

PUBLIC MONITORING OF STREAM AND RIVER HEALTH IN THAILAND: the work by Green World Foundation¹

Oy Saranarat Kanjanavanit²

Abstract

Current environmental and socio-economic situations show a need for public empowerment in the monitoring of environmental health. In 1996, the Green World Foundation began to develop popular biomonitoring of stream water quality using freshwater macro-invertebrates for the first time in Thailand. When the pilot test gains public interest, a more comprehensive 'Stream Detectives' programme is developed, starting with an environmental education project in the River Ping catchment, North Thailand, where secondary schools are linked with local communities to promote the caring of river health. The project, known as 'River and Stream Investigation Project for Youths' (RSPY), has been successful in many respects. In particular, it has induced local initiatives from many sectors in all regions of Thailand. This ranges from schools, local groups and communities, government agencies, and a civic society group.

Today, the principle of 'Stream Detectives' is on its way to establishing itself into both the formal and informal education systems, starting from the primary level. A country-wide network is also being developed with an initiative of volunteers from many sectors. The group has recently identified needs and a set of working plan to strengthen and expand the network.

As Green World Foundation lessens its central managing role, while passing on the torch to the bigger network, sustainability becomes more of a reality. Future needs, however, call for more research initiatives from the scientific community to develop more in-depth knowledge of freshwater macro-invertebrates in more localities, as well as research in popular monitoring of other related ecosystems. A development of national protocol for official monitoring would also lend support to work carried out by the public.

Keywords:

biomonitoring, environmental education, stream and river, Thailand

"The people here might be extremely happy, were they not kept in such abject slavery; bountiful nature, that second mother, treats them as her spoilt children, and does all for them. The forests abound with vegetables and exquisite fruits; the rivers, the lakes, and the ponds teem with fish; a few bamboos suffice to

¹ The paper was first written in October 2000, and later updated in December 2002

² Green World Foundation, 394/46-48 Maharaj Road, Pranakorn, Bangkok 10200, Thailand. Email: gwft@internetksc.th.com, oykan@hotmail.com

construct a house; while the periodical inundations render the lands wonderfully fertile. Man has but to sow and to plant; the sun saves him all further trouble; and he neither knows nor feels the want of all those articles of luxury which form part of the very existence of a European.”

Henri Mouhot (1864:115), on the life of Siamese in 1859

Numerous historical accounts of Thailand paint a picture of land of plenty. Sadly, this is hardly the case today. When the ichthyologist Tyson Robert first came to Thailand in 1970, he found that although “Thai people could catch and eat huge amount of fish at unbelievably low cost”, it was clearly evident that the situation was not quite on the par of what was documented at the beginning of the century when “the country could probably catch more fishes than any other in the world” (Samabudhi, 2000).

It is from around the mid 1970s onward that a momentum decline began to take place. Deforestation, subsequent siltation and reduced water flow, pollution, filling up of wetlands, channelisation of water courses, over-exploitation of river resources including sand and gravel harvesting, river bank conversion, and damming up of rivers, have all combined to contribute to the rapid degradation of Thai freshwater ecosystems. The situation has exacerbated during the past 10-15 years. Once a home of 265 fish species or 40% of freshwater fish diversity found in Thailand, the Moon River has lost 21% of its fish species and another 43% are in marked decline within few years after a large hydro-electric dam was constructed in 1994 (WCD, 2000).

On the count of water pollution, the past decade has been phenomenal. Floats of dead fish have not been uncommon events in industrial areas, sometimes forming a raft of over 400 km long as in the cases of molase spilt by a sugar mill and waste dumping by Phoenix paper pulp plant in the River Pong in the early 1990s. Serious pollution from mining, agriculture, and domestic waste have become regular news. Recent assessment of river water quality in Thailand has found 42% to be highly contaminated with bacteria (Department of Health, 1997, cited by Rojanapaiwong, 1999).

There is clearly a need for active public participation in river management. The new Constitution of Thailand, which has been passed into Law in 1998, supports a significantly increased public role in decision making. This includes the right to participate in the management of natural resources. With regard to the care of river health, however, there are limited means to realise the policy.

In some respects, official monitoring of water quality have been inadequate and often ineffective. The chemical testing and analysis used by governmental agencies hold one major limitation: it can only detect pollution at the time the water samples are taken. This gives an advantage to polluters who deliberately discharge wastes into rivers during the week ends and public holidays when no officers are available to respond to public complaints. Chemical testing is also expensive and not readily available to the general public. Neither does it yield meaningful results, except to the trained personnel.

Against this environmental and socio-economic background, Green World Foundation (GWF) started to explore and develop low-cost popular means to ‘reading’ local environment, hence the monitoring and evaluation of its health. The Bangkok-based organisation was founded in 1991 with the aim of promoting environmental literacy in Thailand. That is to instil love, provoke interests and stimulate enquiring mind among the Thai people, so they are able to gather and analyse information that leads to appropriate decision making on local environmental issues, and finding creative solutions for the care of thier lives and the world they live in.

Although GWF experiences were originally on tropical forest ecology, it later shifted a greater attention to the aquatic habitats, in particular streams and rivers. This is because

they relate directly to all interests and walks of life, and readily accessible. Above all, streams and rivers are bloodlines of the land that feed and link all ecosystems from the mountains to the sea. On its journey, water washes over the soil and cuts along the riverbeds, picking up and depositing minerals, nutrients, and other residues from land uses. To monitor the state of rivers is effectively to check the pulse and well-being of the land.

With this recognition, GWF's efforts on stream education begun in 1996. The work so far could be divided into 2 main stages.

Stage 1: Blazing the Freshwater Name Trail

As with learning to read a book, the first step in learning to read a river is to learn the ABC of its language. Having to adapt to the surroundings, animals and plants are some of the best dialects for reading the state of the environment. The aim of GWF's pilot activity is therefore to develop a simple tool for exploring aquatic life that is useful for environmental monitoring, and to assess Thai users responses.

A search through educational resources found *A Freshwater Name Trail* (Orton *et al*, no date) produced by the Field Studies Council (FSC) of the UK to be particularly striking. It is a 4 pages fold-out identification key to freshwater macroinvertebrates of ponds and streams in the UK. The colourful key works like a board game where users must follow an appropriate trail to identify a given animal, based on observations of its physical and behavioural characteristics. Information on animals and their water quality index is given on the back. Here in one sheet is a complete tool to learn both the alphabets and the basic grammar of the stream language!

GWF contacted FSC and was subsequently included in the AIDGAP project³ with a permission to adapt and test the key for users in Thailand.

In the adaptation the following factors are considered:

- local biodiversity and their ecological adaptations;
- suitability to the Thai users;
- users responses to the general approach and the topic.

The release of the first scientific research on the use of local freshwater macroinvertebrates for biological monitoring of water quality (BMWQ) in River Ping, North Thailand (Mustow, 1997), enable GWF to make a short cut in its effort to develop the local key. As a result, the first popular Thai key was out in mid 1998 (Kanjanavanit & Tilling, 1998).

Although it is difficult at the beginning to find financial support for user-test workshops and subsequent production and printing, the outcome is rewarding. The media is interested; requests for training from various educational and nature conservation groups come flooding in; and the 3,000 copies of key printed are sold out in just over a year. Analysis of the outcome is discussed in a later section (see 'Outcome and Lessons Learned' of RSPY Project below).

Through FSC's publication and education programme, the Thai key has been translated into 4 other languages for regional uses, namely English, Indonesian Bahasa, Vietnamese, and Mandarin Chinese.

Stage 2: RSPY Project

³ Aid for Identification of Difficult Groups of Animals and Plants (AIDGAP), a project implemented by FSC with support from Darwin Initiatives

As the Freshwater Name Trail induced positive responses, GWF saw a good potential in developing a more comprehensive environmental education (EE) with stream investigation as a major tool. With new National Educational Reform being passed into Law, the timing was particularly crucial. The new policy supports environmental literacy by focusing on active learning through direct experiences which relate to a local context. But tangible means are still needed to put the concept into practice.

In October 1997, GWF sought funding from the Danish Co-operation for Environment and Development (DANCED, now part of Danida). Consequently, the 3-year River and Stream Investigation Project for Youths (RSPY), or '*Nak Sueb Sai Nam* (Stream Detectives)' in the Thai language, took off in September 1998.

The Plan

RSPY utilises EE as a long term strategy for sustainable stream and river management. Involving 46 secondary schools in the Ping River catchment in northern Thailand, the project aims to enhance EE among participating teachers and students specifically regarding evaluation of stream health, and strengthen their capabilities for co-ordinating with local communities. It is expected that these initiatives will lead to risen awareness and positive behavioural change, and ultimately, to enhanced sustainable management of the local environment.

As the strategy towards local river care is done indirectly through schools, teachers are the key players in the project's scenario. Preliminary survey of teachers' needs finds their wants to be generally universal. Top of the list are the needs for new ideas, educational resources, new skills, moral and institutional support; with lack of time being the major limiting factor. Accordingly, the project identifies 5 main outputs which are needed to meet the set objective.

- **Co-ordinated River Ping School Network**

In order to promote the exchange of knowledge on effective learning and create synergetic partnerships in the caring of local rivers, the project intends to co-ordinate a network of secondary schools in the River Ping catchment, in accordance with the official Provincial Environmental Education Centres (PEEC) school network in the area. Annual network meetings are to be organised and participating schools receive the 'Stream Detectives' newsletter which is designed to be used as a teacher's guide for integrating EE activities into other subjects, in addition to providing relevant information on EE initiatives and other related activities and conservation news in the River Ping catchment area.

The network and supporting newsletter, therefore, provide ideas, resources, encouragement and institutional support to the teachers and students.

- **Stream Investigation Package**

Designed for use by secondary schools, the Stream Investigation Package provides guidelines for the effective evaluation of local stream health including biological monitoring of water quality utilising inexpensive tools and user-friendly techniques. This is based on the principle method developed by the Danish Blue River Project⁴, where water quality is assessed by an observation of the pattern of macroinvertebrate community. Created with input from educators, experts on local culture, and freshwater biologists from both Thailand and Denmark, the package is to support EE efforts that are

⁴ a project developed by the Biology Teachers Association of Denmark

appropriate for the local environment and learning culture. Prior to finalising the package, field tests are to be undertaken to ensure that the package is easy to use and practical.

This output, therefore, provides an important educational resource to the teachers and students.

- **School investigation of issues related to local stream health**

The RSPY Project supports new policy of student-centred education by encouraging schools to undertake both in- and out-of-classroom activities to investigate issues related to stream health in their respective local communities. Because water is an integral element of daily life, teachers can easily apply the concept of stream health and river management to many subjects.

As a highlight of school stream investigation programme, the project is to coordinate participating schools to carry out a survey of the River Ping water quality (PingWATCH) using both the biological monitoring method from the Stream Investigation Package and chemical analysis. The information generated is to be compiled to create a comprehensive overview of the entire River Ping catchment area.

This output forms the heart of the project as much of the work is initiated and carried out by the main target groups themselves, i.e. the teachers and the students. But as with most unfamiliar journeys, the first few steps are often the most inhibiting. The project intends to provide teachers and students with necessary skills and guidance.

- **Information exchange between schools and local communities**

As the project aims to enhance school participation and share-learning among various sectors of the community, school EE on stream-related issues is to include exchange of information with members of local community. Participants are to be exposed to local knowledge in areas such as history, way of life and stream care through cross-generational learning and relate their new findings to members of the community.

This output is to provide teachers and students with new ideas and local resource persons, while generates better understanding within the community.

- **Disseminated information to the public and interested parties**

In an effort to disseminate information to organisations involved and interested in water conservation, the RSPY Project is to organise two major events. The first event, the Stream Investigation Day, is to be held in the second year of the project to launch the Stream Investigation Package and to demonstrate appropriate usage. The second event, the River Ping Detectives Day, is to be held at the end of the project to present the PingWATCH Report and inform interested organisations and the public about participating school activities. It is hoped that public recognition will give good moral support to the teachers and students.

In addition to public relation, the project plans to create multiplier effects through training workshops on the evaluation and caring of stream health for interested organisations from different areas of Thailand.

Implementation

In implementing RSPY project, GWF places much importance in facilitating natural development of teachers and students, so the outcome would lead to sustainability. The 3-year project are implemented in 3 logical steps.

1. The First Year: laying the foundation

Much of the first year is spent in laying the ground work for the project and build an appropriate foundation for concerned personnel, in particular the teachers. This includes:

- ***Create mutual understanding***

Although RSPY was formulated with input from key stakeholders, not all those concerned could be included in the process. To ensure acceptance and ownership of the project, the project team holds both informal and formal meetings with provincial educational authorities, other relevant organisations, and in particular school principals and teachers. School personnel are invited to join the project on voluntary basis, and participate in the planning of project activities. Of the 47 public secondary schools in the area, 46 join in. Based on the location of schools within the entire River Ping catchment, 6 tributary networks are formed.

- ***Teacher needs analysis and personal data***

Lessons learned from other projects elsewhere have shown that one of the key factors of success is regular contact with participants to give individual encouragement, support and guidance. Thus the project team carries out individual needs analysis and maintains personal data on every teacher to enable the project to give appropriate support to the teachers throughout the project period.

- ***Development and production of Stream Investigation Package***

The Stream Investigation Package (SIP) is the major educational resource for teachers and students, so it must be available within the first year. The multi-disciplinary package took 10 months to develop and produce through the following steps:

Biological Survey

There are but few pioneering scientific researches on bioindicators of stream water quality in Thailand, i.e. the Upper Ping River, North Thailand (Mustow, 1997), and the Pong River, Northeast Thailand (Sangpradub *et al*, 1998). Thus the project needs to do additional survey on the biodiversity of stream macroinvertebrates in order to select and rank appropriate groups of animals for RSPY's BMWQ technique. To cater to local target groups, the ease of identification and relevance to local diet are also considered in the selection of indicator animals. The biological survey is done by a group of freshwater biologists from Khon Khaen University and Denmark. A team of ichthyologists from the Department of Fishery also carries out a survey of indicator fish species and develops a simple fish index system which correlates to the technique developed for macroinvertebrates.

SIP Development Workshop

To ensure that the package is not only scientifically relevant, the project organises a 5 day workshop to draw active input from various disciplines. Educators, experts on local community and indigenous knowledge, teachers, practitioners, and publishers, came together with the biologists to develop approach, techniques, content and format for the package. The topics range from investigation of the stream habitat, community survey, actions for the care of local stream, and the suitable level and necessary guidance for the main target groups.

Production of the Draft Package

The editorial team gathers and digests ideas from the SIP development workshop and produces parts of the draft package in a month. The draft is reviewed by the project team before copies are made for the user test.

User Test and Peer Review

The draft package is field-tested with students and teachers in 4 tributaries of River Ping, including schools in rural and urban areas. This is a very important process to ensure effectiveness of the educational resource. Copies are also sent out to a number of authorities for peer review.

Revision and Production

The editorial team then revises and completes writing and production of the package. As Thai education is currently undergoing the process of reform, particular attention is given to bridging the old style of factual rote learning to the new unfamiliar style of free exploration. The result is a guided enquiry. Figure 1 sums up the process of stream investigation and care as it is approached by SIP. The package carries the title of *Stream Detectives: package for the Investigation and Caring of Stream Health*, and comprises of 5 pocket-sized books:

- Handbook for Stream Detectives;
- Handbook for Stream Detective Leaders;
- Identification Guide to Stream Invertebrates;
- Identification Guide to Freshwater Fish;
- Identification Guide to Stream Bank Animals

SIP is officially launched in the second year, with accompanying exhibition and demonstration.

- ***Training of trainers***

The first year is also the period to build up a team of trainers on both the technical aspects of stream investigation and the techniques of group facilitation. Scientists, professional facilitators and dramatists are invited in as resource persons. The project trainers include members of project team and volunteers.

- ***Training of teacher and student leaders***

While the editorial team develops and produces SIP, the project training team prepares teachers and student leaders with basic skills and understanding of stream investigation and community survey, using the draft SIP. Workshops to exchange EE practice on stream-related issues are also organised for teachers to encourage them to facilitate active learning about local streams.

2. The Second Year: application

As the first year completes general training for teachers and equips them with educational resource, teachers become more confident and ready for application in the field. With hands on experience, the second year sees positive progress among the teachers. At the beginning of this period, however, most teachers still needed guidance and initiatives from the project team. The changes are made through these major events:

- ***PingWATCH I***

PingWATCH is a coordinated survey of the state of River Ping water quality by the network of local schools. The event is initiated and organised by RSPY Project to

demonstrate student capacity in finding credible environmental information. With some help from the project trainers, the trained teachers and student leaders play vital role in training other students for the event which took place in December 1999 - January 2000. Because the event is first of its kind to use biological monitoring, the project coordinates Centre of Environmental Health Region 10 -- an agency under the Department of Health, to carry out chemical testing of water quality at the same sites and time as the school BMWQ survey.

- ***PingWATCH I result meeting***

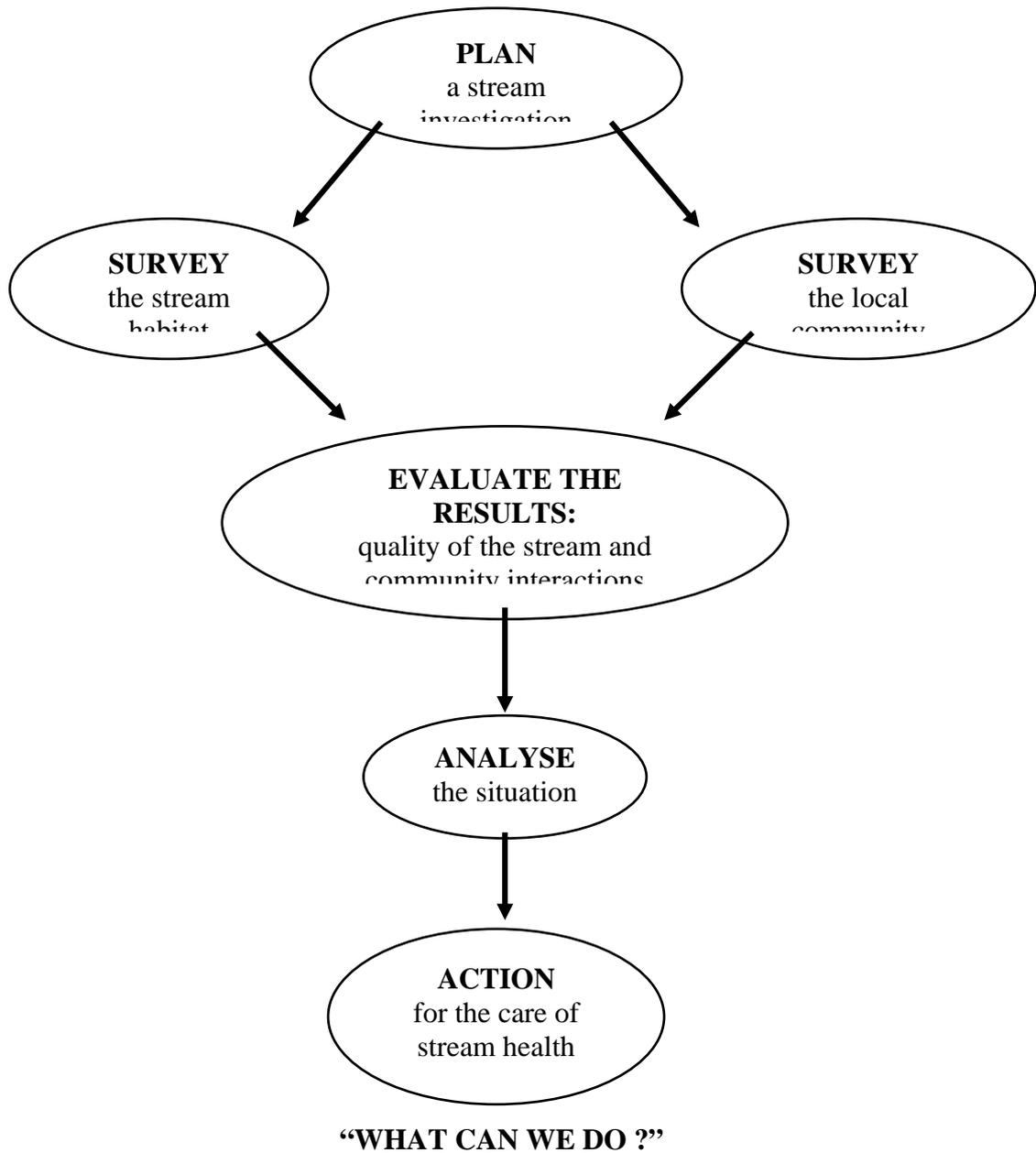
After PingWATCH survey, the teachers all meet up to put together their results. These are colour-coded into 5 main levels from excellent to very poor water quality. As the overview of River Ping water quality appears before their eyes, the project takes a new turn. There is an upsurge of inspiration and personal ownership. Questions are raised on better planning for improved individual results and overview. The participants propose in one voice to repeat the activity in the following year, even though the second PingWATCH is not in the original project plan.

Since some of the survey results cannot be interpreted with confidence due to technical errors, it is agreed that PingWATCH I should be treated as a dress rehearsal and the results would not be widely published. However, it clearly shows that biological and chemical testing complement one another well. As expected, biological monitoring is generally more effective in detecting organic pollution, but chemical testing is necessary for detecting inorganic and toxic contamination.

General public aside, PingWATCH I results and other school activities are shared in the annual meeting with school principals, relevant governmental authorities, and some Sub-district Administrative Organisations. Most express genuine interests and offer support in future undertaking.

Although several schools initiate their own stream-related EE activities in the first project year, others really take off with the PingWATCH event. By the end of the academic term following the event, 31 out of 46 schools took their own initiatives to investigate water quality and some other aspects of stream habitat of their interests. 19 schools undertook various aspects of community survey, with few started to promote awareness within their local communities.

Figure 1: the process of stream investigation and care



3. The Third Year: becoming active citizens and creating multiplier effects

The process of discovery of local streams and their historical and social context arouses further thoughts towards more learning and conservation. As the project moves into its third and final year, more emphasis is being made on linking with local communities and promoting responsible attitudes towards local streams. Few even go as far as taking action for the environment with local community. All in all, students and teachers from 33 schools carried out activities of their own initiatives by the end of the project year. In addition, at least two communities also take initiatives of their own, as oppose to schools taking the lead. Most of the school-community river care work carried out are variations of campaign for a rubbish-free river. In one case, a village headman was so impressed by the diversity of animals students found in traditional irrigation water ways that he convinced other members of the community to abandon a plan to concrete the channels.

Much of these awareness promotion initiatives are no easy tasks which require a range of new skills. The RSPY team therefore make special efforts during this period to raise optimism and build teachers and students confidence in taking a further step out of the comfort zone of school's sphere. The strategy includes:

- ***PingWATCH II***

PingWATCH II takes place in December 2000 - January 2001. The planning is done together with schools from all tributaries of River Ping. This time 5 private schools have asked to join in the original network of 46 public schools. Armed with knowledge from experiences of the previous year, most schools are able to formulate clearer objectives and plans for stream water quality investigation, as they link the activity to local social context. Experienced practitioners are brought in to help guiding teachers and students on fruitful interactions with local communities. Practical ideas and encouragement also emerge from the exchange of experiences between teachers.

As a result, 17 schools actually invite community members and/or other local youths to join PingWATCH activity, 12 make plan of action with community members, and 28 make action plan among themselves after making an assessment of water quality.

- ***Special training on request***

Not all seeds from one tree grow into strong seedlings. In much the same way, the project recognises that not all teachers will progress equally. Since all participants have received the same general trainings and support to build good foundation, the remaining training support is given on request only to strengthen indigeneous initiatives. This includes a training on open-ended interactive drama to raise awareness on a local environmental problem.

- ***Regular consultation***

Many schools find local communities to be interested in the students work and in the care of local stream, but they still ponder on ways to begin. At this delicate point of stepping out of a comfort zone, a negative response, such as indifferences or ineffectiveness, can sometime cause a feeling of despair. The golden question "What can we do?" is particularly relevant now. It is therefore the role of the project team to encourage and remind every one concerned that all long journey starts with just one small step, at the same time helping teachers and students to identify a realistic strategy for their initiatives. In the cases where community work is restricted and difficult socially or politically, initiatives of other nature are encouraged. As it turns out, several students carry out original research or academic projects of their own.

This period also sees an extension of stream detective activities to other area. While the targeted teachers in the River Ping catchment begin to apply their new knowledge on stream education to their teaching, the project is able to turn attention elsewhere. By this time, news of stream detective activities have spreaded and more requests for training pour in. The project team thus organises a number of train-the-trainers workshop, covering all regions of Thailand. Trained groups include local NGOs, teachers, and community members such as monks and nuns, as well as local government agencies such as provincial public health office and science education centre. Most of these groups then initiate their own stream education and care activities there after, some of which are partially supported by the project.

An event called 'River Ping Detectives Day' is then organised at the end of the third project year in conjunction with an Education Reform Fair organised by the Ministry of Education in Chiangmai province. The result of PingWATCH II is reported to the public, along with exhibition and demonstration of stream detective activities initiated and implemented by the targeted schools in the River Ping catchment, as well as work carried out by other groups in Thailand. The range of work is varied and colourful. They could be summarised as follow:

- Integration of activities into school curriculum or other regular work plan
- Development of educational materials
- Making record of local knowledge
- Student projects, some of which include original research
- Taking action for stream care, which can range from personal action to linking or working with a community
- Building river networks within River Ping tributaries and elsewhere

Toward Sustainability

Education reform is a long process, particularly when it involves taking on a new approach of teaching and learning, not to mention a new set of subject matter. It becomes apparent that three years is but a short time to establish new practices. Indeed, most teachers only have two school terms to try out active learning with stream investigation and care. In particular, it coincides with a period of major administrative changes that come with the State education reform process, all of which take up a lot of time from their already tight schedule and huge work load.

Since the interest is clearly on the rise, it is decided that the project should be extended to further strengthen the initiatives made by both the River Ping teachers and practitioners in other areas. During this extension phase, the Green World Foundation is to take on a largely supportive role, in partial funding and/or in kinds. Some additional training is given to interested trainers, but otherwise the other emphasis is on synthesising the project experience into tangible forms. This includes a production of a training package which contains training materials that are proved over the years to be particularly useful, and an evaluation of the project outcome and lessons learned to be disseminated to interested parties.

17 out of the original 46 targeted schools proposed for RSPY funding and carried out their own projects. This ranges from technical research, to development of educational programme, to creating multiplying effects with primary schools, to working directly with local communities on river conservation. Some projects successfully seeks out substantial funding from other sources and only need a small contribution from RSPY.

It should also be noted that as much as 95% of teachers trained by the project have continuously use stream detective activities in their teaching, with an increasing proportion (65% by the end of 2002) integrating it in their regular lesson plans. Since the practice form part of their daily life, chances for sustainability -- at least within the formal education system -- are greater than with occasional projects .

Practitioners from other regions of Thailand are also active. While only 4 groups receive financial support from RSPY, many use their own resources. These groups are particularly noteworthy as most initiate and run their activities after just one training from RSPY. Active members now include not only local NGOs, GOs, teachers and monks, but in the case of Ranong province, a whole civic society supported by a local business and city municipality.

The table below summarises active Stream Detective groups which the Green World Foundation has direct contact up till now. There are, however, growing interest elsewhere. The foundation continues to receive request for training, order for *Stream Detectives Package* or the *Freshwater Name Trail*, as well as news of various practices related to stream detectives concept and activities. This can range from the content of a college exam, to activity of a family outing in a national park, and also lessons in schools which never made direct contact with the foundation.

Table 1: Stream Detective Groups in Thailand

Region	No. of Groups	No. of provinces	Involved agencies
North	8	8	primary and secondary schools, local NGOs, communities, public health office, environmental health office, forest rangers, medical doctors
Northeast	5	5	Monastories, communities, primary and secondary schools, local NGOs, environmental health office
Central	9	5	Primary and secondary schools, local NGO, public health office, science education centre, children museum, environmental education centre (Department of Environmental Quality Promotion)
East	1	1	a civic society group involving city municipaity, local business, local NGO, primary schools
South	11	11	Primary and secondary schools, technical college, local NGOs, forest rangers, science education centres, environmental health office, provincial radio
TOTAL	34	30	

As a loose, country-wide network is building up, RSPY organises an open forum in December 2002 to exchange experiences and lessons learned and to explore ways ahead before the project wraps up officially with its funding agency. This is summarised below.

Outcome and Lessons Learned

Detailed outcome and lessons learned from RSPY project is currently being completed and not yet available for general discussion. However, several points are apparent.

Effectiveness of the project

This can be viewed in two accounts: how far does the project meet its set objective, and what other effects it generates, intended or otherwise.

Meeting the objectives

The original project plan was limited to schools in the River Ping catchment. Its specific immediate 3-year objectives are two folds: 1) that students and teachers from 46 target schools have the ability to evaluate stream water quality; and 2) that they promote responsible attitude toward river conservation within their communities.

In addition to usual assessment during training workshops, the ability to evaluate water quality is reviewed in two stages: during PingWATCHes and during the extension phase one year later to see the level of retention. PingWATCH is a group assessment on all schools involved. It was found that a marked improvement was made between PingWATCH I (23 correct evaluations out of 62 or 37% competency) and PingWATCH II (48 correct evaluations out of 50 or 96% competency). However, tests on 9 schools selected for detailed case study during the extension phase give a lower average score of 58% on knowledge and 70% on skill. This shows a need for refresher training. It is thus recommended that such training series programme be built into a project design should a similar project to RSPY be duplicated elsewhere.

With the second objective, it was found that while 23 out of 46 schools have carried out activities to promote river care in communities outside their own schools, as much as 33 schools have at least carried out such activities with other students and teachers within their schools. This can still have a snooker ball effect on outside communities, with idea on river care and monitoring being passed onto parents, other family members and friends.

Other effects

Experts on environmental education (EE) often lay so much stress on learners taking action for the environment to be the flag ship of successful EE. It is important, however, to appreciate healthy signs of responsible citizens on the make. This involves not only a development of environmental awareness and incentives for conservation, but also self confidence. Interviews and a test on perceived knowledge on River Ping students show those who have been through stream detective activities to have a healthy degree of confidence (70%) on their ability to take care of the environment.

The training for groups from other areas of Thailand also yields fruitful return (see previous section). Since most trained personnel of this category express their own interest to receive training, they are particularly highly motivated and have done much to create multiplier effects on their own with little additional input from RSPY. The training of these groups helps to ensure project's sustainability, as it provides a safety blanket should the main target group fail to continue the practice.

Other spin off includes generation of interest among government agencies, funding agencies, and the general public.

In brief, while the project is just a little short in creating high level of skill and knowledge, it has done well in creating genuine awareness and multiplier effects.

Critical factors for success and failure

Information for this evaluation is gathered both from the experience of RSPY project in the River Ping catchment, as well as from the experience of country wide network of stream detectives .

Critical factors for success

- ***Stream investigation as a tool for EE***

It has been shown beyond doubt that stream investigation is a powerful approach in creating a dynamic learning process that can lead to real concern for the environment. The hidden presence of macroinvertebrates, once discovered, throws up a pleasant surprise which makes learners recognise readily the meaning of the phrase 'living river'. The activity combines the two essential ingredients for successful learning: fun and usefulness. It gives both knowledge and skill which both teachers and learners or practitioners require.

While the idea of 'Stream Detectives' is conducive, it must also be noted that it is well received within Thai society because it is introduced at the right time, socially and politically.

- ***The dynamic of active learning***

While cases for successful learning are varied, they all tell similar tale. They succeed in sparking off interest, and they succeed in inducing further learning.

The most common experience in successful arousal is due to direct experience of finding diversity of life in a stream as already mentioned above. Trainers therefore tend to use a healthy rocky stream for the first introduction. It is also important that the introduction shows the relationship to real life. Learning is particularly successful when the wish to learn come from the learners themselves. These are often people whose interest have already been kindled by water quality problem in their local communities. In one case in northeast Thailand where problem has been built up gradually it is not readily apparent to the eyes of the residents, creative introduction by respected monks -- revered figures in the community -- is a major key in sparking off interest.

Further learning is then sustained through participation. That is both learners and teachers or trainers take the responsibility to develop further knowledge and skills. The task does not rest on one party. The trainers know how to guide or give feed back, and the learners are active in finding things out and subsequently give feed back to the trainers.

It is this process of shared active learning that can do much to build up students self confidence and a sense of self worth. They can then grow up to make real contribution to the society later on.

- ***Creating sustainability and multiplier effects***

A number of successful strategies are commonly identified. Not surprisingly, sustainability is most apparent in established institutions with secured resources where the policy allows practitioners to incorporate stream detective activities into their regular work plan. These tend to be governmental organisations, such as schools and other education centres. Science education centre situated near freshwater streams is ideal. Unlike school teachers, the staff here do not need to create new integrated lesson plan, they can simply run outdoor courses on biological monitoring for students and other visitors in a similar approach to which they have been trained. However, in cases where

the main policy is not yet fully supportive, government workers find a way out in setting up an independent river care society of their own.

In most cases, a core group of activity leaders is deemed vital. These are often keen students in their local areas. A tip in creating such group partly lies in the conduct of trainers themselves. Comradeship can be created when trainers hold students as their equal without special privileges. Others rely on network of colleagues to help out or to make other exchanges.

To maintain people interest in the issue, practitioners successfully use a diversity of media, relevant activities, and study sites which relate to real life in their locality.

Critical factors for failure

Failure is a strong word, thus consideration is limited to the cases where teachers have been largely inactive.

This varies with individuals. It involves teachers who have little motivation of their own. These are, for example, teachers who are assigned by school principals to participate in the project as oppose to making a voluntary decision. Others are old, being near retirement age and simply waiting to receive their pension. Some just want a training certificate or workshop attendance record to create their portfolio for promotion.

Other restrictive factors concern with problems that are deep rooted in Thai education system. Thai teachers have high work load and limited time. They are so badly paid that personal debts accumulated by teachers nation wide have become a national agenda. Few young people today choose teaching as top choices for their career. The new education reform is also demanding on teachers. While it will give teachers more freedom to develop their own curriculum, it also calls for ever so resourceful personnel. To meet the challenge better, capacity development of teachers will take more than what RSPY-- or any other projects -- can do for them. Above all, there needs to be more institutional support and structural reform that will take administrative load from teachers and allow them more time to concentrate on teaching.

It should be noted, however, that the project on the whole did not run into a major problem partly because GWF started to accumulate some experience with small scale pilot activity prior to this undertaking.

Problems in running stream investigative education

A number of common problems are shared among practitioners. However, most find solutions through exchanges within the network. These are too detail and will not be listed here.

- ***Technical problems***

This ranges from difficult terrain such as deep river and steep banks, brackish water, to finding unknown animals. The particular biomonitoring technique developed by RSPY for secondary school level is also found to be too complex with some other target groups.

- ***Need for further capacity development***

After practitioners have been carrying out activities for awhile, they tend to find a need for new set of skills and knowledge which are not readily available.

- ***Lack of ally support***

This is the most common and most serious problem. As mentioned, both teachers and trainers find they need a core group of student helpers to run various outreach activities properly. But each year many of these students leave schools and it takes a lot of input to create new personnel who are as competent. Others find their colleagues to be interested but not determined. Some cases find sufficient young allies, but no support from their heads, so their work does not form a part of policy.

Ways Ahead

To meet future challenges, the network of stream detective practitioners have identified their needs and rough work plan. Interests are divided into four major areas, namely: capacity building of network members, development of teaching/training techniques and approaches, information management, and coordination of networks. These are sub-divided into five regional networks. And, funding permitted, there hopes to be an annual symposium where active practitioners can make exchanges and receive special training.

As the torch is passing onto the bigger network, GWF now turns its attention to developing stream detective activities for the primary school level. It is also looking to develop other related environmental detective programmes, e.g. for the coastal health, so practitioners can make a linkage of the whole river and wetland system, from the head water to the sea.

There is still a need in our society for more research initiatives from the scientific community to develop more in-depth knowledge of freshwater macro-invertebrates in more localities. This would enhance our ability to read more aspects of the environment, such as effects of different land uses. It is also essential for a development of national protocol for official biomonitoring of water quality, which would lend support to work carried out by the public.

Biomonitoring study should further include more research on traditional monitoring systems which can be linked to a scientific approach. Such bridging of perceptions is vital for the empowerment of community environmental management. Not only would a revised monitoring system help community to gain public acceptance, but essentially the plants and animals used for indicators often form part of local diet and medicines. As such, they relate directly to community's way of life and perception of well-being.

In conclusion, the experience of GWF has shown beyond doubt that the public can take an active role in the monitoring and caring of environmental health. They just need the know-how and an opportunity to do so.

Project Team: *Project Manager*, Narumol Aphinives; *Director of Content Development and Resource Production*, Oy Kanjanavanit; *Head of Training and Coordination*, Wipapan Nakpaen; *Educational Resource Writer*, Niramoon Moonchinda; *Assistant Project Administrator*, Chadapan Malipan; *Field Coordinators and Trainers*, Kunakorn Boonsai, Somkiat Juntursima, Onuma Ouy-itsaranukul, Chakkrit Phuangkaew, Porntawee Yodmongkol; *Assistant Field Coordinator*, Insom Sapanna.

Bibliography

Kanjanavanit, O. & Tilling, S., (1998), *The Freshwater Name Trail: a guide to freshwater invertebrates of ponds and streams in Thailand*, Green World Foundation & Field Studies Council, Bangkok & UK

Mouhot, H., (1864), *Travels in the Central Parts of Indo-China, Siam, Cambodia, and Laos*. White Lotus, Bangkok

Mustow, S.E., (1997), *Aquatic Macroinvertebrates and environmental Quality of Rivers in Northern Thailand*, PhD thesis, external programme, Faculty of Science, University of London.

Orton, R. *et al*, (no date), *The Freshwater Name Trail: a guide to freshwater invertebrates of ponds and streams*, Field Studies Council, UK

Rojanapaiwong, S. (Ed), (1999), *State of the Thai Environment , 1997-98*. Green World Foundation, Bangkok. (Thai version) (English version, 2000)

Samabudhi, K., (2000), Farang Ba Pla Hang Mekong (The Fish Maniac of Mekong) , interview of Dr. Tyson Robert in *Sarakadee Magazine*, Vol.16, No.186

Sangpradub, N. *et al*, (1998), *A Correlation Study between Freshwater Benthic Macroinvertebrate fauna and Environmental Quality Factors in Nam Pong Basin, Thailand*. Khon Khaen University, Thailand

WCD, (2000), *The Pak Mun Dam & Mekong River Basin, Thailand*. WCD Case Studies, World Commission on Dams Secretariat, South Africa