Briefing Paper on Transgenic Trees - Agenda Point 26.1 – SBSTTA 11 recommendation

"We have no control over the movement of insects, birds and mammals, wind and rain that carry pollen and seeds. Genetically engineered trees, with the potential to transfer pollen for hundreds of miles carrying genes for traits including insect resistance, herbicide resistance, sterility and reduced lignin, thus have the potential to wreak ecological havoc throughout the world's native forests.

--Dr. David Suzuki, The Suzuki Foundation

Non-governmental organizations, social movements, scientists, indigenous groups, farmers, foresters and others are raising the call for a global ban on the commercial release of transgenic trees into the environment. Such release will inevitably and irreversibly contaminate native forest ecosystems, which will themselves become contaminants in an endless cycle. The potential effects of commercial release of transgenic trees include destruction of biodiversity and wildlife, loss of fresh water, desertification of soils, collapse of native forest ecosystems, major changes to ecosystem patterns and severe human health impacts. Despite all of these predictably disastrous consequences, thorough risk assessments of transgenic tree release have not been done.

Rural and indigenous communities in and around countries advancing transgenic tree plantations will bear the greatest burden of the negative impacts of transgenic trees. In particular, GE tree development is moving rapidly forward in Brazil and Chile. China already has widespread and undocumented plantations of transgenic Bt poplar in close proximity to conventional poplar plantations. Experiments carried out by the Nanjing Institute of Environmental Science show that contamination is already occurring. The technology is also advancing in India, South Africa and Indonesia, the U.S. and several countries in Europe. Because tree pollen is known to travel hundreds to thousands of kilometers, countries sharing their borders should also be concerned.

To further quote world renown geneticist Dr. David Suzuki:

"GE trees could also impact wildlife as well as rural and indigenous communities that depend on intact forests for their food, shelter, water, livelihood and cultural practices.

"As a geneticist, I believe there are far too many unknowns and unanswered questions to be growing genetically engineered plants – food crops or trees - in open fields. GE trees should not be released into the environment in commercial plantations and any outdoor test plots or existing plantations should be removed."

Human Health Impacts

Potential human health impacts are only beginning to be known. These health risks include exposure to hazardous chemicals that are applied to plantations of transgenic trees and harmful effects of inhaling pollen from trees that produce a Bt toxin (a _-endotoxin, such as Cry1Ab or Cry1Ac (CHK).

Numerous studies have raised serious questions about the potential health impacts of _-endotoxins. Work in the U.S. involving farmworkers exposed to Bt sprays found that 2 of 123 had antibodies to the _-endotoxins Cry1Ab/Cry1Ac (Bernstein et al., 1999). A global expert consultation on how to test for allergenicity of GM foods, held jointly by the Food and Agriculture Organization and the World Health Organization (FAO/WHO) in Rome in January of 2001, recommended that a first step in assessing allergenicity of a transgenic protein should be a comparison of the amino acid sequence of the transgenic protein with the amino acid sequence of known human allergens (FAO/WHO, 2001). Dr. Steven Gendel of the US Food and Drug Administration found that Cry1Ab and Cry1Ac have significant sequence similarity to vitellogenin, a known egg allergen, and concluded that "the similarity between Cry1A(b) and vitellogenin might be sufficient to warrant additional evaluation" (Gendel, 1998b: 60). A series of studies published by scientists from Cuba and Mexico found that Cry1Ac is a potent systemic immunogen (e.g. evokes an immune response), as potent an adjuvant as the cholera sub-toxin, binds to gut cells and is capable of causing changes in the permeability of the gut (e.g. Vasquez-Padron et al., 1999a, 1999b, 2000). They concluded, "We think that previous to commercialization of food elaborated with self-insecticide transgenic plants it is necessary to perform toxicological tests to demonstrate the safety of Cry1A proteins for the mucosal tissue and for the immunological system of animals" (Vazquez-Padron et al., 2000b: 58). A study by Dutch scientists, utilizing the methodology for sequence similarity recommended by the FAO/WHO 2001 Expert Consultation, found sequence similarity between Cry1Ac and cedar pollen allergen (Kleter and Peijnenburg. 2002). Finally, the risk of immune response via inhalation is larger than the response from ingestion as inhaled substances are not exposed to gut digestive enzymes as they go directly into the circulatory system. In addition, some of the inhaled proteins can make it to the digestive system via the connection between the nasal passage and the esophagus. Unfortunately, implications of all these studies have not been pursued.

Engineering trees to produce Bt toxin could be far more dangerous. Pines are known for heavy pollination, spreading pollen for hundreds of kilometers. Establishment of plantations of pines that produce Bt pollen could potentially lead to widespread outbreaks of sickness. The impacts on wildlife and humans from consuming Bt plants have not been thoroughly researched. However, animal studies of the effects of Bt published in *Natural Toxins* found that Bt remains active in mammals that have eaten it and may in fact bind to the intestines, leading to "significant structural disturbances and intestinal growths."

Trees engineered to resist glyphosate-based herbicides (e.g. RoundUp) also pose a threat. Charles Benbrook found use of glyphosate-resistant crops resulting in 300-600% increases in the use of the herbicide. Studies in Oregon found that glyphosate exposure significantly increased the risk of late term spontaneous abortions and De Roos and other authors found an association between glyphosate use and the cancers non-Hodgkins lymphoma and multiple myeloma.

RoundUp is known to persist for up to 360 days in some ecosystems, and is commonly found as a contaminant in rivers. Additionally, studies have found that inhaling RoundUp is much more dangerous than ingesting it orally. RoundUp is commonly sprayed from the air where it can drift into nearby communities.

Effects on Forests and Ecosystems

Trees are being primarily engineered for insect resistance (with the Bt gene), tolerance to glyphosate, reduced lignin, and faster growth. The escape of any of these traits into native forests (considered inevitable given the unreliability of sterility technologies), is likely to unleash devastating impacts on native forest ecosystems. Potential impacts include: Contamination with the Bt-toxin insect resistance will decimate insects sensitive to Bt-toxin, such as Lepidopterae (butterflies and moths), and potentially their predators (Hilbeck, 1998) and further impacting on bird populations, ultimately disrupting forest ecosystems for which insects are an integral component. Contamination with the low-lignin gene resulting in forest trees that cannot resist insects, disease or environmental stresses like wind. Escape of the gene for faster growth leading to transgenic trees out-competing native trees and plants for light, water and nutrients and leading to soil loss and desertification.

Claire Williams, a transgenic tree researcher at Duke University in the U.S. discusses the ramifications:

"…The pursuit of genetic engineering in forest research is principally corporate, shaped by the imperatives of private investment, market forces and government regulatory institutions. Novel forest tree phenotypes are created as a means to increase shareholder value of investor companies. And although potential benefits will accrue to shareholders, it is clear that ecological risks of certain transgenic traits engineered into trees are likely to be shared by all. Private investment in forest biotechnology is … fueling the creation of novel transgenic

phenotypes in trees at a rate that is outstripping public policy deliberation and scientific assessment of environmental concerns specific to trees.

"In contrast to seasonally harvested crops, pollen and seeds from trees disperse without hindrance into their surroundings for many years. As seed and pollen production increase with the age and height of a tree, each year more seed and pollen travel progressively farther by a process known as long-distance dispersal. Most commercially cultivated tree species have many wild relatives that grow in similar locations; thus there is a high potential for mating. Biocontainment zones suited to transgenic food crops cannot deter escape of seeds or pollen... Reproductive sterility research for conifers, a complex problem, remains in its infancy.

"At present, we remain ignorant on numerous aspects of tree biology and ecology that affect whether or not we should proceed. A singular priority for forest research is determining the scale of regulatory oversight for transgenic forest trees. The genetic composition of [the world's] indigenous forests is at issue."

G. Sing et al. (1993) found pine pollen in Northern India more than 600km from the nearest pines. Pollen models created in 2004 by Duke University researchers demonstrated pollen from native forests in North Carolina in the U.S. traveling in air currents for more than 1,200km north into eastern Canada. This means that transgenic trees cannot be regulated only at the national level. Transboundary contamination of native forests with transgenic traits is virtually assured. Commercial release of transgenic trees must be addressed at the international level.

Transgenic Trees & Risk Assessment

In July, 2005 the United Nations Food and Agriculture Organization (FAO) published a report entitled "Preliminary Review of Biotechnology in Forestry Including Genetic Modification." They report 225 outdoor field trials of transgenic trees in 16 countries, with 150 in the United States. The remainder are mostly in Europe: France, Germany, Britain, Spain, Portugal, Finland and Sweden, as well as in Canada and Australia. Field tests in the developing world are listed in India, South Africa, Indonesia, Chile and Brazil. China is the only country known to have developed commercial plantations of transgenic trees, with well over one million trees planted across ten provinces.

In the FAO study, transgenic tree researchers were surveyed for their opinions about economic, health and environmental risks associated with transgenic trees. Over half of researchers surveyed reported the environmental threat of escape of transgenic pollen or plants into native ecosystems and forests and their impacts on non-target species as a major concern. The FAO's report concludes,

"New biotechnologies, in particular genetic modification, raise concerns. Admittedly, many questions remain unanswered for both agricultural crops and trees, and in particular those related to the impact of GM crops on the environment. Given that genetic modification in trees is already entering the commercial phase with GM *populus* in China, it is very important that environmental risk assessment studies are conducted with protocols and methodologies agreed upon at a national level and an international level. It is also important that the results of such studies are made widely available."

In the United States, the Environmental Protection Agency selected the Tree Genetic Engineering Research Cooperative at Oregon State University to assess the risks of transgenic trees. The head of this program is Steven Strauss, the leading advocate for GE trees in the U.S. and an advocate for the deregulation of GMOs. The impartiality of the risk assessment of this organization is clearly questionable.

Conclusion

The damaging effects of conventional industrial mono-culture tree plantations is already well-documented. The addition of transgenic tree plantations can only worsen these existing problems. Add to this the utter lack of credible risk assessment of transgenic tree release, especially on a global scale, and it becomes a matter of common sense that there must not be any further forward motion in the commercial development of transgenic tree plantations. The UN CBD must impose a moratorium on the technology and launch a thorough and global examination of the risks of this technology.

In conclusion, Dr. Suzuki states, "The rush to apply the ideas of genetic engineering is absolutely dangerous because we don't have a clue what the long-term impact of our manipulations is going to be."

CBD COP8 – Agenda point 26.1 - (Forest biodiversity: implementation of the programme of work)

Consideration of SBSTTA recommendation XI/11 (contained in UNEP/CBD/COP/8/3). Recommendation XI/11, paragraph 9 states:

Takes note of the potential impacts of genetically modified trees on forest biological diversity and suggests a process on how to address this issue.

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