FuturaGene
Yielding the Future™

Biotechnology for Sustainable Intensification of Plantation Forestry

RISI Latin America, 2015

Dr. Stanley Hirsch

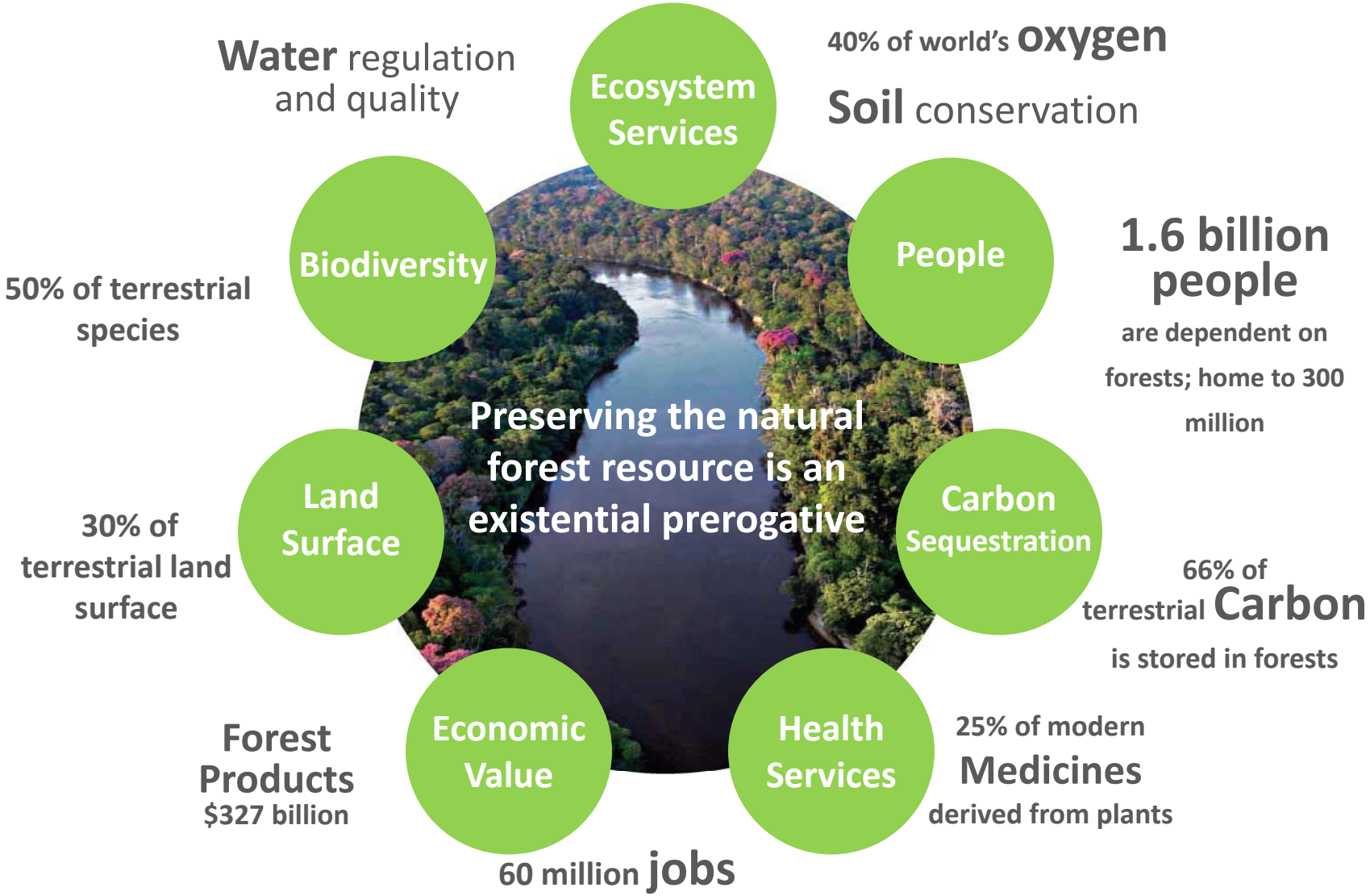
19.08.15

A Suzano Pulp & Paper Company

FuturaGene

Context of the debate

Intrinsic value of Forests



FuturaGene

Context of the debate

Intrinsic value of Forests

- Current wood fiber usage – 3 billion m^3 per annum
- 50% of this wood supplied by planted forests
- 264 million Ha of planted forests – 7% of the world forest base (FAO, 2010)
- Projected wood fiber demand by 2050 – 10 billion m^3 per annum (WWF Living Forests Report)
- This will require 250 million additional hectares of forest

Planted forests are a major part of this solution!

- 2050 is 5 rotations away in the sub-tropics and only one rotation away in northern Europe – thus we need a **step change in productivity**
- To achieve the required productivity gains, we will need increased reliance on **Scientific and Technological Innovation** (STI)

Context of the debate

The rationale for Scientific and Technological Innovation

World economy must be reconciled in **a finite global ecosystem** if natural resources are not to become binding constraint on development.

Ensuring wellbeing within planetary boundaries will require enhanced **resource use efficiency**, whilst meeting increasing demand.

Requires step changes in productivity and process efficiency and an expansion of the quality, scope and scale of products and services.

Improved process efficiency and scope of products **can only be achieved by increased reliance on STI.**

3-fold demand increase by 2050[1]

$200 billion biomass based products[2]

If the principal means to achieve resource use efficiency is to **produce more from less** through an intensification of existing practices,

Which will increasingly rely on STI

then:

We need frameworks:

- **To direct research to meet productivity challenges**
- **To provide governance for technology deployment, diffusion and implementation, down to the local level, and local users.**

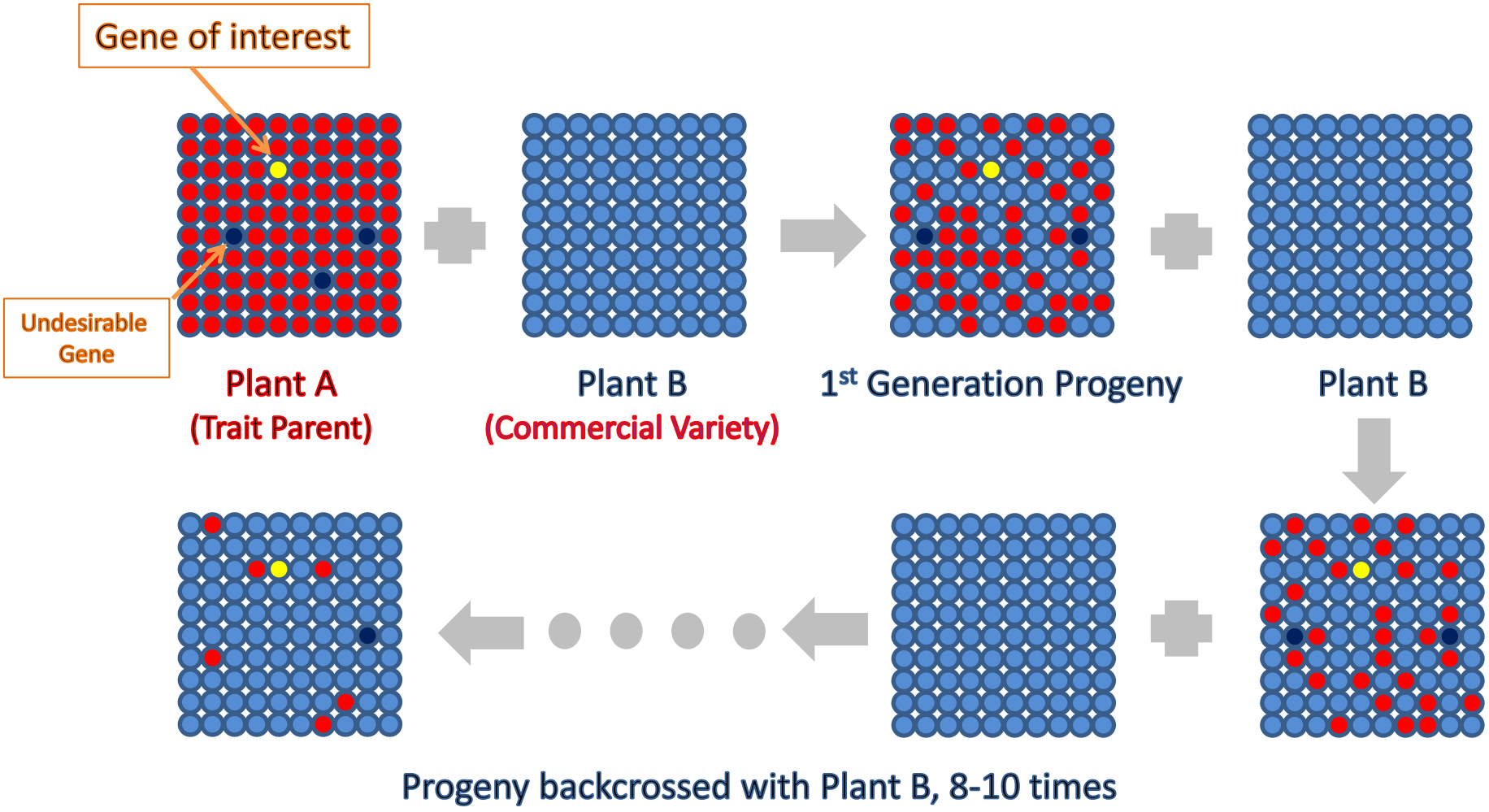
Forest sector carbon neutral by 2030[3]

Sources:
1: WWF Living Forest Report Chapter 4; 2. Forest Products Association of Canada, Biopathways 2, 2011; 3. Eliasch Review: Climate Change: Financing global forests, 2008

FuturaGene

Plant breeding

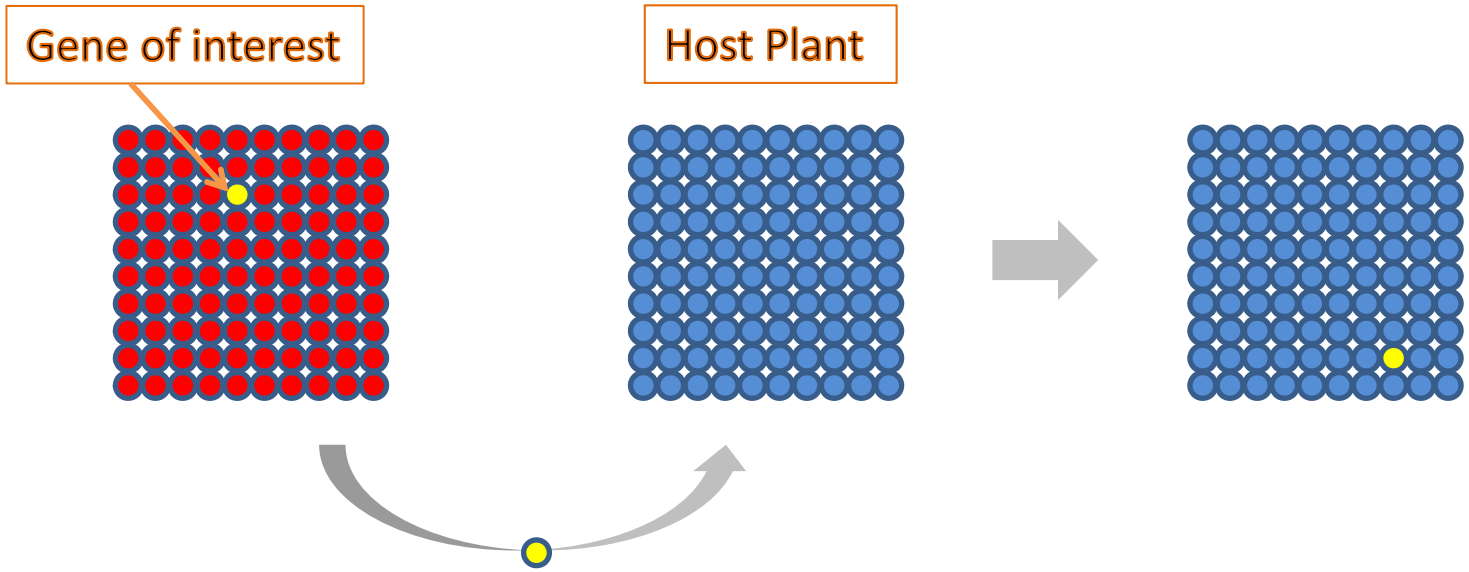
Slow and partially selective



Adapted from Flemish Interuniversity Institute for Biotechnology publication

Biotechnology

Creating a GMO



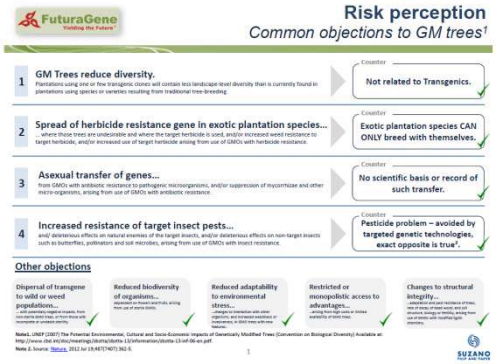
Adapted from Flemish Interuniversity Institute for Biotechnology publication

Context of the debate

GM Technology is part of the STI Solution

Facing the challenge:

- **The root cause of anti-GM ideology is political (1990's):**
  - European political sponsorship of anti-GM propaganda was seen as a means to tackle consolidation of power in the US agrochemical industry.
  - Anti-GM propaganda had immediate and massive emotional appeal and through that granted power to the "green" movement.
  - Anti-GM policy rapidly became an institutional norm granting automatic and self-sustaining moral high ground to any organization that sets out to defend environmental stewardship and human rights (2000).
- **Any logical rebuttals of deficient/pseudo science or emotional comments are evaded.**
- **Risk-Benefit discussions do not work.**
- **Precautionary principle abused** (progression of experimentation, taking scientific knowledge into account).

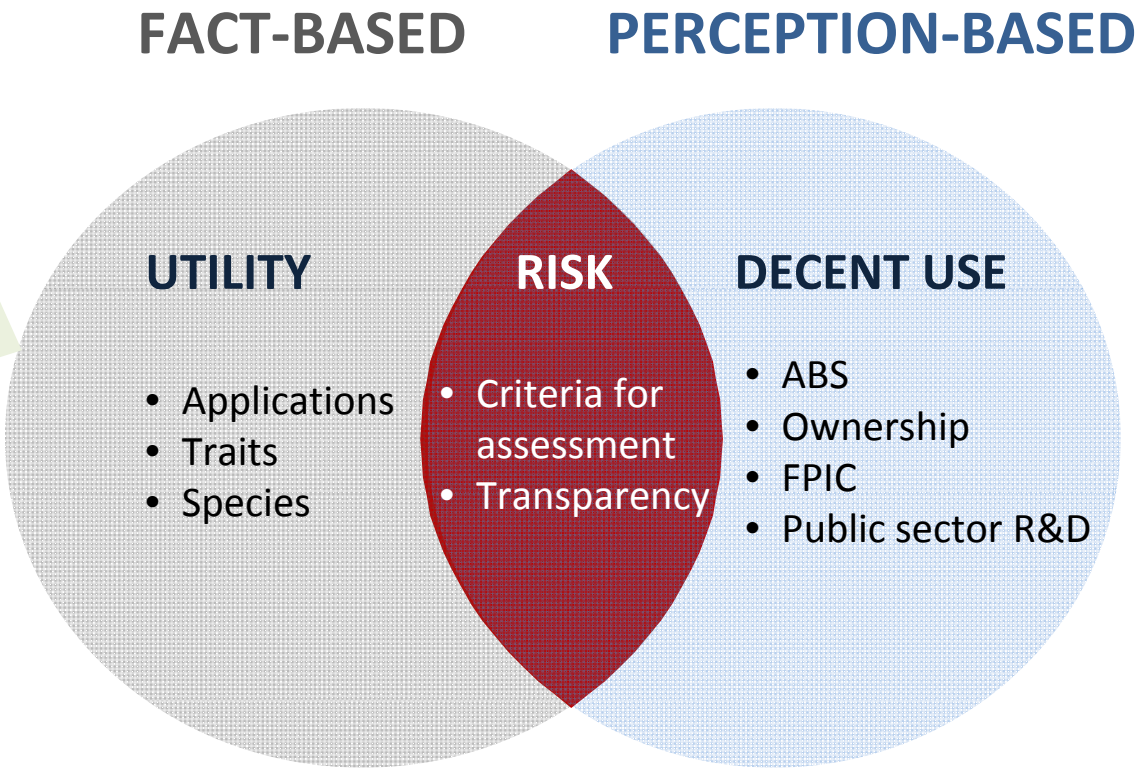


Context of the debate

Public acceptability criteria for GM Trees

"If modern biotechnology is to stand a chance, three main conditions for public acceptance must be met: utility, low risk, and an assurance that biotechnology is used in a decent way"

(GAMBORG AND SANDØE – FAO, 2010)

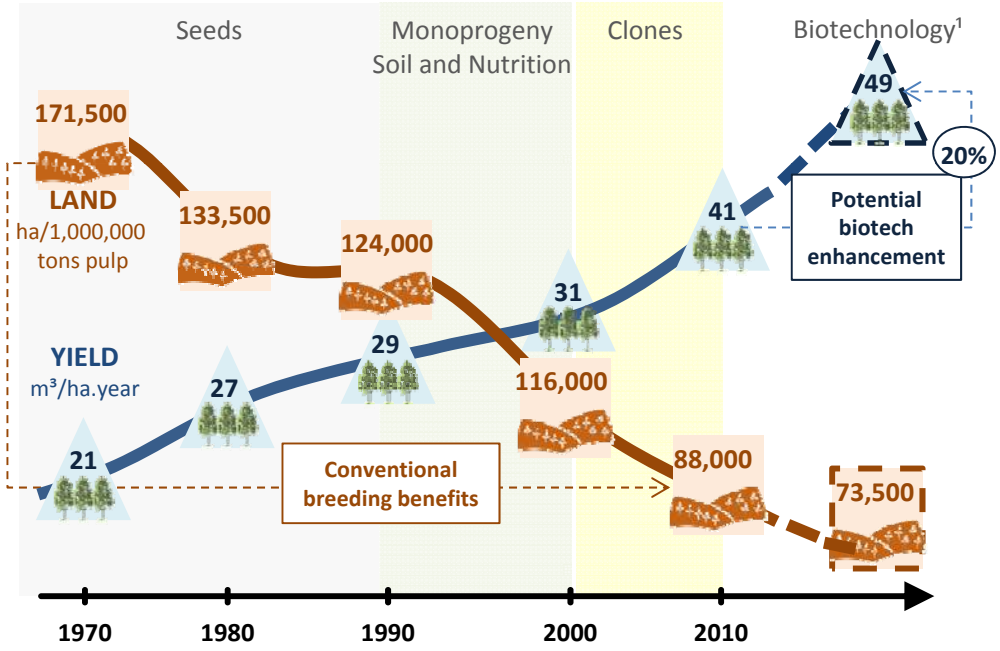


Legend:
ABS: Access & Benefit Sharing
FPIC: Free Prior & Informed Consent

Utility

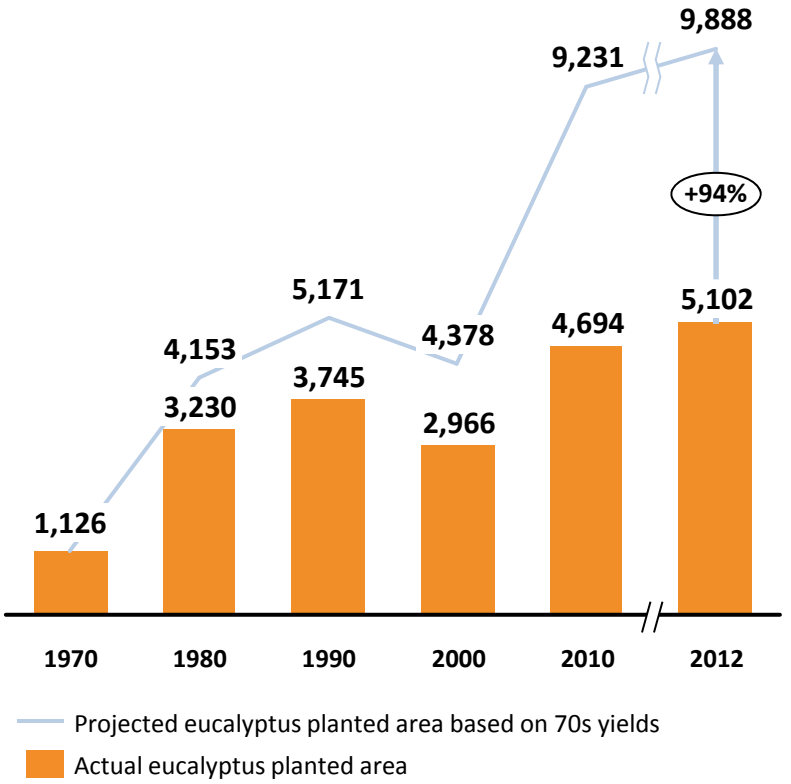
Producing more from less

Productivity and land requirement in selected years



Eucalyptus planted area in Brazil

(000) hectares



Note1. Taking into account current results from late stage field trials.

Source: SBS, Agricultural census - IBGE, ABRAF

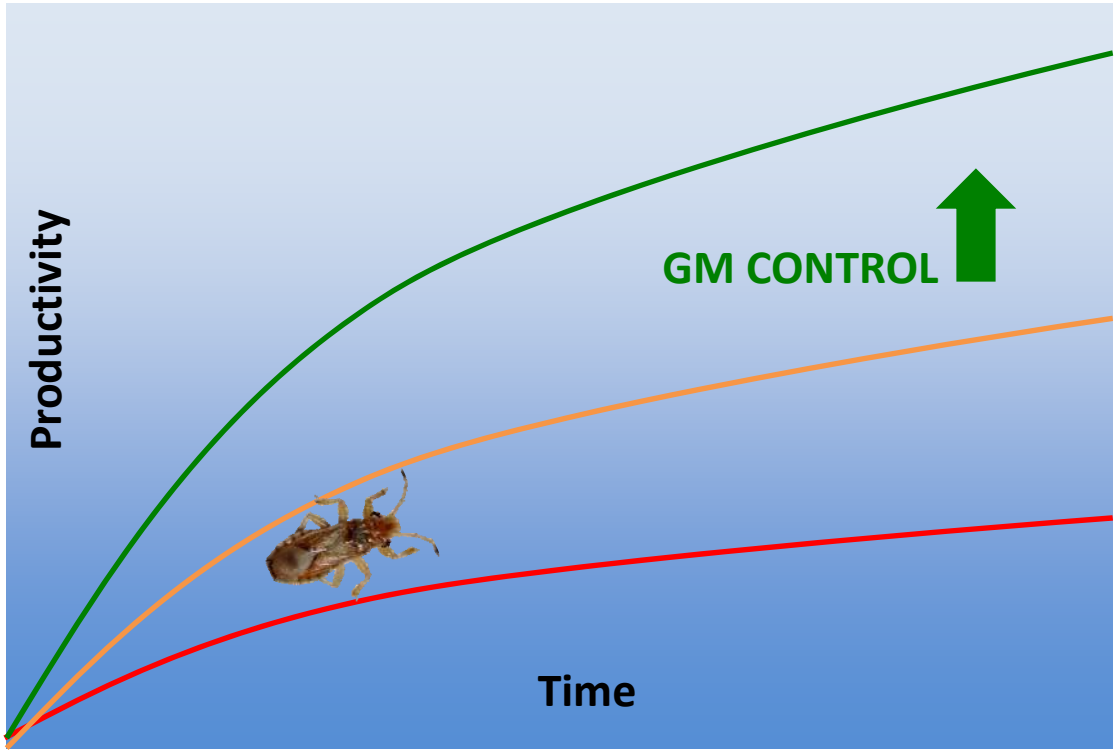
FuturaGene

Utility

Yield Enhancement

Utility

Yield Protection



Estimated crop yield losses worldwide (% of attainable yields)		
Crop	**Without pest control**	**Using mechanical, biological and chemical control measures**
Rice	77	37
Wheat	50	28
Potato	75	40

Source: **Crop losses to pests**, Oerke, E.-C. 2006. J. Agri. Sci. 144: 31–43.

Utility

20-Year Meta-analysis of the effect of GM Crops

Reduced chemical pesticide	37 %
Increased crop yields	**22 %**
Increased farmer profits	68 %

A Meta-Analysis of the Impacts of Genetically Modified Crops,
Klümper, W., & Qaim, M. (2014). PloS one, 9(11), e111629.

FuturaGene

Risk Assessment

Brazilian Biosafety Regime

- **Biosafety Law** - Law 11.105 of 2005 creates the National Biosafety Council (CNBS), the National Biosafety Commission (CTNBio), the Internal Biosafety Commission (CiBio) and the Biosafety Quality Certificate (CQB).

- CTNBio establishes all normatives required to perform work with GMOs, including NR5, for biosafety for commercial approvals.

- Brazilian legal framework follows the **Cartagena Protocol on Biosafety**, the **Codex Alimentarium** and the **Precautionary Principle**. The Brazilian law has been framed within the context of decision IX/5 (1) taken at the 9th Conference Of the Parties (COP9) to the Convention on Biological Diversity (CBD) in 2008.

- **Risk assessment studies** conducted to evaluate the biosafety of FGN's initial GM eucalyptus product carried out according to Brazilian Biosafety Law 11.105 and Normative Resolution #5 – GM event characterisation, environmental testing, health and safety testing.

Risk Assessment

Comparison of EU and Brazilian biosafety

Regulatory framework

- Regulate activities with GMO
- Aim to protect human health and the environment, in accordance with the precautionary principle
- Define "GMO" in a comparable way
- Impose equivalent regulatory provisions (Identification of the competent authority and related structures/ Activities can only proceed with prior authorization by the competent authority/ A process for decision making/ Provisions for public information and involvement/ Obligation to mitigate accidents, inform authorities and investigate the causes/ Indication of control, inspection and enforcement agencies/ Penalties in case of non-compliance)

Risk assessment

- **Data requirements - Normative resolution #5 versus Regulation (EU) N°503/2013**
  - Topics requested by Brazilian and European authorities are very similar and both are based on a comparative approach
  - Differences may exist in the details of the requirements
  - Many of these requirements have been established for field crops intended for downstream food and feed use
- **Risk Assessment**
  - Previous product evaluations indicate that **CTNBio and EFSA GMO Panel followed a similar methodology** and used similar criteria
  - Main considerations are based on general principles of safety determined by international bodies like the OECD, WHO and FAO

Risk Assessment

Comparison of EU and Brazilian biosafety

Decision process

- Similar processes (including facilities for public consultation)
- **Product approvals:**
  - EU has predominantly considered applications of imports
  - EU has approved more GM crops than Brazil
  - Brazil has not approved products that were rejected in EU

Accompanying measures

Brazil and EU are comparable

- **Post market monitoring**
  - Both include case specific monitoring and general surveillance
- **Co-existence**
  - Provisions to ensure availability of non-GM products
- **Labelling**
  - Specific marking/wording for products containing or derived from GMO
- **Low level presence**
  - EU has an approach for setting a 0,1% threshold for certain not-yet approved products

FuturaGene

Risk Assessment

Yield Enhanced Eucalyptus - Biosafety Summary

- **Tree biology**
  - Phenotype – no visible differences
  - Fiber and wood properties – no change
  - Pollen – no changes in morphology or viability

- **Chemical composition** – no significant differences

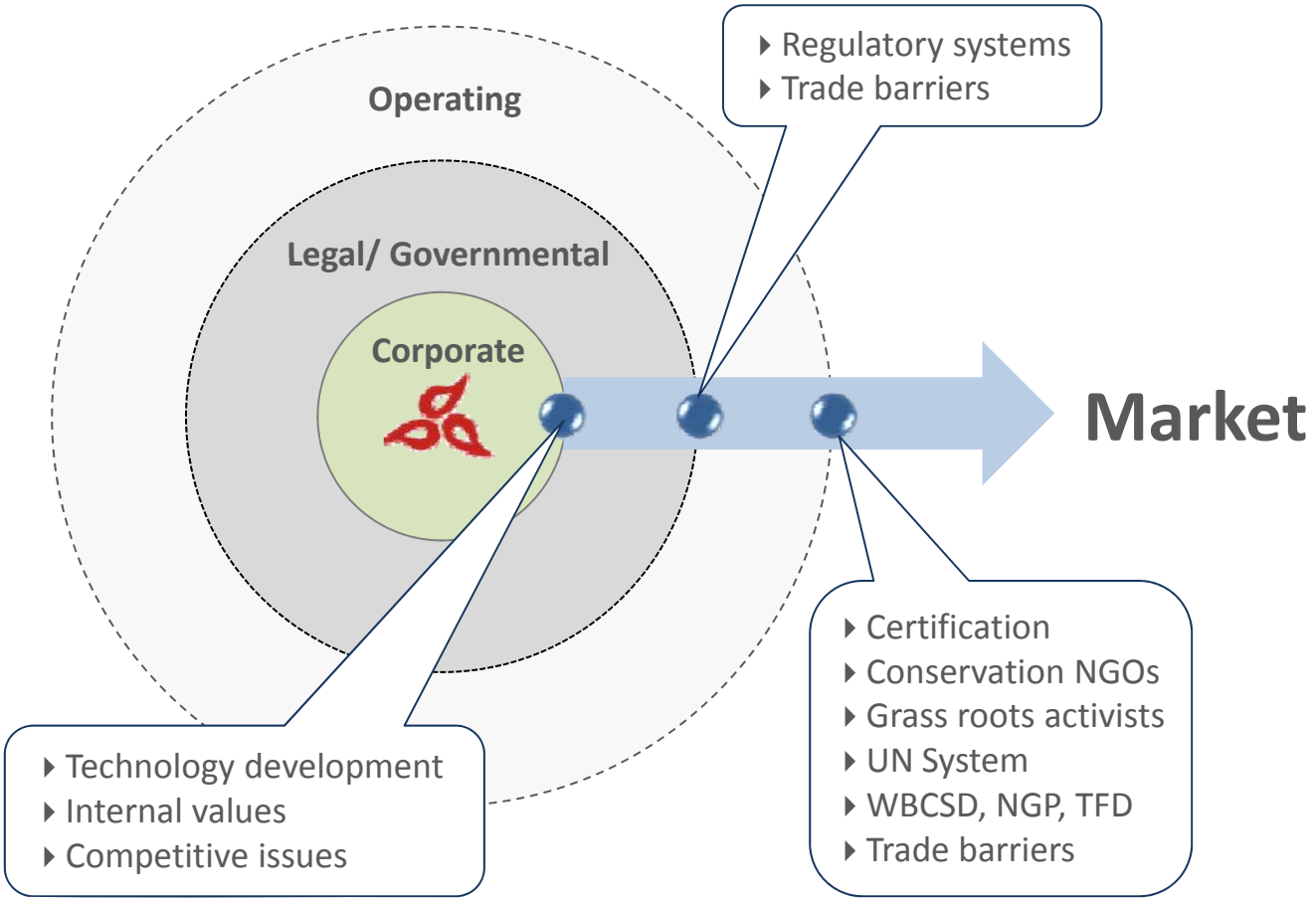
- **Environmental impact**
  - Decomposition rate unchanged
  - No impact on other organisms, including aquatic spp., microorganisms, insects and bees
  - Gene flow – tends to zero at <700m
  - No change in invasive potential
  - Exotic - no potential to cross with wild species in Brazil
  - No physical or microbiological changes in the soil

- **Health** – protein expressed by transgene is non-toxic, non-allergenic

Summary of data: substantial equivalence to conventional counterpart and no detrimental environmental impact.

Decent Use

3 Spheres of Influence on Market Access



Field Crop Biotechnology

- Private sector composed of agro-chemical companies that acquired seed and biotechnology companies.
- Major crop germplasm owned by very limited group of multinationals.
- Intensive breeding over many years - genetic diversity of many crops is low, tight control on seed.
- Trait development tightly linked to chemical business.

Forest Sector Biotechnology

- Forest sector is highly fragmented, as is germplasm ownership.
- Diverse range of geographies & outputs dictate diversity of germplasm: bio-economy will reinforce this trend.
- Many forest companies rely on contract growers – "social farming" – germplasm benefits dissipated - potential for impact in rural development is high.
- Degraded land is used for planting, soil quality requirements are lower than for food crops.
- Crop is perennial and long term, strong incentive to integrate environmental and social sustainability into business models.
- Free, Prior and Informed Consent built into sustainable forest operations.
- Potentially carbon negative.

Decent Use

Operating Space

Social License to Operate

Land Management

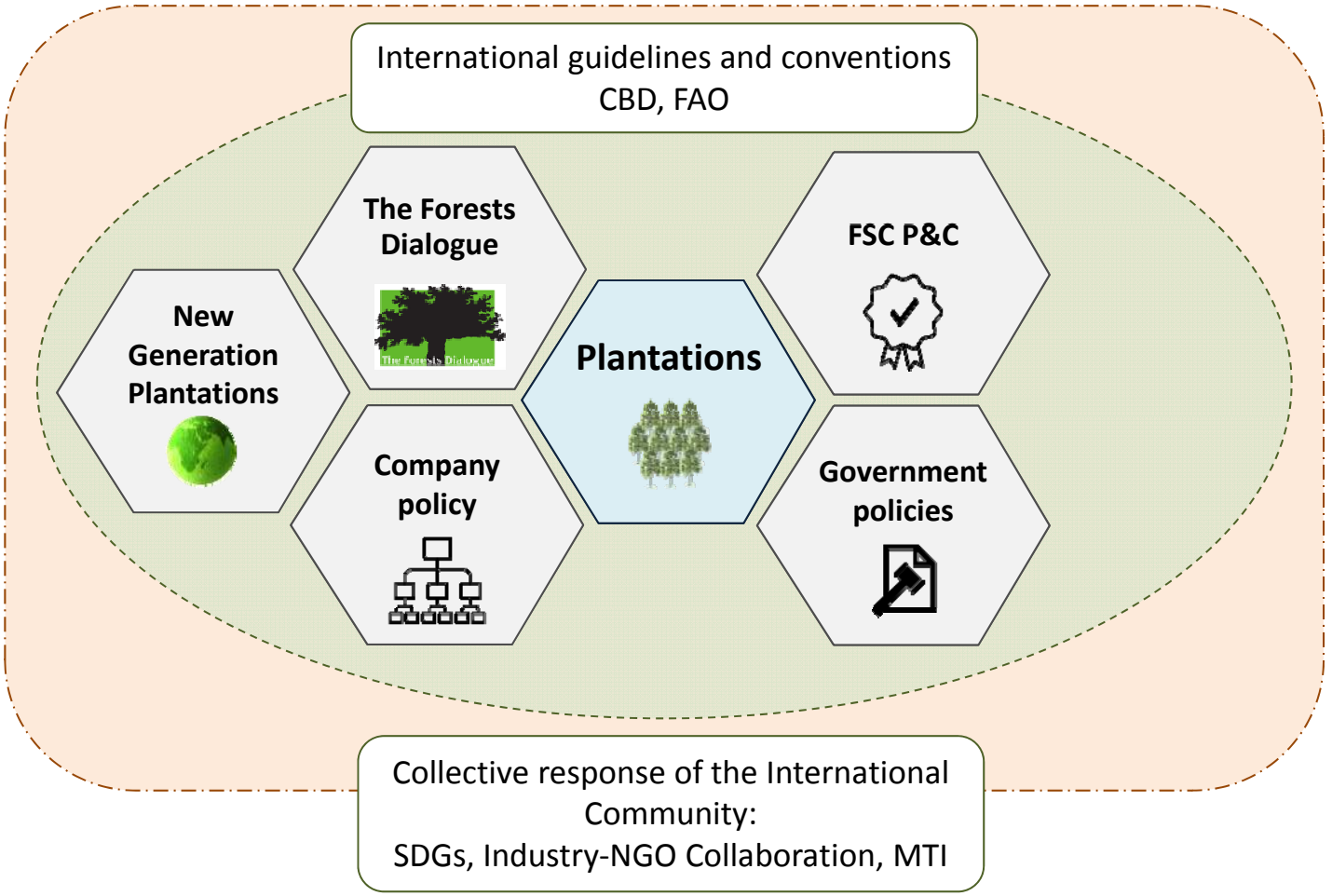
Zoning

- Spectrum of NGOs - Confrontational to Rational
- Certification bodies:
  - FSC
  - SFI
  - PEFC

  - None currently open to GM Tree deployment
  - Complex governance systems
  - Multiple stakeholders

Decent Use

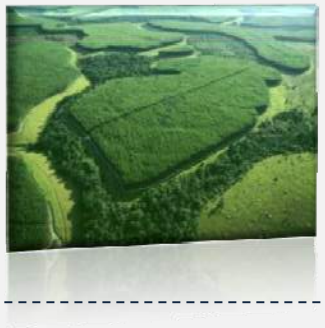
Operating Space -Sustainable plantation management



FuturaGene

Decent Use

Impact of proper governance

Impact		Benefit
Environmental		▸ **0.96 ha reserve** set aside for each hectare planted (**3M ha sector wide**). ▸ Planting on **degraded land** ▸ Protection of riparian zones ▸ **64 million metric tons of CO_2** sequestered annually
Social		▸ **13,000 families** integrated in production chain ▸ **1,000 municipalities** ▸ **$64 million** invested in Social projects in 2013 ▸ **30% - 40% fibre** sourced from outgrowers (Suzano) ▸ **22,400 ha** of outgrower plantations certified – 4x income per hectare compared to ranching
Food Security		▸ **100% production from 0.7%** of land surface ▸ **ILPF (Integrated Agriculture –Forestry Program) targets 70 million ha** degraded pasture land

Decent Use

Dialogue with Civil Society - Brazil Diálogo Florestal Visit

Summary

Sustainability through innovation

Sustainable intensification of productivity is a necessity if we are to meet increasing demand whilst moving to net zero deforestation and degradation.

The step changes needed in productivity can only be driven by an increased reliance on scientific and technological innovation (STI).

The GM tree debate and plantations are linked by the need for sustainable intensification. Most of the arguments against GM trees are actually anti-plantations/anti-business.

Biotechnology is a potential "game changer" and a key tool for sustainable forestry practices. Addresses issues which may have no alternative solutions.

The forest sector is fundamentally different from "AgriBusiness" – fragmentation of germplasm ownership, not driven by chemical sales, interactions with communities and potentially carbon negative.

The forest sector understands the need for productivity enhancement and yield protection and must work in unison with civil society to advance a constructive debate on STI. <u>This is a sector-wide issue and impacts all players!</u>

Final Comment

Convergence

Deep rooted Ideological Conflict

Can be Overcome

when

Leadership on Performance Standards

and

Cooperation on Actions

Impact Common Objectives

Our Purpose

Meeting Global Needs whilst Sustaining Biodiversity & Beauty

FuturaGene
Yielding the Future™

Stanley Hirsch
Group CEO
P. + 972 8 931 9550
stanley@futuragene.com

www.futuragene.com

A Suzano Pulp & Paper Company