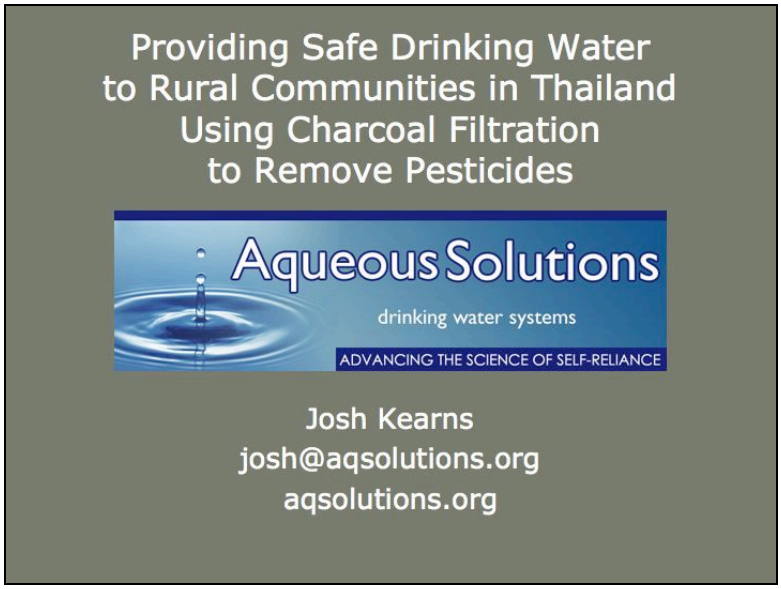
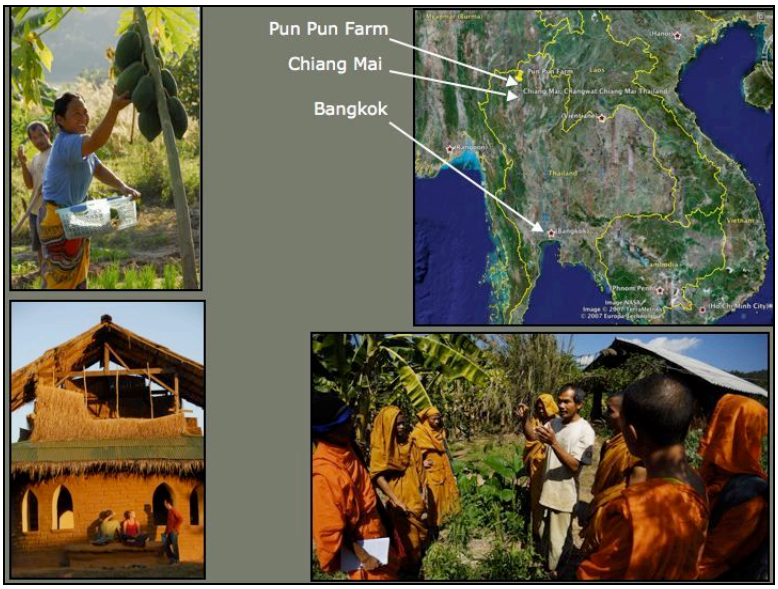
Providing Safe Drinking Water to Rural Communities in Thailand
Using Charcoal Filtration to Remove Pesticides

Transcript of presentation to Lindbergh Foundation Board of Directors
May 17, 2008, Ritz Carlton-Buckhead, Atlanta, Georgia, USA.



Good afternoon everyone. My name is Josh Kearns and I'm presenting a project entitled: *Providing Safe Drinking Water to Rural Communities in Thailand Using Charcoal Filtration to Remove Pesticides.* But first I'd like to say I'm deeply honored to be here and I'm thrilled that the Lindbergh Foundation has chosen to support this work.



The impetus for this project came about a year and a half ago when I was living and working with an organic farming community in the northern part of Thailand.

It was during an extended period of traveling I was doing in Asia. These travels were very much motivated by a desire to try to wrap my head around some of these big issues pertaining to sustainability, and really look hard into this idea of balance between human systems and the natural ecosystems that support our lives and livelihoods.

So part of these travels took me to live with this farming community in Thailand. To give a brief biographical sketch of the community – it's about 1/3 Thais, about 1/3 hill tribe people (indigenous people), and about 1/3 Westerners from various countries, for a total of about 50 or so people, fluctuating with the seasons. So it's pretty diverse; a lot of cultural cross-fertilization going on there.

It turns out that this community is itself very concerned with this idea of balance with the natural environment. And their take on the concept, their strategy for achieving balance is local self-reliance. They consider that, to the extent that individuals, households and small communities can meet a great portion of their basic needs through their own efforts and skills, using locally available resources, and in ways that make sense given the local ecological context, people can be free and happy and healthy, enjoy a great deal of independence and self-sufficiency, and have plenty of space and time to pursue spiritual and philosophical development and so forth. So this is how they are addressing balance.

For several years now, this community has been developing and practicing all sorts of sustainable and self-reliant living techniques – small-scale, biologically diverse organic agriculture; seed saving and biodiversity conservation (mention Pun Pun name); natural building using mostly earthen and organic materials; all sorts of stuff – and they have become quite successful and a bit famous and so now are giving workshops and programs for people from all over Thailand and around the world, which is how I got connected with them.

The impetus for the water filtration project came up about a year and a half ago, in the middle of the dry season. You see Thailand has a monsoon climate with a long dry season from October-or-so until June, which is by the way predicted to get longer and hotter and drier under climate change. Anyway, we ran out of drinking water in mid-January.

In Thailand, as in many places around the world, people harvest rainwater off of roofs for drinking. Even with a big cistern, it's not possible for most households to save enough water during the rainy season to last the whole dry season, certainly not possible for this community especially with all the guests, interns, workshops participants, etc. coming through.

When our water ran out, the farm had to start purchasing bottled drinking water, which is expensive, is trucked over long distances to get to the farm, which is fairly remote implying all the fossil energy expenditure, pollution, contributions to global warming that go along with that, and points up a critical dependence on an unsustainable flow of energy and resources of this community that's meant to be all

about balance and sustainability and local self-reliance.

There's plenty of water around, but it's either pumped from shallow wells, or surface water: ponds, irrigation canals, a couple perennial streams. Thailand's a big agricultural country so there are irrigational canals everywhere. But the water isn't potable, largely because of agricultural runoff – pesticides in other words.

This farming community of course uses all organic methods, but this is very much not the case for the majority of farming in Thailand at the moment. It turns out Thailand is one of the heaviest-pesticide-using countries in Asia. And about three-fourths of the pesticides used there are banned or heavily restricted in the West due to their ecological and human health effects.

This is pattern, incidentally, is very common in so-called developing countries, where agrichemical corporations sell huge quantities of pesticides that are outlawed here. It's certainly true in India and most other places I've traveled in South Asia.

Anyway, this issue of pesticide contamination of drinking water supplies is really a worldwide concern. Every year, hundreds of millions of tons of chemical pesticides are applied widely and intensively in agricultural zones throughout the globe. Many of these chemicals are known or suspected to cause a variety of cancers, developmental and reproductive diseases, neurological dysfunction, endocrine disruption and wide variety of other toxic effects.

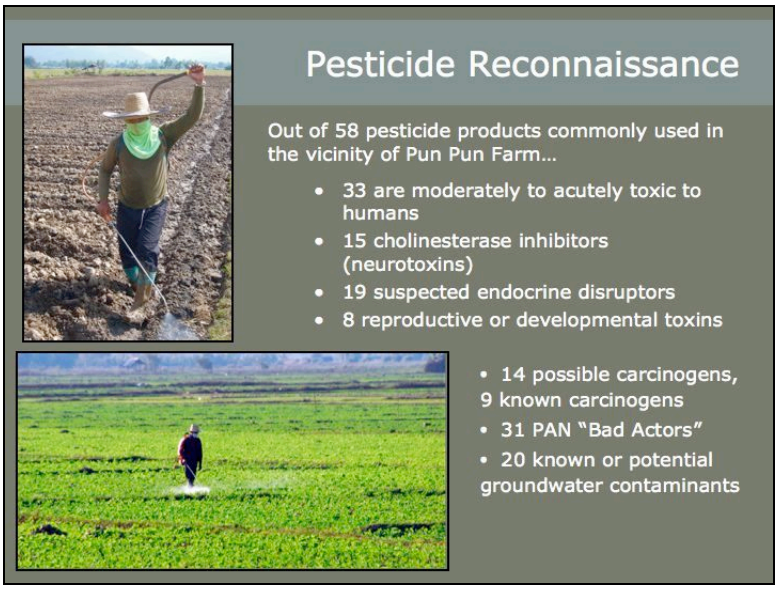
According to the US Center for Disease Control, based right here in Atlanta, we all carry a toxic body burden of dozens of pesticides. Pesticides have been widely detected in human breast milk and umbilical cord blood.

In fact, one study I came across recently from a few years back where they surveyed several *Hmong* women, a hilltribe, from a village that's just down the road, not 10 miles from our farm, where 100% of the women tested positive for DDT in their breastmilk. Findings like this aren't uncommon – many studies from other parts of Thailand, India, Africa, Latin America, even the US and other developed countries. This study just stood out because it hit so close to home.

Anyway, many surveys have been conducted from around Thailand of soils, groundwater, river sediment, surface waters, and so on have indicated widespread contamination by an array of chemical pesticides and their breakdown products.

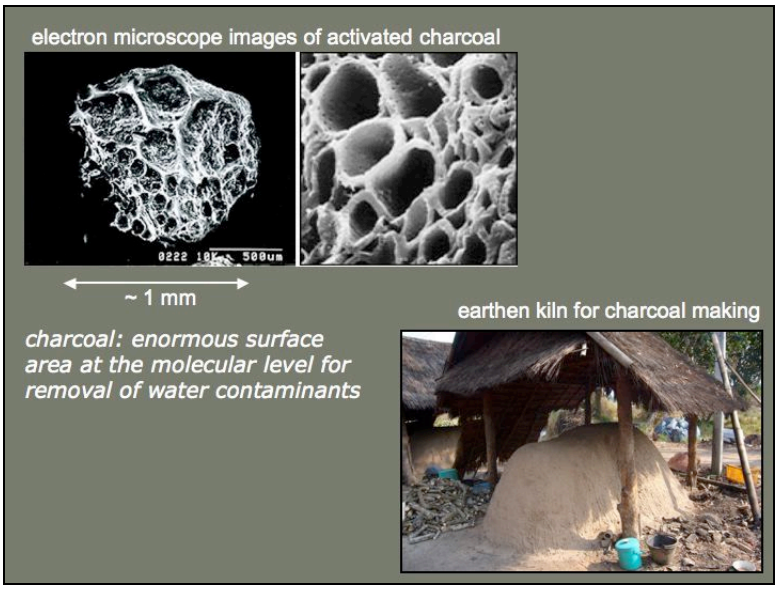
So to design a drinking water filtration system to remove pesticides for this farming community in Thailand, I first needed to do some reconnaissance to find out what we were up against – to identify the agrichemicals commonly used in our region that might be getting into local water sources.

I spent a lot of time over the past two winters talking to farmers in our area, checking out the feedshops in every neighboring village within a 20-mile radius to see what they were selling, and skulking around fields identifying discarded pesticide containers.



Anyway, my pesticide detective work turned up the following: that chemicals used in our area included numerous substances that are acutely toxic, several carcinogens, toxins of the nervous system, reproductive system, endocrine disruptors, and so forth.

So that's the bad news. But I don't want you to be bummed out, so this talk has a happy ending.



I recalled from my training as an environmental chemist that charcoal makes an excellent water filtration medium. In fact, a substance called activated carbon that is derived from charcoal is what's used in most

municipal drinking water treatment facilities in the US and other developed countries. This material has been identified by the US EPA, the WHO, and numerous academic studies as the Best Available Technology for the control of hazardous synthetic organic contaminants such as pesticides in drinking water.

Actually water filtration using charcoal is nothing even remotely new. People have been using charcoal water filtration since the societies of ancient Egypt and India. So it's a technology, if you will, with a several-millenia-long proven track record.

So in a sense, charcoal water filtration is old-hat. But here's why this project is interesting and has me super psyched:

Charcoal is cheap and ubiquitous. People have been making charcoal for 10,000 years, so it's not like this is some weird, gimmicky, high-tech, space-age material we're talking about.

Simple charcoal water filtration systems can be configured and used by just about anyone, just about anywhere in the world, regardless of economic status or level of formal education.

Charcoal water filtration systems can be constructed by folks using the skills of their own hands, which is empowering at the personal level, making them more independent and self-reliant, and using materials that are locally sourced, abundant, inexpensive or freely available, and sustainable.

What all this means is that we're talking about a truly appropriate technology, accessible to millions of people worldwide, that they might provide for themselves, their households and communities a stable year-round source of safe drinking water in a sustainable and self-reliant manner.

Now I think that is HUGE.

Currently, the World Health Organization estimates that 1.1 billion people – fully 1/5 of the world's population – are without access to potable water sources. One of the United Nations' Millennium Development Goals is to reduce that number by half by the year 2015 – this project can help us get there.

And that's why I am so enthusiastic about this work.

So how do we do it?

The short answer is try it and see. That's what this project is – that's what the Lindbergh Foundation has graciously offered to support.

Here's the plan, briefly outlined:

A review of the relevant scientific literature suggests that locally produced charcoals will make a very effective medium for removing pesticides from drinking water. But this needs to be confirmed by direct experimentation with various charcoals and a suite of pesticide water contaminants.

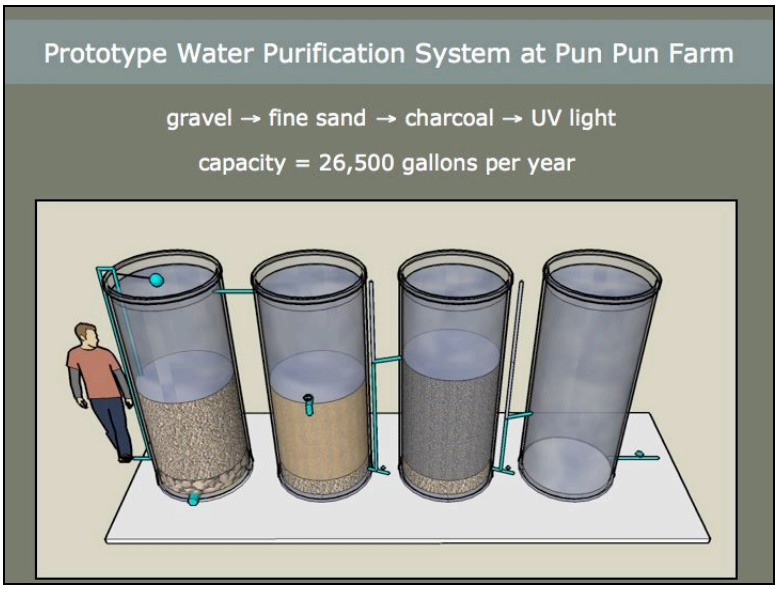
I also want to mention the source materials for charcoal making, to allay any concerns that we're advocating deforestation in order to produce charcoal for water filtration. Charcoal can be made out of just about any kind of organic matter, including all sorts of agricultural and forestry waste materials – prunings from fruit trees, straw, rice husks, nut hulls, coconut coir and shells, corn cobs, saw dust, etc., bamboo, which grows very fast, even bamboo construction waste.

We knocked down an old dilapidated bamboo hut on the farm last winter to make room to build a new guesthouse for farm interns. So we had a big pile of kind of useless bamboo and I said, "let's make it into charcoal!" So we began construction of an earthen kiln on-site for charcoal making – we should get that finished and optimized for charcoal production later this year.

Anyway, what we're talking about here are charcoals made from a variety of agricultural, forestry and construction waste materials – not chopping down virgin tropical hardwoods or something like that.

So one major aspect of the project is to perform the requisite laboratory analyses to confirm the effectiveness of charcoals made from these various materials to adsorb pesticides. I just came back from several months traveling around Asia with a duffle bag full of charcoal samples from the various communities where I visited. Over the next several months these samples will be subjected to a battery of rigorous laboratory analyses in collaboration with researchers at North Carolina State University and the University of California-Berkeley.

So that's the laboratory component of the project. The field component involves the development of a prototype filtration system serving the farm community in Thailand. We've already begun some of the design work and construction, and later this year we'll bring the prototype system fully online.



Here's an illustration done by my colleague of how the system will be configured, with gravel and sand filters to remove turbidity and microorganisms, and an optional germicidal UV unit for further disinfection at the point-of-use.

I've established a collaboration with an analytical chemistry lab at a university in Bangkok – they have agreed to receive water samples from the prototype system over about an 18-month period in order to monitor the system's performance and evaluate its effectiveness specifically for removing pesticides. If anything gets through the filter that could harm members of the community – which includes me, by the way, since I'll be drinking this water same as everyone else – we'll know about it.

And while all this is research and development of the prototype is going on, the know-how and responsibility for the maintenance and care of the system will be being handed over to the community itself, so that it's not something that is dependent upon me to go back every year and maintain and babysit. The community will have full transfer of the knowledge and technology for the project to be an ultimate success.

So that's kind of the project-in-a-nutshell.

I want to end by summing up some factors that I think give this project a very high chance of ultimate success, or, from your perspective, why the Lindbergh Foundation ought to get a really good bang-for-its-buck in supporting this project.

One: Accessibility…A simple, inexpensive technology that uses locally abundant materials for a long-established purpose. This means that this solution to the problem of drinking water contamination, out of the plethora of solutions that are out there, and many of them very good, is accessible and comprehensible to just about everyone in the world.

Two: significant contributions to the scientific literature. The experiments and analyses that we are carrying out at NC State, Berkeley and Kasetsart University in Bangkok are providing new knowledge – people have known forever that charcoal makes a great water filter, but no one has actually done the experiments with endogenous charcoals and a relevant range of pesticides. So this project will produce a host of academic journal publications, which keeps my colleagues in academia happy.

Of course, I am most fired up about getting our research out and publicized in popular format, and getting the technology implemented and actually bringing that benefit to folks "in the field." So we have developed a website that's been getting pretty decent traffic where we provide how-to information, etc. for folks who want to learn about and build their own systems. We're already getting requests for consulting and that sort of thing from other groups in Asia, Latin America and the US, so we'll see where all that might go.

The website is aqsolutions.org if you'd like to have a look.

Also, the fact that the prototype is under development at this particular site, with this particular farming community, which as I indicated is a demonstration center for a whole variety of sustainable and self-reliant living techniques. This means that there's great strategic value in locating the project there where it has the greatest chance to be witnessed by the hundreds of people who visit the farm every year from all over Thailand and around the world. So this is a great opportunity for wide dissemination and uptake of the technology. As part of this project we'll be getting all our how-to materials translated into Thai to aid information transfer to the folks there.

And finally I'll end by emphasizing that through all of this work – the lab research, work in the field and implementation of the prototype and so on – the overall guiding philosophy is the promotion of ecological sustainability and local self-reliance in meeting fundamental human needs, in this case for safe drinking water. This is our strategy for responding to the challenge that humanity is facing right now, the challenge of establishing, or really re-establishing, that critical balance between human systems and the environment, or between our technologies and the natural ecosystems that support our lives and livelihoods.

So I'll leave it at that – thank you very much for listening and I'm happy to take your questions.