Pesticides & Poverty:

Implementing Chemical Conventions for safe and just development

PESTICIDE ECOTOXICOLOGY:

DOCUMENTING AND COMMUNICATING ENVIRONMENTAL IMPACTS

FINAL REPORT ON FOLLOW-UP MINI PROJECTS

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Contents

Executive Summary

1. A training of trainers (ToT) in pesticide ecotoxicology was a key component of PAN's Pesticides & Poverty project. Funding was provided by the EC (Environment in Developing Countries) and by the Africa Stockpiles programme.

2. During ToTs run in Tanzania; Ethiopia; Senegal and Benin during 2006 & 2007, a call for concept notes was made to participants for mini-projects to follow up on and further enhance and embed technical capacity built in ecotoxicology during the ToTs. Six Concept Notes (CNs) were received.

3. Three CNs were accepted:
    a. Mali: Organisation pour un Développement Intégré au Sahel (ODI-Sahel)
    b. Ethiopia: Institute for Sustainable Development (ISD)
    c. Tanzania: initially with Kadetfu, but finally with Aaron Mbogho of the Crop & Plant Protection Office of the Ministry of Agriculture, Dodoma.

   All technical support for the mini-projects was provided by members of the NR Group (Tanzania, Ethiopia & Mali) and/or CERES/Locustox (Mali). This report summarises the specific details of the mini-projects.

4. A total of almost 1000 people from rural communities were surveyed from 37 villages in the three countries, thus raising the significance of pesticide use and environmental and health risks with all these people and within all these rural communities.

5. A significant body of comparable evidence was accumulated on pesticide use, knowledge, perception, management, environmental and health incidents and reporting of pesticide induced incidents within the specific target rural communities in the three countries. Details of surveys and survey results are given in the individual country reports.

6. At least 55 pesticide formulations, based on over 30 active ingredients, were identified as being applied within rural communities in the 3 countries. Carrying out rapid risk assessments (RRAs) on all those identified was impossible. A total of 9 RRAs were carried out on 7 pesticides (3 insecticides – DDT (in Ethiopia), Selecron (in Tanzania), Malathion (in Ethiopia and in Mali); 2 herbicides – 2,4-D (in Tanzania and in Ethiopia), Round-up[*] (in Mali); 2 fungicides – Ridomil (in Tanzania), Blue Copper (in Tanzania)).

7. Quantifying risk in the RRAs proved difficult or impossible due to gaps in the data collected from the questionnaires (specifically with regard to dose rates of individual pesticides and with regard to the fauna and flora and habitats within the survey areas). Questionnaires could be improved in this regard for further rural community surveys. However, obtaining representative and accurate data on actual dose rates used is likely to require more detailed farmer surveys over longer time periods, coinciding with periods in the year when the pesticides are

[*] A very rapid and more generalised risk assessment was performed for Round-up, due to shortage of time and lack of quantitative information – it was not carried out following the guidelines we proposed, but based heavily on an RA by USDA

used. The RRAs are thus largely qualitative, but with quantitative elements to the extent possible based on the data available.

8. Capacity to undertake RRAs was catalysed in Tanzania and Ethiopia, but in both countries, partners require further practice and experience before being capable of conducting judicious RRAs. A very good basis now exists, but the skill-base lies within a very limited number of people. There would be value in extending this skill-base. No capacity to carry out RRAs has been built in Mali, as yet. Existing capacity to undertake RRAs in Senegal has been enhanced – this capacity is within CERES/Locustox which is the regional centre of expertise in ecotoxicology and thus has the potential to spread capacity more widely within West Africa.

9. Widespread illegal use of DDT in smallholder agriculture in the Ethiopian Rift Valley has been shown (involving almost 30% of farmers). This is of significance for the Stockholm Convention and will be reported to the in-country POPs Focal Point. An RRA identifies significant environmental risk from this use of DDT and action is urgently required to mitigate this risk.

10. For all the other pesticides subjected to RRAs, ecological risks were estimated to be negligible, very low, low or (as a maximum) moderate. Details are provided in the individual RRAs, which are based on survey returns and supplementary scientific knowledge. Although these were carried out as ecotoxicological RRAs, some attention was given to the hazards pesticides present to humans. Significant risks to human health were identified for 2,4-D in Ethiopia, due to the extent of its use, evidence of poor understanding of dose rates, poor use of protective clothing and poor storage placement. Similar potential risks are associated with Selecron use in Tanzania and malathion use in Ethiopia (and, potentially, Mali) and with Roundup use in Mali.

11. A small percentage of people surveyed in Tanzania also used DDT (0.6% of households). However if the survey is representative of the occurrence of DDT use in Tanzania it probably poses little environmental or human health risk. Nonetheless, it should be reported to the POPs Focal Point and PIC DNA in country.

12. Although it did not show up in the community survey, the Malian mini-project identified lindane as being used (outside the regulatory framework for pesticides) to treat fish and assist in product conservation. Given the concerns to PAN from lindane and given that this is a particularly ill-advised use (posing significant health risk to consumers) PAN-Africa may wish to offer support to ODI Sahel over this issue. As use is outside the legal framework, the Rotterdam Convention cannot apply BUT the PIC DNA in Mali may still welcome knowledge of this illicit use of lindane.

13. Endosulfan is used by a relatively small percentage of farmers in both Ethiopia (Rift Valley) and in Tanzania (Mbeya region). Again, as this has been identified as a pesticide of concern to partner organisations - ISD in Ethiopia, Agenda in Tanzania – as well as to PAN-UK and is under consideration for addition to Annex III of the Rotterdam Convention - this may be a finding of concern to partner organisations.

14. 439 people from >16 villages within the 3 countries (318 people from 7 villages – Tanzania; 74 people from 2 urban schools representing at least 23 villages – Ethiopia; 47 people from 5 communes – Mali) have been involved in awareness raising workshops and learned about the environmental and health risks from

pesticide use. This number will increase once village workshops have been held in Ethiopia (the 2 held so far have been within schools in towns).

15. In Ethiopia, 70 teenage children and 4 teachers in 2 High schools have a raised awareness of pesticide risks and hazards; these people have enormous potential to spread awareness more widely and to take an active role in ameliorating poor pesticide awareness within the country.

16. In Tanzania, the structure for a potential reporting chain for pesticide induced environmental and human health incidents from rural communities to the PIC DNA has been identified and is in the process of being instituted. This is the first country in the world (as far as we are aware) that has developed such a system. This should be a highly significant instrument in implementing the Rotterdam Convention. The system may not be directly transferable elsewhere (each country will require its own system to fit within infrastructural and cultural parameters specific to that country), BUT the means of investigating and taking action on instituting such a system (involving grassroots consultation) should provide a model for action internationally.

17. In Tanzania, community monitoring teams of 12-15 people have been established in 7 villages with a view to reporting and, once trained, monitoring suspected pesticide induced environmental incidents.

18. In all 3 countries, liaison and collaboration between NGOs and government bodies and other relevant authorities has been greatly enhanced and the potential for future collaborative action on pesticide issues established. Again, this should provide a model for adoption internationally.

19. None of the mini-projects succeeded in training people in completion of the PIC Environmental Incident Report Forms (EIRFs). However, there is now awareness of the existence of the Rotterdam and Stockholm Conventions within the rural communities targeted by the mini-projects in each country – again, a significant advance on the situation prior to the intervention of the P&P project.

20. Use of radio broadcasts by the mini-project in Mali to spread awareness of pesticide issues may have the potential to reach a very large number of people in the Mopti Region. However no evaluation mechanism has been established to quantify any benefit from this.

21. Strengths and weaknesses of the mini-projects from a technical point of view are outlined in this report. Tanzania began from the position of greatest strength and has been most successful in enhancing its in-country capacity to implement ICCs to the greatest extent. The mini-project in Mali suffered from the departure of the lead individual (and only person trained in ecotoxicology) at ODI Sahel. Awareness of pesticide risks and hazard seems particularly low in the Mopti area, is relatively low within ODI Sahel and the need for further support with regard to pesticide management and ecotoxicology is probably greatest (amongst present partners) here.

22. Recommendations are made for any follow-on or future similar projects and suggestions made for further training and technical support needs for partner organisations in the mini-projects

1. Background

The training of trainers (ToT) in pesticide ecotoxicology is the key component of Activity 3 of the Pesticides & Poverty Project: *Documenting and communicating environmental impacts*. Funding was provided by the EC program on Environment in Developing Countries and by the Africa Stockpiles programme managed by WWF, Nairobi.

Pesticides are increasingly widely used in Africa, for migratory pest control or for public health use, as well as in agriculture. The revised FAO Code and draft WHO Code now provide guidance on reducing environmental risks of pesticides, whilst the Rotterdam (PIC) Convention provides for action on severely hazardous pesticide formulations causing environmental problems under conditions of use in developing countries. However, the ability to document adverse environmental impacts of pesticides is severely limited in African countries.

Activity 3 of the Pesticides & Poverty project aimed to meet the Rotterdam (PIC) Convention and FAO Code call for capacity building to manage known hazardous chemicals throughout their use life-cycle. The project identified short-falls in present capacity as areas where training at various levels could provide very real improvements in PIC procedures by identifying, reporting and monitoring non-target pesticide impact. Such capacity, once built, will also assist implementation of the Stockholm Convention (POPs).

This aspect of the project builds on work carried out by a variety of projects on monitoring and evaluating pesticide use within Africa over the last decade, particularly that of the Natural Resources Institute (NRI) and of FAO. It also builds on the work by the various International Convention Secretariats, but is ground-breaking in attempting to take ecotoxicological monitoring to grassroots level and in trying to bridge the awareness gap between village communities, farmer groups, the agricultural and environmental authorities and national authorities responsible for the implementation of the International Chemical Conventions (ICCs). The project has aimed to do this by organising training sessions in the use of ecotoxicological monitoring methods for assessment of pesticide impact appropriate to tropical ecosystems in East African and West African countries. An educational resource (a handbook and method sheets, available through CTA – Grant & Tingle, 2002) developed by experts with extensive experience of ecotoxicology in tropical areas, was used as the basis to train trainers (government staff, regulators, academics and NGOs) in methodologies appropriate to their particular situation. Such capacity building would directly support the key Chemical Conventions and FAO Code of Conduct by providing appropriate local people with the tools to collect robust data that can, if appropriate, be reported through the Rotterdam (PIC) Convention, or used to support the development of locally appropriate alternatives.

The ToT sessions were conducted during autumn 2006 and spring 2007 in Tanzania, Ethiopia, Senegal and Benin and have been fully reported (Tingle, 2006; Tingle 2007a; Tingle 2007b).

During the ToTs, it was stressed that follow up activities would be necessary to consolidate the capacity build by trainees and concept notes were requested from the host organisations of those trained for follow-up mini-projects deemed appropriate and valuable by those organisations.

Following reporting on the ToTs, a final call for follow-up mini-project Concept Notes (CNs) was made by the P&P project manager on 11 May 2007, with a deadline for submission of project outline documents by 21 May 2007.

2. Mini-project rationale, purpose and predicted outcomes

The purpose of the mini-projects was to provide an opportunity for participants from the ToTs to use the training they had received, either to start to roll out awareness-raising on pesticide environmental risks and hazards within their countries or to exercise and help embed their ecotoxicological skills through project activities. Whilst it was recognised that the training of trainers (ToT) was ultimately intended to equip participants to carry out full scale eco-toxicological monitoring programmes, budget and time constraints were inadequate to support large scale projects of this type for the follow-up phase.

Three broad areas of projects were open for consideration as follow-up mini-projects:

i. awareness raising and training others (communities and/or government) using ecotox concepts and tools (e.g. training on EIRF)

ii. Practicing applying the methods in the field (for participants of training), e.g. gathering some field data on a small scale (mostly aiming to gain experience rather than gather scientifically valid data): and

iii. Developing a larger scale project idea and proposal which would be submitted to other funders for funding (we could potentially collaborate with them to identify funders). This last one could be in conjunction with the other two.

The objectives were broadly defined as:

- to further develop the expertise and knowledge gained during the ecotox training of trainers
- to provide resources for implementing chemical conventions and processes
- to build capacity to document hazards and risks
- to raise awareness among government bodies, public interest groups, civil society and other key stakeholder about chemical conventions, environmental impacts of pesticides, and how they can be measured.

Of six mini-projects concept notes (CNs) received, 3 were accepted. They were:

1. **"Community Pesticides Survey and Awareness Raising in Mbeya Region, Tanzania"** – from Ministry of Agriculture, Food Security & Co-operatives, Dodoma, Tanzania; lead contact: Aaron Mbogho
2. "**Training on Impacts of Pesticides on Human Health and the Environment to High School Students of the Rift Valley, Ethiopia**" – from: Institute for Sustainable Development (ISD), Ethiopia; lead contact: Tadesse Amera/Asferachew Abate
3. "**Information et sensibilisation sur les impacts environnementaux des pesticides dans la région de Mopti, Mali**" – from ODI Sahel, Mali; lead contact: Almoustapha Maiga

Through an iterative process involving PAN-UK, the mini-projects partners, the PIC Secretariat and the NR Group, the three mini-projects selected were aligned to comprised the following key elements:

- A survey of a rural community(ies) to assess pesticide use, knowledge and perception
- A desk-based risk assessment exercise for selected pesticides identified during the survey
- Awareness raising within the rural community(ies) of the environmental hazards associated with pesticide use, human health risks, good pesticide management, the existence of International Conventions and Codes to help mitigate pesticide hazards.
- Consultation over potential reporting chains (rural community to PIC DNA) for pesticide induced environmental incidents

- Completion of PIC Environmental Incident Report Forms with community representatives, as appropriate

In order to further build capacity in ecotoxicology and to develop and refine the skills acquired during the ToT, technical support for the follow-up mini-projects was a key requisite. A technical support team from within the NR Group and CERES/Locustox was selected.

3. Technical support provided

Technical support to the follow-up mini-projects was supplied under the following broad headings:

- Review of concept notes and selection of suitable mini-projects for support under the P&P Project
- Finalisation of mini-project content and TORs
- Technical Support team
- Questionnaire design and content
- Survey design and implementation
- Pesticide Rapid Risk Assessment (RRA): Guidance documents
- Selection of Pesticides for RRA
- Review of partner organisation's RRAs
- Review of draft reports on survey results
- Management of technical support: Planning, organisation & logistics

In-country partners carried out the majority of the work themselves, but with the technical support team playing an advisory and "review" role, to ensure that the scientific results from the projects were valid and meaningful. In relation to the questionnaire survey, technical advice was provided on request, but also via review of the questions and phrasing of questions to assure meaningful results; guidance was also provided on survey methodology to assure minimisation of bias. The key technical area where in-country partners had limited or no experience was in conducting rapid risk assessment (RRA) of pesticides. The technical support team took responsibility for identifying the key pesticides for attention in terms of the environmental risk. The team also provided guideline documents to assist attempts at carrying out RRAs and conducted RRAs themselves on the key pesticides identified, as models against which to assess RRAs carried out by partners. Advice was offered to partners in planning the awareness raising sessions that they carried out in rural communities, particularly in relation to activities to assist implementation of the ICCs. The final technical role was in reviewing draft reports on the mini-project activities by partners, particularly in highlighting (scientific) errors in interpretation of ecotoxicological effects of pesticides or discussion of results.

4. Results from the mini-projects

Results from the mini-projects fall into several different output categories:

4.1 Documents, tools and information resources

These are resources that have been used as part of the mini-projects, which have come out of the collaboration between partner organisations implementing the mini-projects and the technical support team. They provide a resource for use in or uptake by future similar project activities in Africa, but with potential for adaptation to use elsewhere in the developing world.

<u>Questionnaire</u>

A questionnaire to examine pesticide use, pesticide management, understanding and perceptions of pesticide risks and hazards, and related topics in the context of rural communities was developed by partner organisations in collaboration with the technical support team. It was used very successfully in all 3 countries as the data collection element of

the surveys of target communities and a huge volume of data was accumulated (see section 4.2).

This questionnaire is a resource for use in future surveys of rural communities' interaction with pesticides in Africa (or, potentially, elsewhere) It has already been used in Nigeria. It is available in English, French and Swahili (see Annex 1). The questionnaire is also available in Oromiffa (local language in Ethiopia) direct from ISD.

Some of the data required to carry out a quantitative pesticide risk assessment was not part of the questionnaire (for example, no questions about the flora, fauna, habitats, soils, etc. were included, nor on specific dose rates of particular pesticides, nor frequency of application of specific pesticides, nor areas to which they were applied, etc. – see below and individual RRAs). If pesticide RRA is a focus for future use of the questionnaire, then this type of data should be routinely collected at the same time as the questionnaire is being completed.

Guidance on survey design and implementation

Guidance notes were prepared and supplied to partners on the design of pesticide use surveys in rural communities specific to each of the countries in which surveys were undertaken (see Annex 2).

Guidance notes on how to carry out rapid risk assessment (RRA) of pesticides

Two sets of guidance notes were produced on RRA of pesticides (see Annex 3). These are described in full in Tingle (2008).

RRAs on 7 pesticides specific to their use in a specified context in rural communities within the 3 target countries

The RRAs are reproduced in Annex 4.

With rural community surveys identifying at least 55 pesticide formulations based on over 30 active ingredients (a.i.) being applied in the 3 countries, carrying out RRAs on all the pesticide formulations identified was impossible. A total of 9 RRAs were carried out on 7 pesticide formulations or active ingredients (3 insecticides – DDT (in Ethiopia), Selecron (in Tanzania), Malathion (in Ethiopia and in Mali); 2 herbicides – 2,4-D (in Tanzania and in Ethiopia), Round-up*[*] (in Mali); 2 fungicides – Ridomil (in Tanzania), Blue Copper (in Tanzania)).

The RRAs assessed the risks of the pesticide formulations identified by the community surveys to the local environment (habitats, flora and fauna, soil types, topography, hydrology) as a function of their application rates (dose and frequency where stated) and target crop.

Very often, insufficient data was available to allow a truly quantitative risk assessment to be made. The RRAs were thus largely qualitative, but with quantitative elements wherever possible (although this varied from RRA to RRA). It is vital that the specificity of these RRAs is recognised – they are only transferable to other use situations with relevant adjustments being made. All RRAs are accompanied by the database of information from which the risk assessment has been compiled. These cover the more generalised risks from the particular pesticide, but again would need to be adapted appropriately to be used to assess risk in a particular area within a particular country.

An RRA for the widespread agricultural use of DDT demonstrated by the survey of villages in the Ethiopian Rift Valley (see section 4.2.2 below), identifies significant environmental risk from this use of DDT and action is required urgently to mitigate this risk. A small percentage of people surveyed in Tanzania also used DDT (0.6% of households surveyed), however it probably poses little environmental nor human health risk due to the limited scale of use in the 9 villages surveyed. If the survey is representative of the occurrence of DDT use in

[*] The risk assessment for Round-up was carried out very rapidly and did not follow the guidelines laid out by the Technical support team - it is less thorough and more limited in its scope than the others

Tanzania, then the hazard it presents nationally may be small. Nonetheless, it should be reported to the POPs Focal Point and PIC DNA in country.

For all the other pesticides subjected to RRAs, ecological risks were estimated to be negligible, very low, low or (as a maximum) moderate (Table 1). Details are provided in the individual RRAs. The community survey data only provide a snapshot of pesticide use: pesticide hazards and risks could change with future crop and livestock management practices

Although carried out as ecotoxicological RRAs, some attention was given to hazards to people within most of the RRAs.

Table 1. Summary of risk level determined by RRAs

Pesticide	Type	Active ingredient	Location/ Nation	Risk level (ecosystem)
DDT	I	DDT	Rift Valley / Ethiopia	Low - High (T – birds of prey and insectivorous birds at highest risk; reptiles and beneficial insects also moderate-high risk; A – piscivorous birds at highest risk; some fish and invertebrates moderate-high depending on exposure)
Selecron	I	profenofos	Mbeya / Tanzania	Low (T) – moderate (A – fish & invertebrates most vulnerable)
Malathion	I	Malathion	Rift Valley / Ethiopia	Low (T – crop pest natural enemies (NMEs) at most risk); Low-moderate (A – fish & aquatic inverts ONLY if misuse)
			Mopti / Mali	Low-High (T – bees at highest risk; then insect NMEs; A – fish & aquatic inverts ONLY if misuse)
2,4-D	H	2,4-D	Rift Valley / Ethiopia	Low-moderate (A – given misuse - & depending on form: T - highest risk to broad-leaved vegetation and fauna dependent thereon)
			Mbeya / Tanzania	Negligible to low (A & T)
Round-up*	H	glyphosate	Mopti / Mali	Low (T – bees) – High (T – broad-leaved plants; possible indirect risk to some small mammals & birds); Low-moderate (A – sensitive inverts, Amphibia & fish) – all at high dose rates only
Ridomil	F	Mancozeb/ metalaxyl	Mbeya / Tanzania	Negligible to low (A & T - fish most vulnerable)
Blue Copper	F	Copper hydroxide	Mbeya / Tanzania	Low (A – molluscs, Crustacea & fish) but rising with repeated use; accumulates in soil

NB. I = insecticide; H = herbicide; F = fungicide
Rift Val/Eth = Ziway & Arsi Negele, Rift Valley, Ethiopia; Mbeya/Tanz = Mbeya region, Tanzania; Mopti/Mali = Mopti district, Mali
(T) = terrestrial ecosystem; (A) = aquatic ecosystem

Significant risks to human health were identified for 2,4-D in Ethiopia, due to the extent of its use, evidence of poor understanding of dose rates, poor use of protective clothing and poor storage placement. Similar potential risks are associated with Selecron use in Tanzania and malathion use in Ethiopia (and, potentially, Mali) and with Roundup use in Mali.

Indeed poor pesticide management and almost complete lack of protective clothing use whilst mixing and applying pesticides within the rural communities in all 3 countries means that risk of minor short-term health risks from most of the pesticides used to those handling pesticides directly exceeds (in terms of likely incidents/accidents caused) the environmental risks they pose.

4.2 Quantitative data on rural communities (pesticide use, knowledge, perception)

A significant quantity of very valuable information has been collected and analysed relating to pesticide use, perceptions, risks and problems in the rural communities surveyed in each of the 3 countries. The data from the questionnaire-based survey was enhanced and clarified during awareness-raising and feedback workshops in Tanzania and in Mali. In Ethiopia, feedback from communities has come via the school students who conducted the survey, based on the responses of their families and neighbours. Further pesticide risk and hazard awareness raising workshops are planned for the target rural communities in Ethiopia.

Forty six pesticide formulations, comprising 31 active ingredients (a.i.), were identified as being used within the 9 villages surveyed in Mbeya, Tanzania. Eight formulations (comprising 8 a.i.) were identified as being used in the 23 villages surveyed in Ziway and Arsi Negele waredas in Ethiopia. Ten formulations (comprising only 2 a.i. that could be confirmed) were identified as being used in the 5 communes surveyed in Mopti, Mali. The results appear to suggest that knowledge of exactly which pesticides are being used is far lower in Ethiopia and Mali than in Tanzania.

Although it did not show up in the community survey, the Malian mini-project identified lindane as being used (outside the regulatory framework for pesticides) to treat dried fish for market and assist in product conservation.

Endosulfan is used by a relatively small percentage of farmers in both Ethiopia (Rift Valley) and in Tanzania (Mbeya region). As this has been identified as a pesticide of concern to partner organisations - ISD in Ethiopia, Agenda in Tanzania – as well as to PAN-UK and is under consideration for addition to Annex III of the Rotterdam Convention - this may be a finding of concern to partner organisations.

Full details are in the 3 mini-project reports (Annex 5, 6 & 7).

Key features arising:

- Farmer knowledge of which pesticides they are using was relatively poor in Mali and in Ethiopia, but appeared remarkably good in Tanzania.
- Pesticide management within rural communities is generally poor in all 3 countries.
- Awareness of pesticide risks to human health and the environment is generally poor.
- Knowledge of pesticide application is generally poor, particularly in Ethiopia and Mali.
- Very few people use any form of protective clothing when applying pesticides in all 3 countries.
- The percentage of farmers who apply pesticides without reading or understanding label instructions or knowing about the dose rate is unacceptably high in all 3 countries.
- The surveys provide strong indications that pesticides are frequently used for purposes other than that for which they are registered in all 3 countries.
- Widespread illegal use of DDT in smallholder agriculture in the Ethiopian Rift Valley has been identified (see 4.2.2 below).
- Limited illegal use of DDT in Tanzania has been identified (0.6% of households).

- Lindane (Gamalin) was identified by local technical services, Mopti, Mali as being used (outside the regulatory framework for pesticides) by vendors to treat dried fish and assist in product conservation. This is a particularly ill-advised use of this insecticide (posing significant health risk to consumers).
- Endosulfan is used by a relatively small percentage of farmers in both Ethiopia (11.8% of the 422 households surveyed in 2 Rift Valley waredas) and in Tanzania (1.7% households of the 489 surveyed in the Mbeya region).
- Health incidents as a result of pesticide use were recorded in all 3 countries, with high incidence of relatively minor symptoms in Tanzania but no serious, long-term illness or other effects noted. In Ethiopia slightly fewer respondents recorded relatively minor symptoms, but 11 cases of long term "illness" were reported and 6 deaths. In Mali, only about 15% of those answering the question had heard of any health incidents within their community resulting from pesticide use – however, whether this reflects low occurrence of incidents or low level of perception that pesticides may cause health issues is unclear from the survey.
- There is no knowledge of the existence of the International Chemical Conventions within the rural communities.
- The only reporting chains for (possible) pesticide induced incidents are for health incidents, but they are inadequately used.
- Only PAN-Mali attempted to cross-reference results to particular groupings within the survey participants (something that questionnaire design and analysis using SPSS aimed to allow) – cross-reference was made to individual Commune and to educational level. The cross-reference to educational level may not have been the most valuable one to make in terms of interpretation of the results and implications for action.

<u>Tanzania</u>

- Almost 84% of respondents use pesticides on their crops (51% regular users).
- 70% of respondents keep livestock and 78% of these use pesticides on their animals.
- More than 50% identify "controlling pests and increasing yields" as the main benefit from pesticides, with 15% stating that they "produce healthy plants and crops" and a further 15% citing that they "kill insects".
- There is a reasonable correlation between the numbers using particular types of pesticide (herbicides, insecticides, etc.) and the stated purpose of pesticide use, although it appears that more want to control insects than claim to use insecticides and fewer want to control fungi than claim to use fungicides. This indicates there may be some confusion over products. The largest anomaly comes with pesticides used on livestock – many claim to use them, but very few veterinary pesticides were listed as being used. This begs the question "are pesticides not designed for use with livestock being mistakenly used on livestock?"
- 47% prefer to use broad spectrum pesticides.
- 20% of respondents stated that they do not read pesticide labels; 42% have bought pesticides without labels; nearly 40% claim not to understand label instructions and a further 40% only understand sometimes; almost 65% have used pesticides with labels in a foreign language that they don't understand. These results provide a clear picture that pesticide misuse is happening to an unacceptably high extent.
- <60% of households apply the same pesticide 0-5 times per year; <75% 0-10 times per year, meaning that >25% apply the same pesticide 11-52 times per year! The significance of this in terms of over-use depends on the dose rates and the number and types of crop managed, etc. and such application frequency may not be surprising if they are growing 4 or 5 crops. However, 14 households are applying 30-52 times

per year i.e. once a week to once a fortnight, which is excessive and likely to be be damaging both to the health of those applying the pesticides and to the target agroecosystem and its fauna.

- 36 respondents stated they were using a mix of pesticides, but included fertilisers in their list (16 of whom were not applying pesticides in their mix at all). Six respondents did state that they applied mixtures to improve plant growth and control pests simultaneously – but 10 cases cast doubt as to those people's understanding of what a pesticide is and undermines the validity of their results to the survey in terms of quantifying pesticide use.
- 9 of those claiming to apply mixtures were applying a mix of 2 fungicides (in one case a mix of 2 brands of the same a.i.) – this is a complete waste of money and effort and increases risks of over- or under-dosing.
- Almost 84% of respondents say that their use of pesticides solves their pest problems – NB. This is clearly perception not necessarily reality.
- Almost 85% of respondents recognise that pesticides can be harmful.
- 65% of respondents were not aware of obsolete pesticides as an issue.
- Almost 75% of respondents store pesticides in their house.
- Slightly under 60% wear normal clothes whilst applying pesticides.
- Almost 35% of respondents indicate that they are on a "pesticide treadmill", with pesticide use increasing each year; an additional 35% state that use varies (i.e. sometimes increases, sometimes decreases).
- Almost 50% of respondents had felt discomfort or illness after applying pesticides, amongst the symptoms reported (number of cases in brackets) – nausea (129), headache (88) and skin irritation (75) were most frequently mentioned, followed by eye irritation (40), chest pain (31) and vomiting (28).
- There was considerable variability in reports of potential non-target impacts, but with a distinct indication that bees (or other pollinators) were perceived to have declined and a slight indication of a decrease in other (non-pest) insects over the last 2 years.

<u>Ethiopia</u>

- >94% of respondents use pesticides
- 35% are unaware that pesticides can be harmful
- 84% thought that pesticides solved their pest problems and 80% that pesticide use increased crop production.
- Around 45% of farmers thought that their pesticide use increased year by year, whilst about 25% thought it decreased. This does give some indication that there may be a "pesticide treadmill" in operation within these communities.
- Widespread illegal use of DDT in smallholder agriculture has been identified. There is a possibility that this is a result of people refering to pesticides generically as "DDT" (as a result of not knowing the pesticide's chemical or trade name) and the result from the survey require verification. Once verified, reporting of this will enhance implementation of the Stockholm Convention in Ethiopia.
- There was reasonable correlation between the numbers of farmers stating that they used pesticides for weed control and the number recording that they use herbicides; similarly for insecticides. However, about 35% stated that they use pesticides for fungal pest control, but <2% recorded using fungicides; about 25% stated they use pesticides for rodent control, but no rodenticides were recorded as being used; about 22% stated they use pesticides for veterinary purposes, but no vermicides were listed

and of the insecticides none were registered for veterinary use. This indicates considerable misuse of pesticides in addition to the illegal use (above).

- There was no record of the number of times that respondents used the same pesticide in a given year; nor of the size of fields to which pesticides were applied; nor the season/time of year when pesticides are applied
- Approx. 55% of respondents do not read labels and, of those that do only 29 (<7%) could understand and follow instructions
- About 52% of respondents wear normal clothes whilst applying pesticides, but 27.5% do wear cotton overalls.
- 40% of respondents had felt discomfort or illness after applying pesticides (9% of these indicating that this only happened sometimes), with headaches (approx. 25%), nausea (approx. 21%), vomiting (approx. 10%), skin irritation (approx. 10%) and eye irritation (approx. 2%), being the reported symptoms.
- From this small sample, 6 families reported deaths within the family as a result of pesticide use and an additional 11 reported “long term injuries”.
- There is some evidence that adverse effects of pesticides are being suffered by the agro-ecosystems managed by these communities, with beneficial organism being perceived to be in decline - spiders, by 40% of respondents (with a further 44% not knowing); - bees by >57% of respondents (and almost 20% not knowing) and other pollinators by >37% (with a further almost 50% not knowing). In each of these cases very many fewer farmers thought that numbers of these groups were increasing (<10% in all cases).
- More than 20% of respondents had heard about environmental incidents occurring, but only about half of these had reported them to the local agricultural advisor/officer.

<u>Mali</u>

It is clear from the ODI Sahel report on the mini-project that the level of knowledge of pesticide issues by communities in the Mopti region is at a low level (although it must be recognised that the sample size for the survey was rather small and the results may not be replicated throughout the region).

- 87% of respondents use pesticides, but only 28% use them regularly. 99% of those using them reckon that pesticides solve their pest problems.
- Almost 70% state that they use pesticides for weed control and only 15% for insect pest control, which correlates reasonably well with the pesticides reported as being used (68% herbicides; 17% insecticides). However, 66% say that they use pesticides on their livestock, but no known veterinary pesticides were listed as being used.
- No one reported using the same pesticide more than 3 times in a single year (<10% respondents), with the vast majority (almost 80%) only spraying the same pesticide once per year.
- A significant minority (under 15% of respondents) reported that pesticide use on their farm was increasing year by year , whilst 42% thought it varied and 40% that it declined. This gives little indication of a serious “pesticide treadmill” situation in Mopti.
- About 60% of respondents claimed to follow pesticide label instructions when preparing pesticides for application, but this included a similar proportion of illiterate respondents claiming to follow label instructions as didn’t (54% vs 46%).
- 84% of respondents claim to know the dose of each pesticide they apply.
- 80% of respondents wore normal clothes during pesticide application.
- About 40% stored pesticides in the house.

- Only 11 respondents (15%) reported knowledge of cases of poisoning from pesticides during the previous year
- No data was recorded on the perceived impacts of pesticide use on non-target fauna

4.3 Improved In-Country Coordination over Pesticide Issues

in-country liaison, information exchange and co-operative working between authorities and other interested parties was improved in relation to pesticide issues. In Tanzania, the working relations between AGENDA and the Ministry of Agriculture and Rural Development and the PIC DNA, strengthened during the ecotox ToT has been further greatly enhanced through co-operation during the mini-project.

In Ethiopia, the working relations between ISD and the Ministry of Agriculture and Rural Development, strengthened during the ecotox ToT has been further enhanced through the mini-project. Young people were also encouraged to interact with their communities on subjects of local importance, to listen and learn but also impart their knowledge where appropriate.

In Mali, a functioning network and liaison between relevant regional organisations in relation to pesticide issues has been established as a result of the mini-project, and recognition has spread of the lack of awareness of the Rotterdam Convention (and probably the Stockholm Convention too – though this would need confirming) and priority has been given to rectifying this by ODI Sahel and it's new regional partners. ODI Sahel has received an invitation to attend the National Workshop on pesticides in April, which will further improve liaison, co-ordination of activities and co-operation between in-country authorities and other parties over tackling pesticide issues. ODI Sahel has expressed its commitment to continuing to work with new partners on pesticide issues and to improve its in-house expertise on pesticides

4.4 Awareness Raised

Following the surveys involving over 1000 people from 37 villages in the 3 countries and awareness raising workshops in Tanzania and Mali involving 318 and 47 people from 7 and 5 villages, respectively: All these rural communities now know of the existence of the International Chemical Conventions (ICCs), of their importance in assisting their countries to deal with particular hazards associated with pesticide use, of the existence of designated national bodies to implement the conventions within their country and of the need to report potential pesticide induced incidents to help implement the conventions (see section 4.6).

Awareness of pesticide risks and hazards has been raised considerably in all 3 countries.

In Tanzania, 318 farmers from 7 villages were involved in the pesticide awareness raising training sessions within the Mbeya region rural communities.

In Ethiopia, 70 students and 4 teachers were trained from 2 High Schools in pesticide and environment, pesticide and agriculture, pesticides and public health and chemical conventions. The high school teachers involved have had their awareness raised of the environmental and health problems associated with pesticides, providing a knowledge resource for the future. They also have the position and capability to spread this awareness more widely and over an extended period of time, potentially reaching a proportion of each year's new intake of pupils. Pesticide awareness raising workshops are planned for a selection of the surveyed villages; the number of participants has yet to be determined

In Mali, 47 representatives from the 5 villages took part in the pesticide awareness raising workshop, along with 3 radio journalists. The journalists then broadcast pesticide awareness raising programmes based on these workshops and including a debate between Officers from the local Crop Protection Office of the Ministry of Agriculture and the Regional Centre for Pollution Control and Public Nuiscance over 2 radio networks in the 2 major local languages. Broadcasts were transmitted twice per week at peak times (19:30 h) throughout March. These broadcasts could reach a total of up to 1.5 M people in the Mopti region (depending on access to radios within the population).

For further detail see the final reports of the mini-projects (Annexes 5, 6 & 7).

4.5 Capacity Built

Capacity building has been a key aim of the ecotox follow-up mini-projects and has focussed on 3 main areas:

- Awareness raising of environmental hazards associated with pesticide use .
- Pesticide risk assessment.
- Implementation of International Chemical Conventions.

Capacity building to raise awareness of the environmental hazards associated with pesticide use and that to collect, compile and assess data on pesticide problems has largely involved the same people and shall be treated together.

A good deal of capacity already exists within all 3 countries to raise awareness of the negative impacts that pesticides can have on both the environment and on human health. The capacity of participants in the ecotox ToTs has been embedded and enhanced, whilst the mini-projects have also spread the capacity to raise awareness wider.

As a result of the ecotoxicology ToTs, limited capacity has been built to conduct field monitoring using certain specific techniques within 7 African countries: Ethiopia, Tanzania, Benin, Senegal, Mali, Morocco and Tunisia (for detail, see Tingle, 2007). This capacity has not been further embedded or extended via the follow-up mini-projects.

<u>Awareness raising and data collection</u>

Sixteen people were involved in **Tanzania** (5 women; 9 men – all Tanzanian) in carrying out the survey and in providing pesticide awareness raising training (see section 4.4). All are from the Ministry of Agriculture (including the ecotox ToT participant) or the Uyole Agricultural Research Institute, Mbeya. The capacity of all these people to carry out successful awareness raising has been enhanced.

The survey of pesticide use in rural communities was highly successful (see section 4.2) and through carrying out this aspect of the mini-project, new capacity to collect relevant and important data on pesticide use, perceptions and impacts has been built within the group of people above.

Capacity already existed in these areas in **Ethiopia** within ISD and elsewhere, which has been enhanced through the mini-project. Significantly, capacity has been extended considerably by inclusion of schools in project activities. A total of 70 students (40 from Ziway and 30 from Arsi Negele) were registered to participate in the training and carry out the local surveys. Their club leader teachers (two from each high school) were also included to make the training more effective.

A training module was prepared in collaboration with the Federal Ministry of Agriculture and Rural Development, Crop Protection Department and the training was given for six days in December 2007. Students and teachers were trained for six days on pesticide and environment, pesticide and agriculture, pesticides and public health and chemical conventions.

Fifty youth were selected from the trained group and the four teachers were taken as supervisors of the data collection. The selected data collectors and supervisors were trained for two days on the concepts and contents of the questionnaire, ethical considerations, instruction of the questionnaire, data collection procedure and coding. They also gained direct experience of cross-sectional survey techniques by carrying out rural community surveys.

The use of school children as a means to reach members of the larger community was found to be instrumental and therefore of value in planning future awareness-raising activities with regard to pesticides.

Capacity in both these areas has been built in **Mali** within ODI Sahel, where knowledge of pesticide issues and of ecotoxicology was previously low (the participant from the ecotox ToT who designed and initially led the mini-project, left ODI Sahel for a career move to Burkina Faso before the survey got underway). Through close interaction with regional partners (see section 4.3.3) awareness raising training was provided to rural communities, although this capacity (particularly in relation to environmental impacts of pesticides) needs to be further built in ODI Sahel. A commitment to do this has been made by ODI Sahel (see section 4.3.3).

A team of six people (4 men; 2 women) was provided with brief training (2 days) to carry out the survey and collect data on pesticide use, perceptions etc. within communities in Mopti. Further capacity building on this would benefit ODI Sahel.

Rapid Risk Assessment (RRAs) of pesticides

Through the 3 mini-projects, building capacity to carry out RRAs of pesticides has been initiated in the East African countries, but requires further development. In Ethiopia this capacity is limited to 2 people (Tadesse Amera of ISD and Dr. Asferachew Abate, Project Coordinating Scientist Martin Luther University Halle-Wittenberg Institute of Soil Science and Plant Nutrition, Addis Ababa), who have made an attempt at an RRA for 2 pesticides heavily used within the Ethiopian rift valley. These people need further practice in RRA along with further technical support to embed their capacity. The skill base in RRA would benefit from being widened (see recommendations below).

In Tanzania this capacity is limited to 1 person (Aaron Mbogho, Agricultural Officer, Ministry of Agriculture, Food Security & Cooperatives, Crop & Plant Protection, Dodoma), who has made an attempt at an RRA for 2 pesticides heavily used within the Mbeya region. Aaron needs further practice in RRA along with further technical support to embed the capacity built to date. The skill base in RRA would benefit greatly from being greatly widened (see recommendations below).

No capacity has been built to carry out RRAs in Mali.

The existing capacity within CERES/Locustox in Senegal has been enhanced. Personnel at CERES are capable of carrying out RRAs on pesticides and of providing training on carrying out RRAs. Nonetheless, their capacity could be further embedded and assured through further collaboration with experienced RA technicians (see Tingle, 2008).

Implementing the ICCs

The capacity to assist in and further the implementation of the ICCs, particularly the Rotterdam Convention (PIC) has been considerably enhanced and developed via the mini-projects (see section 4.6). In the case of the ICCs, awareness raising is a key element in building capacity to implement the conventions (see section 4.4), as is liaison and co-operation (see section 4.3). In Mali and Ethiopia, these have been the key areas of progress in building capacity to implement the ICCs. Awareness of the Rotterdam Convention in Ethiopia has been taken to grass-roots level and investigation is planned on potential reporting chains for pesticide incidents.

In Tanzania, however, considerably greater progress has been made, with institutional structures established to facilitate implementation of PIC. A trial reporting chain for transfer of notification of environmental and human health incidents from grass-roots (local community) level to the PIC DNA has been established within the Mbeya region. Community monitoring teams have also been established in 7 villages in Mbeya region, Tanzania. The role and remit of these teams is under discussion and further training for them is planned in order to further build this capacity.

Tanzania is now very well placed to be the first country in the world (outside those industrialised countries where such channels already exist) to report an environmental incident to the PIC Secretariat using the PIC EIRF (see below).

4.6 Contribution to the Implementation of the International Chemical Conventions

The Ecotoxicology elements of the P&P project have contributed a good deal to assisting with implementation of the ICCs, both in general terms and also in ways specific to individual countries that have sent participants to the ecotox ToT (see above and below).

The following deals specifically with those elements involving ecotoxicological monitoring at community level.

Information to assist ICC designated authorities to implement the conventions

Widespread, illegal use of DDT for agricultural purposes has been detected and quantified in the Ethiopian Rift Valley (see section 4.3 and Annex 5B). The reporting of this to the POPs Focal Point will assist the FP to implement the Stockholm Convention to deal with this discovery.

Limited use of DDT for agricultural purposes has also been recorded in Mbeya region, Tanzania. As with the Ethiopian case, this will assist the Tanzanian POPs FP to implement the Convention.

Community Monitoring

The potential for local people within rural communities to observe, notice and report environmental and human health issues related to pesticide use to local agricultural authorities, health centres and, where appropriate to the DNA or FP for the POPs and PIC Conventions has been raised within the villages included in the surveys in each of the 3 countries.

To date, only Tanzania has started to put in place structures to include members of rural communities in the procedures for reporting and, potentially monitoring, environmental and health effects of pesticides in relation to either convention. Nonetheless, Ethiopian partners ISD also plan to carry out awareness raising activities within the villages participating in the mini-project, at which potential reporting routes and monitoring activities will be addressed.

Further details of community monitoring aspects of the P&P project are covered in Touni & Tingle, in prep.

Details specific to outcomes from the ecotox follow-up mini-projects, particularly that in Tanzania are presented below:

PIC EIRF

The Rotterdam Convention (PIC) has produced an Environmental Incident Report Form (EIRF) for reporting environmental and health-related incidents that have been caused by pesticides. The EIRF is currently available in English and French and requires someone with experience of what is needed to complete the form in order for it to be useful to the PIC DNA.

There is the potential to get these forms translated into local languages, given the time and resources to do so. A pilot project to assess the value and practicability of this may be of benefit. Awareness of the existence of this form (and, indeed of the POPs and PIC Conventions themselves) was found to be very, very low in all 3 countries even amongst those authorities concerned with pesticide issues. This awareness has been considerably enhanced within the areas covered by the mini-projects (see section 4.4), however it is clear that a great deal still needs to be done in this respect in all 3 countries.

Detail of establishment of reporting chain for PIC in Tanzania

During the ecotox ToT, a discussion session was held with participants to outline possibilities for establishing a reporting chain for news of environmental incidents potentially caused by pesticides to be transmitted from the areas (probably rural farming communities) where the incident occurred to the relevant authorities,

including the PIC DNA. The DNA was present, as were members from NGOs with rural operations and thus realistic possibilities were fleshed out, involving Village Environmental Committees feeding information into a reporting network already in place and functioning. All that was then necessary was the appointment of a local contact point for EIRs and a link from the National system to the PIC DNA. A series of flow charts were drawn up to chart the possibilities emerging from the discussion group (see Annex 5).

Detail of establishment of community monitoring groups in Mbeya communities

Following on from this, the ecotox follow-up mini-project ensured liaison between project partners and the project manager and the PIC DNA, Francisca Katagira, to ensure that co-ordination occurred appropriately at all relevant levels. Workshops were planned, organised and held within the villages surveyed during the mini-project to discuss at local level the potential reporting routes. The community follow up meetings involved 7 villages, with a total of 318 farmers participating in the training (people from Mponja (Mbeya municipal) and Mpandapanda (Rungwe district) were too busy to accept the invitation and no committees were formed in these villages). From these participants, the community monitoring teams of between 12 and 15 members were established. The committee members need further training to empower them enough to understand and correctly complete the PIC EIRF for submission to the PIC DNA for pesticides.

The community monitoring committees are expected to play a role of watchdogs for pesticide use; noting, recording and initiating a channel for environmental incidents reports from rural communities to the PIC DNA for pesticides. The following reporting actions were agreed:

- Any committee member noting an incident will report it to the committee leadership which will call a committee meeting to officially receive, discuss, deliberate on and reach a conclusion on the relevance of the incident for reporting.
- Upon their approval, the committee will immediately submit the incident description and a covering letter to the village leadership that will call a village environmental committee meeting, inviting the ecotox monitoring committee members to the meeting and discuss the incident.
- If agreed that is a genuine incident and not a mere misuse or abuse, meeting all the criteria necessary to warrant a report to the DNA, then the EIRF will be filled by any competent person among the group and with a covering letter from the village send to the DNA.
- The committee meeting minutes and resolutions will be copied to the District and Regional Agricultural Officers and/or Administrative Secretaries, as deemed fit.
- The Administrative Secretary of the Village will act as a connecting bridge when there is anything from the DNA to reach pesticide consumers.

No agreement was reached during workshops and awareness raising sessions in the rural communities with regard to potential reporting chains for pesticide incidents relating either to the POPs Convention or the PIC Convention. A network of NGOs and government bodies was established and this will take responsibility for advocacy work with regard to illegal use of DDT with the POPs Focal Point. It will also seek to consult over and suggest a defined reporting chain for pesticide incidents from grassroots level to the PIC DNA.

5. Mini-Project Assessment

This has been a highly successful form of follow-up to the Ecotoxicology Training of Trainers in terms of strengthening and embedding capacity, spreading awareness of pesticide ecotoxicology to a much wider audience, learning new skills, encouraging collaboration and liaison between potential partner organisations, promoting awareness of and implementation of the International Chemical Conventions (ICCs) – particularly the Rotterdam Convention and the Stockholm Convention and collecting valuable data on pesticide use, perception and knowledge within rural communities in the 3 target regions of the 3 participating countries. It has been very demanding in terms of the timescales, resource base and management BUT with positive outcomes.

5.1 Successes

The key successes were:

- Awareness of the International Chemical Conventions (ICCs) has been raised within a limited number of rural communities within 3 countries (2 in E. Africa, 1 in W. Africa).
- Capacity to further raise awareness has been built in all 3 countries. This is important, as the extent of the lack of awareness of the ICCs is enormous.
- Interaction between NGOs and government bodies concerned with pesticide issues has been considerably enhanced in all 3 countries.
- A reporting channel for pesticide incidents from grassroots to PIC DNA has been defined and proposed for Tanzania. This is the first African country to achieve this and possibly the first in the world (outside those industrialised countries where such channels already exist). In Ethiopia and Mali, awareness issues and capacity deficit meant that reporting channels have not, as yet, been suggested. However, awareness of the need has been raised at rural community level and within the potentially responsible authorities within the locality of the mini-projects.
- Community monitoring teams have been established in 7 villages (out of 9 involved in the mini-project) and procedures agreed to implement a successful reporting chain in Tanzania. However, further training of the team members would be required before they could actually commence monitoring of pesticide ecotoxicology.
- A huge amount of potentially valuable information has been gathered from the surveys carried out within rural communities in each of the 3 countries. This can be used to target key areas with regard to pesticide problems for future action.
- Knowledge of pesticides used by those in rural communities has been evaluated in all 3 countries and a list of those brands of pesticide and active ingredients known to users has been made for the 3 target rural communities.
- Widespread illegal use of DDT in agriculture in rural communities in the Ethiopian Rift Valley has been identified and will be reported to the relevant authorities (including the POPs FP).
- The extent of mis-use of pesticides, poor pesticide management and poor pesticide storage and use has been elucidated, allowing the significant risk areas (both from a human health and environmental impact perspective) to be targeted in future interaction with these communities.
- Awareness of pesticide hazards and risks has been raised in all the rural communities involved in the mini-projects, although a good deal remains to be done to embed good practice to reduce the risks.
- Considerable need for training by agricultural extension officers has been identified (and possibly a need for further training of trainers in this discipline identified).

- Key risks from pesticides identified in rural communities surveyed have been identified.
- A total of 9 RRAs were carried out on 7 pesticides (3 insecticides – DDT (in Ethiopia), Selecron (in Tanzania), Malathion (in Ethiopia and in Mali); 2 herbicides – 2,4-D (in Tanzania and in Ethiopia), Round-up* (in Mali); 2 fungicides – Ridomil (in Tanzania), Blue Copper (in Tanzania)).
- Capacity to further raise awareness within rural communities of pesticide risk to the environment has been enhanced in all 3 countries
- Capacity building on pesticide risk assessment has begun in Tanzania and in Ethiopia, with personnel from these mini-projects having gained preliminary experience in pesticide rapid risk assessment (RRA).
- No international flights were required (as part of the follow-up under Activity 3 of the P&P project), thus avoiding carbon dioxide emissions and the contribution this would have made to climate change and thus to exacerbating poverty issues.

5.2 Weaknesses

The key weaknesses were:

- The tight timetable and considerable workload would have been achievable for an organisation focussed entirely on the mini-project (over the period assigned to mini-project activities), but was over-ambitious for all partner organisations with other project and administrative responsibilities.
- The volume of information collected from the questionnaires is considerable and more than could be fully analysed in the time available, given the power of SPSS to cross-reference responses
- There were weakness within the questionnaire, for example the question on which pesticides are used needs to have a box to tick IF the surveyor had viewed the pesticide container(s).
- There are a number of questions on the questionnaire where the answers can only be judged in terms of respondents perceptions, but cannot be verified objectively (e.g. “Does your pesticide use solve your pest problems?” And “Does your use of pesticide increase levels of crop production?”). The same applies to health incidents where, for e.g., no verification of reported symptoms, etc. is possible.
- Data on flora, fauna, soils and habitat types was not collected routinely alongside the questionnaires by enumerators, thus making risk assessment of pesticides limited.
- A greater degree of technical support would have been of considerable benefit to in-country partners.
- The fact that none of the partner organisations managed to carry out the intended attempt at completing at least one PIC EIRF, based on the experience of a potentially pesticide induced environmental incident within a target community was a missed opportunity (though entirely understandable, given the volume of work involved in the mini-projects)
- The need for PIC EIRFs to be translated into local languages was not captured in mini-project finalisation and thus not resourced, leading to a blockage in the successful local implementation of the PIC Convention.
- Quantitative information on awareness raising activities carried out by partners has been collected, but how successful these were qualitatively has only been reported by those presenting the awareness raising workshops (if at all) – the quality is vital in determining the degree of success of awareness raising (although there is no doubt that the greater the number of people who hear about the risks and hazards of

pesticides, the greater the chance of the message reaching those within the community).

- The capacity built amongst partner organisations to carry out pesticide risk assessment in each country is centred on a very small skill base (and is non-existent in Mali).
- Opportunities to ensure that capacity to carry out pesticide risk assessment was distributed more widely via ecotox networks established in each of the countries participating in the ecotox ToT, both within and between countries, were missed (or, at least, inadequately explored).

5.3 Lessons learned

- In Tanzania, not a single farmer (in the villages surveyed), very few village leaders and a minority of agricultural extension workers are aware of any of the international chemical conventions signed and ratified by their country. This lack of awareness appears similar in both Ethiopia and Mali.
- The use of the English language was identified as an impediment towards implementation of the chemical conventions and other agreements in Tanzania. It is of a paramount importance to have the conventions translated into the national language(s) of the implementing countries to facilitate involvement at grass-roots level. It is likely that this is also the case in Ethiopia as well as the francophone countries (despite the availability of the PIC convention text and PIC report forms in French).
- Partners in Tanzania suspect that most of the farmers overdo pesticides application because they are unaware of economic thresholds for any pests. Increased agricultural extension support on IPM and alternatives to pesticides would likely mitigate this.
- More could undoubtedly have been achieved as a result of the mini-projects in each of the individual countries, had they been the sole focus for technical support OR had the technical support resources available been greater.
- More could also have been achieved had technical teams been in place in country to provide hands-on support.
- Providing technical guidance and, more particularly, assessing how well technical capacity has been built, where further technical input would be valuable and in what form can only be done as well at a distance as it can “face to face” in certain circumstances. For the mini-projects, having the technical support “on the ground” would have given considerable advantages.
- Similarly with assessment of the success of community-based awareness raising initiatives.
- There was a valuable volume of information collected from the questionnaires and simply insufficient time and resources to deal with it in anything more than a superficial manner. There is great scope to revisit the results and analyse them more thoroughly (particularly with a view to cross-referencing results from one question to another to assist interpretation). If funding were available, there is little doubt that a publication for a “development” or “scientific” journal could be produced from each mini-project and, probably, several publications of a quality high enough to go to peer-reviewed journals.
- There has been little exchange between the partner organisations in different countries over their experiences with the mini-projects, which has been a real lost opportunity (if understandable given the tight schedule and huge volume of work with limited resources). It is recommended that this report be widely shared and used to attempt to stimulate further south-south exchange over pesticide issues and

particularly over the implementation of the ICCs (with a special emphasis on PIC). There is a great deal that Mali and Ethiopia could learn from the work on pesticide incident reporting chains in Tanzania; whilst Mali has valuable experience to share over the use of radio broadcasts to reach a wider audience; and Ethiopia has significant experience in working with youth, via it's inclusion of high school students in it's mini-project, that could be repeated to great value elsewhere.

- Quantifying risk is a difficult task even with access to the best of data and proved particularly difficult or impossible in the RRAs due to shortcomings in the data collected from the questionnaires (specifically with regard to dose rates of individual pesticides and with regard to the fauna and flora and habitats within the survey areas). Questionnaires could be improved in this regard for further rural community surveys or a detailed list of data requirements drawn up for enumerators to complete during their visits to target communities. However, obtaining representative and accurate data on actual dose rates used is likely to require more detailed farmer surveys over longer time periods, coinciding with periods in the year when the pesticides are used.

6. Recommendations

1. Key areas of concern with regard to poor pesticide application and management have been exposed by the surveys of rural communities. These should be identified to local authorities responsible for such pesticide issues and used to focus attention and resources to deal with them promptly.
2. The Guideline documents on Pesticide RRA should be shared more widely amongst ecotox ToT participants (the Ecotox Network) from all countries and, perhaps, an away-day on RRA organised by those who carried out the RRAs during the mini-project in each country to bring the Ecotox Network together, share what had been learned from carrying out the RRAs and highlight where their RRAs needed improvement to try to further embed capacity built to date.
3. Rolling out community-based surveys (as practiced during the mini-projects) more widely within all 3 countries would be of great benefit to authorities (and may prove particularly informative for the PIC DNA and POPs FP).
4. Resources to support further, more detailed examination and analysis of the results of the projects in Tanzania and Ethiopia, particularly, would lead to the potential to publish papers on the surveys and their results in peer-reviewed journals.
5. The example of Tanzania as a developing country that has taken the first steps towards establishing a reporting chain from community level to PIC DNA should be shared as widely as possible to inspire similar efforts elsewhere – NB. The example will NOT be directly transferable elsewhere, because it will be country specific, depending on institutional structures already in place, consultation with authorities with relevant responsibility, etc. Engagement with the PIC Secretariat over this action is recommended.
6. PIC EIRFs need to be translated into local languages, if the PIC Convention is to be successfully implemented. Engagement between PAN-UK and the PIC Secretariat may be valuable in seeking means to achieve this, along with decisions on the extent (globally) to which it may be of benefit.
7. Electronic versions of the 2 sets of Guidelines for carrying out RRAs on pesticides (Grant & Tingle, 2008a; 2008b) should be sent to each individual participant in the ecotox ToTs (in French or English, as appropriate) for them to use as needed. The lead partner organisation in each country (see above, plus ODI Sahel in Mali and CERES/Locustox, Senegal) will also keep electronic copies. These can be further distributed in-country, as appropriate.
8. Electronic copies of each of the pesticide RRAs prepared during the follow-up mini-projects (see section 4.1.4 above and Annex 4) should be sent to each participant of the ecotox ToTs and follow-up mini-projects.
9. Electronic copies and “hard” (paper) copies of the Handbook and Methods Sheets (Grant & Tingle, 2002) which formed the basis of all the ecotoxicology training material generated during the P&P project have been distributed to all participants in the ecotox ToT (in French or English, as appropriate) and shall also be sent to ODI Sahel. The lead partner organisations in each country (see above) also have a small stock.

Country specific recommendations are provided below:

6.1 Recommendations from the Tanzania mini-project

1. Local agricultural advisors and extension officers should be informed of the finding that a quarter of respondents to the questionnaire in the 9 Mbeya villages spray the same pesticides between 11 and 52 times per year. Every effort should be made urgently to ensure that this extent of pesticide application is actively discouraged and the dangers it presents to the environment, to treated agro-ecosystems and its

complete lack of economic sense as well as dangers to human health be highlighted within the communities.

2. The use of DDT in agriculture detected during the survey should be reported to the PIC DNA and POPs FP.
3. PAN-UK should support AGENDA, the PIC DNA and the Ministry of Agriculture to seek resources to enable the community monitoring teams established to be more fully trained and equipped to carry out their role – possibly via lobbying the PIC Secretariat to actively support Tanzania in this regard.
4. Attempts to find resources to enable Tanzania (and other African countries) to translate the PIC EIRF (and preferably the Convention text – or at least key elements thereof) into local languages should be supported by PAN-UK.

6.2 Recommendations from the Ethiopian mini-project

1. The finding from the community survey in Ziway and Arsi Negele waredas that there is widespread use of DDT in agriculture should be reported to the POPs DNA at the earliest possible opportunity.
2. The RRA on DDT should be presented to the PIC DNA for information and potential action, should they deem fit.
3. Every effort should be made to support ISD in providing feedback and awareness raising workshops within a selection of the villages targeted by the questionnaire survey, with village leaders and other representatives from each of the 23 villages included.
4. At these workshops (or other pre-determined event) the issue of reporting chains for pesticide induced environmental and human health incidents from community to PIC FP (DNA) should be investigated and ideas discussed. Given interest by the POPs FP, they may wish to investigate whether the same reporting channel could be of value to them as well. The results should be shared with the PIC FP (and POPs FP, as appropriate)
5. ISD should be encouraged to examine and analyse the results for several of the questions from the questionnaire which were excluded from their report, but would be valuable for interpreting results (for example, crop areas treated with pesticides by respondents; frequency of applying the same pesticide per year; timing of application of pesticides, etc).and are particularly important for carrying out RRA of pesticides.
6. Were resources available, the scope for ISD to conduct RRAs on all pesticides identified by the mini-project survey and review of these by NRGroup members, could be of considerable benefit

6.3 Recommendations from Mali mini-project:

1. ODI Sahel needs to build in-house capacity on pesticide issues, pesticide management, pesticide ecotoxicology and pesticides and human health. It is strongly recommended that PAN-UK liaise with PAN-Africa over possibilities for making such capacity building a reality. PAN-Africa (in the person of Henry Diouf, Alassane Sarr, Souley Lawan or Siré Badji who attended the ecotox ToT) possibly alongside staff from CERES/Locustox – Makhfousse Sarr, Ibrahima Ndour and Baba Gadji - should take the lead and include PAN-Mali within future work in Mali.
2. Liaison with the PIC Secretariat may well be of value to highlight to them the problems of poor pesticide awareness in rural Mali – certainly Mopti. They may be able to facilitate improvements.
3. Given the concerns to PAN from lindane, and given that its use for treatment of dried fish identified during the mini-project is particularly ill-advised (posing significant health risk to consumers), PAN-Africa may wish to offer support to ODI Sahel over this issue.

As use is outside the legal framework, the Rotterdam Convention cannot apply BUT the PIC DNA in Mali may still welcome knowledge of this illicit use of lindane.

4. ODI Sahel should organise a feedback workshop (preferably several) to target the villages who contributed to the survey and provide them with the results from the questionnaire survey along with further pesticide awareness raising (including a session on the Rotterdam Convention and how it can help them and how they can assist the PIC DNA in implementing the Convention).

6.4 Future training and technical support

The future training needs vary from country to country. Overall,

- More technical support is required on the process of carrying out pesticide risk assessment in all countries.
- Technical support would be needed for other organisations using the questionnaire for surveys of different rural communities, both for survey design and for analysis and interpretation of the results.
- Further technical support would be valuable in fully analysing and interpreting the 3 surveys carried out to date.
- In all countries further technical support (backstopping) is needed in carrying out field sampling and monitoring techniques that were learned during the ToTs.
- Further training (by a specialist with appropriate ecological/faunal skill base) would be necessary to learn and carry out field sampling techniques from the Handbook that have not yet been introduced.
- Given the loss of Almoustapha Maiga, ODI Sahel would benefit from an Ecotoxicology ToT, similar to those carried out in Senegal and Benin. They would now be in a good position to host such a ToT and to invite appropriate participants from within their network.

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