FRANKENTREES THREATEN INDIA'S FORESTS

by Philip Carter

Imagine vast plantations of a single species of tree. You walk into one of the plantations, and notice that something is wrong. You wonder what is missing, and then realise – there are no insects, no bees or butterflies going between flowers in the spaces between the trees, no cicadas singing their ancient song to summer. You look at the ground where grass and flowers should be, but there is nothing – all have been killed by aerial spraying of glyphosphate, a broad-spectrum herbicide used in Monsanto's 'Roundup', leaving only the trees alive. The trees are genetically engineered to be resistant to the herbicide.

You look more closely at one of the trees, looking for ants or other small insects living on the tree itself. You can find nothing – the tree itself seems to be incapable of supporting life. It has also been engineered to produce *Bacillus thuringiensis* (Bt) toxin, an insecticide, which it exudes from its bark, leaves and roots, killing the vast array of insect life that a tree normally supports. The soil itself around the tree seems devoid of life, for the Bt toxin has killed both insects and microbes in the immediate vicinity.

Shaken, you walk through a gate in the barbed-wire fence surrounding the plantation, to stroll in the wild forest outside. At least there, you think, you can enjoy nature's diversity and calm down a little. And at first

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GM giants like Monsanto are having a greater hold on agriculture; in India, they have engineering high-quality herbicides, hybrid seeds (corn and sunflower) and biotech traits (Bt cotton).

it seems to be so, as there are butterflies and bees in the air, and cicadas chirping. Then, you notice a tree, which seems similar to those in the nearby plantation. Curious, you walk up to it, to find a number of dead beetles on the ground underneath it, which seem to have fallen off the tree. Looking closely at the bark, you find dead ants on the branches, which have been killed by Bt poison exuded by the tree. The deadly genetically engineered, or transgenic, insect-killing trait, has escaped into the surrounding forest!

Really concerned now, you board a bus for a national park 300 km. away. Fighting to control your emotions, you walk in the wild forest, but after a while come to a stand of a similar species of tree to the plantation. Inspecting them one by one, you find that a significant number are killing the insects that have fed on them. For although the plantation trees were supposedly engineered to be sterile, a significant number were not, and each produced a huge amount of transgenic pollen which, blown by the wind, has contaminated the forest over a vast distance, crossing state and national boundaries.

This is the threat now looming for India's forests, potentially with the full support and encouragement of the Indian Government in a proposed new National Forest Policy being debated behind closed doors. Genetically modified trees, or 'Frankentrees' as they have been labelled by environmental groups, have the potential to radically and permanently change the world's forests. As with GM crops, a major issue is gene escape, but the effects are more far-reaching due to the central role played by trees in the ecosystem.

The *Indian Financial Express* recently reported that "the proposed National Forest Policy is expected to give a thrust to GM trees for boosting the paper industry as well as improving the quality of by-products of wood." After some inquiries, *Ecologist Asia* staff were unable to discover details of the proposed National Forest Policy. They did, however, find that the new draft National Forest Policy for the state of Himachal Pradesh contains support for GM trees, with the following clause included:

"Regeneration of felled areas will be ensured in time bound manner and productivity of plantations will be increased through use of genetically improved seeds and planting stock."

This lack of transparency is disturbing due to the potentially devastating effects of GM tree deployment on the wild ecosystem, especially via gene escape, which is already well-documented in the case of GM crops. The Friends of the Earth, an environment group, notes a problem called 'gene stacking,' where plants incorporate various traits such as herbicide tolerance and insect resistance, acquired from cross-

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Monoculture plantations are rapidly replacing the diversity afforded by complex forest systems.

pollination from transgenic GM crops. In Canada, oilseed rape plants have been found with three different herbicide tolerant genes.

Canada was also the location of a particularly bitter lawsuit between Saskatchewan farmer Percy Schmeiser and leading US-based GM company Monsanto. Monsanto accused Schmeiser of having 'Roundup-Ready' canola in his fields, which Schmeiser said was the result of genetic contamination due to cross-pollination. According to Schmeiser's website, the Supreme Court of Canada ruled in his favour in 2004, saying that although Monsanto's patent was valid, Schmeiser did not have to pay the $15 per acre 'technology fee' as he did not actually profit from having the gene present in his crops.

Such a hard-line approach to enforcing genetic 'intellectual property' rights is a potential nightmare in the case of GM trees. Many species of tree are wind-pollinated, their pollen carrying for thousands of kilometres. If a tree in a forest far from a GM tree plantation is found to have a patent-protected transgenic gene due to genetic contamination, does that mean the owner of the land the tree grows on, be it farmer or government, has to pay a 'technology fee' to the patent owner?

The Indian subsidiary of Monsanto says it is not working with GM trees in India at this time. In response to a query by email, Monsanto India representative Susan Joseph said from their Mumbai office that "Monsanto's India business consists of developing high-quality herbicides, hybrid seeds (corn and sunflower) and biotech traits (Bt cotton)." However, when asked about Monsanto's likely course of action if the new Indian Forest Policy promotes GM trees, she did not respond.

Anne Peterman of the US-based based Global Justice Ecology Project, which is coordinating an international campaign against GM trees, said in response to this, that "Trees are being engineered to resist Monsanto's herbicide Roundup. If Roundup-Ready trees are proposed for India, this is a connection to Monsanto, even though they may not be directly involved in the R&D. They will definitely profit from these trees through the increased sales of their toxic Roundup herbicide."

If, as suggested by the *Indian Financial Express*, the purpose of GM deployment in India is to boost the paper industry, then it is likely that one trait that will be genetically modified is the amount of lignin in the trees. Reducing the amount of lignin, which provides rigidity and strength to plant cell walls, is potentially a money-saver for the pulp and paper industry, which does not have to remove the lignin during processing of wood fibre.

However, there is a downside as pointed out by Prof. Joe Cummins of the UK-based Institute of Science in Society (ISIS). In a paper on lignin reduction, he says that "the advantages of reduced lignin are offset by

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the disadvantage of plants with reduced lignin, which are more readily attacked by predators such as insects, fungi and bacteria." In another ISIS report entitled *GM Forest Trees – The Ultimate Threat*, Prof. Cummins and Dr. Mae Wan-Ho state that commercial interest in GM trees is now increasing, with over 200 permit applications in various countries to the end of 2003. The GM traits included herbicide tolerance, insect resistance and lignin modification to species including poplar, pine and eucalyptus.

Weak lignin-reduced GM trees are likely to require additional genetically engineered traits, such as Bt insect resistance and herbicide tolerance. It is then only a matter of time before the traits escape into the wild ecosystem, as has already happened with GM crops of various kinds. According to the ISIS report, laboratory feeding experiments have shown that one class of Bt toxins produced in GM crops can harm butterflies, lacewings and mice, while another class acts against insects belonging to the order *Coleoptera* (beetles, weevils and stylopids), which contains about 28,600 species. Bt toxins are known to leach out of the roots into the soil, with potentially huge impacts on the soil biota.

Like radiation contamination, genetic contamination of wild forests lasts essentially forever, as contaminated wild trees spread their transgenic pollen. However, unlike radiation contamination, which can at least be detected with a Geiger counter, genetic contamination is pernicious and hard to detect. One country now experiencing the consequences of this is China, which is reported to have already commercialised and extensively planted GM poplars. According to Peterman, "They are so widespread throughout 10 provinces of China that no one knows exactly where they are." Gene escape into surrounding forests appears inevitable.

"International agencies such as the United Nations' Food and Agriculture Organisation (FAO) also are playing a key role in the commercialisation of GM trees (also known as genetically engineered, or GE trees)."

Peterman continues "it was the UN FAO that helped China get its GE trees programme going, along with funding from the UN Development Programme, which has resulted in the first commercial planting of GE tree plantations."

In response to a question by email, Pierre Sigaud of FAO said that "FAO takes no stand for or against GM trees." In a statement on biotechnology on its website, FAO says that it supports "a cautious case-by-case approach to address legitimate concerns for the biosafety of each product or process prior to its release." With the FAO's involvement in China's GM trees programme, it seems clear that this represents a de facto stance in favour of industrial plantations of GM trees. There was no reply to an email asking for further clarification of the FAO's position.

Another likely route for GM tree commercialisation is through their inclusion in 2003 in the Kyoto Protocol's Clean Development Mechanism to act as potential 'carbon sinks'. ISIS states this may lead to Northern companies and governments establishing plantations of GM trees in the South, with all the accompanying environmental hazards. Environmental groups question the effectiveness of GM tree plantations in this regard, and see it as a way for industry to fund plantations of lignin-reduced transgenic trees for pulp and paper production. According to Peterman, "including GM trees under Kyoto opens them up for subsidies from the World Bank's various carbon funds. This is important because getting GM trees to the point where they are commercially produced is a long and expensive process."

Species that could be commercialised in India include GM eucalyptus, which has been called the "selfish tree" because of the large amount of water it uses, with an accompanying effect on India's vulnerable water tables. Glyphosphate spraying, for example with Monsanto's Roundup, will also lead to inevitable contamination of drinking water and health problems for local people, such as cancer and miscarriages. Denmark has already banned glyphosphate for this reason.

Against this background, India's new National Forest Policy is being shaped, possibly with pressure from companies that stand to profit from GM trees. As India's already-stressed forests struggle into the 21st century, with the human communities, wild ecosystems, and especially water supplies that are dependent upon them, it is time to ask for transparency in this process.

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