

RCHREWARDS BERZ

Research in Indonesia is exploring how smallholders can increase rubber production, retain biodiversity and provide additional environmental benefits





The World Agroforestry Centre, an autonomous, non-profit research organization, aims to bring about a rural transformation in the developing world by encouraging and enabling smallholders to increase their use of trees in agricultural landscapes. This will help to improve food security, nutrition, income and health; provide shelter and energy; and lead to greater environmental sustainability.

We are one of the 15 centres of the Consultative Group on International Agricultural Research (CGIAR). Headquartered in Nairobi, Kenya, we operate six regional offices located in Brazil, Cameroon, India, Indonesia, Kenya, and Malawi, and conduct research in eighteen other countries around the developing world.

We receive our funding from over 50 different investors. Our current top ten investors are Canada, the European Union, Finland, Ireland, the Netherlands, Norway, Denmark, the United Kingdom, the United States of America and the World Bank.



RICH REWARDS FOR

Research in Indonesia is exploring how smallholders can increase rubber production, retain biodiversity and provide environmental benefits



© World Agroforestry Centre, Nairobi, Kenya, 2011

Suggested citation: Pye-Smith C. 2011. RICH REWARDS FOR RUBBER? *Research in Indonesia is exploring how smallholders can increase rubber production, retain biodiversity and provide additional environmental benefits*. ICRAF Trees for Change no.8. Nairobi: World Agroforestry Centre.

ISBN 978-92-9059-299-0

Publisher: World Agroforestry Centre

Author: Charlie Pye-Smith

Supervision: Paul Stapleton

Editor: Betty Rabar

Design and Layout: Reagan Sirengo

Cover photo by Charlie Pye-Smith

All photographs by Charlie Pye-Smith except page 11 by Eric Penot

Front cover: Since the end of the civil war in Aceh, farming communities have had better access to highquality rubber and cocoa seedlings. Members of a women's group in Meunasah Krueng.

This booklet may be quoted or reproduced without charge, provided the source is acknowledged. No use of this publication may be made for resale or other commercial purposes.

All images remain the sole property of their source and may not be used for any purpose without written permission of the source.

World Agroforestry Centre United Nations Avenue, Gigiri P. O. Box 30677-00100 Nairobi, Kenya. Phone + (254) 20 722 4000 Fax + (254) 20 722 4001 Via USA phone (1-650) 833-6645 Via USA fax (1-650) 833-6646 Email: worldagroforestry@cgiar.org Website: www.worldagroforestry.org



	Page
Introduction	iv
RUBBER MATTERS	1
The changing patterns of land use	2
RESEARCHING THE ALTERNATIVES	11
Adopt and adapt	13
Do these rubber systems make economic sense?	16
THE SEEDS OF CHANGE	19
Spreading the message	20
Further afield	22
THE PRICE OF PROGRESS?	26
But what is it actually worth?	27
Acknowledgements	31

Foreword

In the mid-1990s, the landscape in many parts of Sumatra and Kalimantan was undergoing rapid change. International agencies such as the World Bank were promoting high-yielding monocultural rubber plantations and these were beginning to replace traditional, species-rich jungle rubber gardens on many smallholdings.

Monocultural plantations provided farmers with higher yields and better incomes than jungle rubber. But there were disadvantages too. Converting jungle rubber to monocultural plantations required considerable capital investment, and the shift to more intensive systems of rubber production was causing significant loss of biodiversity.

These trends prompted the World Agroforestry Centre and its partners to devise alternative systems of rubber agroforestry which would improve smallholder yields and incomes, yet retain a good measure of some biodiversity. Over the next decade, scientists tested a range of systems, selecting technologies that were appropriate for smallholders who had relatively little cash, limited family labour and small landholdings.

The various rubber agroforestry systems which we researched and promoted have proven to be highly attractive to tens of thousands of smallholders. All achieve higher returns to labour than jungle rubber, at investment costs substantially below those of monoclonal smallholder systems. Furthermore, some provide higher returns to labour than the best monoclonal systems, at





a lower investment cost. Some of these rubber agroforestry systems provide farmers with fruits, timber, resins and medicinal plants, as well as latex. They also act as an important refuge for biodiversity, even if they are not as rich in wildlife as jungle rubber.

However, there is no getting away from the fact that the area under jungle rubber is likely to decrease further, as farmers convert their land to more profitable uses. During recent years, our scientists have been looking at the possibility of establishing reward systems which could encourage some farmers to retain their jungle rubber and the important ecosystem services they provide. As this booklet shows, this remains a work in progress.

We are grateful to our many partners in this innovative work, including the Indonesian rubber research community, CIRAD and the many organizations which have provided support for our research on rubber agroforestry. Special mention goes to the Common Fund for Commodities, the UK Department for International Development (DFID), the International Fund for Agricultural Development (IFAD), the United Nations Environment Programme (UNEP), the European Union, the Canadian International Development Agency (CIDA) and Bridgestone Japan.

Dennis Garrity Director General World Agroforestry Centre

Around 80% of Indonesia's latex is produced by smallholders.

Abdul Roni is among the thousands of farmers in Sumatra to benefit from the World Agroforestry Centre's rubber research. MATARAM SULT

Introduction

Like most farmers in the Indonesian province of Jambi, Abdul Roni used to make a meagre living from his rubber gardens, just enough to keep his family in clothes and food, but not enough to pay for the children's education or much else. However, his life began to change for the better when scientists from the World Agroforestry Centre encouraged him to replace some of his low-yielding 'jungle rubber' gardens with a different form of rubber agroforestry.

"I changed the way I manage my land," he says. "In 1996, I cleared the jungle rubber, planted high-yielding clonal varieties and learned how to space my trees, weed between the rows and control disease. I also started to use fertilizer, something I'd never done in the past." Five years later, he began to tap his young rubber trees, and today his yields are three times higher than they were before. He has also planted timber trees among the rubber and these will provide wood to build homes for his children.

A few days before Roni showed us round his rubber gardens in Sepunggur village, Bungo District – he arrived on a new Honda scooter – he had sold 200 kg of wet rubber at the local auction market for 3.4 million rupiah (US\$ 377), a considerable sum of money in rural Indonesia.



▲ A block of wet rubber, awaiting transport to the auction market in Bungo District.

This was his harvest for two weeks from 2 hectares of rubber garden. His three eldest children were born too soon to benefit from his new higher-yielding rubber system, but the remaining four have been more fortunate. "I've been able to pay for my fourth child to go to university, and I'm earning enough money now, from the rubber and

other businesses, to pay for the education of the youngest three," he says.

2

The shape of things to come?

Roni is one of many hundreds of farmers in Sumatra to benefit from a series of research programmes managed by the World Agroforestry Centre, the Centre de coopération internationale en recherche agronomique pour le développement (CIRAD) and the Indonesian Rubber Research Institute. The research began in the mid-1990s, by which time many millions of dollars had already been spent by agencies such as the World Bank and the Asian Development Bank on the promotion of high-yielding monoclonal rubber plantations. In



A High-yielding clonal rubber grafts in a village nursery.

Bungo district and elsewhere, these were beginning to replace traditional jungle rubber systems on many smallholdings.

"The monoclonal plantations gave farmers much higher yields than jungle rubber gardens, and therefore better incomes," says Suseno Budidarsano, an economist based at the World Agroforestry Centre's Indonesian headquarters in Bogor. "But there were also some disadvantages. For one thing, they required considerable capital investment – which many households could not afford."

The conversion of jungle rubber to more intensively managed rubber and oil palm plantations was also causing significant losses of biodiversity. Intensively managed plantations are the equivalent, in arboreal terms, to a field of maize or rice. In contrast, traditional jungle rubber supports hundreds of woody species and provides a rich habitat for fauna and flora, as well as a wide range of products which smallholders can use or sell.

Jambi and other rubber-growing parts of Sumatra and Kalimantan – Indonesian Borneo – were witnessing rapid change when the research began. Both natural forests and traditional jungle rubber gardens were under threat, and this prompted the World Agroforestry Centre and its partners to ask whether it was possible to devise alternative systems of rubber agroforestry that would do two things: improve smallholder yields and incomes, and at the same time retain some of the biodiversity typical of jungle rubber.



1: RUBBER MATTERS

Natural rubber is one of Indonesia's most important crops, covering around 3.5 million hectares of land, mostly in Sumatra and Kalimantan.

About 7 million Indonesian farmers gain some or all of their income from growing and selling rubber. Figures from 2000 to 2005 reveal that smallholders dominated rubber production, managing just over 85% of the area under the crop and producing 81% of the latex. Government-owned plantations accounted for 6.3% of the area under rubber and large coals private plantations 0.20%

large-scale private plantations 8.2%.

Farmers first began to plant rubber in Indonesia in the early years of the 20th century. They established the crop using slash-and-burn techniques on logged-over forest land or cropland which had been left fallow. Most farmers used seedlings wildings - uprooted from mature rubber gardens when they wanted to establish new gardens or reinvigorate old ones. Once the seedlings began to flourish, they allowed other species to regenerate, thus leading to the creation of species-rich jungle rubber gardens which provided latex for sale and various other products that could be used or sold, such as rattan, resin, bamboo and medicinal plants.



▲ Under the traditional system, farmers plant seedlings uprooted from mature rubber gardens. These 'wildings' are ready to be planted out.

After 25 years or so, rubber gardens become progressively less productive. Farmers then have two options. They can clear their ageing rubber gardens and replant with new seedlings, either local wildings gathered from existing plantations or high-yielding clones of the sort which increasing number of farmers are now using. This is known as the cyclical rubber agroforestry system. Or they can leave their jungle rubber gardens intact and fill the gaps left when old or diseased rubber trees are removed or die by planting young seedlings. This system is known as *sisipan*.

"Farmers are often reluctant to practise the cyclical rubber agroforestry system," explains Janudianto, a soil scientist at the World Agroforestry Centre. "To clear an old rubber garden and establish a new one requires considerable investment, and farmers also have to forego any income from rubber for at least five years."

For these reasons, smallholders in Indonesia have traditionally practised the *sisipan* system. It requires less investment and less labour, but it suffers from one major defect: productivity is very low. Take, for example, the experience of Roni. "When I had jungle rubber, I used to get around 1200 kg of wet rubber per hectare per year," he says, "and that was average for round here." Now, using one of the rubber agroforestry systems promoted by the World Agroforestry Centre, he gets three times as much.

The changing patterns of land use

6

The last few decades have seen a dramatic change in the way land is used over much of Indonesia, with Sumatra being at the forefront of a land-use revolution. Bungo District, where the World Agroforestry Centre has conducted much of its rubber research, provides a microcosm of the changes which have taken place in Jambi province and many other parts of Sumatra.

In 1973, tropical forests rich in biodiversity covered 75% of the land surface. By 2005, they covered just 30%. In 1973, rubber agroforestry occupied 15% of the land and monocultural rubber accounted for 2%. By 2005, monocultural rubber, much of it in the hands of private companies and the government, covered 27% of Bungo district's land surface, and rubber agroforestry less than 11%. However, the reality is not as simple as the figures imply, for rubber is grown under a range of different intensities, with monocultures at one end of the scale and jungle rubber at the other. (See box 1: Rubber's range.)

The increase in the area under intensive rubber cultivation is one reason why the area under extensive, low-input production – in other words, jungle rubber – has decreased.

However, oil palm plantations have also been established at the expense of jungle rubber. In 1973, oil palm was grown on just one out of every hundred hectares in Bungo district. Today it is a major land use, covering 20% of the district. Similar changes have been seen throughout the rest of Sumatra and in many parts of Kalimantan. Between 1995 and 2008, the area under oil palm increased fivefold in Indonesia. It is estimated that around 7.65 million hectares of land has been converted to oil palm estates, and permits have already been issued to develop a further 6.5–7.0 million hectares.



▲ Under threat? Jungle rubber systems are under threat from oil palm development and monoclonal rubber plantations.

These land-use trends have serious implications for the jungle rubber system still practised by a significant portion of the 45,000 households in Bungo district, and millions elsewhere

in Indonesia, who gain much or all of their living from the sale of latex.

8

"We wanted to explore whether it was possible to bring about moderate increases in yield by introducing new clones and better management, without burdening farmers with high costs, and without causing a great loss of biodiversity," explains Suseno. The researchers also wanted to establish whether farmers could be rewarded for establishing rubber agroforestry systems which provided environmental benefits, such as biodiversity conservation, which are lost under more intensive systems of land management.



Ratna Akiefnawati, the World Agroforestry Centre's field manager in Jambi, has worked closely with rubber farmer Abdul Roni.



Rubber's range

The World Agroforestry Centre has classified rubber-based systems in Indonesia according to their intensity of management, as illustrated by the photographs on the opposite page. Intensively-managed monoculture rubber plantations contain less than 1% non-rubber trees, none of which have been planted deliberately. Simple mixed rubber agroforests contain up to one-third non-rubber trees, which have been deliberately planted or retained, between five and 20 non-rubber species greater than 2 m in height and 5–20 non-rubber trees as tall as, or taller than, the rubber trees.

In complex rubber agroforests at least a third of the trees belong to species other than rubber. They contain over 20 non-rubber species higher than 2 m and over 20 non-rubber trees as tall as, or taller than, the rubber. Finally, there are the very complex rubber systems known as jungle rubber. *Kebun karet tua* in Jambi and *Tembawang* in West Kalimantan are examples of this. At least two-thirds of the trees will be non-rubber species, and their products – fruit, resin, timber, medicines – may be more important to smallholders than rubber latex. Old jungle rubber is the last stage before it is cleared and replanted with rubber or other crops.

Simple mixed rubber agroforests contain up to one-third nonrubber trees.

line i

1055

2: RESEARCHING THE ALTERNATIVES

Early research on rubber agroforestry in Indonesia was conducted by CIRAD, with whom the World Agroforestry Centre subsequently formed a close relationship when it began to explore the issue in the mid-1990s. Working with scientists from CIRAD and the Indonesian Rubber Research Institute, Ratna Akiefnawati and her fellow researchers, including Ilahang in West Kalimantan, collaborated with more than 150 farmers over the following decade, testing a range of rubber agroforestry systems in Jambi, West Sumatra and West Kalimantan.

"One of our main considerations was selecting technologies that would be suitable for smallholders," recalls Ratna. "This meant they had to work for households who had little cash and limited family labour, small land holdings, and little or no access

to high-yielding planting materials and other inputs."

The scientists devised three rubber agroforestry systems (RAS) with the objective of intensifying, to varying degrees, the low-yielding systems practised by most farmers at the time.

The least intensive – RAS 1 – was similar to the existing mixed rubber system, with one notable difference.



A young rubber plantation intercropped with upland rice.

Farmers used high-yielding clones rather than low-yielding wildings. To reduce the cost of establishing RAS 1 rubber gardens, they planted food crops between the seedlings during the first year. The only weeding was carried out within the rows of rubber, with natural vegetation being allowed to grow below rows. Farmers were also encouraged to select and promote other valuable species, relics of the old jungle rubber system. These could include fruit, timber and resin-bearing trees.

12

RAS 2 was a more complex agroforestry system which involved planting timber and fruit trees as well as rubber trees, at a density of 550 rubber trees to 90–250 non-rubber trees per hectare. This was a more intensive system than RAS 1, requiring higher levels of weeding and the regular application of fertilizers. Farmers were encouraged to plant upland rice and other marketable food crops during the first two or three years, while the trees were being established.

The demonstration plots in Jambi fell under these first two categories. The third system devised by the World Agroforestry Centre – RAS 3 – was used to rehabilitate degraded grasslands in Kalimantan. Like RAS 2, this was a complex agroforestry system with rubber and other trees planted at similar densities. After the first year, farmers planted leguminous cover crops and perennial tree crops to shade out the *Imperata* grass.

The farmers provided the land and labour, and the research organizations the expertise and materials, including clonal rubber. Scientists conducted a range of trials, investigating the suitability of different clonal varieties, different frequencies of weeding and fertilizer use, and different spacing configurations for rubber and other tree species. They also studied how different annual and perennial crops fared under RAS 1 and RAS 2 and conducted experiments on tapping frequency.

Adopt and adapt

"The research programme started with three distinct rubber agroforestry systems, but many farmers didn't follow all the protocols," explains Laxman Joshi, a forester who was in charge of the programme during its second phase, from 2004 to 2009. "For example, they might have adopted a different weeding intensity than the one recommended, or used more or less fertilizers." By the time the second phase of the programme began, the scientists were able to identify nine different variations of management within the three RAS types. Five fell within RAS 1, two within RAS 2 and two within RAS 3.

There were several reasons why farmers didn't stick to the protocols, and these varied from one area to another. In Jambi, farmers were particularly eager to limit damage to their clonal rubber caused by wild pigs. Although wild pigs do not eat rubber saplings, they frequently dig up the ground in search of tubers and destroy the plants. Wild pigs are particularly plentiful in Jambi, where the population is predominantly Muslim. In Kalimantan, the demonstration sites were seldom bothered by pigs because the predominantly Christian, pig-eating Dayaks have kept their numbers in check. As it happens, Abdul Roni suffered little damage from wild pigs as they are a favourite dish of a neighbouring Batak community. He decided, nevertheless, to adopt more intensive practices, including the use of fertilizers, as he was keen to maximize his yields.

"We found that when farmers have clonal rubber, they don't want complex systems with many other species and they favour more intensive forms of management," says Joshi. "The non-rubber species they plant or retain will nearly always be ones they consider useful, such as fruit and timber trees." Take, for example, the experience of a family which has worked closely with the World Agroforestry Centre in the village of Rantau Duku. Their story could be told by many others.

When we arrive at their demonstration plot – researchers are still conducting trials on different spacing regimes for a variety of clones – we are greeted by an elderly woman called Bairam. She explains that her son, Hotem, is away, but she is happy to talk about the family's rubber gardens.

"When I was young, we didn't have any rubber clones, and we used to plant the local wildings when we replaced old trees," she says. "In those days, we didn't make much money from the local rubber, just enough for us to survive." She isn't sure of her precise age, but she can remember the Japanese invasion of Sumatra in 1942. The introduction of clonal rubber has transformed the way the family manages much of its land. "Now, my son gets much higher yields with his clonal rubber than we ever did before, and this has

given him a good income," she says with satisfaction.

When Hotem established his new clonal gardens, he decided to retain some mature trees which he considered particularly useful. These included fine specimens of *petai (Parkia speciosa), gaharu (Aquilaria spp)*, which provides a valuable resin, and *pulai (Alstonia scholaris),* whose wood is used for fencing.



The introduction of clonal rubber has transformed the way Bairam's family manages the land.

On other RAS 1 demonstration plots, you may see more intensive, or less intensive, forms of management, and the mix of trees that have been retained may differ. Just down the road, for example, a farmer has kept several species of fruit tree, including durian and *duku*. On RAS 2 plots, non-rubber species are even more important in terms of the goods and services they provide a farmer. "Under both systems, farmers have a much more diverse source of income than farmers who are growing rubber as a monoclonal monoculture," says Janudianto. "In this sense, these mixed rubber gardens provide a better safety net for smallholders."

The research has come up with a number of key findings, other than the fact that the majority of farmers, given the opportunity of using clonal rubber, favour intensive systems of management in which all trees provide goods which can either be sold or consumed. Several clonal varieties were found to be highly productive when grown in rubber agroforestry systems, yielding up to three times more than the wildings they replaced. When farmers plant other crops among the rubber, these can increase the productivity of the land without reducing rubber yields, although certain fast-growing trees can suppress yields significantly. The rate at which rubber and other species grow is strongly influenced by spacing, weeding intensity and the use of fertilizers. Farmers traditionally like to tap their rubber on a daily basis, but the research found that clonal varieties often perform well, or better, when tapped once every two days.



Many farmers grow the fruit tree Lansium domesticum
locally known as 'duku' – in their rubber gardens.

Do these rubber systems make economic sense?

There are three key questions to answer. First, how profitable are the three rubber agroforestry systems, and the nine variations of RAS 1, 2 and 3, when compared with each other, with traditional mixed rubber, with monoclonal smallholder systems and with smallholder oil palm? Second, what are the labour requirements of the various land-use systems? And third, how much do these systems cost to establish and maintain?

The World Agroforestry Centre used two indicators to assess profitability. One was returns to land; the other, returns to labour. Both involve the use of a measure known as net present value (NPV). For the first measure, this is calculated as the 'surplus' remaining after accounting for the costs of labour, capital and other materials. The second measure effectively converts the 'surplus' to a wage, after accounting for the purchase of inputs and discounting for the cost of capital.

The monoclonal smallholder systems, such as those promoted by the World Bank and the Asian Development Bank, provide 50% higher returns to labour than newly established mixed rubber, but at a much higher cost of investment. All rubber agroforestry practices promoted by the World Agroforestry Centre achieve higher returns to labour than jungle rubber systems at investment costs substantially below those of monoclonal smallholder systems. If their performances are compared to best



World Agroforestry Centre researchers in the field in Bungo District. From left to right, Ratna Akiefnawati, Jasnari, Suyitno and Janudianto.

practice for monoclonal systems, three of the RAS management systems provide 69% higher returns to labour at just 54% of the investment costs of monoclonal systems. Furthermore, the best RAS practices – all within RAS 1 – can compete with oil palm, with similar returns to labour and at 75% of the investment costs.

Put simply, the systems which have been researched and promoted by the World Agroforestry Centre are very attractive to smallholders. Even in areas where it is financially advantageous for farmers to convert their rubber plantations to oil palm, there are good reasons why many may baulk at doing so. For one thing, when the price of latex falls, farmers can leave it in the trees; when the price of palm oil falls, farmers still have to harvest the oilseeds. Rubber agroforestry systems also provide farmers with a range of products other than rubber, and they retain some of the environmental benefits of jungle rubber, more about which in the last chapter. COLRO WASITO

8 AL

5

2

of the local division in the local divisione

Cokro Warsito and his wife have established a thriving rubber nursery in Sumber Sari village, Tebo District.

3: THE SEEDS OF CHANGE

In 1992, Cokro Warsito left his home in central Java on a motorbike, accompanied by his third son and a television. "In those days I was a poor man, making very little as a casual labourer on other people's farms," he says. From Java he made his way to one of the transmigration areas in Jambi in the hope of creating a better life. Soon after he arrived, he sold the motorbike and television and bought a small plot of land with an old wooden shack in Sumber Sari village, Tebo District. Since then, he has

transformed his land and his family's life. He has built a fine house and he now owns three cars, 10 dairy cows, a large nursery and several productive rubber gardens. "I've been able to pay for all my children's education," he says with pride. Three have graduated from university; two are still in high school.

Once he had cleared the land, Cokro planted coffee and rubber, having learnt how to graft clonal seedlings while he was working for a large rubber company. He soon sensed a business opportunity, and set up a small nursery, initially selling around 5000 grafted clonal seedlings a year to other transmigrants. "In those days, the demand was much lower than it is now, and so was the price of rubber," he recalls. "I used to sell my grafts for around 325 rupiah each." Today, they fetch 3500–4000 rupiah (US\$ 0.38–0.44).



Cokro grafting clonal rubber budwood onto hardy rootstock.

It wasn't long before rubber prices and the demand for clonal seedlings began to rise. With the help of his family and the World Agroforestry Centre, Cokro significantly increased his output, and today he produces 100,000 seedlings a year. "The Centre first got in touch with me in 2004," he recalls, "and they supplied me with new clones and rootstock and trained me in new grafting techniques." The Indonesian Rubber Research Institute subsequently certified his clonal nurseries, which means he is now able to sell seedlings to government departments, as well as to private companies and individuals.

Cokro's rags-to-riches story helps to illustrate the remarkable changes which have taken place in Jambi over the last two decades. Rubber has not only been good business for Cokro, but for the province as a whole, which is one of the reasons why land prices have risen so dramatically. "When I bought my 2-hectare plot of land almost 20 years ago, I paid 1 million rupiah," says Cokro. "It is now worth 200 million rupiah (US\$ 22,000)." Cokro's thriving business owes much to the strong demand for high-quality clonal rubber seedlings

- a demand stimulated, in part, by the research activities of the World Agroforestry Centre.

Spreading the message

Introducing new agricultural technologies is one thing. Ensuring that they are widely adopted is quite another. Two separate studies have shed light on the rate of adoption of the rubber agroforestry systems promoted by the World Agroforestry Centre in Sumatra and West Kalimantan. The first focused on 200 households, 107 of which had been exposed to the Smallholder Rubber Agroforestry Project, in four districts. Eighty-



A Profits from sale of high-yielding clonal rubber have enabled Cokro Warsito to establish a small dairy herd.

nine percent of farmers knew about clonal rubber, but only 67% had adopted the technology in their fields. The main reason cited for this was lack of capital. The study also found that farmers in West Kalimantan knew more about clonal rubber, and adopted the technology more enthusiastically, than farmers in Jambi.

A second study, conducted in 2010 in Sanggau District, West Kalimantan and Bungo District, Jambi, compared rates of adoption in 30 villages in each district. These included villages which had benefited from RAS experiments and those which hadn't. In villages where the project had been active, the area and number of households adopting the new systems increased tenfold. This is not nearly as surprising as the fact that rates of adoption in villages where the project had not been active have been almost as high.

There appear to be three reasons for this. First, smallholders in Indonesia have heard of clonal rubber varieties and their advantages, and many have tried them – not always with success – in the past. This means that it does not require a huge effort to promote new clones. Second, the first of the studies, conducted in 2007, found that the World Agroforestry Centre was a key source of information about clones for farmers who were not associated with its present or past projects. This suggests that its dissemination methods in local languages had been effective. Finally, the government and development agencies have actively promoted the use of new clones.

Jambi is one of several provinces which have sought to increase the use of clonal rubber, with the district Forest and Plantation Agencies (FPA) playing a key role in introducing farmers to more intensive practices. "Rubber is very important for the people of Bungo District, but smallholder productivity still remains low," says Dasmardi, secretary of the Bungo FPA. "We're supporting farmers by providing improved clonal material, and we have benefited from the research conducted by the World Agroforestry Centre in Jambi." The research has helped the FPA to identify the best cultivation techniques and most suitable clones. The FPA has also used some of the RAS demonstration plots when training farmers.

Dasmardi believes there is a bright future for rubber as a smallholder crop. "Fifteen or 20 years from now, I think many more farmers will be using high-yielding clones, and smallholder rubber production will be much more productive," he says. "By using these clones, there will be less need to open up new land for rubber gardens, and that will take some pressure off natural forests."

Further afield

22

In November 2009, a group of farmers from Aceh Province, which occupies the northerly tip of Sumatra, were brought to Jambi on a study tour organized by the World Agroforestry Centre. Ratna Akiefnawati and her colleagues took them to see some of the demonstration sites and introduced them to local farmers.

"After our trip to Jambi, our eyes were opened," says Husaini, a farmer from the village of Blang Luah in West Aceh. "We could see that the incomes of many farmers there was so much higher than ours, and that's what encouraged us to start thinking about rehabilitating our own rubber gardens." Since the



World Agroforestry Centre and Winrock International researchers, James Roshetko (left) and Pratiknyo Purnomosidhi (right) with rubber farmers in Aceh

study visit, Husaini and the other members of his farmers' group had produced and sold over 16,000 clonal rubber seedlings by the end of 2010. They have ambitious plans to expand their production to provide clonal seedlings for their own farms and a source of income through the sale of seedlings to the local forestry and estate crops agency.

Prior to the 2004 tsunami, which killed some 200,000 people, Aceh had suffered from three decades of civil war. "There were very few tree nurseries, and development

agencies who wanted to get hold of improved varieties usually travelled to North Sumatra to buy them," says James Roshetko of the World Agroforestry Centre and Winrock International. Most farmers, however, used low-yielding local varieties in their rubber gardens.

Between 2007 and 2009, Roshetko managed an agroforestry programme, funded by the Canadian International Development Agency, whose aim was to establish 'nurseries of excellence' (NOEL) in the province. "The farmers desperately needed highquality clonal rubber, fruit seedlings and technical training. We saw local farmer-owned nurseries as the best way to achieve this," he says. High-yielding clonal rubber was a priority. Rubber provides approximate 97% of farm incomes in coastal areas and 43% of farm incomes inland. Average yields, prior to the tsunami and the 2005 Peace Accord were just around 800–1200 kg wet rubber per hectare per year. Many of the rubber gardens were old and unproductive, and few farmers used fertilizers.



▲ Ismail, one of the members of the Blang Luah farmers' group, in his rubber nursery.

Other projects funded by the European Union and the Common Fund for Commodities (CFC) also provided support to establish rubber nurseries and demonstration plots of improved rubber agroforests in West Aceh. Under these, farmers received training on how to produce high-quality, high-yielding rubber clones.

Of the 56 nurseries established during the NOEL project – it is described more fully in another *Trees for Change* booklet – 24 were spontaneously set up by farmers' groups who had observed the programme's activities from a distance. One of these was Husaini's group in Blang Luah.

"At the moment, it's too early to say how much rubber we will get, because it will be five years before our clonal trees are mature enough to tap," explains Husaini. "However, I

think we will get at least three times as much latex as we did in the past." He adds that the adoption of clonal rubber and high-quality fruit seedling, and the new systems of management, will have a significant impact on local livelihoods. Like many other farmers in Aceh, he is also growing crops other than rubber in his improved rubber gardens.

24



The latest generation of rubber clones.

The World Agroforestry Centre is helping villagers in Lubuk Beringin to explore the possibilities of rubber ecocertification.

4: THE PRICE OF PROGRESS?

26

"If present trends continue, the area under jungle rubber will gradually decrease in Sumatra and Kalimantan, and this will be accompanied by a steady loss of biodiversity," says Janudianto. "Unless there is some sort of reward system for retaining jungle rubber, many farmers will convert it to more profitable land uses."

To the untutored eye, jungle rubber looks much as the name implies: like a jungle. Studies in Bungo District have found that jungle rubber harbours 689 seedlings of woody species, mammals and birds. Rubber and oil palm monocultures contain, in contrast, just a handful.

Research in Jambi identified 37 species of mammal in jungle rubber systems, of which

nine were endangered. Six of these were primates. Jungle rubber is also an important habitat for bats and birds. A study in Jambi identified 17 bird species in rubber plantations less than five years old, compared to over 130 species in plantations over 20 years old. The rubber systems promoted by the World Agroforestry Centre may not contain as many species as traditional jungle rubber, but they are nevertheless important for biodiversity. A survey in four villages in Kalimantan identified 76 species of seedling and ground vegetation and 13 saplings with medicinal properties. These were used by local people for the treatment of diseases ranging from malaria to skin wounds.



Slabs of rubber awaiting collection in Lubuk Beringin.

Jungle rubber is forest-like in its level of ground cover, its water infiltration characteristics and its ability to control erosion. Indeed, it is one of the few land uses that can be considered environmentally friendly. A 60-year-old rubber agroforest stores roughly the same amount of carbon as a 25-year-old secondary forest, 110 tonnes per hectare. This is just under half the amount found in primary forest in Bungo District. Put another way, jungle rubber could have an important role to play in sequestering and storing carbon under schemes designed to reduce emissions from deforestation and degradation (REDD).

But what is it actually worth?

The environmental importance of jungle rubber prompted the World Agroforestry Centre and some of its local partners to investigate the possibility of setting up schemes which would reward smallholders for retaining these species-rich agroforestry systems. Much of the work has focused on Lubuk Beringin, Bungo District, which became nationally

famous in 2009 when the Ministry of Forestry recognised the first ever *Hutan Desa* – or village forest – in Indonesia. This designation gives the villagers the right to manage a watershed protection forest, opening the door for the wider application of negotiated agreements which will enable local communities to receive payments for protecting environmental services.

As Ujjwal Pradhan, the World Agroforestry Centre's regional coordinator for Southeast Asia points out, by designating the village as a *Hutan Desa*, the government has acknowledged the significance of community land tenure, something which is vitally



A green future for Lubuk Beringin? A micro-hydro scheme provides the village with all its electricity.

important when negotiating environmental agreements. "If communities don't have rights of tenure in the forests, then they cannot participate in a meaningful way or derive benefits from REDD agreements," he says.

28

If the villagers sign up to such agreement in future they will be rewarded for retaining land uses that sequester or store carbon. The complex rubber agroforests in Lubuk Beringin – all 80 households have rubber gardens – could therefore provide a dual income, one from rubber production, the other for providing environmental services.

During the past decade, the World Agroforestry Centre and its partners have explored whether eco-certification could achieve much the same goal, by rewarding the villagers for conserving traditional jungle rubber. "We were the first to start talking about the possibility of certification for the rubber agroforests in Lubuk Beringin," recalls Laxman Joshi, "and during the first phase of the RUPES (Rewarding the Upland Poor for Environmental Services) project we investigated a reward mechanism for the conservation of traditional jungle rubber."

Agreements to conserve 2000 hectares of jungle rubber were made with four villages and 'interim' rewards were provided in the form of micro-hydro generators and village nurseries, while long-term payment mechanisms were being sought. However, it became clear after a few years that there was no great appetite from donors and conservation organizations to offer support for schemes like this, on land which is privately owned and managed.

During the second phase of the RUPES project, Joshi and his colleagues approached a multi-national rubber company. A series of meetings and discussions led to the signing of an agreement between the company and the Centre to provide technical support to four villages, including Lubuk Beringin, in order to improve the quality and quantity of rubber production. The company agreed to provide a premium price for better quality

latex. It also provided villagers with training and equipment and bought their rubber at an above-average price. By the end of 2010, the company had bought three shipments directly from the villages.

However, this does not constitute eco-certification, as Joshi points out. "In fact, I do have a concern that if farmers are getting more money for their rubber, they will be encouraged to intensify their production." Eco-certification, in contrast, would reward farmers for *not* intensifying production.

At the time of going to press, the villagers, the World Agroforestry Centre, local non-governmental organizations and Lembaga Ekolabel Indonesia (LEI) were still investigating the possibility of eco-certification, and LEI had already drawn up draft criteria and indicators for jungle rubber. At present, just 7% of the world's natural

rubber comes from these species-rich rubber systems, and Joshi believes that certification should focus on niche markets. "I think it would be possible to promote certification of jungle rubber for rubber to be used, for example, by Formula One or hybrid cars," he says, "and we've already had some interest from the Netherlands about supplying certified rubber to make bicycle tyres."

In Lubuk Beringin, the villagers remain optimistic about their future, and that of their forests. The designation of the *Hutan Desa* is seen as a first step in establishing a reward system for protecting their watershed. Certifying



A Rubber certification schemes could help to save species-rich rubber agroforests, such as this one near Lubuk Beringin.

their jungle rubber gardens would help them to resist the urge to adopt more intensive rubber systems. However, there is still some way to go before this becomes a reality.

30

Acknowledgements

Thanks go to the many people who provided assistance and information during the research and writing of this booklet. Special mention should be made of Janudianto and Ratna Akiefnawati, both of the World Agroforestry Centre, for organizing the field trips to Jambi; and James Roshetko of the World Agroforestry Centre and Winrock International and Pratiknyo Purnomosidhi of the World Agroforestry Centre for arranging the field trip to Aceh. We are also grateful to the following: Ujjwal Pradhan, Suseno Budidarsono, Retno Setyowati, Elok Mulyoutami, Aulia Perdana and Jusupta Tarigan of the World Agroforestry Centre; Laxman Joshi, formerly of the World Agroforestry Centre and now with the International Centre for Integrated Mountain Development (ICIMOD); Hayu Wibawa of the Indonesian Ecolabel Institute; and Farid Zulfikar of the Indonesian Conservation Community (WARSI). We would also like to express our gratitude to the many villagers, extension workers and government officials who were so generous with their time and knowledge.

Other titles in this series

FARMING TREES, BANISHING HUNGER: How an agroforestry programme is helping smallholders in Malawi to grow more food and improve their livelihoods.

SEEDS OF HOPE: A public-private partnership to domesticate a native tree, Allanblackia, is transforming lives in rural Africa.

RESTORING LIVES AND LANDSCAPES: How a partnership between local communities and the state is saving forests and improving livelihoods in Guinea.

THE FRUITS OF SUCCESS: A programme to domesticate West and Central Africa's wild fruit trees is raising incomes, improving health and stimulating the rural economy.

A WINDOW ON A BETTER WORLD: An innovative agroforestry development programme is transforming lives and landscapes in rural Cameroon.

FODDER FOR A BETTER FUTURE: How agroforestry is helping to transform the lives of small-scale dairy farmers in East Africa.



Research in Indonesia is exploring how smallholders can increase rubber production, retain biodiversity and provide additional additional environmental benefits

Massive investment has encouraged many smallholders in Indonesia to convert their jungle rubber gardens to high-yielding monoclonal plantations. This has improved yields and incomes, but led to the loss of fauna and flora. For over a decade and a half, the World Agroforestry Centre has researched and promoted alternative systems of rubber agroforestry. These have enabled farmers to improve their incomes, without losing all the biodiversity associated with jungle rubber. This booklet explores how this research is helping to shape lives and landscapes in rural Indonesia.

ISBN 978-92-9059-299-0