Asia-Pacific Network for Global Change Research

Climate Change Impacts on the Ecology of the Rice Pest Complex and the Resulting Threat to Food Security and Farming Economy in South Asia

Final report for APN project 2005-15-NSG-Pallewatta

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2005-15-NSG-Pallewatta

Final Report submitted to APN

Overview of project work and outcomes

Non-technical summary

A regional scoping workshop that brought together collaborating researchers from Bangladesh, India and Sri Lanka was held in Sri Lanka from 22nd -24th September 2005. The main objective of this meeting was to discuss and to more fully develop the theme of climate change, ecology of rice insect pests and the threat to rice farming and food security in South Asia that was the topic of a research proposal submitted to APN's Call for Proposals 2004. An APN grant of US $ 15,000 was awarded to the group of collaborating scientists to hold the above workshop to address the comments from reviewers so that a proposal on the same theme could be submitted to APN's Call for Proposals 2005. The main result of the workshop was a proposal that was submitted to the above in 2005. The second most important result was the far greater level of understanding of the work on this theme that has been carried out, the existing gaps in data and the future work in participating countries. The objectives of the workshop were all met and there is as a result a much greater sense of mutual support, understanding, enthusiasm and a sense of direction of work and obviously far greater mutual friendship between the collaborating researchers.

1. Objectives

In April 2005, Asia Pacific Network for Global Change Research awarded a sum of US $ 15,000 to the proposal submitted by the proponents in 2004 with the following objective.

- To hold a scoping workshop to develop the project further, narrow the objectives and provide a clear focus to the final proposal to be submitted to APN.

Further at the regional workshop held in Sri Lanka from 22nd-24th September 2005, the above was expanded to include the following specific objectives. For more details of this presentation please see Appendix 2. The workshop set out to:

- Define the overall direction of the final proposal
- Agree on the specific components that will be included in the final proposal
- Set actions and a time frame for completion of final proposal

2. Amount received for each year supported and number of years supported:

The sum of US $ 15,000 was awarded out of which US 12,000 was provided as the first tranche of funds. The number of years supported was one.

3. Participating Countries: Bangladesh, India, Pakistan, Sri Lanka

4. Work undertaken: The establishment of a regional network of collaborating scientists from among the participating countries was carried out. This was achieved with much advice and support from Dr. J. Ratnasiri of Sri Lanka who had extensive experience of carrying out research supported by APN on climate change related work. Two senior researchers each from Bangladesh and Pakistan, three senior researchers from India and six researchers from Sri Lanka formed the network. The increased number from Sri Lanka was due to the lower costs that entail their participation being the host country for the scoping workshop as well as the having the only other socio-economist of the team. The expertise in modeling rice insect pest populations and in climate models was much

greater in India and this was reflected in the increased number of collaborating scientists. The inclusion of the researchers in the network for developing the final proposal was on the basis of their expertise on management of insect pests of rice, socio-economic conditions affecting rice production and finally on climate models. There were three climate change modellers, six entomologists, one insect pest population modeller, two socio-economists cum policy specialists within the network.

Once the network was established, discussions on the framework, the time period of the workshop were carried out through email and telephone. The background organization was carried out by the PI with support from others in Sri Lanka. The regional scoping workshop was held from 23rd -25th September 2005 at the Palm Garden Hotel, Mt Lavinia in Sri Lanka. The number of overseas participants was two from India and one from Bangladesh. The number of participants from Sri Lanka was seven. The participant from Pakistan was unable to attend as so as one participant from Bangladesh and India respectively. However, they all were part of the network that would contribute to the preparation of the final proposal. The list of participants and their contact details are available in Appendix 8. The objective of the regional workshop is listed above. This was further elaborated into more specific objectives to be attained by the end of the workshop by the principle investigator. The specific objectives (listed above) were related to the comments made by reviewers to the proposal submitted in response to APN's call for proposals in 2004. The participants were also asked to reflect on the following questions:

5. Results

The agenda of the workshop is given in Appendix 1. At the workshop the main activities centered around seeking the views on the proposed topic of work from the participating countries followed by discussions on how to integrate those into the final framework of the proposal. The guidelines provided by APN for preparation of the final proposals were extensively consulted. Details of the main discussion points and the model on which the final proposal was based in given in Appendices 5 and 6. The following questions were also posed to the collaborators by the principal investigator.

- Are you in agreement with the previous tone and direction of the previous final proposal?
- Do you wish to have a new direction for the final proposal to be submitted in 2005?
- If so, please define a new title and objectives

In addition participants from each country contributed a number of published and unpublished material that would be relevant to the proposed work. This contributed to the data base of information that was gathered as a result of the regional workshop.

6. Relevance to APN scientific research framework and objectives

The proposed project that was developed fully as a result of the workshop will undertake development of future climate scenarios, collating information on insect pest damage to rice crops and resulting loss of yield and undertaking gap-filling studies, applying rice crop models to project future yield losses and determining resulting impacts on farmer economies. The rice fields are an important component in the ecosystem in the South Asian region and their response to climate-change induced pest infestation has not been

worked out. Any increased losses due to this process will affect the food security in the region where rice is the staple food. It also addresses the human dimension aspect of how the farmer economy will be affected. The resulting recommendations will assist the policy makers to initiate appropriate adaptation measures. As such, the project is relevant to the APN science agenda of Climate, Ecosystems and biodiversity, and use of food resources**.**

7. Self evaluation

When comparing the objectives of the proposal to fund the workshop and its outcomes, all the participants including the organizers can be very satisfied with the outcome of the regional workshop. The project proposal benefited very much from the opportunity that was provided to contributing scientists to meet with and discuss intensively the details of the proposed work. This resulted in a focussed effort, as it enabled the discussion of specific technical details of the main components and as the participants gained very much from the exchange of ideas and knowledge on the various components of the proposed work. After the workshop, there was far more understanding of the work that has been carried out and needed to be carried out by the participating countries. The objectives of the workshop were all met and there is as a result a much greater sense of mutual support, understanding, enthusiasm and a sense of direction of work and obviously far greater friendship between participants.

9. Potential for further work

The gaps in the existing body of data, especially field work on pest population changes with respect to many environmental variables were highlighted during the workshop. Thus it was obvious that in order to obtain a holistic view of the theme, the scope of research work needed to be expanded much beyond what was possible through a single APN award for research. The participants discussed several other sources of funding and other means of support required for a longer term approach.

10. Publications

The result of the scoping workshop was the final proposal that was submitted to APN Call for Proposals 2005 and this report on the work carried out in order to prepare the final proposal. The lists of references that are included in the reports contain the major documents that were gathered as a result of the meeting of the regional partners. We are continuing to explore further opportunities for seeking support for the topic of climate change, ecology of rice insect pests and the threat to rice farming and food security in South Asia, which we wish to research.

11. References (only the major ones have been included here)

Dhaliwal,G.S. and Arora, R. 1994. Trends in Agricultural Pest Management, Commonwealth Publishers, New Delhi.

Kalra,N. 2004. Impacts of Climate Change in India (Agricultural Impacts), Final Report of Joint Indo-UK Programme, Indian Agricultural Research Institute, New Delhi 110012, India

Kiritani,K. Pest Management in Rice. Ann. Rev. Ent. 24, pp.279-312.

Matteson, P.C. 2001. ORYZA2000. Modelling lowland rice, IRRI, 2001.

Matthews, R.B., Kropff, D. Batchelet and H.H. Van Laar (eds.) Modelling the Impact of Climate Change on Rice Production in Asia. CAB International in Association with IRRI

12. Acknowledgments

All of us who were collaborators in this effort that includes the regional scoping workshop and preparation of the final proposal that was submitted to APN Call for Proposals 2005 wish to thank the Asia Pacific Network for Global Change Research and the International START Secretariat for the financial and other forms of support without which the formation of our network and discussions on future work would not have been possible. We also wish to thank the University of Colombo, Sri Lanka for supporting the work of the principal investigator, and the respective organizations in Bangladesh, India, Pakistan and Sri Lanka for which the other collaborators work and all the staff who helped to make the regional workshop a success.

Technical Report

Preface

The on-going research studies funded by APN for investigating the impact of climate change on major crops such as tea and coconut generated interest among a group of Sri Lankan researchers to investigate the impact of climate change on insect pests that attack rice. Rice being the staple food of Asians was of paramount importance in agriculture and in ensuring food security for the people of Asia. A group of researchers drawn from the Bangladesh, India, Pakistan and Sri Lanka that included climate change scientists, entomologists and socio-economists were assembled to write a proposal that was submitted to APN's call for proposals 2004. That proposal was awarded a sum of US $ 15,000 to develop the proposal further on the same theme and to carry out a more in depth literature survey of the topic. This technical report describes the process by which that proposal was refined.

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1.0 Introduction

Climate change and its projected impacts on agriculture and food security in many developing countries, particularly in the South Asian region with a large percentage of people living below poverty level[1], is a matter of serious concern. Rice often called the world's most important crop, and grown extensively and intensively over many parts of Asia has been the focus of attention most notably from the International Rice Research Institute and similar organizations[2].

Very few studies have addressed the changes in the crop-pest interactions that could arise due to the anticipated climate change. In addition, as crops and regional impacts can vary significantly, there is a need for crop specific and region specific studies. Insects with their often rapid responses to changes in weather variables are ideal candidates to model crop-pest interactions under climate change scenarios. There is a serious lack of detailed work on crop-pest interactions with climate change projections for most countries in South Asia. Even for rice crop, there was almost no work carried out on the impacts of climate change on its production mediated through changes that can take place in populations of serious insect pests of rice

Therefore a proposal to address this theme that was regional in scope with contributions from senior researchers in Bangladsh, India, Pakistan and Sri Lanka was submitted to APN in response to its call for proposals 2004 on the ideas set out below. The proposal sought to establish the base line data and undertake analyses that will allow for examination of changes of pest distributions and associated yield loss with projected climate changes in four countries**; Bangladesh, India, Pakistan and Sri Lanka**. This work was being undertaken with full knowledge of the fact that pests cannot be treated in isolation but as complexes that include animals, diseases and weeds, which form an integral part of the rice agro-ecosystem. However, as a first step, we sought to address a few key insect pests that are important under field conditions. The proponents were awarded a grant of US $ 15,000 in order to develop the proposal fully through a regional scoping workshop.

2.0 Methodology

Following the award of the grant from APN, the process of consultation and organizing the workshop was begun from June 2005. Two senior researchers from Bangladesh and Pakistan, three from India and there were seven from Sri Lanka were invited to the regional workshop that was held in Sri Lanka in September 2005. Preliminary instructions were sent to participants such as requesting their response to the overall direction of the proposal submitted in 2004 and general guidelines for the structure of presentations to be made at the workshop.

a) The objective of the regional workshop was:

- To develop the project further, narrow the objectives and provide a clear focus to the final proposal to be submitted to APN.

At the workshop the above was further defined into a set of more specific objectives that were to be attained by the end of the workshop. They are:

[1] 85% of the regional population live below $2 per day and 43% of these global poor people live in South Asia (www.developmentgoals.org).
[2] 90% of the global production comes from Asia and 31% from South Asia (www.faostat.fao.org)

- Define the overall direction of the final proposal
- Agree on the specific components that will be included in the final proposal
- Set actions and a time frame for completion of final proposal

The participants were also asked if the following questions on the overall direction of the proposal:

- Are you in agreement with the tone and direction of the proposal submitted in 2004
- Do you wish to have a new direction for the proposal?
- If so, please define a new title and objectives

b) The proposed research consists of three major areas: climate change, insect pests of rice and their impact on rice yields, socio-economic factors that affect farmers, farming systems and resultant food security in South Asia and the interactions between them. All discussions at the workshop also followed this general grouping of aspects. The methodology by which the format and content of the final proposal was finalized is summarized below.

Presentations made by each participant at the workshop discussions were followed by discussions and comments on the points raised by each. A general discussion of all the aspects was carried out in the second and third days of the workshop. The review and discussions of the topic of proposed research was based on the existing work that had been carried out on each aspect in each country and the professional judgement of the participants. Each of the comments made by the reviewers of the 2004 proposal was discussed in detail by the participants and appropriate responses to be included in the final proposal for the APN call for proposals 2005 were decided. The comments made by reviewers are listed in Appendix 2.

3.0 Results & Discussion

a) Summary of discussions of the workshop

a) The general direction of the proposal of 2004 was felt to be appropriate for the proposal of 2005. A conceptual model within which the overall research was to be carried out was developed. In view of the more detailed discussions and review of the literature that took place as a result of the regional scoping meeting, it was appropriate to develop a set of more detailed criteria for gathering data on the three main areas of the proposal, namely, insect pests and their impact on rice yields, climate change variables that are of special significance to populations of major types of insect pests of rice and the socio-economic indicators relevant to rice farming and farmers and food security. Each area was discussed extensively with respect to what was relevant to each country and then appropriate for application at a regional level. Finally all aspects were reviewed and agreed upon for inclusion into the research proposal. Insect pests of storage being an very important cause of post harvest loss of rice were included in the proposal of 2004. Subsequently following discussions at the regional workshop in 2005, it was decided to omit them as their inclusion would very much complicate the number of factors that will have to included in the field studies and climate modeling. It was not practical to include storage pest within the time frame within which the work had to be completed.

(i) **Climate change scenarios for the South Asian region**

Drs. Ratnasiri and Basnayake presented the work that has been done on development of Global Climatic Models (GCMs) and climate change scenarios for this region. Dr. Basnayake presented the climate data availability for Sri Lanka in particular and the density of collection points which has relevance to selection of the rice growing areas under the proposed research. He also presented data on the trends in key climate variables for Sri Lanka and discussed their implications for the present work and outlined PRECIS, the Hadley Center regional climate modeling system. He discussed the existing types of Regional Climatic Models (RCMs). Dr. Ratnasiri presented an overview of the climate change and crop production work carried out in Sri Lanka. He highlighted the major weaknesses in application of the available models for relating climate changes to crop production and identified the areas where further work needed to be carried out in climate models so that they can be applied with greater relevance for the South Asian region and for this kind of research. Appendix 3 contains the presentations made on this aspect of the proposal.

In the ensuing discussion, two major decisions were made by the participants. They were:

- The candidate climate model selected at the workshop for this study was the RCM PRECIS developed jointly by the Hadley Center, UK and the Indian Institute of Tropical Meteorology, Pune. It will be used in this study for generating high resolution regional future climate scenarios. It was decided to invite collaboration from a leading Indian climate change modeller, Dr. Rupa Kumar Kolli of the IIM to this research proposal. It was agreed upon unanimously as Dr. Kolli leads a research group that develops climate models that are most applicable to this region and can be adapted most easily for this work.
- The climate variables that are of most relevance to population change of insects are temperature, rainfall and relative humidity. The last variable especially is very important for changes of insect populations over the short term. The available regional scenarios for temperature change can be used as it is in this study while rainfall and humidity variables need to be developed further to suit the scales of this work.

(ii) **Selection of insect pests, their population changes and estimation of yield losses due to their attack**

The entomologists from each country outlined the importance of the major insect pests of rice from their respective countries. These species were prioritized based on the basis of a few criteria listed below;

- Known responses of populations to weather variability
- Yield loss
- Area of distribution of the pest species

The latter two criteria are directly related to the degree of economic importance of the insect pests.

Insect pest species to be addressed in the proposed research work were then nominated from Bangladesh, India and Sri Lanka. The exception was for Pakistan which was not represented at the workshop, but the criteria for evaluation were sent to the collaborating scientist for nominations of pest species, which was duly done. It was decided to include

the Brown Plant Hopper (BPH) (*Nilaparvata lugens*), the Rice Gall Midge (*Orseolia oryzae*) and the Rice Leaf Folder (*Cnaphalocrocis medinalis*), Yellow Stem Borer, (*Scirpophaga incertulas*), Paddy Bug **(***Leptocorisa oratorius*) and Whitebacked planthopper (*Sogatella furcifera*). Though they are common to all four countries, the relative extents of damage caused by these pests vary from country to country. In Pakistan, BPH was not a serious pest that warranted inclusion into this study but the other two species were important.

It was pointed out that due to climate change, some insect pests can shift their status from being currently minor pests to major pests. This aspect needed to be kept in mind during the analyses of data and conclusions to be drawn from the overall research work. It was agreed to collate all the existing data on each selected insect pest species using including agricultural reports from research and extension organizations in each country as well as other types of documents as a first step in the proposed research work. The assessment of damage to the insect pest under consideration is a complex one. The existing methods for estimation of yield losses from insect pests (see section 6.0) were referred to during the extensive discussions on this topic and it was decided to develop common protocols for estimation of yield losses for each species at the beginning of the study. These would be applied in field trials for gap-filling studies to be carried out in representative rice fields in each agro-climatic zone/region in each country. In each field plot a suitable tract of rice fields will be selected for continuous monitoring of pest populations and their damage from the seedling stage to harvest. The sizes of field plots for carrying out gap filling studies will be agreed upon after initial field surveys in selected areas.

The existing methods and models for forecasting pest population changes and yield loss with change of climatic and other factors were also discussed. It was also pointed out that standard statistical methods (i.e. regression analysis) would suffice to model crop-pest interactions at with respect to various variables as these were established methods that have been applied successfully in other countries and situations. Section 6.0 includes some documents consulted in this regard.

One of the presentations made at the workshop dealt with the computer simulation models developed for modeling climate-crop interactions. One of them developed by the Indian Agricultural Research Institute, known as INFOCROP (see Bibliography and Appendix 4), was considered a possibility for modeling crop-pest interactions and yields. One of the key outputs envisaged at the end of the study was a series of digital maps of the geographical distribution of each pest species in each agro-climatic zone/region of each country with any changes that may have taken place during the study. The climatic scenarios would be applied to existing pest distributions to develop a set of future pest distributions.

(iii) Selection of geographical areas and rice farming types

This aspect dealt with selection of geographical areas for carrying out field work on the insect pests to fill in gaps in the existing data for investigating climate impacts on pest population changes, and for concomitant socio-economic investigations. The basis of selection was made according to the need to include all the agro-climatic zones of a participating country, the most important rice varieties of a country, the major types of rice cultivation methods such as rain fed and irrigated and as much as possible the socio-economic diversity of the country in terms of rice production (see Appendix 6 for list of selected varieties and areas). They are wet, intermediate and the dry zones with irrigation. Sri Lanka would consider including a region with rain fed rice cultivation as well. Due to the constraints of time and financial support it was decided to select one representative area from each agro-climatic zone for field experiments.

(iv) **Socio-economic context of rice production**

This was discussed extensively with Professor Joyashree Roy and Dr. W.G. Somaratne taking the lead.

Assessing the socioeconomic impacts will take into account diverse geographic and social groups in participating countries and will consider as priority, the human populations and economic sectors that are most likely to be heavily impacted by changes in rice production. Developing country rice farmers are most likely to be a group that will not possess the capacity to adapt readily to climate change. The overall impact on the livelihoods and socio-economic status of farming communities (among others) will be determined. Examples of some of the indicators that can be employed for this purpose are: Farm incomes; Partial Factor Productivity (PFP) (i.e. changes in yield per hectare, income per man day; yields per man day); loss of labour hours spent by the family (due to pest attack); increase in the consumption and cost of pesticides; level of food security; level of marketable surplus; level of poverty; quality changes of rice (visual and shelf life). In addition, a suite of measures can be employed to measure the impact on the national economy induced by production losses due to pest attacks. The future impacts on the socio-economics and the resulting threat to food security will next be assessed based on the projections on climate change induced pest damage worked out as described above.

The following main points were agreed upon.

- The Life Cycle Analysis (LCA) approach was to be adopted for analysis rice production in each country. This would enable a more holistic assessment that would include all main elements that comprise rice production. The farmers of the field trial plots would be trained and asked to maintain crop diaries as this was considered as one of the most suitable ways of obtaining much of the required information on the changes to the crop, pest populations and damage levels.

- A set of detailed criteria was developed that would form the core variables that would be monitored for each area in which field collection would be carried out. Appendices 5 and 6 have more details.

(v) **The sampling regime**

Simultaneous sampling of pest numbers, weather data and socio-economic data from each selected area in each selected region in each country was required under the framework established for the proposed research. A common set of protocols was to be developed for carrying out the pest and socio-economic data. Recording of weather data would be through already existing weather stations or simple weather recording equipment to be set up in the field sites. It was decided that sampling for pest population changes and recording of data (to be recorded in the crop diaries) would have to be carried out at least on a weekly basis fro each field site. The field trials for gap filling studies would require collection of data on pests, socio-economic conditions and weather data on a continuous basis for a period of 1.5 years to enable data gathering over four seasons of rice cropping per selected site.

b) Results

(i) The most important result of the workshop is the final proposal that was submitted to APN call for proposals 2005. A framework for the entire body of work was developed with detailed criteria for inclusion of climate models, insect pests, crop varieties, candidate areas for carrying out field studies, socio-economic aspects, and for development of the policy relevant documents. A new collaboration on climate modeling

from the Indian Institute of Meterology was included in the list of collaborators which was an added bonus. The framework developed for the proposal is given in Appendix 6. The detailed final proposal is listed below.

(ii) The next most important result is the establishment of a closer working relationship between participants and the opportunity to exchange ideas on the main components of the proposed work.

(iii) A compilation of the main documents in support of the proposed research was also possible with a better understanding of data gaps and the rice insect pest scenario in each country.

(iv) The participants also discussed potential for obtaining financial and other means of support to the proposed work from other funding agencies as it was clear from the workshop discussions that the topic of research would need longer term and more sustained financial and other forms of support over longer period of time rather than that of a three year period of funding. It was felt that other outputs from the proposed work would include policy papers providing recommendations on adaptation measures at policy level, a manual for farmers on adaptation measures at the field level based on integrated pest management of insect pests and publications in peer reviewed journals.

The final proposal submitted to APN in 2005 is included below without the CVs of the collaborators as otherwise it would make this document longer than the stipulated number of pages.

Final proposal submitted to APN Call for Proposals 2005

Part One: Full-Proposal Cover Page (1 page)

1. Project Title

Title: An Assessment of threat to food security and farm economy from climate induced rice insect pest infestation: A South Asian perspective.

Duration: 2 years from August 2006 to July 2008 (Commencement of second rice season)

Funding: **US $ 100,000** for the following:

	Activity	Cost US $	APN Contribution
1	Networking Rice Scientists	32,600	**12,600**
2	Collate Data	31,000	**16,000**
3	Analyze the available Data	13,000	**8000**
4	Undertake Gap-Filling Studies	35,000	**21,000**
5	Develop Cl. Change Scenarios	23,000	**13,000**
6	Project Pest Damage Impacts	18,000	**12,000**
7	Hold Final Workshop	20,000	**15,000**
8	Prepare Final Report	5000	**2000**
9	Miscellaneous	2000	**400**
	Total	**179,600**	**100,000**

2. Project Leader, Institution and Country

Dr. (Ms.). Nirmalie Pallewatta,
Senior Lecturer, Department of Zoology,
University of Colombo, Cumaratunga Munidasa Mawatha, Colombo, Sri Lanka.

3. Project relevance to the APN Science Agenda

The project is directly concerned with the Climate as well as Ecosystems and Biodiversity.

Since the project plans to study the threat to food security resulting from loss of rice yield due to any increase in insect pests due to climate change, it is relevant to the Use of Food Resources.

4. Regional collaboration and leverage of support being sought (monetary and/or in-kind)

The project will be carried out in collaboration with the following scientists:

INDIA: Prof. Joyashree Roy, Jadavpur University, Calcutta
Dr. S. Suresh, Tamilnadu Agricultural University, Coimbatore
Dr. Naveen Kalra, Indian Agricultural Research Institute, New Delhi
Dr. K. Krishna Kumar, Indian Institute of Tropical Meteorology, Pashan, Pune

BANGLADESH:
Dr. Ahsan Uddin Ahmed, Centre for Water and Environment, Unnayan Parishad, Dhaka
Dr. Masum Ahmad, Bangladesh Agricultural University, Mymensingh

PAKISTAN:
Dr. Abdul Rehman, National Agricultural Research Centre, Islamabad

It is expected that the above Institutions will provide in-kind support in terms of support staff, utilities, laboratory and computer facilities towards execution of the project.

It is also expected that once the project is approved, the collaborating scientists would seek funding from their national funding agencies to supplement and sustain the project beyond its approved period.

Part Two: Project Summary Sheet (2 pages / 13 Columns)

Column 1:

Title of proposed project: **An Assessment of threat to food security and farm economy from climate induced rice insect pest infestation: A South Asian perspective.**

Column 2:

Proponent's Name and Title: Dr. (Ms.). Nirmalie Pallewatta, Senior Lecturer
Name of Institution: Department of Zoology, University of Colombo
Address: Cumaratunga Munidasa Mawatha, PO Box 1490, Colombo 00300
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Fax: 94-11-2503148
E-Mail: nirmalip@sltnet.lk, nimmi@zoology.cmb.ac.lk
Website: http://www.cmbmail.ac.lk

Column 3:

Amount requested from the APN for 2006/2007:	**US$ 50,000**
(Note that US $35,000 was the average awarded for 2005/2006)	
Duration of Proposed Project:	**No Years: 2 years**
Funding secured from other sources:	**US$ in kind at present**
Total amount of APN funding requested:	**US$ 100,000**

Column 4:

Has the proponent or collaborators been awarded APN Grant(s) in the past? If yes, please provide details.

Yes. The proponent received a grant of US $ 15,000 for the project APN 2005-15-NSG and Dr Janaka Ratnasiri, a collaborator received a grant of US $ 103,000 for the APN Projects 2001-20 and 2002-05.

Column 5:

In 100-150 words, describe the project's relevance to the APN and its current Science Agenda:
The project will undertake development of future climate scenarios, collating information on insect pest damage to rice crops and resulting loss of yield and undertaking gap-filling studies, applying rice crop models to project future yield losses and determining resulting impacts on farmer economies. The rice fields are an important component in the ecosystem in the South Asian region and their response to climate-change induced pest infestation has not been worked out. Any increased losses due to this process will affect the food security in the region where rice is the staple food. It also addresses the human dimension aspect of how the farmer economy will be affected. The resulting recommendations will assist the policy makers to initiate appropriate adaptation measures. As such, the project is relevant to the APN science agenda of Climate, Ecosystems and biodiversity, and Use of food resources.

Column 6:

Outline the activities to be conducted and why you believe these activities are necessary:
The following main activities will be carried out under the proposed project:

1. Develop a network of Rice Scientists in Bangladesh, India, Pakistan and Sri Lanka.
2. Collate past data on pest damage in selected agro-ecological zones of the four countries.
3. Undertake necessary gap-filling studies to complement data gathered above.
4. Undertake regression analysis studies to develop models of crop-pest interactions.
5. Obtain climate change scenarios downscaled for each country for applying to the study areas
6. Work out the impacts on pest damage under these scenarios using rice crop models.
7. Assess the impact on farmer and national economies arising out of reduced production levels.

8. Hold a regional workshop to discuss and disseminate the results of the study.

Networking of rice scientists initially is essential to collate data and disseminate findings. Gap-filling studies are essential as there would be many lacunas in the availability of data covering all agro-ecological regions. Use of regional climate models is necessary to work out the future climate scenarios applicable at country level. Use of crop models is essential to determine the response of rice yield when several factors are in force simultaneously.

Column 7:

Provide information on the member and/or approved countries involved. (See page xx of Guide):

INDIA:

Prof. Joyashree Roy, Professor of Economics and Coordinator of Global Change Programme of Jadavpur University , Kolkata
Dr. S. Suresh, Professor of Entomology, Tamilnadu Agricultural University, Coimbatore
Dr. N. Kalra, Head, Simulation & Informatics Div., Indian Agricultural Research Institute, Delhi
Dr. K. Krishna Kumar, Senior Scientist, Indian Institute of Tropical Meteorology, Pashan, Pune

BANGLADESH:

Dr. Ahsan Uddin Ahmed, Director, Centre for Water and Environment, Unnayan Parishad, Dhaka
Dr. Masum Ahmad, Professor of Entomology, Bangladesh Agricultural University, Mymensingh

PAKISTAN:

Dr. Abdul Rehman, Senior Scientist, National Agricultural Research Centre, Islamabad

Column 8:

Summarize the proposed project methodologies: For gap-filling studies, a suitable tract of rice fields will be selected for the monitoring of pest populations and their damage from the seedling stage to harvest.
In Socio-Economic studies, the overall impact on the livelihoods and socio-economic status of farming communities will be determined using sustainability indicators that can be employed for this purpose
For climate scenario development, the daily sequences of weather generated from the high-resolution regional climate model (PRECIS) will form the main source of future climate data input to the crop/pest-simulation models, used along with local base-line meteorological data for the period 1961-1990.

Column 9:

Describe the mode of operation of the project team (i.e. what is the specific role of each team member?) and provide evidence from country-team members that they have agreed to carry out these roles:

1. The entomologists in each country will collate data on yield losses due to identified insect pest infestation through field surveys, questionnaires to field officers and studying past records.
2. The climate scientists will gather data on past climate parameters in the study areas in each country for use in regional climate model studies to work out the future climate scenarios.
3. The agriculture economists will study how the yield losses will affect the farmer's livelihood as well as the farm economy and resultant food security based on the data that will be collected during field survey
4. The team members will interact through e-mail correspondence and a website.
5. A workshop will be held mid-way in the second year to discuss the results and plan the final report.

Each collaborator has provided his/her CV indicating consent to be a member of the team.

Column 10:

What are the expected outcomes/products, and how sustainable will the activities be upon completion of an APN Grant if awarded?

1. Report of the Regional Workshop held in the second year.
2. Policy paper giving recommendations to policy makers on adaptation measures at policy level.
3. A manual for the farmers giving recommendations on adaptation measures at field level.
4. A set of publications in peer-reviewed journals.

It is expected that team members would be able to seek funds from their own national funding agencies or their own Institutions to continue any unfinished work.

Column 11:

How will team-evaluations be performed to ensure project objectives are being met?
It is proposed to have a regional workshop mid-way in the second year with the participation of natural and social scientists from the four countries to evaluate the results so far obtained, present them to other stake holders in the region and make any mid-course corrections, before finalising the report.

Column 12:

Provide a concise timeline for the proposed project:

Activity	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Develop a network of Rice Scientists								
Collate past data on pest damage								
Obtain climate change scenarios								
Undertake regression analysis studies								
Undertake necessary gap-filling studies								
Work out the impacts on pest damage								
Assess the impact on farmer and national economies								
Hold a regional workshop								
Prepare final project report								

Column 13:

Provide a concise literature review for the proposed project:
Matthews, R.B., M.J. Kropff, D. Bachelet and H.H. Van Laar (Eds) (1995), Modelling the Impact of Climate Change on Rice Production in Asia. CAB International in association with IRRI
Dhaliwal, G. S. and Arora, R. 1994. Trends in agricultural insect pest management. Commonwealth Publishers, New Delhi
Matteson, P.C. (2001) ORYZA2000: Modeling lowland rice, IRRI, 2001
Kiritani, K., Pest Management in Rice, Annual Review of Entomology, Vol (24), pp. 279-312.
Kalra, N. (2004), Impacts Of Climate Change In India (Agricultural Impacts), Final Report of Joint Indo-UK Programme, Indian Agricultural Research Institute, New Delhi 110012, India

1. Project Title- An Assessment of threat to food security and farm economy from climate induced rice insect pest infestation: A South Asian perspective.

2. Fully Detailed Proposal

2.1 Introduction- Climate change and its projected impacts on rice, which is the staple food for billions of people in South and SE Asian countries with a large percentage of people living below poverty level[3], is a matter of serious concern. Rice is grown extensively and intensively over many parts of Asia and has been the focus of attention most notably from the International Rice Research Institute (IRRI). One of the challenges faced by rice farmers is the control of losses due to insect pest infestation, which causes losses up to about 25% with new high yielding varieties (Dhaliwal and Arora, 1994). Climate change has also been found to be a new threat to rice cultivation. Using the ORYZA1 model developed by IRRI, rice production in the Asian region was found to decline by about -4 % under climate change expected to occur within the present century (Matthews, et. al., 1995). Very few studies have addressed the changes in the crop-pest interactions that could arise due to the anticipated climate change.

At present there is no detailed work on crop-pest interactions under climate change projections, particularly for rice, for countries in South Asia. We propose to establish the base line data and undertake analyses that will allow for examination of changes of pest distributions and associated yield loss with projected climate changes in four countries**; Bangladesh, India, Pakistan and Sri Lanka**. As a first step, we will address a 4-5 insect pests that are most damaging and common in the countries.

2.2 Objectives-

The main objectives of the proposed study are:

- To analyze the threat to food security in the South Asian region due to potential damage to rice yield from climate induced major rice insect pest infestation;
- To assess infestation by identified rice insect pest populations under different climate scenarios at the national and regional scales for 2020 and 2050;
- To assess impact of climate induced rice insect pest infestation on food security and farm economy in each participating country;
- To recommend adaptation strategies to minimize the losses to farmers, policy makers and other stake holders.

2.3 Proposed Methodology-

The methodologies described hereunder were decided upon by the collaborating scientists at a Project Development Workshop held in Colombo in September 2005.

***Insect pests and their damage studies*:** Two criteria have been applied for the selection of candidate insect rice pests, viz: economic criterion of yield loss and weather variability. This results in the selection of five major insect pests common to all four countries. They are: *Nilaparvata lugens* (Brown Plant Hopper), *Orseolia oryzae* (Rice Gall Midge), *Cnaphocrocis medinalis* (Rice Leaf Folder), *Scirpophaga incertulas* **(**Yellow Stem Borer), *Leptocorisa oratorius* (Paddy Bug) and *Sogatella furcifera* (Whitebacked planthopper). Though they are common to all four countries, the relative extents of damage caused by these pests vary from country to country (Heong and Escalada, 1998).

On suggestions made by country representatives, two rice varieties were selected for study from each country, based on the following criteria: the extent of planting of a major variety and the degree of impact of attack by insect pests selected for this study. Accordingly, the selected varieties are BR13 & BRRI24/28 for

[3] 85% of the regional population live below $2 per day and 43% of these global poor people live in South Asia (www.developmentgoals.org).

Bangladesh; CO-43, ADT 43/45 for India; Basmathi and IR6 for Pakistan; and BG 352 & BG 300 for Sri Lanka. For study areas, districts were selected belonging to different agro-ecological zones representing major climatic zones - wet, intermediate and the dry zones with irrigation - and as much as possible the socio-economic diversity of the country in terms of rice production.

In view of the current inadequacy of data that is required to correlate the insect pest populations and their damage with variables of climate change, it is necessary to fill the data gaps through fieldwork. This will be carried out through a series of experimental field plots in each country. A suitable tract of rice fields will be selected for continuous monitoring of pest populations and their damage from seedling stage to harvest. The sizes of field plots will be agreed upon after initial field surveys in the selected districts. Regression correlation will be carried out to establish the nature of the relationships between pest, climate data and damage.

Climate Change Studies: The weather variables that are important for assessing the impact of rice insect pests within climate change scenarios are temperature, rainfall and humidity. The regional climate model known as PRECIS developed jointly by the Hadley Center, UK and the Indian Institute of Tropical Meteorology, Pune will be used in this study for generating high resolution regional future climate scenarios. The daily sequences of weather generated from PRECIS will form the main source of future climate data input to the crop/pest-simulation models. The PRECIS simulations that are made at IITM, Pune comprise future time slice of 2071-2100 with high and low GHG emission scenarios. Daily meteorological data such as rainfall, max/min temperatures, humidity, vapour pressure, surface winds, solar radiation etc. obtained during the base line period 1961-1990 in each country will be utilized in the proposed work.

Socio-Economic Studies: This will take into account diverse geographic and social groups in participating countries and will consider as priority, the human populations and economic sectors most likely to be heavily impacted by changes in rice production. Developing country rice farmers are a group that is unlikely to possess the capacity to adapt readily to climate change. The overall impact on the livelihoods and socio-economic status of farming communities (among others) will be determined. Examples of some of the indicators that can be employed for this purpose are: Farm incomes; Partial factor productivity (PFP) (ie. changes in yield per hectare, income per man day; yields per man day); loss of labour hours spent by the family (due to pest attack); increase in the consumption and cost of pesticides; level of food security; level of marketable surplus; level of poverty; quality changes of rice (visual and shelf life). In addition, a suite of measures can be employed to measure the impact on the national economy induced by production losses due to pest attacks. The future impacts on the socio-economics and the resulting threat to food security will next be assessed based on the projections on climate change induced pest damage worked out as described above.

2.4 Main Activities

The following main activities will be carried out under the proposed project:

i. Develop a network of scientists in the region working on rice pest problems and their socio-economic impacts (please see Appendix 1.3 also).
ii. Collate past data on selected rice pest distributions in selected agro-ecological zones of a country, yield reductions due to pest damage, socio-economic parameters, and climatology data.
iii. Undertake regression analysis studies to develop models of crop-pest interaction dependence on climate parameters for selected agro-ecological regions.
iv. Obtain climate change scenarios by downscaling from GCM outputs corresponding to different emission scenarios for each country and determine the pest damage under these scenarios.
v. Assess the impact on farmer economies arising out of reduced production levels of rice, and the resulting threat to food security in each country.

vi. Hold a regional workshop to discuss the results of the study, prepare policy papers outlining the adaptation measures to be implemented at policy level.
vii. Conduct training programmes for extension officers on the recommended adaptation measures for the benefit of the affected farmers.

2.5 Output of the Study:

The following form the key outputs of the project:

- Proceedings of the Regional Workshop incorporating a series of GIS maps indicating pest distributions, climatic data and projected scenarios for each country.
- A published report incorporating a set of scenarios and recommendations for appropriate adaptations developed using information on ecological, socio-economic and climate data obtained and analyzed through this study.
- Recommendation for Integrated pest management (IPM) system as an option that is environmentally friendly and more effective in the longer term, for incorporation in an early warning system for pest attack, appropriate for climate change scenarios used.
- Establishment of a regional network of rice scientists to identify the future threats of climatic change-induced pest infestation and its damages and likely socio-economic effects in the South-Asian region.
- A policy paper (please see Appendix 1.3 also) for agriculture policy makers in the government recommending adaptation measures to minimise the adverse impacts on the farmer and national economy.
- A set of papers published in peer-reviewed journals.

2.6 Detailed Work Plan: This is included in **Appendix 1.2** to keep the main proposal as much as possible within the stipulated number of pages.

2.7. Relationship to APN Agenda

***Science Agenda*:** The project uses currently available crop growth models to study the impact of climate change on rice yield through direct interaction as well as through insect pest damage. This is new knowledge for rice farmers which can be transferred to the farmer communities. This area of research will complement research already being done on rice by various institutions, regional and national. Since rice is the staple food for majority of the population in south and S-E Asian countries, self-sufficiency in rice production is a critical issue. The outcome of the study will therefore be helpful for the agricultural as well as trade policy makers in the long-term planning of production or import/export of rice. It will also be helpful in the long-term land-use planning and water management for rice cultivation.

Policy Agenda: There are strong infrastructure and extension services established in all four countries to disseminate research findings in agriculture to farmers, as well as policy analysis and policy formulating organizations. The project team envisages getting them involved through national inception workshops and evaluating panels, in order to get their inputs and also to provide them with information necessary for them to formulate appropriate policies. The project team will also work closely with the national UNFCCC Focal Points in order to provide them with necessary information for the preparation of the National Communications on Climate Change.

Institutional Agenda: All the collaborating scientists are from the state organizations and they have cooperated in providing facilities to the scientists to undertake the proposed studies during normal working hours, as a part of the government's contribution towards the project. It may be noted that no administrative overheads are payable on the project, and hence such expenditure will form in-kind contributions from the participating organizations.The project team will work in association with other APN programmes such as CAPaBLE project being implemented in Sri Lanka to build capacity among the farmer communities. It will contribute to national media as well as newsletters of agriculture and environment

organizations highlighting the importance of the project being undertaken. It will also collaborate with the National Committees of IGBP and its core projects being carried out in the member countries.

3. Regional Collaboration

The project is being executed by scientists from Bangladesh, India, Pakistan and Sri Lanka, as a collaborative project. The collaborators who are entomologists working in Universities plan to seek funds from national agencies to continue the research undertaken in the project.

4. Relationship to the Human Dimensions of Global Change

A main goal of the project is to study how the farmer economy is affected by any decline in the rice production resulting from climate-change induced pest population growth in rice fields. The farmer will be the centre of analysis, and will attempt to provide them with information necessary to adapt to such situations.

5. Capacity Building for Global Change Research

The senior collaborators from the Indian Inst. of Tropical Meteorology, Indian Agri. Res. Inst., Delhi and Economics Dept. Jadavpur University, Kolkata, will provide the necessary training to scientists involved in the study in the use of regional climate models, crop growth models and socio-economic models for studying the impacts of global climate change on agriculture production. It is expected that they will disseminate this knowledge to others. The project has built into it, components that will provide hands-on training to field officers providing advice to rice farmers in improving their yield, policy makers with statistical and policy analysis.

6. Scientific Contribution of each Participating Country

Scientists from India, Bangladesh and Sri Lanka participated in the Project Development Workshop where all scientists collectively agreed on the methodologies and contributed for the preparation of the draft proposal. The Pakistan scientist though was not present, contributed through mail. Scientists from India will also assist in the capacity building as outlined above.

7. Links to Policy and Sustainable Development Issues

One output will be a policy paper (please see Appendix 1.3 also) for agriculture policy makers in the government recommending adaptation measures to minimise the adverse impacts on the farmer and national economy. Climate variability even at present is a threat to the farmer economy, causing losses both during droughts and heavy rains. It is envisaged that with proper model studies, prior information of such events could be made available to the farmers, along with advice on organic fertilizer use, mitigating of methane emissions and proper water management that will contribute to sustainable farming.

8. Relationship between Global Change Research Programmes and Networks

The proposal was initially submitted in 2004 through the Sri Lanka National Committee of IGBP which assisted in its development. The SASCOM assisted in identifying experts from India for crop modelling and socio-economic modelling as well as some of the collaborators. The Rice Res. & Dev. Inst. in Sri Lanka and IARI, Delhi were participants in the previous APN Project on CO_2 Elevation Studies on Rice (Proposal Number 2000-08, Principal Investigator: Dr A P Mitra, NPL, New Delhi, o-Investigators in Sri Lanka: Dr Janendra de Costa, University of Peradeniya Dr M W M Weerakoon, Rice Research and Development Institute, Batalegoda).

9. Related Research Work

Research on insect pest damage and its control has been carried out extensively in all four countries and given prominence in agriculture research by the respective governments. Some examples are:

- Kiritani, K., 'Pest Management in Rice', Annual Review of Entomology, Vol (24), pp. 279-312.

- Matthews, R.B., M.J. Kropff, D. Bachelet and H.H. Van Laar (Eds). 1995, Modeling the Impact of Climate Change on Rice Production in Asia, CAB International, Wallingford,Oxon UK
- Dhaliwal, G. S. and Arora, R. 1994. Trends in agricultural insect pest management. Commonwealth Publishers, New Delhi.
- ORYZA2000: modeling lowland rice, IRRI, 2001
- Rosenzweig, C. and ML Parry, 1994, Potential impact of climate change on world food supply. Nature 367
- Heong K.L. and M.M. Escalada (Eds) 1998, Pest management of rice farmers in Asia, IRRI, Manila

Studies on impact of anticipated climate change on rice production in the region have also been undertaken over the past decade, particularly with the crop models developed by IRRI and IARI, New Delhi. Some examples are.

- Kalra, N. (2004), Impacts Of Climate Change In India (Agricultural Impacts), Final Report of Joint Indo-Uk Programme, Indian Agricultural Research Institute, New Delhi 110012
- Pathak, H., Ganguly, A.K., Chander, S. and Sinha, P. 2004. The impact of climate change on pests and diseases and strategies for their management. In Advances in Plant Protection Sciences, Prasad, D and Singh, A. (Eds.), pp. 98-113
- Aggarrwal, P.K., Kalra, N., Chander, S. and Pathak, H. 2004. INFOCROP: A generic simulation model for annual crops in Tropical environments, IARI, New Delhi, pp. 132.
- Abrol, Y., S.Gadgil and G.B. Pant (Eds.) 1996, Climate variability and Agriculture, Narosa Publishing House, New Delhi.

However, no studies, to the best of our knowledge, have been carried out on the climate–change induced crop-pest interactions on rice.

Appendix 1.1- Full timeline for the entire duration of the proposed project.

Activity	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1. Develop a network of rice scientists								
2. Collate past data on pest damage								
3. Obtain climate change scenarios								
4. Undertake regression analysis studies								
5. Undertake necessary gap-filling studies								
6. Work out the impacts on pest damage								
7. Assess the impact on farmer and national economies								
8. Hold a regional workshop								
9. Prepare final project report								

Appendix 1.2

Detailed work plan

Activity with persons involved	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1. Develop a network of rice scientists 1.1 Establish means of co-ordination between collaborators (web site and other pathways) 1.2 Establish framework for project, common methodologies, time frame for deliverables N. Pallewatta and all collaborators								
2. Collate past data on pest damage 2.2 Collection of past pest data and other data on related variables N. Pallewatta, T. Jayasuriya, N.C. Kumarasinghe, D. Dharmasena, S. Suresh, Mausm Ahmad, Abdul Rehman								
3. Obtain climate change scenarios 3.3 Analyse and select climate scenarios and data J. Ratnasiri, S.Basnayake, K.Kumar								
4. Undertake regression analysis studies N. Wickramasinghe and entomologists listed in 1 above								
5. Undertake necessary gap-filling studies 5.1 Select field sampling plots in each country and establish sampling procedure 5.2 Gather data on pests and socio-economic variables N. Pallewatta, T. Jayasuriya, S. Suresh, Mausm Ahmad, Abdul Rehman, N.C. Kumarasinghe, D. Dharmasena J. Roy, W.G. Somaratne, N. Wickramasinghe								
6. Work out the impacts on pest damage N. Pallewatta, T. Jayasuriya, S. Suresh, Mausm Ahmad, Abdul Rehman, N.C. Kumarasinghe, D. Dharmasena J. Roy, W.G. Somaratne, N. Wickramasinghe								
7. Assess the impact on farmer and national								

economies J. Roy, W.G. Somaratne								
8. Hold a regional workshop N.Pallewatta (to co-ordinate) and all collaborators								
9. Prepare final project report N. Pallewatta with inputs on different sections from all collaborators								

Appendix 1.3- Additional explanation of text in the main body

Establishment of a network of rice research scientists

The collaborators in each country will circulate letters among the Faculties of Agriculture of the major universities and the Agricultural (or Rice) Research Institutes seeking information (with contact details) of their scientists working on rice pests and forward the responses to the principal collaborator. The network will be ideally made up of regional scientists involved in Crop Science, Entomology, Agricultural Economy, Agronomy, Climate Change (variability, impacts and adaptation) rather than 'rice scientists' alone as this a multi-disciplinary/inter-disciplinary field. However, resources and time constraints may not permit this ideal situation to be established within this project limits.

In addition the information on papers on rice pests from which the information on rice scientists could be obtained through the internet. There are many websites and sources of information that provide information of existing networks on rice scientists and databases of rice scientists maintained by IRRI (example of this is the attached document in PDF format on rice databases) and other organizations. Information will be sought from these databases. Further, directories of scientists maintained by various professional societies of researchers can be used.

Policy documents and their intended audience

There will be separate publications targeted to different audiences such as;

a. Policy makers
b. Scientsits through journal papers
c. Farmers through the Extension services of the Agricultural Departments of each country.

Appendix 2.1- Detailed budget estimate for the project in US Dollars

	Activities and details	**Sri Lanka** Co-ordinating nodal centre	**India**	**Pakistan**	**Bangladesh**
1	Networking Rice Scientists (see detailed budget in 2.2)	6600	2000	2000	2000
2	Collate Data	4000	4000	4000	4000
3	Analyze the available data	2000	2000	2000	2000
4	Undertake Gap-Filling Studies	5000	6000	5000	5000
5	Develop Cl. Change Scenarios	3000	4000	3000	3000
6	Project Pest Damage Impacts	3000	3000	3000	3000
7	Hold Final Workshop	15,000	---	---	---
8	Prepare Final Report (100 printed copies+ design and layout with graphics + production of maps)	2000			
	Total	**40,600**	**21,000**	**19,000**	**19,000**
9	Miscellaneous	**400**			
		TOTAL REQUESTED FROM APN = 100,000			
	In-kind contributions from all collaborators in the region (computers, printers, scanners, use of broad band internet lines, office space, laboratory space and	**Approximately US $ 79,000 over the project period**			

	time contributions from laboratory technicians, other types of assistants and volunteer students)	

APPENDIX 2.2

DETAILS OF ACTIVITY 1 (Networking of Rice Scientists) IN TOTAL BUDGET IN APPENDIX 2.1 in US $

Networking of Rice Scientists	**Sri Lanka** Co-ordinating nodal centre	**India**	**Pakistan**	**Bangladesh**
Assistant to team leader for sending out communications and establishment and maintenance of web site for network@ 100 x 24 months	2400	----	----	----
Stationery and communication (postage and telephone)	3000	2000	2000	2000
Cost of using utilities (water and electricity) of the University of Colombo, Sri Lanka @300/year	600	--------	-------	--------
Cost of financial services provided by the University of Colombo in administration of project funds @ 300/year	600	-------	-------	------
TOTAL	6600	2000	2000	2000
	TOTAL FOR ACTIVITY 1=			

4.0 Conclusions

The participants agreed that the topic of the proposal had a great deal more work to be done in order to obtain a holistic view of the relationship between impact of climate change, impact of insect pests and the resulting effect on food security in South Asia.

The main objectives that were to be addressed through the regional scoping workshop were:

- To hold a scoping workshop to develop the project further, narrow the objectives and provide a clear focus to the final proposal to be submitted to APN.

Further at the regional workshop held in Sri Lanka in September 2005, the above was expanded to include the following specific objectives. Therefore the workshop set out to:

- Define the overall direction of the final proposal
- Agree on the specific components that will be included in the final proposal
- Set actions and a time frame for completion of final proposal

The following results were obtained:

- The main result of the workshop was a modified proposal for carrying out research under the topic which was submitted to the APN call for proposals 2005.
- The second result was the closer interaction between the collaborators and the refining of ideas for research under the proposed work established as a result of the workshop. The collaborators agreed on the fact that they had a team that was able to work well together, which was a very promising outcome of the scoping workshop.
- A compilation of the main documents in support of the proposed research was also possible with a better understanding of data gaps and the rice insect pest scenario in each country.
- The need to engage in a longer term, holistic view of the connection between climate change, insect pests of rice and their population changes and socio-economic factors in each country was underscored through this meeting. It was felt that policy makers of each country should be engaged to impress upon them the need to give more attention to impacts of climate change on agriculture.

5.0 Future Directions

In South Asian countries there are many data gaps in this area of research. It was evident that a great deal more work including field studies to gather some types of primary data on pest population changes needed to be carried out in order to obtain a more detailed and analytical picture of the interactions between climate change, changes in populations and distributions of insect pest of rice and the socio-economic indicators of well being and food security.

The full proposal was submitted to APN for consideration for the 2005 round of grants in December 2005. During the regional meeting, several other options for funding sources in the event of a shortfall of funds from APN or a grant not being awarded to this proposal, were discussed. Participants sent the team leader contact details of potential funding bodies during the past three months and the team leader is in the process of contacting

them and exploring the possibilities. The team leader also had discussions (in early 2006) with a visiting academic to the University of Colombo where the background of the APN proposal and the ideas of the group of collaborators for the future were explained. Interest was shown by the visiting academic on the climate change and food security in rice theme of this proposal. It is expected to take forward these discussions toward seeking support for the research programme.

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Appendices

Appendix 1- The Agenda and Programme of the regional scoping workshop

Appendix 2- Introduction to the workshop and its objectives

Appendix 3- Presentations made on climate change aspects

Appendix 4- Summary of presentations made on entomological aspects

Appendix 5- Proposal framework and socio-economic aspects

Appendix 6- List of variables to be measured during the research work

Appendix 7- List of Participants

Funding sources outside the APN

- University of Colombo, Sri Lanka, Department of Zoology- Provision of office space and facilities to the principal investigator, approximately US $ 2000 over the period of work

Glossary of Terms

APN	Asia Pacific Network for Global Change Research
BPH	Brown Plant Hopper
GCM	Global Climate Model
IRRI	International Rice Research Institute
LFA	Life Cycle Analysis
PFP	Partial Factor Productivity
PRECIS	Providing Regional Climates for Impact Studies
START	Global Change Systems for Analysis, Research and Training
RCM	Regional Climate Model