



***Summary:** Over the past decade, the use of herbicides such as paraquat has brought about a transformation of the landscape in upland provinces such as Xieng Khuang. As an essential ingredient in the ‘maize boom’ these chemicals are a serious threat to human health and a contributing factor in the loss of biodiversity and declining soil fertility. Government and donor policy has helped to create this mess but there are no obvious solutions. In this situation, social learning and action research may be more appropriate than more traditional approaches to transferring technology and behaviour change.*

The arrival of herbicides has been a game-changer for farming systems in the uplands of Laos. The use of these chemicals is now at the heart of a ‘wicked problem’, a complex and unpredictable situation that is a huge challenge to government agencies and development organisations trying to help rural communities.

Large areas in Xieng Khuang province that were previously producing rice and a wide range of other food products under swidden agriculture, have been turned in monocultures of maize, a crop that is exported to produce animal feed in neighbouring countries. This transformation started a decade ago, in 2004, when the first farmers started using toxic chemicals to clear their fields. Now - in Districts like Kham and Nonghet - almost every rural household has a spray machine.

A set of photographs that illustrate the situation in these Districts is available here: <https://www.flickr.com/gp/33057984@N00/4jj91f>

Everybody knows that this situation is unsustainable. Soil fertility is declining, the use of herbicides is affecting human and environmental health, and the market for maize is unstable. The current system cannot last another decade. For the immediate future, however, an awareness of the problems is less important than the cash that maize is bringing into households that - until recently - were among the poorest in South-East Asia. For farmers, the short-term response to falling yields is to clear more land, plant a larger area, and - inevitably - use more and more herbicides.

Nobody has a credible long-term plan for these communities. In other provinces, the private sector has convinced farmers to switch from maize to other export crops such as cassava or banana, but the problems associated with agro-chemicals are the same or worse. Efforts to introduce less harmful production practices, such as conservation agriculture (known by the French acronym SCV), have produced good results in research plots and received enthusiastic support from the Ministry of Agriculture and Forestry (MAF), but maize farmers have rejected these practices because of the cost and complexity of the techniques.

Ironically, it is Government policy that has created, or at least expedited, the rapid spread of herbicides in the uplands. The replacement of shifting cultivation with commercial farming, and an emphasis on export commodities over local food crops, have been core elements in the agriculture strategy for more than a decade. In some areas this vision of commercial agriculture became a reality in the form of rubber plantations, but in other areas, it is maize that has transformed the landscape. The Government got what it wanted, but it seems that farmers have replaced one set of problems with another.

In Xieng Khuang, the changes over the past decade are often seen in terms of a 'maize boom', or even a 'maize tsunami', but arguably the key factor in this farming revolution is the chemicals, not a specific crop. Without herbicides, it would be impossible to clear and cultivate the large areas on which cash crops are now being grown. Herbicide applications, combined with ploughing, have replaced the traditional practice of burning, and these applications can be repeated every year, rather than in cycles of 5 or more years. Labour intensive farming has been replaced by chemical intensive farming, and it seems there is no turning back.

There is another irony in this transition. The World Bank has argued that

improvements in labour productivity in the agriculture sector are a key to the development of Laos, because this will release labour for other sectors. But the biggest improvements in productivity over the past decade have been in places like Kham District, where the use of tractors, herbicides and hybrid varieties have allowed farmers to produce thousands of tonnes of maize. There is no question that this has greatly increased the cash flowing into rural communities, and there is certainly an outflow of young people from these areas, but these improvements in productivity cannot be maintained.

When asked about their aspirations, most families in this area hope that their children will go to college and get a better education. But the corollary is that once their sons and daughters graduate, they will not want to return to the village. Which is why these farmers also complain about the shortage of labour to work their maize fields. And thus we return to the use of herbicides; a cycle that is killing rural communities. Only the poorest households are still engaged in hand weeding, and the women in these families are hoping they will soon be able to afford the chemicals that will relieve them of this burdensome task.

Maize and modernization

'Four goals for a better life' *Vientiane Times, 24 June 2008*

The Xieng Khuang provincial Agriculture and Forestry Department is working to achieve four priority goals in its fight against poverty in the province.

The department hopes the province can boost the production of food supplies, produce more goods for sale, end slash and burn agriculture, and encourage sustainable forestry management.

To achieve these goals, the department has set up specific measures to encourage people in the province's eight districts to grow more crops, raise more livestock and plant more trees. ...

Kham district in particular is seen as the frontrunner in agricultural production, with many people here experienced in the cultivation of sweetcorn [i.e. maize] for local sale and export.

Last year, the province grew sweetcorn on more than 14,500 hectares, which yielded 69,000 tonnes worth more than US\$4.6 million (40 billion kip). More than 8,000 hectares of sweetcorn were grown by Kham district farmers.

The province will try to boost crop yields by 4-5 percent each year in a bid to export more produce by 2010. ...

"These crops have considerable export potential," department director Bouasone Dalavong said.

"We believe we can help people to escape from poverty if we all work together to achieve the goals we have set," Mr Bouasone said.

Meanwhile, the richer families can hire others people to spray their field. As one village head put it, he now pays somebody ‘who is not afraid to die’.

One of the commonly used herbicide is paraquat. This chemical was banned for use in Laos more than five years ago under MAF regulation 2860, but the government has made no effort to enforce the ban and the product is widely available. In Kham District staff of the District Agriculture and Forestry Office (DAFO) openly sells it. There are various brands of paraquat coming from Vietnam and Thailand, which range in price from ‘Fansipan’ at 40,000 per litre to ‘Gramoxone’ at 170,000 kip per litre. Gramoxone is produced in Thailand under license to Syngenta, a Swiss company, and despite the cost it is being used in villages that are classified as poor. Three other herbicides are also being used as shown in the table below:

Name of product Chemical	Brands	Toxicity (WHO)	Use	Legal status	Enviro impacts
Paraquat dichloride	Gramoxone, Fansipan	II	non-selective, contact	banned	acquatic sp.
2,4-D	Outlaw	II	broad-leaved, systemic	permitted	fish, bees
Glyphosate	Roundup, Lymphoxim	III	non-selective, systemic	permitted	acquatic sp.
Atrazine	Atamex	III	broad-leaved, systemic	permitted	acquatic sp.

As the area being sprayed has expanded, the methods have ‘improved’. The use of plastic knapsack sprayers with a capacity of 20 litres, costing only US\$ 20 each, is widespread. But farmers in some areas are now using motorised pumps that cost \$250. When connected to a large barrel of herbicide and a hosepipe of up to 500 metres in length, the operator can spray between 1,000 and 2,000 litres per day. From a distance, the operator looks more like a fireman than a farmer, expect that he or she is ‘burning’ the landscape rather than putting out any flames. Within 24 hours, plants will turn brown and shrivel, leaving nothing but lifeless soil.

The burning effect is not limited to the fields; a burning sensation on the skin, in the eyes, and in the nose and throat, are the first symptoms of paraquat poisoning. This may be followed by difficulty in breathing, stomach pains, vomiting, nosebleeds, seizures, coma and death. In addition to these acute symptoms, which may be noticed soon after exposure to paraquat (ie. as a result of spraying, spilling or accidentally drinking the chemical), chronic exposure may cause permanent

damage to the lungs and kidneys. Although farmers may not see the chronic effects of the chemical, deformities of toenails and fingers nails are a visible indication of prolonged exposure to paraquat.

How much herbicides are being used in the uplands of Laos?

In October 2015, a survey of pesticide sales and use was carried out in 2 Districts of Xieng Khuang by staff of the Provincial Agriculture and Forestry Office (PAFO) with support from the Lao Upland Rural Advisory Service (LURAS).

Shopkeepers in Kham District reported selling 12.9 tonnes of herbicides in the previous maize growing season, with a retail value of \$70,000. A survey of pesticide use by farmers in 10 villages of Kham suggests that the shopkeepers (who included family members of the District Agriculture and Forestry Office) were under-reporting, and actual sales are between 5 and 10 times higher.

Shopkeepers in Nonghet District reported selling 95 tonnes of herbicide in the same period, with a retail value of US\$ 408,000. These figures closely match the reports from farmers.

The breakdown of reported sales of herbicides from the two districts was: Glyphosate 61,680 litre, Atrazine 35,820 kg, Paraquat 8,200 litre, 2,4-D 2,480 litre.

Data from the farmer interviews in Nonghet indicate that the average household growing maize is buying 81 litre of herbicide per season. Once diluted, each family is spraying more than 16,000 litres on their fields, using 4 or 5 times the recommended rates.

By way of comparison, the US Airforce sprayed approximately 2 million litres of herbicide on Laos during the Secret War. This was undoubtedly a terrible crime. Farmers in Kham and Nonghet sprayed 19 million litres in the past 12 months. The products used by Lao farmers do not contain Dioxin, which was responsible for birth defects caused by Agent Orange, but they are using largely quantities of chemicals that are both deadly and illegal.

The lethal dose of paraquat is between 7 and 8 ml. The amount of paraquat sold in these two districts in a single cropping season is enough to kill one million people.

Not surprisingly, farmers are aware of the problems. Reports of illness and death from pesticide poisoning are widespread in Xiang Khuang. Local officials also report that drinking paraquat has become a common method for committing suicide in the Hmong community. Nevertheless farmers keep spraying with minimal precautions. The fact is that risk-taking is part of daily life in rural areas. Farmers knowingly take risks every time they smoke a pack of cigarettes, every time

they get on a motorbike after drinking a half a bottle of rice whiskey, every time they fix an electrical appliance in the rainy season, and so on. The acceptance of risk by rural people is often overlooked by development organisations that conduct awareness raising and training, believing these activities will lead to changes in behaviour. The evidence suggests a high failure rate for efforts to convince Lao farmers to stop using pesticides. Many farmers *want* to use the most hazardous chemicals; they think they are getting good value when the 'medicine' is strong. Better informed households - including village heads and families of agricultural officials - have often been early adopters of new pesticides, and sometimes engage in selling these materials.

It has been suggested that maize in the uplands is a 'transitional' crop, and that what is happening is a short-term phenomena that allows farmers to convert natural assets into cash and material goods, and thereby graduate from the poverty of subsistence farming. This argument provides a veneer of strategy to a situation that is actually out of control. While it's convenient to think that small farmers are applying the national policy of 'turning land into capital', the truth is that they have no idea what lies ahead. Most of the income from maize has been consumed rather than saved, and it now looks increasingly likely that the seven fat years (a typical period for gains from maize) will be followed by seven leans years.

While it is not clear what INGOs or bilateral aid programmes can best do to help these communities, it *is* clear that some projects are a waste of time and money. In one village, where every household is now dependent on maize production, where spraying equipment is seen on every veranda and where - at the start of the cropping season - the community is surrounded by hillsides devoid of vegetation, one project has created a chicken-raising group. Not surprisingly, only 3 families could be persuaded to join. A Lao expression comes to mind: *one hair can hide a mountain*, meaning that small things can prevent us from seeing the big picture.



If we are to move ahead, we need to see the mountain. The crisis that upland communities are facing cannot be addressed from a single perspective, whether it be soil fertility or pesticide use or market opportunities. A holistic perspective must include all of these factors, plus land tenure, food security, labour availability, cultural preferences and governance issues. The complex and dynamic relationship between these factors means that the situation in the Lao uplands can be described as a 'wicked problem' or a 'social mess'. Such situations cannot be definitively solved, but we can develop responses that make life better for the most vulnerable people.

In developing a response, we need to learn from past successes and failures. The results of upland development efforts over the past decade suggest that we should be skeptical of readymade solutions. The promotion of untested alternatives, research that is divorced from local realities, or training that ignores farmers' own understanding of costs, benefits and risks are unlikely to lead to changes in behaviour.

In conclusion, traditional extension approaches are unlikely to help upland farmers address the challenges they are facing. Promoting yet another technical fix, or putting our faith in a new value chain, will not make the wicked problems go away. Instead, what appears to be needed is an integrated approach that involves social learning and action research. What projects like LURAS have started to do, and which merits further support, is bringing farmers and other stakeholders together so they can share experience, review options and negotiate a way forward.

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Afterword:

The draft of this discussion paper generated a mixed response. While some experts – from both the government and development community – found the analysis persuasive, one or two others were unhappy that the paper made no mention of the work being done by their projects. The author would like to correct this oversight by mentioning the work of CCL, EFICAS, FAO, SAEDA, TABI and UDIN. The full names of these organisations or projects are not relevant to this analysis, but it is important to recognise that UN agencies, bilateral donors, and NGOs (both international and local) have all been supporting training in Xieng Khuang that is aimed at reducing the use of pesticides. The training goes under various names, including ‘safe-use’, ‘risk reduction’, ‘integrated pest management’ and ‘promotion of organic farming’.

All or most of these projects will claim that their activities have been successful. Data is available showing that *X* many farmers have been trained and this has led to a *Y* percent decrease in the use of pesticides. However, there are a number of factors that can skew the results. Project staff usually collect this data soon after the training has been conducted, which is likely to lead to a rather favourable assessment of their own work. Furthermore, Lao farmers - who are routinely told what to do by the Government - have a tendency to exaggerate their compliance with official advice.

Nevertheless, there is no doubt that a large number of farmers have been trained and many have changed their behavior.

But the problem is clearly getting worse.

We only need to look at the devastation of the landscape in parts of Kham and Nong Het, and visit the shops where the volume of chemicals and number of spray machines is visibly increasing year by year, to realise that the combined efforts of all these projects is not producing the desired impact.

In ‘dev-speak’, the official language of the development community, we like to talk of *impact pathways*. What seems to be happening in the impact pathway for herbicide reduction is a lot of activities, some outputs, and hardly any outcomes. Clearly something else needs to be done.

The considerable effort and expenditure by development projects over the past decade has shown that awareness raising and training is not enough to stop the tide of destruction being caused by herbicides in the uplands. Other measures are

needed. Strengthening the regulation of pesticide imports and sales is one area that obviously needs attention. Finding profitable alternatives to maize is another route that needs to be explored.

More generally, we need to stop seeing small farmers as the guilty party in the toxic landscape, just as they were demonised for practicing 'slash and burn'. Like farmers in most countries, smallholders in the uplands of Laos are changing their practices in response to economic opportunities that are created by a combination of global markets and government policy. These farmers are more likely to respond to incentives created by the private sector than to advice from development projects. Consequently, we need to find measures that involve changes in the behavior of companies and officials, rather than putting the burden for change solely on the shoulders of rural people.

These measures need new approaches and new alliances. This is not a criticism of what various projects have done in the past, but a call for them – for *us* - to work together in order to do something different in the future. The LURAS project wants to collaborate with others to make this happen.

One of the characteristics of a wicked problem is that it is *contested*; there is a lack of agreement about both the nature of the problem and the validity of solutions. It is unsurprising, therefore, that the draft of this paper generated a mixed response. The author has no doubt this this latest version will have also have supporters and detractors. Hopefully this debate will help all of us to move forward.

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