



They say that in the spring in China, you can actually hear the bamboo growing.

But it's not just the plant itself that's growing fast. With 6 million hectares of bamboo plantations, the industry in China is expanding rapidly. In 1981, the country's industrial bamboo production was valued at RMB 400 million (US\$64 million); by 2013, the annual productive value of the bamboo industry was over RMB 167 billion (US\$27 billion). And it's expected to reach RMB 300 billion (US\$48 billion) by 2020, employing an estimated 10 million people.

Bamboo is part of a massive expansion in forest plantations in China. Over the last 25 years, the country has planted 37 million hectares of trees in an effort to combat erosion, desertification and climate change, restore degraded land, grow its timber industry and improve incomes for rural communities. China already has 79 million hectares of forest plantations – the largest area in the world – and is on track to meet its target of increasing forest cover to 23% of its landmass by 2020.

Nevertheless, China has a major timber deficit. The country is the largest producer and consumer of paper products, and its timber and pulp imports have tripled in the last decade. China's plantations – and bamboo plantations in particular – have an important role to play in taking pressure off forests elsewhere in the world. They also provide an important source of income for smallholders in rural areas, and have great potential to mitigate climate change by sequestering carbon. At the same time, new technologies are opening up new markets for bamboo, including as a greener alternative to steel and plastics.

Exciting things are happening here, with implications for industry and the environment on a global scale. So we've come to the heart of bamboo country – Zhejiang province in eastern China – to discover what lessons we can learn and what ideas we can share.

Monday 15 June

The first day of an NGP study tour: old friends are reacquainted, new friendships established. This unique platform isn't trying to tell foresters how to run plantations: it's built on experience, examples and learning as a group.

Our group this week is made up of 50 representatives from global pulp and paper companies, the China State Forestry Administration, and NGOs like WWF and the International Network for Bamboo and Rattan (INBAR). At the kick-off meeting in Shanghai, everyone is talkative and keen to communicate. The focus is on how plantations can intensify production in a sustainable way – and the particular role that bamboo can play.

According to the *Guinness Book of World Records*, bamboo can grow up to 91cm in a single day. While that's exceptional, there's no doubt that this is an exceptionally fast-growing plant. So it's no wonder that there's growing interest in bamboo as an alternative fibre source. One company that's begun trialling bamboo-based products is NGP participant Kimberly-Clark, which is seeking to reduce its forest footprint. Skip Krasny explains that the company currently procures 30% of its fibre from boreal forests, which are managed on an 80-100 year rotation and grow by just 1-3m³ per year, but is investigating alternative fibres. The challenge at the moment is security and consistency of supply – currently there's just not enough bamboo fibre on the market.

One thing that's holding back supply is small producers' lack of technology and knowledge in growing and harvesting, according to Li Nuyun, the secretary of the China Green Carbon Foundation. There's a growing gap in output between the large and small producers. The big companies have the knowledge and the technology, but there are tight controls over the area of land they can own in China; villagers, meanwhile, have the land but lack the knowledge and the technology.

There's great potential, then, for small producers to increase their output, and to connect with global markets. That's one of the challenges we'll be exploring on this study tour.



One company that certainly has the knowledge and technology is Futuragene, a subsidiary of NGP participant Suzano and an international leader in plant biotechnology. They're researching a number of species – but not yet bamboo, which presents the greatest of breeding challenges. Bamboo only flowers once every 70 years, and no one seems sure what triggers the flowering, so it's difficult to "improve" it through conventional breeding. Bamboo seed is very scarce and is difficult to store, so plantations are usually established using rhizomes (horizontal underground stems – anyone who's ever had bamboo growing in their garden will know about them). Futuragene is cultivating various species, focusing on areas such as drought resistance. Applying this research technology to bamboo could increase our understanding of this extraordinary plant, enable it to flourish in more conditions and accentuate key characteristics.

After some good discussion on the idea of sustainable intensification, it's a three-hour drive to Anji, in Zhejiang province – the centre of the bamboo industry. Our hotel is, of course, furnished with bamboo.

Tuesday 16 June



Our first stop of the day is the Anji Bamboo Museum. The museum has 304 bamboo species – around half the total number in China. The gorgeous green seas of bamboo in the museum gardens are an astonishing sight, even in the pouring rain. We're also lucky enough

to meet two pandas, which were transferred here from a protected area in Sichuan as part of a conservation and research programme. Pandas, of course, depend almost entirely on bamboo, but there's more than enough to keep them going here. The museum houses exhibitions on the history and utility of bamboo, in everything from food and clothing to transport and construction.

After lunch, we head to the village of Liujiatang to visit a local farmers' cooperative, which manages nearly 300 hectares of bamboo. There are 135 families who "invest" their land into the cooperative: this allows them to produce bamboo shoots and poles for making furniture on a more commercially viable scale. Each year, a hectare of bamboo can produce nearly a 1,000kg of edible bamboo shoots for the local canning industry, and about 15,000kg of bamboo poles. About 30% of the profit is retained by the cooperative, with the rest shared out between the members.

Chu Xuesong, the secretary of the cooperative, says it supports eight full-time jobs, as well as seasonal labour during harvesting. Ecotourism is a growing market. People enjoy visiting the plantations and helping with the harvest work – in fact, Mr Chu believes this will soon be more profitable than the production side. He participated in the last NGP study tour to South Africa, which helped him develop the ecotourism idea. He also introduced segregated recycling into his village after seeing it in South Africa. It's a reminder of how fertile these study tours can be.

Learning by doing is an important part of NGP's philosophy, and our practical experience today includes digging for bamboo shoots and tasting bamboo wine (it's a hard job sometimes...). To make bamboo wine, you drill a small hole in the bamboo stem and inject a sorghum-based spirit called baijiu. The hole quickly seals up as the bamboo grows so fast. Leave it to mature for six months, then drill a hole and you get instant bamboo wine. (Just don't forget to mark and record the pole...).



Wednesday 17 June



The scenery around the village of Hanggai is stunning, with magnificent mountain peaks and deep gorges. The hillsides are lush and green, and not just because of the continuing rain: since the 1980s, large-scale afforestation has helped to restore the landscape in the area.

We're here to visit another community-owned plantation. The village manages around 600 hectares of Moso bamboo – the most commercially important species. Since 2009, it's been FSC certified – the cooperative is one of 15 members of a larger FSC group scheme run by the Anji County Bamboo Industry Association.

It's time to get practical again. Local staff show us how to cut bamboo tops – the high silica content means they can blunt conventional saws. We also learn how to calculate the volume of wood within a bamboo plantation. Since bamboo grows more or less straight, you can work out the total volume of a pole by measuring its diameter at 1.5 m above the ground, measuring the height of the pole, and remembering your π equations from school. Then you count the number of poles in a 20m x 20m area to work out the total number of poles in the plantation. The cooperative does this every year to make sure they're managing the plantation sustainably.

The poles are harvested at around six years old, mostly for flooring and furniture. Only 15% of the area can be harvested at a time. FSC certification is also encouraging increased use of organic fertilizer, and ensures workers have proper insurance and safety equipment. Overall the cost of FSC certification seems high for a low-impact, community-run activity. Although FSC-certified bamboo attracts a small premium, this is hardly enough to cover the costs.

What FSC certification does offer, though, is market access. After lunch, we visit YongYu, a large manufacturer which sources FSC-certified bamboo. YongYu sells a variety of bamboo products, including office and household furniture and flooring, mainly to Europe and North America. The company first began looking into FSC after a request from a Canadian customer, and now holds an FSC Chain of Custody certificate and is a member of WWF's Global Forest and Trade Network. Mr Xiao, the director of the company's ecological research centre, says that customers in Europe expect FSC certification – although there's a lot of group discussion about how the FSC model could be better applied and administered for bamboo.

Mr Xiao is keen to emphasize that bamboo is not just a timber alternative – it's also an alternative to plastic and steel. It has huge potential for construction in seismic areas, an idea the Chinese Academy of Engineering is actively developing. He adds that high-tech and innovative uses of bamboo can add economic value and improve incomes for community growers, but can also take pressure off forest resources – very much in line with NGP's objectives and the themes of this study tour.

After the meeting, there's time for a spot of shopping in the local bamboo market – study tour participants come away with bamboo T-shirts, bamboo mugs and a host of other souvenirs. Then it's time to leave Anji and head to Linan.

From our time in Anji, it's clear that China has a bamboo culture. It's embedded in everything – music, housing, clothing, food. People feel connected to bamboo and therefore connected to bamboo plantations; in many ways, it feels similar to the Scandinavian attitude to forestry. People in China and Scandinavia feel connected to forests – they know people who own and work in them, they're a familiar part of the landscape and the culture, and that makes people more open-minded and accepting. Plantations present a much bigger challenge when communities and societies don't feel that connection.



Thursday 17 June



With almost 2,000 staff, 24,000 students and 2.5 million books and e-books in the library, Zhejiang Agriculture and Forestry University is the place to come for bamboo research. We're here this morning to learn about some of the latest innovations in bamboo technology and carbon sequestration.

We're shown how new technology can more than double the proportion of bamboo that can be used in flooring and construction, by splitting and flattening the poles. Heat treatments are also being used to reduce the starch content in bamboo, which improves its durability, particularly outside. Advancements like these are helping to increase the possibilities for using bamboo. And those possibilities are practically endless – the interior of Madrid airport uses 200,000m³ of bamboo. We're shown stunning designs for a new bamboo Chinese opera house, and wind turbine blades where bamboo replaces 60% of the fibreglass.

As well as substituting for materials with a heavier carbon footprint, bamboo can play a significant role in absorbing CO₂ from the atmosphere. We visit the Carbon Sink Laboratory, which is looking at carbon sequestration of different species of bamboo, and the impact of different management practices. This university has three carbon flux monitoring towers to study carbon sequestration by bamboo; I think the whole of the UK only has one.

Professor Xu Qui Fang points out that in most forests, the majority of carbon is stored below the ground – not just in the biomass of roots and rhizomes but also in soil carbon. Forest plantation management requires soil preparation at the end of each rotation, which inevitably leads to the loss of soil carbon through oxidization. Bamboo, however, simply regrows from the rhizome, and the carbon remains in the soil.

Another contribution bamboo can make in mitigating climate change is through the use of biochar. Adding charcoal to soils can improve their structure, fertility and water retention, and lock in carbon for thousands of years. Not only is bamboo one of the most productive sources of biochar, but its open cell structure makes it particularly valuable as a filter, for wine producers (vines need a lot oxygen) and for improving heavy clay soils.

After the university, we pay a brief visit to the Hangzhou Xi Ma Ke Food Company in Linan, a bamboo cannery. The factory buys 40,000 tonnes of bamboo shoots every year, and supplies supermarkets, China East Airlines and the tourist trade. It employs around 600 people during the busiest times of year, and has a strong reputation for paying a good price for shoots from local villages. It's another good illustration of key NGP concepts: harvesting and processing shoots from local bamboo plantations creates shared value, while using the same land (and plant) to supply food and fibre is another example of sustainable intensification.



Carbon sequestration using bamboo isn't just a theory: this afternoon, we're visiting a community-based bamboo carbon scheme. It's been set up by the China Green Carbon Foundation (CGCF), a non-profit organization and NGP participant operated under the governance of the Chinese State Forest Administration (SFA). The CGCF receives voluntary donations from businesses, organizations and individuals wanting to offset their carbon emissions, and uses them to plant forests and pay carbon credits to the farmers who manage them. Since its establishment in 2010, CGCF has received US\$100 million in offset payments. This has funded projects in 20 provinces and cities to date, with a total area of 80,000 hectares.

We visit the village of Ni Luo in the county of He Qiuo to see a trial bamboo carbon project. In this scheme are 42 households who are paid US\$5 per tonne of carbon; a hectare of moso bamboo can store around 200 tonnes. Farmers don't have to pay a fee to participate, but are expected to commit for the long term – they get paid every five years. The local forest bureau regulates the scheme and acts as broker, with the carbon credits being paid for by a local construction company. Every five years, the local university will carry out a formal audit.

It's worth pointing out that this is an entirely voluntary scheme – it's not connected to any government CO₂ reduction pledges, emissions taxes or the Clean Development Mechanism (CDM). As well as providing a useful additional income for smallholders, it enables smallholders to access carbon finance to improve their forest management techniques. The SFA provides outreach services to farmers who join the scheme: in particular they aim to reduce fertilizer use and encourage the development of an understory, which can increase carbon absorption and benefit biodiversity. Crucially, the farmers can still harvest bamboo shoots and poles, under an agreed sustainable harvesting protocol.

There appears to be a strong demand for carbon credits – companies see it as good CSR. Planting trees to offset carbon emissions isn't a new idea, and has its critics. But there are certainly lessons to be learnt here.



Friday 19 June

No field visits on the last day of the tour – so of course the sun is shining. We're back at Zhejiang University for a day of discussion and to reflect on what we've learnt.

First up, we hear from Susanne Lucas of World Bamboo, a US-based trade organization that promotes the sustainable use of bamboo. They organize the World Bamboo Congress, which takes place in South Korea this September, and also run events around World Bamboo Day (September 18 – put it in your diary).

We also hear from Li Yanxia of INBAR, a network organization whose mission is to improve the well-being of the producers and users of bamboo and rattan while managing these resources sustainably. She talks about the potential for bamboo to restore degraded areas. In Allahabad, India, bamboo is being grown to restore degraded heavy clay soils that had been used for brick production. The water table has risen from a depth of 40m to 15m, soil carbon has increased from zero to 0.8 tonnes per hectare, and the bamboo provides an income for rural people. INBAR wants to see 5 million hectares of bamboo-based restoration by 2020. Much of this will be in China, but there are plans for 500,000 hectares in Ethiopia and 50,000 hectares in the Philippines.

We need to be conscious that bamboo is not a wonder plant, and can be invasive in some circumstances. The focus of international development is nearly always on moso bamboo from China. But there is huge potential for exploring native species of bamboo in other countries.

The tour ends, as is becoming customary at NGP events, with some lively conversations facilitated by social learning techniques. This time we use a setting called “Open Space”, which gives everybody the chance to ask one or two burning questions – the question you can’t go home without finding talking about... These prompt some great groups discussions on a range of topics. It’s a very effective way to get questions, ideas and possible answers out of this rich and diverse group.

What is clear is that, despite people’s different backgrounds and agendas, we’re all aiming for the same thing: to have a positive impact on the environment, the climate and socio-economic development. And we all leave excited by the role bamboo can play in this, and inspired to see how we can apply what we’ve learnt in China in our own contexts.

