



Forages and farmers

Case studies from South-East Asia



Australian Government
**Australian Centre for
International Agricultural Research**



CIAT

Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture
Consultative Group on International Agricultural Research



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John Connell, Werner Stür and Peter Horne

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Cover: A farmer (Mrs Kieu) harvesting forages to feed fish and cattle in Ea Kar, Daklak province, Vietnam.
Photo: Jim Holmes

Foreword

Since the 1960s Australia has played a key role in the development of tropical forage varieties for livestock systems in the developing world. Australian research agencies (especially the Commonwealth Scientific Industrial Research Organisation (CSIRO) and the International Center for Tropical Agriculture (CIAT)) compiled the largest tropical-forage germplasm collection in the world, with over 30,000 entries. While this collection contained plants that had the technical potential to improve smallholder livestock production in South-East Asia, the potential was unproven.

In the early 1990s the Australian Centre for International Agricultural Research (ACIAR) and the Australian Agency for International Development (AusAID) began funding a series of research and development projects to identify the most promising grass and legume varieties from this collection. The aim was to confirm their adaptation to different environments and production systems, and to demonstrate their potential to enable significant livelihood impacts in smallholder farming systems. This research, which continues today, covered a wide range of production and farming environments across seven countries (Indonesia, Vietnam, the Philippines, Laos, Thailand, Cambodia and China).

Approximately 40 broadly adapted and robust forage varieties were identified and described in an earlier ACIAR publication (*Developing forage technologies with smallholder farmers: how to select the best varieties to offer farmers in South-East Asia*, ACIAR Monograph No. 62). Subsequent publications in the series provided technical information on how to grow, manage and use forages (ACIAR Monograph No. 88), and simple action–research approaches needed to integrate forages on smallholder farms (ACIAR Monograph No. 99).

This latest publication in the series documents, through case studies, the nature and scale of livelihood impacts that can emerge from the combination of robust forage varieties, sound management practices and research approaches that encourage farmer innovation. In an environment of high demand for livestock products and reliably high prices for those products, these stories provide compelling evidence of the potential for smallholder livestock keepers to develop profitable and productive enterprises.

A handwritten signature in black ink, appearing to read 'Nick Austin', with a long horizontal flourish extending to the right.

Nick Austin
Chief Executive Officer
ACIAR

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Acknowledgments

The farmers highlighted in the case studies in this book (and many who were not) provided warm hospitality to the authors and generously gave access to their lives. This was against a backdrop of collapsing commodity prices, displacement due to rebel activity, family illness and loss, and increasing desperation and insecurity. Their stories, which provide a greater understanding of their resilience, innovation and aspirations, are often inspiring, going far beyond the technical subject of forages and touching on the richness of impacts that ultimately drive wider adoption.

The impacts described through these case studies resulted from support provided to the farmers over many years by a committed group of researchers and extension workers in Indonesia, the Philippines, Vietnam, Laos and Thailand. While it is not possible to thank all, particular acknowledgment is due to Phonepaseuth Phengsavanh (Laos), Francisco 'Papang' Gabunada (the Philippines), Vu Hai Yen and Truong Tan Khanh (Vietnam), and Heriyanto, Ibrahim and Maimunah Tuhulele (Indonesia) for their substantial contributions in documenting the cases.

The photos for this publication were supplied (as indicated by their initials) by Jim Holmes (JH), Brad Collis (BC; CoreText), Phonepaseuth Phengsavanh (PP), Ganda Nakamaneer (GN), Somvanh Phommaly (SP), and the authors John Connell (JC), Werner Stür (WS) and Peter Horne (PH).

Special thanks are due to Jim Holmes, whose photos bring the farmers' stories alive and clearly illustrate the context of their livelihoods; and to Jenny Owen, for her patient and detailed review of the cases.

Glossary of forage varieties

<i>Arachis pintoi</i> 'Itacambira'	a high-quality forage legume loved by pigs and chickens; 'Itacambira' is the accession CIAT 22160 and there are several other accessions with similar properties: 'Amarillo' (= CIAT 17434), 'Porvenir' (CIAT 18744) and CIAT 18748
<i>Brachiaria humidicola</i> 'Yanero' and 'Tully'	a stoloniferous grass variety suited to grazing but also used for cut-and-carry feed in some areas; 'Yanero' is also known as <i>B. dictyoneura</i> 'Llanero' (= CIAT 6133); 'Tully' has been released in Australia; 'Yanero' is leafier and less stoloniferous than 'Tully'
<i>Calliandra calothyrsus</i> 'Besakih'	a tree legume particularly well adapted to higher altitudes in the tropics; used as a supplementary feed for buffaloes, cattle and goats
<i>Desmodium cinerea</i> 'Las Delicias'	a small leguminous shrub used for feeding goats in the Philippines; also known under the incorrect name <i>Desmodium rensonii</i>
<i>Gliricidia sepium</i> 'Retalhuleu'	a tree legume particularly well adapted to wet-dry tropics at altitudes below 500 metres; used as a supplementary feed for buffaloes, cattle and goats

<i>Leucaena leucocephala</i> 'K636' and local varieties	a tree legume particularly well adapted to better soils in the tropics; a very high-quality feed used as a supplementary feed for buffaloes, cattle, goats, pigs and poultry
<i>Panicum maximum</i> 'Simuang'	a productive, high-quality, bunch-type grass suited to fertile soils in the tropics; used as a cut-and-carry feed for buffaloes, cattle, goats and herbivorous fish
<i>Pennisetum purpureum</i> 'Napier'	a productive, high-quality, tall grass suited to highly fertile and irrigated soils in the humid tropics; used as a cut-and-carry feed for buffaloes, cattle and goats
<i>Setaria sphacelata</i> 'Lampung'	a bunch-type grass well suited to planting in contour hedgerows and cut-and-carry feeding systems; 'Lampung' (<i>Setaria sphacelata</i> var. <i>splendida</i>) produces no or little seed but can easily be propagated by rooted stems
<i>Stylosanthes guianensis</i> 'Stylo184'	a forage legume, it is often called 'Stylo184'; a bushy legume that grows well in most soils and is good-quality feed, being a protein supplement for buffaloes, cattle, goats, pigs and poultry; it can be made into leaf meal and is used a lot by farmers in Laos for supplementing pig diets

Currencies and exchange rates at the time of interviews (2005)

Baht (Thailand)	42 baht = US\$1
Dong (VND) (Vietnam)	16,000 dong = US\$1
Kip (Lao PDR)	8,000 kip = US\$1
Peso (the Philippines)	52 peso = US\$1
Rupiah (Indonesia)	8,000 rupiah = US\$1

Introduction

This book presents 11 case studies that tell the stories of innovative farmers, both men and women, who transformed marginal farming into a productive, profitable and market-oriented enterprise.

By diversifying their farming systems, they reduced labour-intensive cropping practices such as slash-and-burn agriculture. These changes resulted in improved living conditions and many farmers could afford to send their children for further education.

In all these cases one factor—growing forages on their farms—played a critical role in this transition. Forages enabled farmers to take advantage of the opportunities created by the additional feed resource, and change their livelihood systems. Several other elements combined to produce these successful outcomes, including innovative farmers; a client-oriented participatory approach to supporting farmer innovation; technically and methodologically competent and committed researchers and extension workers; well-adapted, robust forage varieties; steadily rising prices for livestock; and, perhaps, luck.

These case studies were compiled to supplement more-conventional monitoring and evaluation, which captured numbers but not the richness of the impacts that drive adoption. These studies were an attempt to capture that richness of impact. They are written in the voice of the farmers. This book is their stories.

The cases were collected in upland areas of Indonesia, Laos, the Philippines, Thailand and Vietnam, where the International Center for Tropical Agriculture (CIAT) and its local partners had introduced tropical forages, grasses and legumes to smallholder farmers. The study team selected the case study families from a range of innovative farmers suggested by the extension workers in their area, based on the need to document a broad range of examples. Many more farmers could have been selected.

... stories of
innovative farmers
who transformed
marginal farming
into productive
enterprises

The case studies were based on interviews with all household members (husband, wife and children), a farm walk, and background information from extension workers and local government. This all took place in 2005.

The people, farms and situations described in the case studies varied greatly, but all the farms were small and families relied for their food and income on the crops and animals they could grow. Many farms, but not all, were located in hilly or mountainous environments with infertile or difficult soils that limited crop options, and where subsistence crops were grown for family consumption.

For most, livestock production was important for their farm operation, cash income and savings strategy, but feeding animals was a major challenge. Farmers generally did not have enough time to provide sufficient good-quality feed for their animals. They were caught in a labour–productivity trap: more labour was needed to improve the feeding of animals but the low productivity of the animals did not justify the extra investment of time.

Traditionally, most of the feed needed for ruminants (primarily buffaloes, cattle and goats) comes from crop residues (such as rice straw and maize stover),

Many farms were located in mountainous environments with difficult soils and limited crop options.



Photos: JH

vacant fields and communal areas on which animals can graze or from which farmers can cut grass to bring to their animals. The competition for feed resources on these communal areas has increased over time. Communal land has been allocated to new farmers, grazing has been prohibited to protect the natural environment or to reforest land, and there are increasingly more animals and people using these areas. Consequently, most traditional grazing lands have become heavily overused, and farmers have to spend increasing amounts of time herding and feeding their animals. This situation has made livestock production increasingly less productive and profitable.

While raising animals has become progressively more time consuming, farmers have seen prices for animals (and the price of meat in the market) increase consistently every year. This trend is likely to continue as living standards in Asia improve and city people eat more meat. This is a strong market opportunity for farmers to increase livestock production, but smallholders simply do not have the time to care for more animals if they use traditional animal-raising practices.



Researchers encouraged farmers to test forages which, for many, were a new concept.

■ Planting forages—only the first step

Most farmers began by growing only small areas of forages on their own land (often no more than 500–1,000 square metres). This provided a significant immediate benefit—they now had an easily available feed with which they could supplement traditional feed resources, especially on days when they were busy, such as at harvest time. It now took only a short time to cut forages to feed their animals for a day. It was, however, only when farmers began to change their farming practices and use forages as a significant source of feed over more-extended periods that impacts on productivity and income were gained.

The farmers featured in these case studies, and many others like them, were innovative. They quickly recognised that planted forages were an opportunity to change the way they raised animals. They started to keep animals closer to their homes or brought them back home every day. They found that the condition of these animals improved with better feeding and more active management.

Some farmers started to keep one or two animals in pens, feeding them well with their new forage resource. These animals generally fattened quickly and farmers made a good profit.

As they made more money from livestock, they were able to reduce less-profitable farm activities such as slash-and burn-cropping.



Photo: BC

Photo: JH



Additional income from animals allowed families to send children to school.

Many farmers changed the way they raised their buffaloes, cattle, goats, pigs and fish to capitalise on the opportunities provided by the new forages. They invested more resources in animal production, so they were able to raise more animals, produce them more efficiently and sell them on a regular basis. These farmers became more market oriented, making the transition from livestock keepers to livestock producers.

As they made more money from livestock, they were able to reduce less-profitable farm activities such as growing subsistence crops in slash-and-burn systems. Children no longer had to spend so many hours herding cattle, and additional income from selling animals allowed families to send children to school and college.

Conversations with the case study farmers 1–2 years after the initial interviews showed that not all had continued with livestock production. Some had moved into new enterprises (such as fruit trees), some became livestock traders or shopkeepers, and some had sold most of their animals to send their children for education. For all, however, forages and livestock production had been the stepping stone to better livelihoods.

These farmers became more market oriented, making the transition from livestock keepers to livestock producers.

For all ... forages and livestock production had been the stepping stone to better livelihoods.

There had also been failures. Not all farmers who planted forages found them useful. Some could access enough common-property feed resources to feed their animals easily. Others had family members with enough time to look after the grazing animals. Some were more interested in cropping than livestock production. There were also some farmers who invested in livestock enterprises that simply did not work out—not because feed was limited, but because of the many other factors that need to come together to make a successful enterprise.

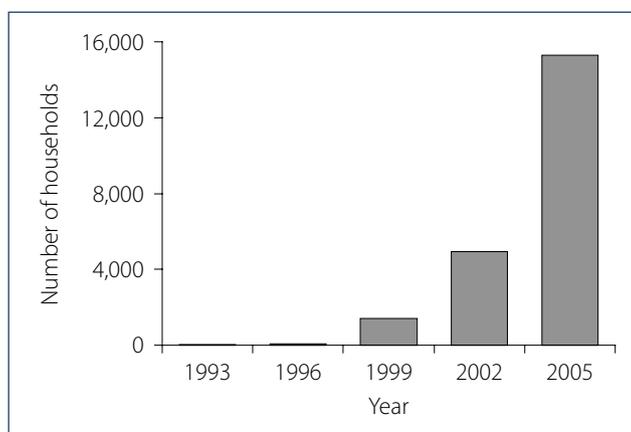
In the vast majority of situations, however, forages have worked well and enabled farmers to transform livestock raising from a marginal farm activity to a productive, profitable and market-oriented enterprise.

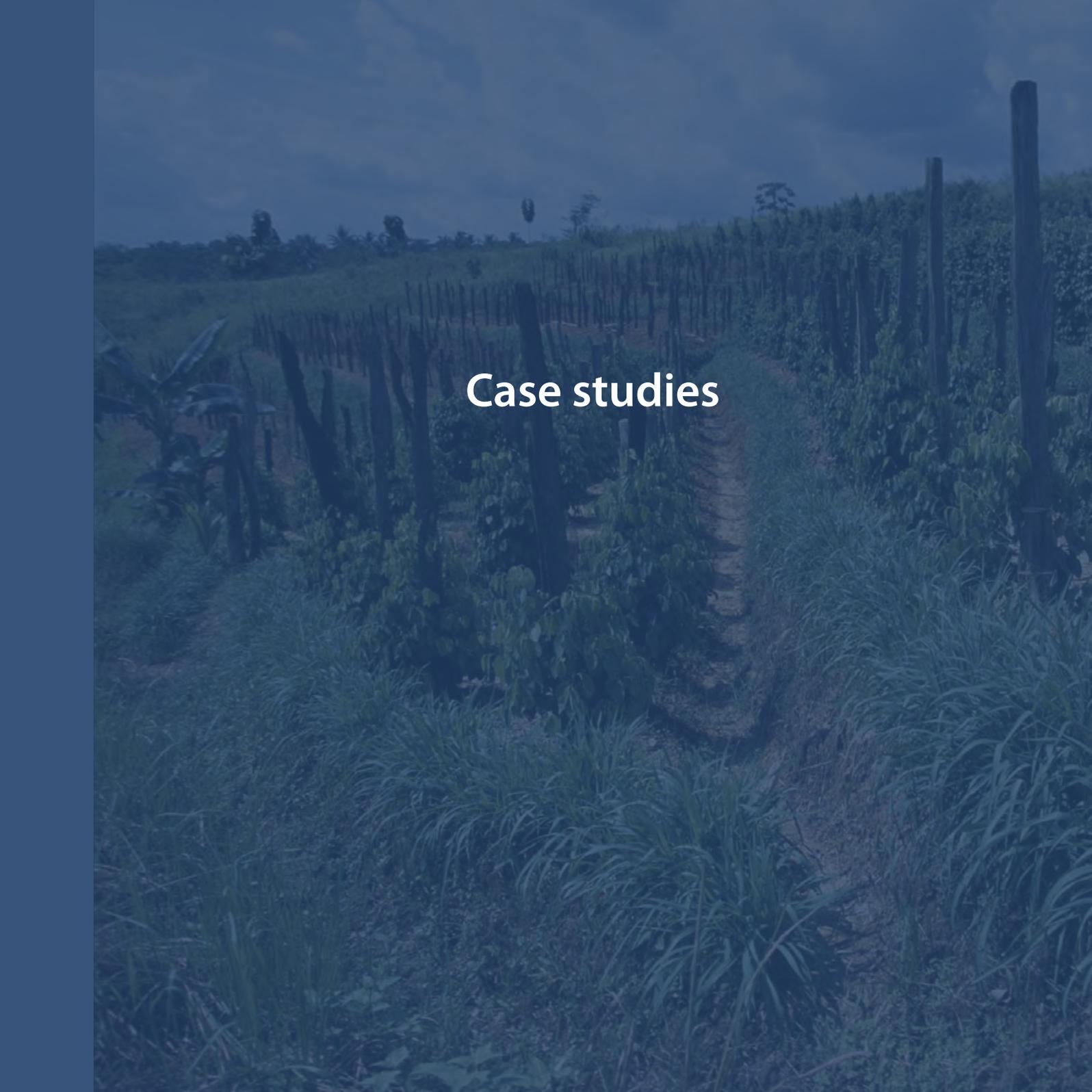
■ Adoption of managed forages

In 2005 CIAT conducted an adoption study in the areas where it and its local partners had introduced forages in South-East Asia. In these areas alone, there were more than 15,000 smallholder families that were growing and using managed forages (see diagram below). As many government and non-government organisations have started to promote the planting of forages in adjacent areas, it is difficult to estimate the full extent of adoption.

The planting of forages on smallholder farms to feed livestock for market is now becoming normal practice in many areas.

Adoption of planted forages by smallholder farmers in CIAT project areas in South-East Asia





Case studies

Claiming back the land

... and making money from manure

This is the story of Javanese transmigrants who now live on small upland farms in an area of extensive *Imperata* grasslands in Sepaku, East Kalimantan, Indonesia.



Photos: JH



Fire, wild pigs, infertile soils and the aggressiveness of *Imperata* made planting of valuable crops such as pepper (above) almost impossible.

Using forages, cattle and manure, innovative farmers like Sumali (left) and his family transformed this desperate situation into a productive agricultural system.

Sumali's family reclaimed wasteland to grow rice, maize, peanuts and soybeans.

Sumali's story



Photos: JH

When Sumali's family first migrated to Sepaku in East Kalimantan, they were allocated 2 hectares of land from which to make a living. It was overgrown with *Imperata* grass but, through hard work, they were able to reclaim 0.75 hectare on which to plant rice, maize, peanuts and soybeans.

It wasn't long before things started to get tough. After only 2 years, crop yields fell dramatically because of low soil fertility. The invading *Imperata* was a constant problem. It brought fire, wild pigs and rats, which devastated every crop they tried to plant. Many other farmers with the same problem were able to survive by keeping a few cattle on the communal grazing areas, but Sumali was poor and did not own any cattle.

In desperation, 3 years after they arrived, the family abandoned their land. Sumali had little choice but to sell his labour, cutting wooden roof shingles and earning barely enough for the family's needs.

■ Forages enabled a new livestock enterprise

Ten years later, government extension staff came to Sepaku looking for farmers who might be interested in trying new forage varieties. The varieties were well adapted to the Sepaku area, but neither the extension staff nor the farmers knew if these varieties could provide any benefits to the farmers. A small group of farmers volunteered to test the new forages, and Sumali was one of them.

Although he had no livestock of his own, Sumali planted the varieties in small plots on his abandoned fields because one of the extension staff invited him to share-raise a cow. Sumali was impressed with two varieties (*Paspalum atratum*



Imperata grass (foreground) invaded Sumali's farm, bringing fire, rats and pigs, making agriculture impossible.

'Terenos' and *Brachiaria humidicola* 'Yanero'), which thrived despite the wildfires, pigs and rats. Furthermore, with these grasses, feeding their cow was easy.

In the second year Sumali cut these forages to fatten and sell two share-raised cattle, sharing the profit with the owner. He was so encouraged by the results that he quickly trebled his area of forages using cuttings from the small plots. This, in turn, allowed him to obtain two breeding cows from a livestock dispersal program.

Many of Sumali's neighbours did not have the new forage varieties and fed their cattle with native grasses, often cut from many kilometres away. This made such demands on their time that most of their cattle were neglected. With his expanding forage resource, Sumali was able to take in some of these thin cattle to fatten.

Within 6 years he had fattened and sold 10 cattle, sharing the profits with the owners. This brought in a profit of 13.5 million rupiah, enough to buy three extra cattle of his own.

Forages were able to suppress growth of *Imperata*, allowing Sumali to start fattening cattle.

After 8 years Sumali now has 0.3 hectare of forages, and he plans to expand this even further. New forage areas can be established from cuttings, which are available on the farm and become productive within 45 days. With such rapid establishment, Sumali can respond quickly to market opportunities for fattened animals.

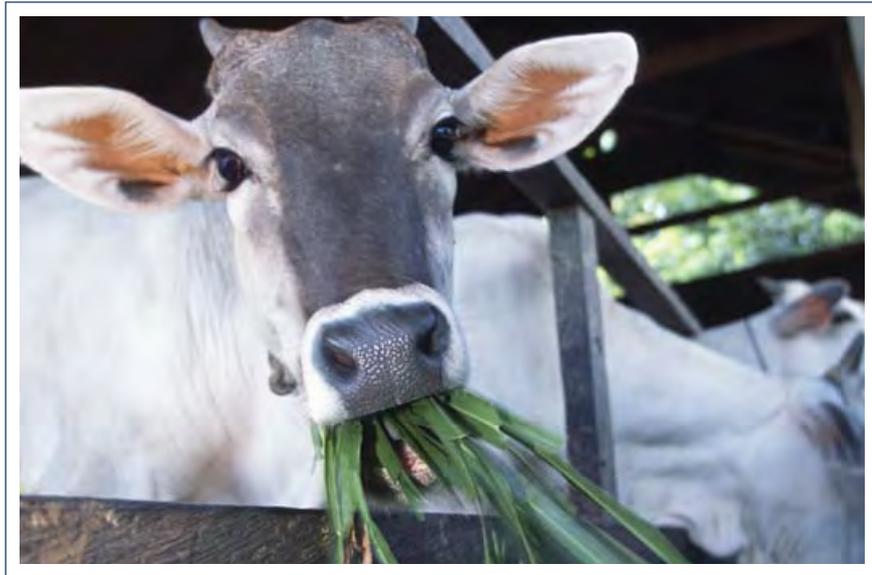
■ Making money from manure

The soils of the Sepaku area are infertile, so farmers must apply manure to sustain crop yields. Few can afford chemical fertilisers, so manure is in high demand.

Once he was fattening more cattle and feeding them about 40 kilograms of fresh forage per head, Sumali was able to collect large quantities of manure for sale. The more cattle he could take in for share-raising, the more manure he could produce.

In the seventh year of testing forages, Sumali produced 24 tonnes of dried manure, composted with sawdust and lime. Selling this gave him a clear profit of 11 million rupiah, almost as much profit as he had made from fattening cattle over the previous 5 years. At the start of the following year, Sumali had already received an order for 20 tonnes of composted manure worth 15 million rupiah.

Within 6 years he had fattened and sold 10 cattle, sharing the profits with the owners.



Photos: JH



As they fattened more and more cattle, selling manure became the mainstay of the family's income.

■ Forages protecting the crops from fire

As income from his livestock became more substantial and reliable, Sumali was able to stop cutting shingles. Feeding the cattle with forages from plots close to the house took little time, so he was able to use his time to develop the farm again.

He experimented with the forage variety *Brachiaria humidicola* 'Yanero' to protect his crops from wildfires. 'Yanero' does not die back in the dry season, so provides little fuel for wildfires. Planted as a 3-metre-wide green belt, 'Yanero' proved to be an excellent firebreak. This allowed Sumali to confidently plant more than 1 hectare of high-value pepper and to begin cultivating field crops.

Now that he can protect his land from fire, he has recently established an area of teak as a long-term investment for the family. He is integrating forages with his crops as contour hedgerows, cut-and-carry plots and firebreaks.

With forages used as firebreaks, Sumali was able to redevelop the farm with crops such as pepper.



Photos: JH

Different forage varieties are now planted in the crop land as plot boundaries, firebreaks and erosion controls.



■ Securing the family livelihood

Fattening cattle and selling manure have provided enough income to allow Sumali and his wife to improve their home and, more importantly, to provide a better education for their children. Their eldest son has just finished school and they can now afford to send him to university in the provincial capital.

As Sumali further develops and expands the farm, the family's prosperity continues to grow.



'We will never give up raising livestock because of the good income from manure.'

Other Sepaku farmers

Ten years after the first three or four farmers started testing forages in small plots, there are now more than 150 farmers in the Sepaku community planting and using large areas of forages to fatten cattle. This is having a positive impact on a wide variety of people, including shopkeepers, pepper farmers and livestock traders.

Sepaku village, East Kalimantan, Indonesia



■ The shopkeeper

Drullah (pictured) turned to livestock to escape from subsistence living. In the beginning, native grasses were scarce and the only forage variety he knew (hybrid *Pennisetum* 'King Grass') was poorly adapted to the area. He discovered new forage varieties that were robust and easy to manage. After planting 0.5 hectare, he was able to increase the size of his herd. The sale of nine cattle funded his daughter's nursing studies. For Drullah, who is 68 years old, selling another three cattle has provided the down payment on a small dry-goods shop by the road.



■ The pepper farmer

To protect his pepper plantation from erosion during heavy downpours, Sarni (pictured) planted *Setaria sphacelata* 'Lampung' along the terraces. This also provided feed for his goats and reduced the fattening time from 10 to 6 months. Some soil erosion still occurs in his pepper plantation, so he is continuing to experiment. He is now testing the legume *Arachis pintoii* 'Itacambira', which covers the ground completely and so should be more effective in controlling erosion.



■ The livestock trader

Mr Suadji (pictured) buys 8–10 head of cattle each week. He pays 15% more for cattle fed on the new forages as they yield more meat (up from 60 kilograms to 80–90 kilograms). This saves on his fixed costs for transport and slaughter. Meat from the cattle fed on forages is also of better quality (leaner, finer grained) and is preferred by his customers.



Photo: JH

From livestock keeper to producer

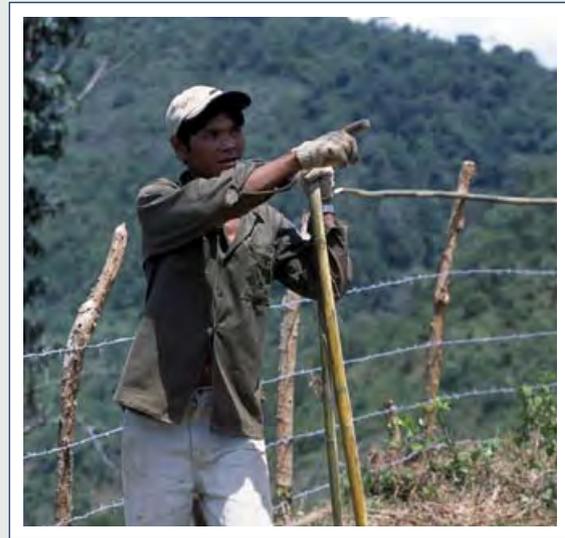
Raising cattle closer to home

Sing and his family practised slash-and-burn agriculture (below) to grow upland rice in Houei Hia village in mountainous northern Laos. They also raised a few cattle, which grazed unsupervised in distant forests.

Rice yields were declining because of ever-shorter fallow periods, and weeding the rice fields required more labour than they could manage.



Photos: JH



Sing (above) and his family planted forages to escape this dilemma, and moved to a more active and productive cattle production system. Selling cattle now provides enough money to buy rice, which means they no longer need to use slash-and-burn agriculture to cultivate large areas of upland rice.

Sing's story



Photos: JH

Houei Hia village sits on the slopes of a rugged mountain range in northern Laos. For more than 100 years the farmers have slashed and burned nearby forest plots to cultivate upland rice. After 2–3 years of rice cultivation, the field would be left fallow for many years so the forest could regrow, replenishing soil fertility and controlling weeds. Farmers typically supplemented the rice they grew in these plots with wild foods and cash from selling cattle that grazed in the forest.

In the last 30 years this farming system has changed dramatically. Increasing human population in the area has forced farmers to use shorter crop rotations (now frequently less than 4 years), but there is not enough time for the forest to regrow

Like his neighbours, Sing kept a few cattle to provide income during hard times, but often they were lost in the forest.



in these shorter fallow periods. Consequently, rice yields have fallen significantly, weed problems have increased, and the farmers of Houei Hia have little choice but to work much longer hours in the fields and cultivate larger areas of rice just to maintain the total amount of rice harvested.

In the face of these challenges, Sing and his young family were especially vulnerable. With persistent health problems and four young children in the family, they did not have enough labour to cultivate the land needed to meet the family's rice needs.

Like others in the village, Sing normally kept one or two cattle to provide income during hard times. His cattle roamed freely in the hills, up to 10 kilometres away, and it could take 2–3 days to find them, if at all. Sometimes they disappeared because of disease, injury or theft; and occasionally they damaged other farmers' crops, resulting in a heavy fine. 'Sometimes it was easier to simply shoot them and bring the meat back to the village to eat,' Sing recalls. He felt there had to be a better way to provide for his family.

[Sing] felt there had to be a better way to provide for his family.



Sing was the innovative farmer in the village who tested new forage varieties to feed cattle.

■ Moving the cattle closer to home

After hearing about these problems from the farmers of Houei Hia, district extension staff offered new varieties of forages to the farmers to test in small plots and then feed to their cattle. Seven farmers agreed to do this, not really knowing where it would lead. After 3 years only Sing wanted to continue, and he expanded his forage area. With a supply of forages on his doorstep, he wanted to see if he could keep his cow and calf tethered next to the house during the cropping season instead of letting them roam in the hills.

When the cow and calf were first brought in from the forest they were wild, but by the end of the season they had become accustomed to the new feed and to their owner. When Sing released them to graze in the forest at the end of the wet season, they preferred to remain close to the village, returning every few days for some cut forage grasses and salt. Sing realised that if he had more forage he could keep his cattle closer to home all year round, so they could never get lost in the forest.

Using forages, their cattle were easy to feed close to home and fattened quickly, bringing 30% higher prices.



Photos: JH



‘Under our old free-grazing system, it would have been impossible to keep this many cattle’, said Sing.

He expanded his forage area so that in the following seasons he was able to feed his cattle three times a day. He could provide more and better-quality feed than previously, when he had needed to go to the hills to cut and collect native grasses. He also discovered that, by providing a diet of different grasses mixed with the forage legume ‘Stylo184’, his cows and calves fattened more quickly than without the legume. He became fully convinced of the benefits of the new forages when he sold one 10-month-old calf for 850,000 kip, while his neighbour, Teo Ouan, made just 650,000 kip for a calf 2 months older than his own.

■ Raising cattle to buy rice

Three years after first experimenting with feeding forages to his cattle, Sing’s herd had expanded to five head (of which two were cows). During this time Sing had increased the original forage plot near the house to 0.6 hectare. Sing has now reduced, by 50%, the area of land that he slashes and burns to grow rice. He plans to build up the cattle herd to include five to seven cows so that he can sell at least three calves each year. This will be enough to purchase all the rice the family needs and stop slash-and-burn cultivation altogether.

... by providing a diet of different grasses mixed with the forage legume ‘Stylo184’, his cows and calves fattened more quickly than without the legume.

**This will be enough
to purchase all the
rice the family needs
and stop slash-and-
burn cultivation
altogether.**

'We want our children to go to school and not be poor like us,' says Nang Jit.

Sing's wife, Nang Jit, also experimented with feeding forages to her pigs. After she started adding a small quantity of fresh 'Stylo184' to their feed each day, she noticed that the pigs grew far more quickly. It took just 3–4 months for the young pigs to reach marketable weight, compared with 5 months before she started using 'Stylo184'. With the sale of pigs raised by Nang Jit, the family hopes to have enough income from livestock for all their household needs.

■ Making the transition to livestock producer

To have enough feed for all these animals, Sing estimates he will need about 1 hectare of forages. So he is fencing a large new field with barbed wire bought with the proceeds from the sale of cattle. He will establish forages in the bottom half of the field, and in the top half he will corral his herd. He will use manure from the cattle to fertilise the forages below.

Establishing a fenced area of forages is a clear illustration of the move that Sing is making, away from slash-and-burn cultivation and free-range grazing towards a more-stable and sustainable agricultural system.



Photo: JH

Other Houei Hia farmers

A remarkable change is happening in Houei Hia village. Farmers are moving away from the traditional practice of free-range grazing, in which just finding and catching cattle was a major problem, towards a system of managing cattle closer to home, feeding them cut forages. Five years after Sing began experimenting with this system, 22 of his neighbours (out of a total of 68 households in the village) are now using large areas of forage to feed their cattle close to home. With their extra income and the newly available time and labour, the Houei Hia farmers have been able to reduce slash-and-burn agriculture, and have begun to diversify into other enterprises such as raising goats.

... almost all the forage adopters are raising goats in pens near their houses and taking advantage of the current high prices for goat meat.



Houei Hia village, Luang Phabang province, Laos

■ Learning from the younger brother

Even though Sing had begun to use forages and was reaping large benefits from them, Thongwan (Sing's older brother, pictured) did not immediately take up forages himself. Thongwan's interest was cropping, and he was proud of his reputation of being a hard-working man who could grow more upland rice than any other farmer in the village. It took more than 3 years before Thongwan realised what his younger brother was achieving. Seeing Sing's cattle, which were not wild and grew much more quickly than his own, convinced Thongwan to give forages a try. He is now expanding his forage area to match that of Sing. With the income from the sale of cattle in the future, he hopes to improve the house, buy a motorcycle and provide an education for his children.



Photo: JH

■ Providing income in difficult times

When the last of her children left home, Mrs Vilai (pictured) started planting forages in small plots to feed her cattle and goats. Not long afterwards, she and her husband both became too ill to cultivate their land. Fortunately, Mrs Vilai had learnt about growing forages, so she could expand the forage area next to the house to 0.4 hectare, and can now fatten and sell animals to buy food and other essentials. Maintaining the forage plots and feeding animals is much easier than cultivating rice in the steep fields.



Photo: PH

No longer a captive of coffee

Diversifying livelihoods with forages

This is the story of Mrs Kieu (below) and Mr Truong (right) from Ea Kar, Daklak, Vietnam. Here the landscape is undulating with small pockets of paddy rice and fish ponds. The main crops grown are coffee, maize and cassava. Coffee was the most important source of income until the collapse of coffee prices in 1999.



Photos: JH



Forages were introduced in Ea Kar in 2000. Innovative farmers used them and quickly developed new, highly productive and lucrative livestock systems. They also benefited from the huge demand for forage planting material. Many farmers in Ea Kar are no longer solely dependent on coffee.



Kieu's story

Kieu ... stocked the pond with grass-eating carp and produced 90–100 kilograms of fish ... every 18 months.

During the 1980s and 1990s coffee had transformed Daklak province, Vietnam. At the end of the war in 1975, the province was a quiet backwater, but by 1999, thanks to coffee, the economy was thriving. The area of coffee planted by smallholders had increased from 50,000 hectares in 1990 to more than 250,000 hectares in 1999, and coffee prices were good.

In 1999, when coffee prices tumbled to 25% of their peak level, smallholder coffee farmers were hit hard. The poorer farmers growing coffee on sandy soils were unable to provide the fertiliser and water needed to sustain yields. Many lost their entire investment and, without the safety net of other farm activities, found themselves at risk of being without livelihoods. They responded by cutting out their coffee trees and looking for an alternative.

The story of Mrs Nguyen Van Kieu and her family is typical. They used to have 2.5 hectares of coffee on their farm in Ea Kar district, but by 2000 they had reduced this to just 0.5 hectare, and cropped the rest of their land with maize. But Kieu had an eye for an opportunity. The original coffee plantation had needed a lot of irrigation, so the farm had a large pond (2,500 square metres). To provide extra income, Kieu had stocked the pond with grass-eating carp and produced 90–100 kilograms of fish weighing 0.8–1.0 kilograms each every 18 months. With less water needed to irrigate coffee, Kieu decided to try to make the fish pond more productive.

■ From coffee to growing forages for fish...

When fish had been just a sideline activity, it would take someone in Kieu's family up to half of each day to collect just one basket (20–30 kilograms) of grasses soft enough to feed to the fish. When she wanted to improve productivity, Kieu knew



Kieu planted forages to feed her fish, increasing pond output tenfold and freeing-up 2–3 hours of labour each day.

that this was not nearly enough feed, especially towards the end of the season when the pond would be full of large fish. So she planted 500 square metres of new forage varieties around the pond and gradually increased the amount of grass fed to the fish to more than 100 kilograms each day. When the pond was harvested 18 months later, the total fish yield was over 1,000 kilograms (10 times her previous yield), and was worth about 10 million Vietnamese dong. Most of the fish were larger than before (1.5–2.0 kilograms each) and fetched a higher price per fish. With forages the pond had been transformed from a sideline source of food for the family, requiring much labour, to a major and profitable household enterprise.

■ ...and then for cattle

Encouraged by the success of the fish pond, Kieu expanded her forage area to 7,000 square metres, almost half of the area that had previously been used for coffee. In particular, she decided to expand the areas of *Panicum maximum* 'Simuang' (because



With extra forage available, Kieu was able to build up a small herd of cows to produce calves for sale.

... she is able to provide buyers with technical advice on which ones are suited to their land and how to establish plots from cuttings.

Kieu recently sold 5 tonnes of cuttings worth US\$370 — equivalent to the income from 0.5 hectare of coffee.

of its soft palatable leaves suitable for fish) and *Paspalum atratum* 'Terenos' (which grew well in the wetter areas near the pond). With irrigation water from the pond, the forage plots produced enough feed for Kieu to purchase a pregnant cow. Over the following 3 years she built up a small herd of three cows, two calves and a bull.

...and then for selling forage cuttings

With her large and productive forage area, Kieu discovered yet another business opportunity—selling cuttings to other farmers. Like Kieu, other farmers in the area had been looking for alternatives to coffee and were beginning to produce cattle and fish. Consequently, the demand for forage cuttings grew rapidly and, in the first year, after expanding her forage area, Kieu sold 4 tonnes of cuttings at 1,000 dong per kilogram to a group of visiting farmers. It was this income that had helped Kieu to buy her first cow.

Farmers now regularly come to Kieu's farm to buy cuttings. As she feels confident with the varieties she sells, she is able to provide buyers with technical advice on which ones are suited to their land and how to establish plots from cuttings. Before digging out the grass clumps and breaking them into cuttings, she harvests the green forage to feed to her cattle and fish. She then replaces each clump with a new cutting, effectively rejuvenating the forage plot. The areas that have been replanted regain full productivity within 4–6 weeks. So, from one forage plot, Kieu gains two benefits.



About 400–500 kilograms of cuttings are needed to establish 1,000 square metres of new forage plots. Sales to new farmers are typically a few hundred kilograms at a time. The volume of sales has increased every year and, in the first few months of the latest wet season, she had already sold 5 tonnes.

Selling cuttings may be a short-lived enterprise for Kieu but, for now, it is very profitable. Forages have helped diversify the family's farming and eased the transition away from coffee.

Photos: JH



From one plot the family gets two benefits—forage for their fish and cattle, and the sale of cuttings.



Selling forage cuttings became a lucrative new business.

Truong's story



Photos: JH

Mr Truong's farm in Ea Kar is just 2 kilometres from the district centre and is hemmed in on all sides by intensive cropping of pepper and coffee. When coffee prices fell in 1999, Truong decided to replace his coffee trees with pepper and ginger, which were fetching much better prices at that time. He also decided to diversify into fattening cattle. There were always thin cattle for sale from farmers who were unable to find enough feed. Besides, he was familiar with cattle, having long used his skills at slaughtering to supplement his farm income. So Truong started keeping cattle in a pen in the pepper orchard next to the house.

He fed the cattle on a recommended concentrate mix (consisting of maize, molasses, cassava, peanut meal, salt and urea) and native grass. As the surrounding area is intensively cropped, he had to hire a labourer to cut and collect grass from roadsides and fallow fields. It was difficult to find local grasses and this lack of feed limited Truong to fattening just two cattle at a time and only during the wet season. Despite this, his cattle gained up to 40 kilograms in 2 months, and he was able to fatten four batches (eight head) in a year.

■ Improving the output of cattle fattening

Truong wanted to be able to fatten more than two cattle at a time but was being held back by the lack of fresh feed. So he planted the forage grass *Panicum maximum* 'Simuang' between the pepper vines in his backyard. Having forages beside the house meant that collecting feed now took only 15–30 minutes per day. Delighted with this improvement, he replaced all his 700 square metres of ginger with 'Simuang'.



Truong used concentrate and native grass to fatten his cattle but, with grass being hard to find, he was limited to fattening just two head at a time.



Having forages planted in the backyard greatly improved feed availability, doubling the output of fattened cattle.

Truong slaughters his own cattle for the local market, making 12 million dong profit per year—twice the profit from pepper.



Photos: JH

With the greatly improved availability of feed, Truong could now comfortably fatten four cattle at a time. Furthermore, by irrigating the 'Simuang' through the dry season, he was able to increase the number of batches he fattened from four to five per year. Altogether, his output of fattened cattle increased from 8 to 20 head, an additional 12 head per year.

To add value, Truong slaughters his own animals and sells the meat to the district markets. He makes a clear profit of 0.6 million dong per head, or 12 million dong per year.

Escaping volatile commodity prices

Truong had hoped that pepper would replace coffee as his main source of income, but even pepper prices are volatile. In 2005 the net profit from his harvest of 500 kilograms of pepper was just 5.75 million dong. In comparison, his 700 square metres of 'Simuang' had provided an additional 7.2 million dong income per year and he had saved 4.5 million dong per year on the cost of labour to harvest grass.



Fattening cattle is helping Truong make the transition to a more stable and diversified income for his family.

While fattening and slaughtering cattle has provided a reliable income in a time of volatile coffee and pepper prices, it requires constant hard work. Truong's pepper orchard is still maturing. He looks to a future when pepper will provide more of the family's income and he can reduce the amount of time he spends on the cattle.

Other Ea Kar farmers

... they were making more than five times the profit from their forage area ... than from coffee ...

Many Ea Kar farmers have switched to producing and fattening crossbred cattle, which are preferred by traders. They can do this only because they have plenty of good-quality forage. Beef cattle from Ea Kar are now known for their high-quality beef, and most animals are sold in city markets in Dalat and Ho Chi Minh.

A recent study of 30 farmers in Ea Kar who were using forages to fatten cattle showed that, on average, they were making more than five times the profit from their forage area (US\$425 per 1,000 square metres) than from coffee (US\$75 per 1,000 square metres).



Ea Kar district, Daklak province, Vietnam

Before the collapse of coffee prices, cattle raising in Ea Kar district was rare. Since 2000, when forages were first evaluated by farmers in this district, the number of cattle has doubled, and there are now 2,400 households growing and using forages. Of these, 400 households are fattening calves and thin cattle for sale. This rapid increase in the number of farmers using forages was possible because of the availability of cuttings produced by farmers like Mrs Kieu.

■ Buying forage cuttings

Mr Ninh (pictured) comes from a neighbouring village and is a typical client of Mrs Kieu. He has one cow and one fish pond of 2,000 square metres, but has difficulty collecting enough feed for them. Each day he has to make three trips to collect native grass, and even then he cannot collect enough. This year he will reduce his coffee plantation area by 0.3 hectare and plant forages. To begin planting this area, he purchased 1 tonne of cuttings of *Panicum maximum* 'Simuang' from Mrs Kieu.

Using forages, he expects to be able to provide much more feed for his fish and cow, and spend only a short time each day cutting grass. Another 10 farmers in his village will begin planting forages at the same time as Mr Ninh.



Photo: JH

Reducing vulnerability

Making crop–livestock systems more sustainable

This is the story of smallholder farmers like Jocelyn (pictured left) living in San Migara village in a mountainous area of northern Mindanao, the Philippines. They and their families were threatened by increasing poverty.

Crop yields were falling because of soil erosion and declining soil fertility. Farmers needed to cultivate ever larger areas of land, which they could no longer manage with the available family labour. Feeding their draught cattle using the traditional *bakero* system of tethering animals in distant pastures was also labour intensive and unsustainable.

Planting labour-saving forages allowed them to escape from this poverty trap. Now they have time to invest in new income-generating activities.



Photo: JH

Jocelyn's story



Photos: JH

San Migara village is perched high on the side of a mountain in northern Mindanao, the Philippines. It was established by poor settlers in 1987 and now numbers 80 families. The village land is steep and infertile, limiting the options available for agriculture. Although they live only 1 hour's drive from the district centre, the farmers are still pioneering the land.

Following her husband's stroke, Jocelyn was not sure how she could cultivate the fields as well as look after the family's cow.



Soon after moving to San Migara, Jocelyn and her husband set about cultivating their steep fields to grow maize and sweet potatoes. Heavy downpours often removed the topsoil and any fertiliser they applied. Each year the yields declined. Then, 4 years ago, Jocelyn's husband suffered a stroke and lost the use of both his legs. Jocelyn had to shoulder the responsibility of providing for the family, including cultivating their fields and looking after their cow.

One thing soon became clear—it was impossible for Jocelyn to continue their traditional system of *bakero* (tethering the cow in distant pastures and moving it several times each day) as this took too much of her time away from the fieldwork. She felt she may have no choice but to sell the cow.

She tried planting forages in small blocks near her house but found that this did not provide enough feed to solve her problem. So she decided to plant the forage grass *Setaria sphacelata* 'Lampung' in hedgerows through each of her fields. Her idea was that no matter which field she was working in, there would always be a ready source of feed for her cow.



Forages planted in hedgerows throughout the fields meant that Jocelyn could feed the cows while working, taking little extra time.

Since she established the hedgerows in all her fields, no serious erosion has occurred.

Avoiding selling the family's only cow ensured the income needed to keep Jocelyn's children at school.

Now, each morning, Jocelyn takes the cow to the field and tethers it nearby in the shade. She then cuts about 30 kilograms of forage from the hedgerows and lets the cow feed while she works on her crops.

Integrating forages as hedgerows in each field has allowed Jocelyn to avoid the drastic step of selling the family's only cow. It now takes no more than 30 minutes to cut feed, and she can keep watch over the cow and calf while she works. This gives Jocelyn hope for the future. Growing maize and sweetpotatoes is a pioneering activity that provides only for the family's basic needs. Keeping a cow produces calves that provide the income needed to keep her children at school.

Crop production has also benefited from the forage hedgerows. Since she established the hedgerows in all her fields, no serious erosion has occurred. As the hedgerows capture nutrients that run off the fields in every heavy downpour, the forages remain productive throughout the year.



Photos: JH

Lucia's story



Lucia's house and resources are better than most in San Migara, yet she too has had to struggle to build a new livelihood under difficult conditions. At first she tilled her fields to plant maize, and grazed her one cow using the traditional *bakero* system. As natural feed was scarce, she could never raise more than one cow at a time, and even that used much of the available labour in her household.

When she first started feeding her cow planted forages, it responded quickly. Its condition improved and its coat became sleek. With more succulent feed available, the cow needed less water, an important consideration as water in San Migara must be hauled long distances from wells.



Cutting and carrying forage for seven cattle was too great a burden for Lucia's family.

**The forage blocks
have now been
grazed for 5 years
and are still green
and productive.**

Lucia's son now feeds the cattle with cut grass each morning before letting them graze in the afternoon, saving much labour.

Seeing how healthy her cow looked, Lucia recognised an opportunity and planted three large blocks of forage grasses—two of 0.5 hectare each and one of 0.75 hectare. She also planted *Setaria sphacelata* 'Lampung' in hedgerows through her steep maize fields.

Lucia now had enough feed to raise six extra cattle, which she obtained from a municipal livestock dispersal program. Cutting and carrying enough forage for these seven animals proved, however, to be too great a burden. To solve this problem, she let the cattle graze on the large blocks of forage, supplementing them with forage cut from the hedgerows in the morning. The forage blocks have now been grazed for 5 years and are still green and productive.

In the 3 years since receiving the six cattle, five calves have been born. To ensure enough feed through the dry season, Lucia has started to plant leguminous trees along the hedgerows in her maize crops. She hopes that this way of raising cattle may be the beginning of a sustainable and more diversified livelihood for her family and friends.



Photos: JH

Fermin's story



Fermin used to sell his labour in San Migara. He felt caught in a trap—each time he tried to cultivate more than a small area of field crops for himself, he would lose the essential income from his day-labour. He could see no way out of this dilemma. Even if he had owned a cow, as Lucia did, he would not have had the time for the traditional *bakero* system of tethered grazing.

As the benefits of planting forages became clear from the experiences of his neighbours, Fermin planted a small area and obtained a cow from a livestock dispersal scheme. He soon realised that the forage area was insufficient, so he gradually expanded it to 0.3 hectare, about one-third of his fields.

His cow has now calved twice in the past 2 years, with the value of each calf being equal to the total income he can obtain from cultivating his small plot of field crops. Fermin thinks that he will eventually be able to manage a herd of four cattle and so be able to sell two calves per year. To do this he is expanding his forage area to about 1 hectare. Without forages Fermin would still have been tied to day-labour to survive.



If Fermin realises this ambition, his income will be almost four times the amount he earned before planting forages.

Forages have allowed Fermin to produce calves for sale and for cultivating his fields, and so escape the daily labour trap.

Other San Migara farmers

Almost all the sloping fields around San Migara are now planted with forage hedgerows. Traders have started coming to the village specifically to buy forage-fed cattle, for which they are paying a premium of 20% above normal prices, as each carcass yields more meat and the meat is of better quality than that from other cattle.



San Migara village, Mindanao,
the Philippines

Selling fresh forage

A new cash crop for smallholder farmers

This is the story of Mrs Lau (pictured below) and Mrs Dou in Ngoi Xanh village, Tuyen Quang province, northern Vietnam; and of Mr Prasat in Yasothon province, north-eastern Thailand.

The environment and farming systems in northern Vietnam and Thailand are very different, but innovative farmers in both



Photo: JH



Photo: GN

countries, even those without cattle, saw similar market opportunities and independently developed a new, highly lucrative cash-crop enterprise.

Who would have thought that there is a market for fresh grass, as in Yasothon (pictured)?

Lau and Dou's story



Photos: JH

Mrs Lau (above) and Mrs Dou are neighbours and sisters-in-law in Ngoi Xanh village, Tuyen Quang province, Vietnam. Their small adjacent farms comprise paddy fields tucked into narrow valleys between low ridges planted with tea and fruit trees. For many years farmers in Ngoi Xanh raised cattle and buffaloes but, in 1995, local authorities banned free grazing to protect the natural environment. Several times Dou was fined when her buffalo was caught grazing in nearby forests. Without spare labour to supervise grazing, many farmers (including Lau and Dou) were forced to sell off their livestock. Within 2 years there were only three cattle left in the village.

In 1997 Lau participated in a provincial project that was developing approaches to erosion control on smallholder farms in Tuyen Quang. She tested several forage varieties planted as hedgerows on her sloping land, including *Stylosanthes guianensis* 'Stylo184'. When she fed the stylo to her pigs and fish, she noticed a significant improvement in their condition. While the production of pigs and fish were only minor activities for Lau, this response raised her hopes that she might again be able to start keeping cattle if she grew her own feed. She bought a cow and planted 400 square metres of the grass *Panicum maximum* 'Simuang'. Since then, each year her cow has borne a calf.

Having seen Lau's good results, Dou planted 900 square metres of 'Simuang' and obtained credit to buy two cows. Within 3 years she was able to increase her herd to three cows and three calves.

Theirs is not an isolated story within the village. By 2003 the planting of forages and the availability of cheap credit meant that the village herd had recovered

from 3 to 40 cattle. At the same time the management of cattle had changed from free grazing to raising them in pens or tethered near the house.

■ Making money from grass

Recognising the opportunity for intensive forage-based livestock production, the provincial government established four new dairy farms with more than 2,000 milking cows near Ngoi Xanh village. The dairy farms started to grow forages on their own land but could not grow enough for their daily needs (80 tonnes fresh feed). This created a new opportunity for farmers—growing forages for sale.

The smallest of the four dairy farms (the Hoang Khai Dairy with 143 cows) contracted 60 farmers to grow 20 hectares of forage for them, and purchased fresh forage from all farmers who delivered it to the farm.

The dairy prefers the grass *Panicum maximum* 'Simuang', which is soft and palatable, and pays 160 dong per kilogram of fresh 'Simuang'. *Pennisetum* hybrid 'King grass' is also grown by farmers but fetches only 100 dong per kilogram as it is less leafy than 'Simuang'.



Regulations forbidding free grazing meant that forages were essential for Lau and Dou to continue raising cattle.

When large dairy farms opened in the district, farmers were able to grow forages for sale.



Photos: JH

Growing forages for sale has proved to be much more profitable than growing rice for many of the farmers of Ngoi Xanh village.

■ Converting rice paddy to forage fields

With her larger herd of cattle and the expanding local market for fresh forage, Dou decided to take a risky step and convert some rice paddy to forage production. Initially, she experimented with 700 square metres of rain-fed paddy that used to produce only one crop a year yielding 120–150 kilograms of rice, worth 250,000 dong. Dou found that one harvest of ‘Simuang’ averaged 2.25 tonnes of fresh grass, worth 360,000 dong—more than the total value of the rice crop from the same area. With seven forage harvests per year, the income from this plot was 2.5 million dong, 10 times the value of the rice it used to produce and more than the value of a healthy young calf.

Following this success, Dou took the radical step of converting an additional 400 square metres of paddy to forage production. If the market for fresh forage remains strong, she and Lau each plan to expand forage production onto an additional 1,000–1,500 square metres of paddy land.

Growing forages for sale has proved to be much more profitable than growing rice for many of the farmers of Ngoi Xanh village. From a single planting, they can harvest forage every 1–2 months (depending on the season). There is much less labour required than for a rice crop, and the benefits are so substantial that some farmers who don't have livestock have started to grow forage as a cash crop.

■ A flexible option for the future

The regulations preventing free grazing created a need for forages, cheap credit facilitated a rapid increase in the number of cattle, and large dairy farms provided a new market opportunity for fresh forage. These external influences were unpredictable and may change in the future.

There is talk of the dairy farms being privatised and the cows being distributed to smallholders.

Regardless of the future, for the time being sales of fresh forage play an important role in the livelihoods of Lau and Dou. Growing forages for sale is a flexible enterprise option requiring little investment, which farmers can enter and leave quickly depending on the market demand.



Dou converted paddy land to grow forages for sale, increasing the income from the paddy tenfold.

Some farmers have planted forages in paddy fields on a large scale, using mechanical cutters and harvesting teams.



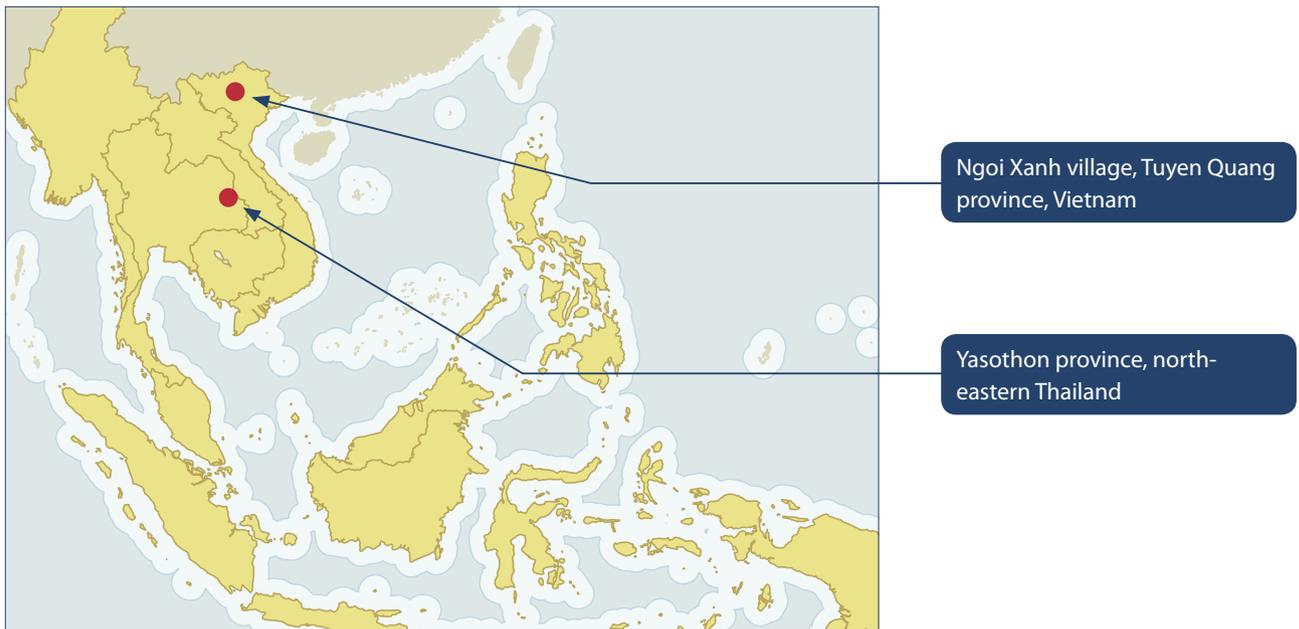
Photos: JH

Growing forages as an intensively managed cash crop is an option that farmers can easily adopt if the demand is strong.



Other Ngoi Xanh farmers

Half of the 55 households in Ngoi Xanh village are now growing forages for sale. Some of them grow it like Lau, on sloping land among their tea and fruit crops, while others grow it on a large scale in paddy fields, using mechanical cutters and harvesting teams. In this and neighbouring districts, more than 1,200 farmers are growing forages to feed their own livestock and sell to the local dairy farms.



Prasat's story



Photos: GN

His neighbours were sceptical but Prasat had discovered a lucrative new market.

Prasat lives in Yasothon province in north-eastern Thailand, where he grows rice, cassava and watermelons for a living. Frequent flooding was seriously reducing his yields, so he started looking for alternatives. Smallholder beef production was expanding in his area but there was limited feed, so Prasat planted a small area of the grass *Panicum maximum* 'Simuang' to see if he could sell fresh forage to these producers. His neighbours were sceptical but Prasat had discovered a lucrative new market.

Over several years he expanded his forage area to 4 rai (approx. 0.6 hectare). He harvests 'Simuang' 10 times per year, cutting it rotationally so he has grass to sell every day. The yield of fresh forage is 40 tonnes per rai per year. In 2005 Prasat made a net return of 88,000 baht from his 4 rai of 'Simuang', more than five times the net return from growing rice. With the savings from forage sales over 5 years, he has been able to buy seven cattle, which eat any forage he cannot sell and provide manure to fertilise the forage fields.

Other Yasothon farmers

There are now 450 Yasothon farmers selling fresh forages to local cattle producers. In 2004 they sold 5,500 tonnes of fresh forage, much of it grown on paddy fields with irrigation, manure and chemical fertiliser inputs.



A Yasothon farmer in her forage field shows a bunch of fresh forage worth 10 baht (US\$0.25).

Tripling returns from coconuts

Productive cattle making plantations profitable

Subari and his wife Jariyah (both pictured) live in Samboja, East Kalimantan, Indonesia. Their farm is close to the sea and the soils are sandy and highly acidic. Coconuts were the only crop that could thrive in these soils. Farmers grazed cattle under their coconuts, but woody weeds and other unpalatable vegetation were taking over the land. Feeding cattle had become a major challenge.



Photo: JH



Photo: JH

With the price of copra (the dried meat of the coconut, which is sold for extraction of oil) slipping year by year and cattle becoming thinner, their livelihoods were under threat.

A new grass variety changed their farming practices. Now they sell fat cattle several times a year, tripling the income from their cattle–coconut operations.



Subari's story

Subari was forced to sell most of his cattle when the burden of cutting grass from distant fields became too great.

Looking for a better life, Subari and his wife Jariyah moved from the very intensive farming systems of Java to Samboja in East Kalimantan. Initially, life was hard. The sandy, acidic soils of their 4.5-hectare farm prevented them from developing paddy rice. To get established, they grew field crops and gradually developed 3 hectares of the farm into a coconut plantation. Coconut was one of the few crops adapted to these soils and soon became the dominant one in the area. But when coconut prices fell in the 1980s, smallholder farmers like Subari had to look for new ways to secure the family income.

At that time there was still extensive communal land in Samboja that could be used for grazing, so Subari started raising cattle. This land gradually became degraded as the population of cattle in the area increased, forcing Subari to travel farther and farther inland to find feed. By 1994 this became so great a burden that the family sold most of their cattle. Despite the high demand for beef from growing urbanisation in the province, there seemed little potential for raising cattle in Samboja.

■ Raising cattle: a fresh start

Livestock extension staff visited Samboja in 1996, bringing with them forage grasses that were adapted to the low fertility soils and occasional flooding typical of the area. Subari was one of the first farmers to try these new varieties. He discovered that one variety, *Brachiaria humidicola* 'Tully', grew particularly well under the coconuts in his plantation. The new varieties also appeared to be more palatable to his cattle than the native grasses. So, over the next 5 years, the family planted 'Tully' throughout the whole of their coconut plantation, using cuttings.



Brachiaria humidicola 'Tully' grew well under the coconuts, so Subari expanded it throughout the 3-hectare plantation.

The 3 hectares of forage produced much more feed than they needed for their own cattle, so they began to buy thin cattle from other farmers to fatten. Typically, a 1–1.5-year-old calf fattened over 3–6 months would earn a profit of at least 2 million rupiah, two-thirds of the family's annual income from coconuts. With forage cut from the plantation, they could now fatten and sell three cattle each year.

■ Getting the most from their forages

While 'Tully' was the variety best adapted to their difficult soils and occasional flooding, its leaves are coarser and less palatable to cattle than many other forages. After experimenting with different frequencies of cutting, Subari found that regular cutting produced softer feed. So they now cut the whole 3 hectares once each month and add fertiliser once every 3 months. This maintains the productivity of the forage and, at the same time, ensures that the cut feed is soft and palatable.

By making the most of their forage resource, the income from cattle is now double the income from coconuts.



Photos: JH

Cutting this amount of forage requires a lot of labour. Each day three or four members of the family work together for a full hour to cut and fill six fertiliser bags (50 kilograms each) with forages. While this is a lot of work, the family now has a secure livelihood.

■ Getting the most from their cattle

Subari, Jariyah and their children have become skilful livestock producers, managing their 18 cattle in different ways to make the most of their forage resource. Cattle for fattening (3 head) are kept penned all day, and are handfed cut forages in the morning and evening. Breeding cattle (1 bull and 4 cows) are tethered under the coconuts to graze on the forages during the day, with supplementary forages given each evening. Growing cattle (10 head) are allowed to graze on the family's second plot of land, a fenced 1.5-hectare field of native grasses. As this plot is heavily grazed, their diet is supplemented with cut forages in the evening.

■ Diversifying livelihoods

Forages are allowing farmers in Samboja to move away from their dependence on coconuts. Subari's family currently earns about 6 million rupiah from fattening three calves per year. As the annual income from their coconuts is just 3 million rupiah, the forage beneath the palms is tripling the returns from their land.

To further diversify their farm income, Subari has begun to intercrop some of the coconuts with high-value fruit trees (durian, rambutan, mango and jackfruit). These will create a denser canopy and eventually shade out the forages. Before that happens, however, Subari plans to plant forages on their remaining 1.5-hectare grazing area. Because this is only half of the present forage area, in future the family will need to make decisions about how best to allocate their resources of land, labour and capital among their different enterprises.

Forages and livestock may eventually disappear from Subari's farm, but they have done the job of creating new opportunities for the family to diversify their income sources away from a reliance solely on coconuts.



With a large forage resource at hand, Subari's family increased their herd to 18, and now fatten 3 head for sale each year.

Other Samboja farmers

The time needed to collect feed has been reduced from 120 hours to just 6 hours per month.

Before the new forage varieties came to Samboja, the main reason for farmers to keep cattle was to accumulate capital as insurance against hard times. Feed was scarce and farmers had to travel long distances to cut native grass just to maintain their cattle. Now, with forages providing a reliable and handy feed resource, cattle raising is becoming a serious market-linked enterprise for many. Half of the 147 farmers in Subari's village now plant forages in their coconut plantations and fatten calves for sale.

Samboja village, East Kalimantan, Indonesia



Photo: JH



Half of the farmers in Subari's village now plant and cut forages for their cattle.

A recent study of 22 Samboja farmers who integrated forages into their coconut plantations showed that the time needed to collect feed for cattle has been reduced from 120 to just 6 hours per head per month. Forage users sold an average three head of cattle within the first 3 years of adopting forages, whereas non-adopters sold, on average, less than one head in the same period. As well as making more sales of fattened calves, the adopters were receiving about 0.5 million rupiah more per head than the non-adopters.

Forages have made possible the development of a cow-calf enterprise that takes advantage of the high demand for beef that has resulted from rapid urbanisation in the province of East Kalimantan.

■ Weighing up the costs and benefits

Mr Supingi's coconut plantation is a bit further back from the beach than Subari's, so the soil is less sandy. He has planted it with the forage varieties *Setaria sphacelata* 'Lampung' and *Brachiaria humidicola* 'Tully' and 'Yanero'. Supingi (right) found that 'Tully' did not affect the yield of his coconuts, but he suspects 'Lampung' has reduced the yield from 1,000 to 800 nuts per hectare.

Despite this, Supingi says the value of the forages as feed for his 15 cattle far outweighs the reduction in coconut yield.



■ Replacing weeds with profits

Umar (right) and his wife are both teachers at the local school. They inherited a 40-year-old coconut plantation from Umar's father. It was infested with weeds, so twice a year they had to employ labourers to weed the plantation. Learning from Subari's experiences, they planted forages as an understorey throughout the plantation. This suppressed the weeds and the coconut yields actually increased, from 400 to 600 nuts per hectare.

The main benefit, however, came from the increase in the number of cattle they could raise. Previously, when they had to collect native grasses, they had been able to keep just four cattle. Now, with forages, they have increased their herd to nine cattle. With the sale of two or three cattle each year, the couple were able to build themselves a better house and buy a motorcycle.



Buying thin and selling fat

Forages creating market opportunities

Nenglao (pictured) and his wife Nang Song live on a small farm in Xang village, Xieng Khouang province, Laos. They grow rice in a small paddy field near their village and also in upland areas.

Nenglao found that, despite having access to a paddy area, his family could grow barely sufficient rice for themselves. There was never



Photo: BC



Photo: JH

enough time to weed their fields as well as find feed for their draught buffalo.

Planting forages saved time. It also opened new opportunities for Nenglao, and farmers like him, to develop a profitable livestock enterprise. This radically changed their lives.

Nenglao's story



Photo: PH

In 1974, towards the end of war in Laos, the people of Xang village moved to a more secure location near the capital of Xieng Khouang province. The new land had been badly damaged by bombs and fire, leaving them little choice but to practise shifting cultivation—slashing the forest and planting rice on the steep hillsides—to survive. The labour burden was heavy and yields were low.

Searching for more productive agricultural options, Nenglao Ly worked hard to convert 0.5 hectare of the valley floor into a rice paddy. As the wet season

Finding enough feed for the draught buffalo was a demanding chore for Nenglao's family.



Photo: JH

approached each year, he had to buy a buffalo to plough the paddy, but feeding the buffalo was not an easy task. Nenglao and his wife Nang Song had to walk 5 kilometres from the village each day to find grass. This took 3–4 hours. Grass was scarce and they could never cut enough to feed the buffalo adequately. Throughout each year it would grow thinner as it worked, and they would have to sell it for a loss at the end of each wet season.

Despite all the hard work, their upland fields and paddy produced only enough rice to feed the family for 8–9 months a year. The extra labour needed to look after the buffalo meant that the children had to do more work on the farm during the wet season and could not always attend school. It seemed to Nenglao that they were getting nowhere. They needed something new if they were ever going to escape from poverty.

■ Fattening a draught buffalo

In 2001 Nenglao started evaluating six new forage varieties in small plots near his house. He had never before imagined growing feed for a buffalo but was willing to try anything new that might improve their lives. The forages grew rapidly in the first season, so each day he gave the cut feed to his recently purchased draught buffalo. By the end of the wet season 5 months later, despite having ploughed the fields, the buffalo was in better condition than when Nenglao bought it.

Nenglao and his neighbours were astonished. They had never seen a buffalo gain condition while ploughing, and thought that it must be because this was an exceptional animal. Nenglao sold the buffalo for 4.4 million kip, making a profit of 0.5 million kip, enough to buy rice to feed the family for a month.

The following year Nenglao wanted to see if he could again fatten a draught buffalo. He particularly liked the forage grasses *Panicum maximum* 'Simuang' (as it produced lots of soft leaf in the wet season) and *Brachiaria brizantha* 'Marandu' (which stayed green in the dry season). So, before purchasing the new draught buffalo, he expanded the forage area to 3,000 square metres using cuttings of these varieties.

They needed something new if they were ever going to escape from poverty.

By the end of the wet season the buffalo had grown fatter and Nenglao sold it for a profit of 0.6 million kip.



Photo: PH

As in the previous year, by the end of the wet season the buffalo had grown fatter, and Nenglao sold it for a profit of 0.6 million kip. His expectations had been confirmed—with forage grasses he could plough his fields and fatten a draught buffalo at the same time.

Nenglao then realised that fattening a buffalo didn't have to be limited to the ploughing season. He purchased two more buffaloes in quick succession and fattened them through the dry season.

In little more than 12 months he had fattened and sold four buffaloes, for a total profit of 1.8 million kip. This was enough to buy 600 kilograms of rice, equivalent to the yield from 0.5 hectare of shifting cultivation.

Demand for buffaloes has grown rapidly in Xieng Khouang. Nenglao was offered 10 million kip for one fat animal, but he refused the offer, expecting to be able to receive an even higher price.

■ Expanding into other livestock enterprises

With an expanding forage resource, new opportunities opened up for Nenglao. He purchased two draught buffaloes to fatten and hired one of these to a neighbour for the ploughing season for 0.3 million kip. From this animal he gained both the hiring fee and the profit from fattening it. Nenglao was also able to sell cuttings and fresh forage to other farmers who had been convinced by his experiences and wanted to start fattening their own cattle and buffaloes.

■ Leaving shifting cultivation behind

The changes brought about by fattening buffaloes are much more than just extra income to buy rice. Previously, Nenglao and Nang Song had to work solidly from early until late, one task barely finished before having to move onto the next. Now, with feed readily available, everyone in the family has more time. Using this extra time, Nenglao converted all their upland fields to permanent crops and

Using this extra time, Nenglao converted all their upland fields to permanent crops and forages.

Nenglao was able to start selling cuttings and fresh forages to neighbours and other villages.



Photo: JH

With the extra income and labour savings from fattening buffaloes, the children can now attend school every day.



Photo: JH

forages. The family no longer does any shifting cultivation. As it now takes only 1 hour each day to cut and carry forage for their buffaloes, the children have enough time to attend school every day.

'I now have much more time to plan the future of the family', says Nang Song. This has been such a profound change in her life that she has been giving forage cuttings to other women in the village so they can also share in the benefits.

Other Xang farmers

The agricultural systems in Xang village have changed dramatically. All 21 households now grow forages and sell their animals as part of a livestock marketing group. Seven households have followed Nenglao's example, fattening thin buffaloes and cattle for sale. Farmers from other villagers in the district now regularly come to Xang for ideas and planting material. The new livestock enterprises in the village have made a major contribution to the farmers' ability to reduce their dependence on shifting cultivation. Within 5 years the area under shifting cultivation in the village dropped from 40 to 11 hectares.

Raising livestock has helped reduce the area of shifting cultivation by more than 70%.



Xang village, Xieng Khouang province, Laos



Va Yer Lao can fatten and sell a buffalo in 3–4 months for a profit of US\$70—a large amount for a poor farmer in Laos.

■ Sending the children to school

Using 30 million kip saved from fattening cattle with forages, Kapoh Lao (pictured) and two other families bought land and built two small houses close to the schools in the provincial capital. Five of their children now live there during the school week.

Forages have indirectly allowed these children to get a better education and thereby access experiences and opportunities beyond the village.



■ Fattening cattle

Chea Khoa (right) did not have cash to buy thin buffaloes to fatten, so he started fattening his own cattle. Within a year he had fattened two animals and now buys thin cattle from other farmers to fatten. He estimates that the value of one cow grazing in the hills for 3 months will increase by 0.4 million kip. If fed on forages over the same period, its value will increase by 0.9 million kip, providing an extra 0.5 million kip profit from using forages.

Chea Khoa has planted 3,000 square metres of forages, mainly the grasses *Panicum maximum* 'Simuang' and *Paspalum atratum* 'Terenos'. Some of his land is prone to flooding and 'Terenos' grows particularly well in these conditions. He also grows the forage legume *Stylosanthes guianensis* 'Stylo184' and mixes the cut legume with the grasses in a ratio of two parts grass to one part 'Stylo184'. He finds that the legume stimulates the cattle to eat more feed so they fatten more quickly. Chea Khoa is now experimenting with composting manure as a fertiliser for his rice paddy fields.



Improving the farm

Over many years Mrs Yea Lee and her husband (pictured) have accumulated 4 buffaloes and 15 cattle, which graze in the mountains. Some time ago they tried to fatten one animal with native grasses but it was too difficult to find enough feed. They now have 0.5 hectare of forages, mainly *Panicum maximum* 'Simuang'.

Yea recently sold one buffalo for 3.9 million kip. If she had fattened this animal on native grasses, she says it would have been worth only 2.5 million kip. With the profits from fattening buffaloes and cattle on forages, the family has bought a motorcycle, a hand tractor and a home rice mill.



Photo: BC

Affordable and prolific goats

Providing flexible options

This is the story of smallholder farmers living in mountainous areas in Indonesia and the Philippines. They produced barely enough food for their families and thought that livestock might provide an answer. Cattle were too expensive and more of a long-term investment. Small, prolific animals like goats, however, were affordable and were likely to provide quick returns.



Photos: JH



To be productive and avoid damage to crops, the goats needed to be kept in pens, and the farmers had to supply all their feed. Providing the right mix of grasses and legumes was vital to the success of goat production.

Profitable goat production allowed these farmers to invest in the long-term development of their upland farms and their children's education.

Rodolfo's story



Photos: JH

... to maintain reasonable maize yields, they had to apply expensive chemical fertiliser.

In 1984 Rodolfo and Rosalea Gurro had to abandon their land in Dansolihon village, northern Mindanao, the Philippines, because of rebel activities in their area. When they returned 10 years later, a large landowner had occupied the farm. After much conflict they were granted a lease on just 1.7 hectares of the land that they had previously occupied.

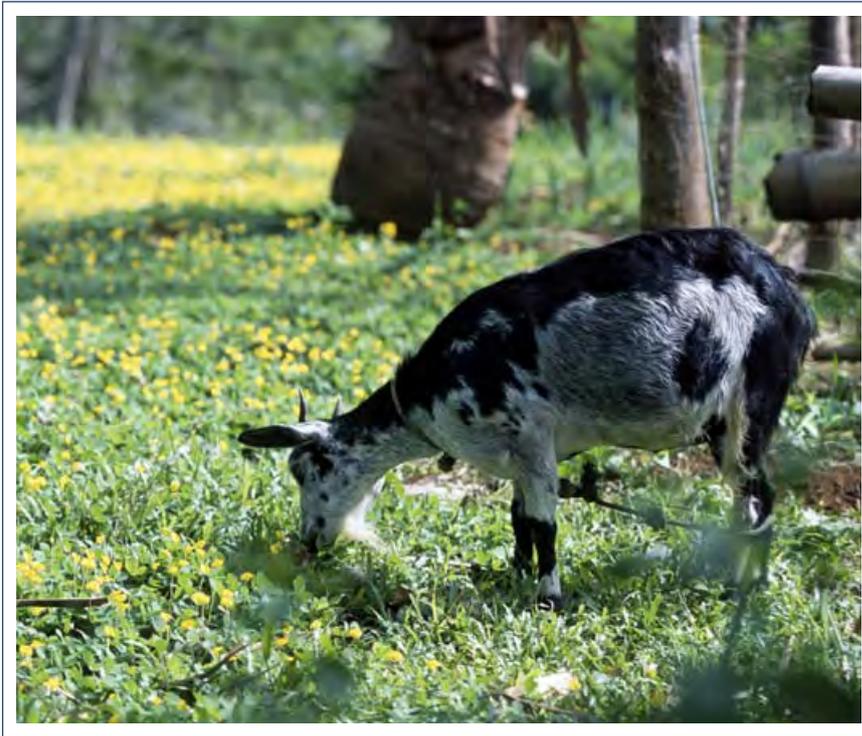
Rodolfo decided to grow maize but, with just one buffalo remaining after their exile, it was impossible to plough all their land. Furthermore, to maintain reasonable maize yields, they had to apply expensive chemical fertiliser. It became clear that they could not rely on maize as their sole source of income.

Fruit trees were Rodolfo's long-term hope for a sustainable livelihood, but the family needed income while the fruit trees were establishing. So they replaced some of the maize land with gardens to grow vegetables for sale, and they also started to raise livestock.

■ Diversifying into raising goats

Initially, Rodolfo and Rosalie tried to raise cattle, but this took too much of their time and they did not have enough money to invest in more than one or two head. They needed livestock that required less labour and a smaller initial investment, so they bought one female goat and tried goat farming.

Rodolfo also started testing several different varieties of forage. He was particularly impressed with the growth of his neighbour's 'Napier' grass (*Pennisetum purpureum*) and planted it on some of his own land using cuttings. Each day he fed the goat with one load of fresh grass, and by the end of the first year his goat had produced two sets of twins.



Rodolfo and Rosalea could not afford the time or money needed to raise cattle, so they started with one female goat.

Encouraged by this success, Rodolfo obtained an additional four female goats on credit from the village cooperative and expanded the 'Napier' area to more than 0.5 hectare, almost one-third of the farm.

While the 'Napier' grass grew vigorously, Rosalea noticed that fewer twins were born when the goats ate only grass. Others in the village cooperative who had experienced similar problems suggested that they supplement the diet of their goats with legume leaf. So Rodolfo planted several blocks of the forage legumes *Arachis pinto* 'Itacambira', *Calliandra calothyrsus* 'Besakih' and *Desmodium cinerea* 'Las Delicias'. After the goats had been given a small amount of legume leaf every day, their feed intake, body condition and reproduction rapidly improved.

With so much extra feed available, Rodolfo no longer had to rise so early each morning. He tethered the goats close to the forage area so that he could cut

He tethered the goats close to the forage area so that he could cut forages and feed the goats easily.



With forages like *Arachis pintoi* planted on the farm, goats were easy to feed and became a productive enterprise.

forages and feed the goats easily. This eliminated the need to move them several times each day and allowed him to focus on his other farm work without interruption.

■ Maintaining the productivity of cut forages

After several years the 'Napier' grass plot started to turn yellow because the regular cutting had depleted soil fertility. Rather than resorting to expensive chemical fertiliser to solve the problem, Rodolfo now collects and returns goat manure to the forage fields once every 3 months. While this has not completely solved the problem, it has maintained productivity of the grass at a level sufficient for the needs of his current flock.



Once every 3 months Rodolfo applies six fertiliser sacks of goat manure to the forage plots to maintain productivity.

■ Easing the transition into horticulture

Rodolfo is now working towards his dream of developing fruit trees as a secure source of income. Over the past year he has had enough time to start planting mango trees on the sloping parts of the farm, and will continue to expand the area and types of trees. Even though he hopes fruit will become the main source of income for the family in the future, he will continue to raise goats. His aim is to have enough forage to feed 12–14 female goats and 2 male goats, providing the income they need to cover day-to-day expenses and their children's education.

Fifteen other farmers in Dansolihon village are using large areas of planted forage for raising goats and cattle. These farmers are all members of the village cooperative, which purchased goats and loaned them to its members.

Ruslan's story



Photos: JH

Makroman is just a short drive from Samarinda, the thriving capital of East Kalimantan province, Indonesia. Ruslan and his family moved there in 1974 as part of an early influx of transmigrants. Like most settlers, initially he planted field crops for quick returns. As they became more established, he was able to develop a small area of paddy on the swampy soils at the foot of his sloping land.

In 1990 the family obtained two cattle, and a year later three native goats, for share-raising (a system where farmers raise animals that belong to someone else—commonly, the profit from fattening or calf production is shared 50:50).

Forages planted as hedgerows through the upland crops captured nutrients washing from the sloping fields.





Ruslan was forced to rely on dryland agriculture to provide for his family, but the lateritic soils gave very low yields.

With no land for grazing, all the animals had to be handfed. Ruslan and his wife had to spend most of the afternoon collecting native grasses for feed. By the time this was done, they rarely had the time or energy to continue fieldwork, however urgent.

By the mid 1990s they began to experience serious problems on the farm. Field crops needed increasing fertiliser inputs just to maintain yields. Native grasses for feeding the livestock had become depleted, so the family had to travel much further afield to collect sufficient feed each day. Of most concern were declining rice yields in the paddy fields, which they eventually had to abandon.

Having to focus on the upland areas, Ruslan planted a small area of fruit trees, but these developed slowly in the poor lateritic soils of the farm. At this point Ruslan and his wife felt that they had exhausted all their options. They had little choice but to work harder for diminishing returns, hoping that, in time, the fruit trees would bear well.

With good quality forage available every day, their goats reached marketable size in 6 months, 2 months faster than before.

■ **Regaining livelihood security through goats**

Lack of feed limited goat production, one of the few low-risk options the family could afford. At about this time they received seed of some forage varieties from the livestock extension service, and Ruslan started planting forages as hedgerows through his upland crops. The hedgerows grew rapidly, capturing fertile soil and nutrients that washed from the slopes during storms. Seeing this, Ruslan expanded the forages as an understorey in the young fruit-tree orchard.

The immediate benefit of having forages on their farm was the saving of the half-day that Ruslan and his wife usually spent collecting grass. They used this saved time to focus more on the fruit trees and to build the fertility of their upland soils.

With good quality forage available every day, their goats reached marketable size in 6 months, 2 months faster than before. To capitalise on this opportunity, Ruslan obtained another five native goats and six milking goats from a livestock credit scheme. He built pens for the goats near the house. Over the next 6 years the flock produced 28 kids, of which 9 were returned to the credit scheme. The other 19 were sold for 200,000–300,000 rupiah each. The sale of one goat allowed the family to buy 250–350 kilograms of rice.

For 3 years Ruslan was also able to sell forage cuttings to other farmers in the village, bringing in an additional 2 million rupiah. Within a few years, of the 80 households in Makroman, 60 farmers planted forages, averaging 3,000 square metres per farm.

■ **Making a transition to fruit trees**

Ruslan is gradually converting all his sloping land from annual crops to fruit trees. As the fruit trees in one area mature, he replants the forages in new areas as hedgerows among the field crops. He has followed this cycle three times now but will soon run out of empty land. Goats are such an important source of regular income for the family that he will sacrifice some of his fruit trees for intensive production of forage.

Photo: JH



Goats fed on the forages provided vital income, allowing Ruslan's family to make the transition to growing fruit trees.

■ Windfalls and big expenses

The income from goat production and the availability of forages on their farm has allowed Ruslan and his wife to start fattening cattle. They bought one calf and sold it 6 months later for a profit of 2 million rupiah. Recently, they sold two fattened cattle and used the proceeds to rebuild their house.

The sale of forage cuttings has provided occasional windfalls. After one such sale, Ruslan's wife bought a set of crockery that she rents out for weddings and other large social events in the village. For Ruslan's family, forages have opened up new opportunities where previously there seemed to be little hope.

For Ruslan's family, forages have opened up new opportunities where previously there seemed to be little hope.

Windfalls from forages and livestock funded rebuilding of the house and the purchase of crockery, which Ruslan's wife rents out.



Photo: JH

Dansolihon village, Mindanao, the Philippines

Makroman village, East Kalimantan, Indonesia



Legumes for pigs

Making women's lives easier

This is the story of women farmers and their families from mountainous regions in northern Laos. Pigs are supplying a vital source of cash income and food for these families, as well as meeting ceremonial needs.

Women are responsible for raising the pigs. They used to spend 2–3 hours each day just gathering and preparing feed. Even so, finding and cutting enough green feed for pigs to



Photo: PH



Photo: PP

grow well was too time-consuming, with the result that most of their pigs were underfed and grew poorly.

The legume 'Stylo184', a reliable source of quickly gathered and nutritious green feed, was the key to improving the women's pig production. It reduced feed preparation time by more than one precious hour each day, and the increased supply of green feed doubled pig growth.

Sone's story



Photo: PP

Sone and her children would spend 2–3 hours each day collecting palatable green plants from the forest ...

Raising pigs as a form of savings is a very common practice among the diverse ethnic groups scattered throughout the mountainous regions of northern Laos. With an average of three to four adult sows per household producing litters of six to eight piglets, the sale of pigs contributes substantially to household income, especially for the poorest families.

In traditional systems the scavenging pigs are fed a diet of starchy foods (including cassava, maize and water yams) supplemented with rice bran and soft-leaved plants collected from the forests. These diets are highly deficient in protein and are in short supply for 3–4 months each year. To make the situation worse, disease epidemics frequently kill more than 70% of pigs in a village.

Sone and her husband Onkeo live in inaccessible Kieuw Nya village, 60 kilometres from the provincial capital, Luang Phabang. Her pig production system was typical of the village—the family normally raised four or five sows at a time to produce piglets for sale. During the day the sows roamed the village scavenging for food. Sone and her children would spend 2–3 hours each day collecting palatable green plants from the forest, which they would cook with rice bran, cassava and maize before feeding it to the pigs at night. Sone also fattened the piglets she could not sell at 30 kilograms. On the traditional diet it could take 10 months for these piglets to reach a saleable weight of 60 kilograms.

■ Improving survival and growth of piglets

Sone and Onkeo joined a small group of farmers in the village that started evaluating the forage legume *Stylosanthes guianensis* 'Stylo184' as a supplement for their pigs. 'Stylo184' is rich in protein, grows well in poor soils and can be fed

Photo: PH



Fifteen farmers in Sone's village started growing 'Stylo184' in small plots to feed their pigs.

directly to pigs without being cooked. Most importantly, it grows well in the early part of the wet season when rice bran, maize and cassava are in short supply.

By supplementing the pigs' diets with a few handfuls of 'Stylo184' each day, the time taken to fatten pigs from 30 to 60 kilograms dropped from 10 to 6 months. Furthermore, the time needed to collect and prepare the 'Stylo184' dropped to less than 30 minutes each day.

With these promising results, Sone decided to confine the pigs in pens. This made it easier to provide better feed and health care. Free-range sows typically had litters of six to eight piglets, of which only two or three would survive. With confinement, most piglets survived, a threefold increase in productivity.

In their traditional system of raising pigs, the main limitation to production in Sone's family had been the amount of labour needed to collect and cook the fresh green feed. With a readily available source of green feed in 'Stylo184' and with the pigs confined in pens, the family has been able to manage more animals (14 pigs in 2005), providing more than half of the family's income.

Confining the pigs and providing better feed has not completely resolved the problem of diseases, but it has meant that Sone and Onkeo can sell their piglets

With a readily available source of green feed in 'Stylo184' and with the pigs confined in pens, the family has been able to manage more animals ...

sooner, reducing the risk of losing them in an epidemic. It has also meant that they can afford to buy veterinary inputs. They have now started to select and separate some of the better piglets and fatten them before sale.

A few handfuls (500 grams each) of fresh 'Stylo184' each day almost halved the time needed to fatten piglets.



Photo: PH

By confining piglets and feeding them with 'Stylo184', many more survived.



Photo: PH

Phao Kai's story



Mrs Phao Kai lives in Pik Noi village, which is closer to Luang Phabang than Sone and Onkeo's village. Being close to town, she saw an opportunity for fattening pigs for the city market. She started buying young pigs, weighing about 20 kilograms, from farmers like Sone, and fattening them on wild water yam, leafy plants collected from the hills and rice bran. Feeding the pigs took 2–4 hours each day, and it required more than 10 months to fatten a pig to the marketable weight of 60 kilograms.



Feeding young pigs with a mix of rice bran and 'Stylo184' halved the time to marketable weight.

Instead of selling 3 pigs a year, she now sells 12, quadrupling her output.

Phao Kai wanted to reduce the amount of labour she put into pig production, so she planted plots of *Stylosanthes guianensis* 'Stylo184' and sweetpotato near the pig pens.

With the extra feed available from her forage plots, Phao Kai could now feed a batch of six pigs at a time instead of only two. Furthermore, she has found that by feeding the pigs with legume leaf, sweetpotato tubers and vines, she can fatten a pig to 60 kilograms in just 5–6 months. This means that she can produce two batches of pigs a year. Instead of selling 3 pigs a year, she now sells 12, quadrupling her output.

Phao Kai's experiences have changed the perception of pig raising in the village from being a sideline activity to being a profitable enterprise. Of the 65 households in the village, 16 are planting 'Stylo184' and other feeds to fatten pigs.

In northern Laos confining pigs and feeding them with small amounts of 'Stylo184' doubles growth rates.



Photo: PP

Other farmers in northern Laos

A recent survey of 30 pig farmers in 11 villages in northern Laos found that the growth rate of their pigs doubled, from 100 grams per day on traditional feeds to 200 grams per day when supplemented with an average of 300 grams of fresh 'Stylo184' leaf each day. This resulted in a halving of the time needed for fattening pigs to marketable weight. The time spent collecting fresh feed dropped from 90 to just 20 minutes per day when 'Stylo184' was available near the house.

By the end of 2007 there were more than 1,400 farmers like Phao Kai and Sone developing ways of using 'Stylo184' as a supplement for feeding village pigs. Most



Kieuw Nya and Pik Noi villages,
Luang Phabang province,
northern Laos

feed it to their pigs fresh, but some are producing leaf meal to use in the dry season when other sources of fresh leaf are not available.

Many farmers improved their pens and feed troughs, and installed water nipples so that pigs could drink water all day. Many also started to produce their own 'Stylo184' seed so that they can replant their fields every 3–4 years and maintain good levels of legume production.

Farmers in different regions of South-East Asia are producing leaf meal from 'Stylo184' for use in the dry season.



Photos: PP (top left) and SP

Feeding the hungry fish

... not just the buffaloes

Leun and his family (below) make a living from tea, cassava, maize, paddy rice and fish on a very small farm nestled among the hills in Tuyen Quang province, Vietnam. Agriculture on the farm is very intensive and market oriented.

They stock their fish pond with grass-eating carp, which eat soft leaves from grasses and crops. Collecting this feed took many hours each day, so Leun's family grew fish only for home consumption.



Photos: JH



Leun, and other innovative farmers like him, discovered that new grass species, originally introduced for buffaloes, were suitable for grass carp. They made the most of this discovery, with amazing results.

'You don't hear the cries of your hungry fish' so you don't pay much attention to feeding them.

Leun's story



Photos: JH

There is little vacant land in Yen Son district, Tuyen Quang province, Vietnam. The hillsides are covered with forests, tea plantations, cassava and maize, and the valleys are jammed with paddy fields. Agriculture is so intensive that the farmers faced a dilemma—they could not find enough native grass to feed the buffaloes that were essential for ploughing the paddies. Over a period of 2 years, 50 farmers evaluated forage varieties as a possible solution. After much experimentation, they concluded that it was not worth allocating their valuable land just to grow forage. 'If our buffaloes get thin in the dry season, it doesn't really matter because they'll fatten again in the wet season.'

But the story didn't end there. Two inquisitive farmers started feeding forage grasses to their fish. Their experiences are now changing the lives of thousands of farmers in Tuyen Quang and other provinces of Vietnam. This is the story of one of them.

■ Farming fish: good potential but no feed

The short, steep-sided valleys of Yen Son are ideal for small farm ponds, and fish farming is common. Mr Dao Van Leun had a single fish pond but it was not a profitable activity for the family. As a local saying goes, 'You don't hear the cries of your hungry fish', so you don't pay much attention to feeding them well. He raised common carp and tilapia, which took about 3 years to reach 0.5 kilogram bodyweight.

In 1993 the extension service introduced Chinese carp, which grow more rapidly than common carp. Leun added these to his pond and was able to harvest 50–60 kilograms of fish of about 1.0 kilogram bodyweight each year. Grass-eating carp can, however, consume very large quantities of feed—as much as 60–70% of

their bodyweight in fresh grass each day. Collecting grass to feed the fish became a significant daily chore for the family.

Grass for feeding to fish needs to be softer than that for buffaloes, so the family had to collect grass from many different areas. Leun and his wife would go by bicycle to the hills and collect two baskets of grass (40 kilograms each) for the buffalo. After school their three children would collect a smaller basket (15 kilograms) of softer grasses for the fish.

As good-quality grass was scarce, this work would often take up half the day. Eventually, the family could no longer sustain the effort, and they were forced to sell one of their two buffaloes, and feed their fish with what little grass and crop by-products (leaves of banana and cassava) they could find.

■ Forages enabled profitable fish farming

While Leun had initially tested new forage varieties to feed his buffalo, he was naturally inquisitive and wanted to see if forages could be used to feed his fish. Grass-eating carp feed on the surface, so he selected two varieties with soft, broad leaves that floated on the top of the pond—*Panicum maximum*



With grasses planted near the family's fish pond, collecting feed takes only 30 minutes each day instead of many hours.

Leaves of the forage grasses are broad and soft, and float on the surface of the pond where the fish feed.



Photos: JH

Feeding on forage grasses, the average size of fish harvested from the pond has doubled.



'Simuang' and *Paspalum atratum* 'Terenos'. The fish devoured this new feed, so Leun gradually expanded the area of these two varieties to 1,000 square metres, planting the grasses on the sloping land around his fish pond and paddy fields.

As grass-eating carp need soft, fresh leaves, Leun managed his plots to ensure that the forage he cut was no more than 7–10 days old. He also increased the annual stocking rate of grass carp fingerlings in the pond from 10 to 40 kilograms. With the larger forage area, careful cutting management and higher stocking rate, the productivity of the pond tripled to 170 kilograms of fish per year. Equally important, collecting grass now only took 30 minutes each day.

At first, local merchants were suspicious. The fish coming from the village were so big and heavy that they thought the farmers were stuffing them with gravel! Soon, fish from the village were actively sought by merchants and became a regular source of income for Leun's family. The pond was stocked each March and

The fish coming from the village were so big and heavy that merchants thought the farmers were stuffing them with gravel.



Fish are sold to local traders and, unlike cattle and buffaloes, also provide food for the family.

Use of forages led to increased income and more food on the table.



Photo: JH

Of the 96 households in the village, about half have fish ponds and all of these now grow forages.

harvested in December, when the price tended to be the highest, providing an income of just over 2 million dong, equivalent to the income from selling a calf.

Leun now actively manages the productivity of his forage plot by fertilising it with urea and liquid pig manure.

■ Profitable fish created new opportunities

Having become convinced of the value of forages, Leun started planting *Brachiaria brizantha* 'Marandu' (a grass that can tolerate long periods without rain), specifically for feeding his buffalo during the dry season.

Of the 96 households in the village, about half have fish ponds and all of them now grow forages. Like Leun, many are also using forages to feed other livestock.

There are other significant benefits for the family that are more difficult to quantify. Now that the children don't have to collect feed after school, they are not as tired and have more time to study. Leun's wife is a teacher and has seen the improvement in her children's grades.

Next year one of their sons will go to the provincial capital to study in the higher grades at school. Had it not been for the forages, the family would have needed his labour at home to maintain fish and buffalo production, and he would not have been able to continue his schooling unless they sold their last buffalo.

Other Tuyen Quang farmers

With many farmers raising fish, a small market for the sale of grass cuttings has arisen as other farmers establish plots of their own. In the first year after establishing his forage plot, Leun was able to sell 9 million dong worth of cuttings.

A recent study of 30 randomly selected farmers who were raising fish in Yen Son found that using forages saved them between 200 and 700 hours of work in each production cycle. The majority of these farmers doubled the stocking rate of carp fingerlings in their ponds to take advantage of the extra feed. The median fish production per 100 square metres of pond doubled as a result of using

... as a result of using forages, the benefit:cost ratio of the fish production system increased by approximately 70%.



Yen Son district, Tuyen Quang province, Vietnam

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Eight years after the two Yen Son farmers made their first tentative evaluations of forages for feeding fish, there are now 1,700 farmers growing forages in this and neighbouring districts. More than 500 of these were using forages to feed fish, and the numbers are rapidly expanding. This was an unexpected outcome and emphasises the importance of encouraging farmers to innovate with new technology options, even at the early stages of introduction. It also showed that the introduction of the grass carp alone was not sufficient to make fish farming profitable as feed was limiting productivity. Planting forages resolved this constraint.

■ Making money from fingerlings

With the improved productivity of fish in the area, the demand for fingerlings increased and Mr Canh (right) and Mr Binh saw an opportunity to make money from fingerlings. Canh has only a small pond (200 square metres), but it has a fresh water supply. This allows him to raise fry from the hatchery to fingerlings, which he sells to farmers at 35,000 dong per kilogram. He feeds the fry for 2 months on a concentrate and then changes to 10-centimetre-long forage tips.

Binh buys fingerlings from Canh and continues to feed them on the forage tips to become young juveniles. He sells these to other farmers at 16,000 dong per kilogram. He also uses them to stock his own pond. Since he started using forages, the productivity of his pond has increased from 200 to 500 kilograms of fish annually. 'Now that I have a profitable fish system, I have time to think about the future of my family and explore other options', he says.



Photos: JH



Escaping from slash-and-burn

Beating the labour–productivity trap

Jonggor's family (pictured) lives in Kieuw Talun Nyai village in northern Laos. The family grew barely enough upland rice for themselves using slash-and-burn methods. Producing rice in this way took all their labour and left them little time for other livelihood activities. They were caught in the classic labour–productivity trap of shifting cultivation.

Jonggor tried to escape this trap by buying a cow and two calves so he could sell calves regularly. Sadly, he found that the amount of labour needed to look after these animals was more than the family could manage, and the calves did not thrive.

Planting forage grasses proved to be the solution to his problem. Jonggor now produces many calves for sale and is able to buy most of the rice needed by his family. Now they have time to use for more productive enterprises.



Photo: JH

Jonggor's story



Photos: JH

Kieuw Talun Nyai village sits on top of a high ridge in the mountainous northern region of Laos. The villagers rely on an annual cycle of slashing and burning the steep slopes from February to April, planting rice into the bare soil in May and June, and constantly weeding through the wet season until the crop is harvested in November. It is a hard life, with many risks, including failure of the rains, too much rain and weeds overwhelming the rice crop.

Each year Jonggor Her's family would plant 2 hectares of rice. Once the cycle began the family could not stop—not for bad weather, poor health or lack of energy. Even after the birth of each of her children, Jonggor's wife Yuneng Hun would return to work in the steep fields within a month, with the baby strapped to her back. At the end of all this effort they would have produced barely enough rice to feed the family for a year.

Cattle: a way out of the labour trap?

Realising that there was no future for his family in labour-intensive slash-and-burn agriculture, Jonggor bought a cow and two calves. His plan was to build up a small herd of cows and sell the calves born each year to reduce the family's dependence on growing upland rice.

Jonggor found that there were many times when the cattle had to be kept near the house (such as when the cow was about to give birth or during the season when ticks are common in the forest). At these times he had to spend 2–3 hours each day collecting just one load (50 kilograms) of feed. 'This one load was enough just to keep my animals alive', he said.



Jonggor's family used most of their labour in their slash-and-burn fields but produced barely enough rice to survive.

The underfed cows gave birth to weak calves that struggled to survive when they returned to the forest. In the first 4 years after buying cattle, two of the four new calves died from malnutrition. The herd had barely increased in size and the family had a significant extra labour burden.

■ Making cattle more productive

In 1997 Jonggor asked to be involved in an evaluation of new forage varieties being offered by the district extension service. As he had no experience with forages, he planted them in small plots near the house where he could observe them each day. With 250 square metres of forages just 5 minutes' walk away, Jonggor was able to cut two loads of feed each day for his cattle, instead of one, and it took only 30 minutes. With more feed available, the cow produced a strong healthy calf and had plenty of milk to feed it.

Jonggor used to spend 2–3 hours each day collecting one inadequate load of feed from the forest for his cattle.

With more and better quality feed, all the calves now survive and the herd has grown to 15 head in 6 years



Having forages nearby doubled the amount of feed cut each day and reduced the collecting time to just 30 minutes.





Jonggor uses his motorcycle to purchase veterinary medicines for other farmers in the village.

After this initial success, Jonggor expanded the forage area to 1,800 square metres. With more and better quality feed available, the impact on the family's herd has been dramatic. Since Jonggor started using the forages, every calf born has survived and the herd has increased over 6 years to 5 cows and 10 calves. Without forages and with only native grass from the forest, he would have been able to maintain only 2 cows.

■ Leaving slash-and-burn behind

In addition to increasing the size of his herd, Jonggor has sold six male calves over the past 3 years. With the income from these sales, he bought rice for the family. Once this most basic of needs had been met, he was able to also buy a small motorcycle.

By purchasing rice with income from cattle, Jonggor was able to reduce the area of slash-and-burn rice production from 2 hectares to 0.5 hectare. He now intends to start planting and selling cucumbers, which require less weeding than rice.

Yuneng no longer spends all her time weeding the fields, and has been able to start a small business making embroidery for sale. This now earns more income than the value of all the rice they produce from the slash-and-burn fields.

Providing better nutrition for their cows improved survival of the calves. This opened the door for new enterprises, allowing Jonggor and Yuneng to start leaving slash-and-burn farming behind.

The family now buys most of its rice, freeing up time for Yuneng to start a profitable business making embroidery.



Photo: JH

Other Kieuw Talun Nyai farmers

About half of the 110 households in Kieuw Talun Nyai village are now growing and using forages to feed their cattle, pigs and goats. Four other farmers in the village have used the income from livestock to reduce slash-and-burn rice production, and others are about to follow Jonggor's lead.

As the number of livestock increased and started to provide substantial income in the village, the farmers became more interested in looking after their health. Being handfed, the cattle were tame and it was easy to monitor their health and

Being handfed, the cattle were tame and it was easy to monitor their health and provide medication.



Kieuw Talun Nyai village, Luang Phabang province, Laos



provide medication. Jonggor now uses his motorcycle to ride 2 hours down the mountain to the Provincial Livestock Department to purchase veterinary medicines for all the farmers in the village.

For more information

There are many resources that provide information on tropical forages and livestock production. A small selection of these is listed below as a starting point.

For information on selection, management and usage of tropical forages:

Cook B., Pengelly B., Brown S., Donnelly J., Eagles D., Franco A., Hanson J., Mullen B., Partridge I., Peters M. and Schultze-Kraft R. 2005. Tropical forages: an interactive selection tool. CSIRO Sustainable Ecosystems, Department of Primary Industries and Fisheries, Centro Internacional de Agricultura Tropical and International Livestock Research Institute: Brisbane, Australia.
<<http://www.tropicalforages.info>>

Horne P.M. and Stür W.W. 1999. Developing forage technologies with smallholder farmers: how to select the best varieties to offer farmers. ACIAR Monograph No. 62. Australian Centre for International Agricultural Research: Canberra, Australia; and International Center for Tropical Agriculture: Vientiane, Laos.
<<http://www.aciar.gov.au/publication/MN62>>

Stür W.W. and Horne P.M. 2001. Developing forage technologies with smallholder farmers: how to grow, manage and use forages. ACIAR Monograph No. 88. Australian Centre for International Agricultural Research: Canberra, Australia; and International Center for Tropical Agriculture: Vientiane, Laos.
<<http://www.aciar.gov.au/publication/MN088>>

International Center for Tropical Agriculture (CIAT) website:
<<http://www.ciat.cgiar.org/forrajes/index.htm>>

Australian Centre for International Agricultural Research (ACIAR) website:
<<http://www.aciar.gov.au/>>

For information on participatory approaches to developing forage technologies:

Horne P.M. and Stür W.W. 2003. Developing agricultural solutions with smallholder farmers: how to get started with participatory approaches. ACIAR Monograph No. 99. Australian Centre for International Agricultural Research: Canberra, Australia; and International Center for Tropical Agriculture: Vientiane, Laos.

Participatory Research and Gender Analysis (PRGA) website:

<<http://www.prgaprogram.org/>>

International Center for Tropical Agriculture (CIAT) website:

<<http://www.ciat.cgiar.org/ipra/ing/index.htm>>