Genetically Modified Trees

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This discussion document, by staff members of EPN, is intended to foster dialogue regarding a key issue of concern or an opportunity for advancing the goals of the Environmental Paper Network's Global Paper Vision. The information contained in this document is the sole responsibility of the authors and does not necessarily indicate a consensus viewpoint or formal position of the members of the EPN.

Genetically Modified Organisms (GMOs) are one of the most controversial issues in the environmental movement. One of the priorities for responsible fibre sourcing in the Global Paper Vision is that stakeholders in the pulp and paper industry should commit to 'Refuse fibre from genetically modified organisms.' This document is intended to contribute to discussion among civil society and help to ensure attention is paid to this important topic, responding to the fact that the pulp and paper industry is actively involved in developing plantations of GM trees.

Even those in favour of GMOs generally agree that a strong precautionary approach needs to be taken to ensure all risks and consequences are evaluated. The Cartagena Protocol on Biosafety[i] is particularly important in this respect.

In the case of Genetically Modified trees no sufficient risk assessment is possible due to the complexities involved.[ii] These include the complexity of trees as organisms; their large habitats and numerous interactions; their low level of domestication, their long life span; their ability to spread seeds and pollen great distances (including across national borders); and their deep interrelation with soil fungi and microorganisms. Trees also impact on the water table, food security and climate change. For a fuller list of issues see the box below.

Socio-economic impacts on indigenous and local communities and on forestry workers would also require deliberation on many issues including health risks and competition for water and land.

Many of these issues are too complex to enable all possible risks to be effectively examined, especially in terms of natural forests, as opposed to monoculture tree plantations.

Due to the impossibility of doing a full socio-economic and ecological risk assessment of the effects of GM trees, the 140+ civil society organisations that are signatories to the Global Paper Vision therefore conclude that GM tree field trials and plantations should not be allowed to go ahead.

Issues to be considered in risk assessments of GM trees

- **Low level of domestication.** Domestication of most tree species began just six decades ago. As a result, the way they interact with their environment is both more complex and less understood than that of their agricultural counterparts.[iii]
- **Long life cycles.** Trees life cycles can be decades or even centuries. They are more genetically diverse (even within a single species) than agricultural crops and are therefore more able to survive in unmanaged ecosystems.[iv]Trees have also evolved to spread their seeds and pollen over great distances (up to 3000 km.)[v] Birds, squirrels, bats and deer help trees conquer distant habitats[vi] and the possibility and impact of GM contamination is therefore highly unpredictable. Any assessment of the effect of GM trees on a habitat would need to assess both the location where the tree is grown, and the much wider vicinity.[vii]Regulations related to GM trees would therefore need to work across national borders.[viii]
- **Impact on the water table and the climate.** Trees can have manage water supply and rainfall, and help regulate the climate due to carbon sequestration. GM trees should be assessed for the risk of damaging the water table, poor carbon sequestration, soil erosion, acidification, drought and more.
- **Complex organisms.** Trees are far more complex than other GMOs. For example, if a tree is engineered to reduce lignin content, the pleiotropic effects (when a single gene influences two or more seemingly independent characteristics) may mean that the tree may be more prone to diseases, and need more pesticides (with severe impact on surroundings habitats).

- **Impact on the surrounding habitat.** Trees have a huge impact on biodiversity and wildlife. Modifications to trees can therefore have a dramatic effect. For example, if engineered to constantly produce insecticides, trees can directly and indirectly impact pollinators, other insects, songbirds and predators crucial for food production and the food chain.
- **Interrelation with soil fungi**. Over millions of years, complex links have developed between trees and soil fungi. The effect of GM trees on non-target life forms around the roots (mycorrhizal) or on microorganisms and other species are unpredictable and hard to measure.
- **Impacts on ecosystem.** Trees feed a large number of species[ix] in what is known as the food web. Any risk assessment would therefore have to take the effects on whole food webs into account. The problem is that little is presently known about trees impact on the food web and therefore ecosystems. Risks may be particularly severe in the ecosystem where the tree is native (e.g. Eucalyptus species in Australia).
- **Increasing expense for farmers.** When a tree is modified, it can also be patented. This has caused huge problems in terms of rice and other food staples being patented and then sold at a high price. Farmers can also lose out because GM trees are normally destined for large-scale plantations which are often grown on land that has been grabbed from communities and small scale agriculture. Such plantations can also impact water tables as trees use so much water to survive. If trees are engineered to maximize growth, that could also have a direct impacts on water consumption.
- **Effect on the local climate**. Forests play an important role in regulating the weather and climate. Micro and macro effects on the climate of any GM trees would therefore also have to be assessed.[x]

Questions to consider

- How can a global ban on GM trees best be promoted?
- Where and what are the highest risks and how can they be reduced?
- Which actors globally are behind the most problematic high-risk GMO projects?
- How can the coalition of stakeholders opposed to GM trees be strengthened?

Comments and suggested answers to these questions are welcome. Please contact sergio.baffoni@environmentalpaper.eu and hag@environmentalpaper.eu

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[i] https://bch.cbd.int/protocol

[ii] Federation of German Scientists (2008). Genetically Engineered Trees & Risk Assessment: An overview of risk assessment and risk management issues: 2.

[iii] El-Lakany MH (2004). Are genetically modified trees a threat to forests? Unasylva 55(217): 45-47, Sedjo RA (2006). Toward commercialization of genetically engineered forests: Economic and social considerations. Resources for the Future March 2006, Libby 1973 in FAO (2004).Preliminary review of biotechnology in forestry, including genetic modification. Forest Genetic Resources Working Paper FGR/59E. Forest Resources Development Service, Forest Resource Division. Rome, Italy.

[iv] Finstad K, Bonfils AC, Shearer W & Macdonald P (2007). Trees with novel traits in Canada: regulations and related scientific issues. Tree Genetics & Genomics 3(2): 135-139.

[v] Campbell ID, McDonald K, Flannigan MD &Kringayark J (1999).Long distance transport of pollen into the Arctic.Nature 399: 29-30, Gregory PH (1973).The microbiology of the Atmosphere. 2nd edition. Leonard Hill, Aylesbury, UK in OECD (2006). Safety assessment of transgenic organisms: Consensus documents on the biology of trees. OECD Consensus Documents Volume 2 (1996-2006), Chapter 4.

[vi] Nathan R, Katul GG, Horn HS, Thomas SM, Oren R, Avissar R, Pacala SW, Levin SA (2002). Mechanisms of long-distance dispersal of seeds by wind.Nature 418: 409-413.

[vii] Sterility is often proposed as a solution to the problems of outcrossing and contamination and the risks linked to the wider uncontrolled spread of GE trees. Yet reality is more complex for two reasons. Firstly, sterility cannot prevent vegetative propagation, which many trees are capable of. Second, there is no functional GE sterility system in place that would offer the reliability and effectively required for biosafety purposes. Furthermore, since tree can live many years, it is difficult to predict if sterility will be permanent or if the tree will adjust, as the changed, "disused" gene may become active in the course of time.

[viii] Federation of German Scientists (2008). Genetically Engineered Trees & Risk Assessment: An overview of risk assessment and risk management issues: 11.

[ix] Also annual crops have interrelations with soil fungi and microorganisms in a different scale.

[x] Federation of German Scientists (2008). Genetically Engineered Trees & Risk Assessment: An overview of risk assessment and risk management issues: 4.