into Spanish. A number of people supported this idea, names of contacts who would be interested in becoming involved in this initiative were provided, and two volunteers at least said they would be prepared to do translations.

However, as a few commentators pointed out, considerable time and effort will be needed to establish this Spanish component, publicise that it is or will be available, and to ensure there are sufficient local experts in the region who will be able to respond to management, identification and diagnostic requests. Therefore, while there appears to be a demand for this Spanish translation service and a number of current PestNet users have expressed a willingness to help, the view of certain moderators is that this should not be pursued until a committed "champion" is willing to initiate and manage the service and obtain any funding required to publicise and promote the service.