

Biotechnology - a solution for wilding conifers in New Zealand?

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Wilding Conifers

Wilding conifers (particularly Douglas-fir) are a major problem:

- Invade conservation/pasture land
- challenge to control
- Restrict new plantings



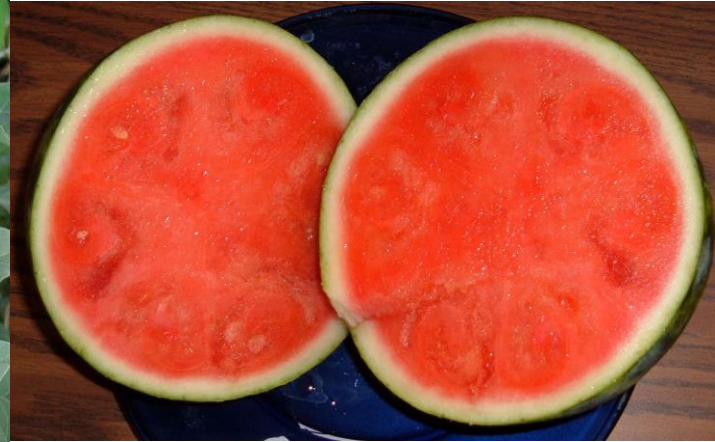
Prevention

Use biotechnology to prevent development of functional cones.

No Viable Pollen or Seed

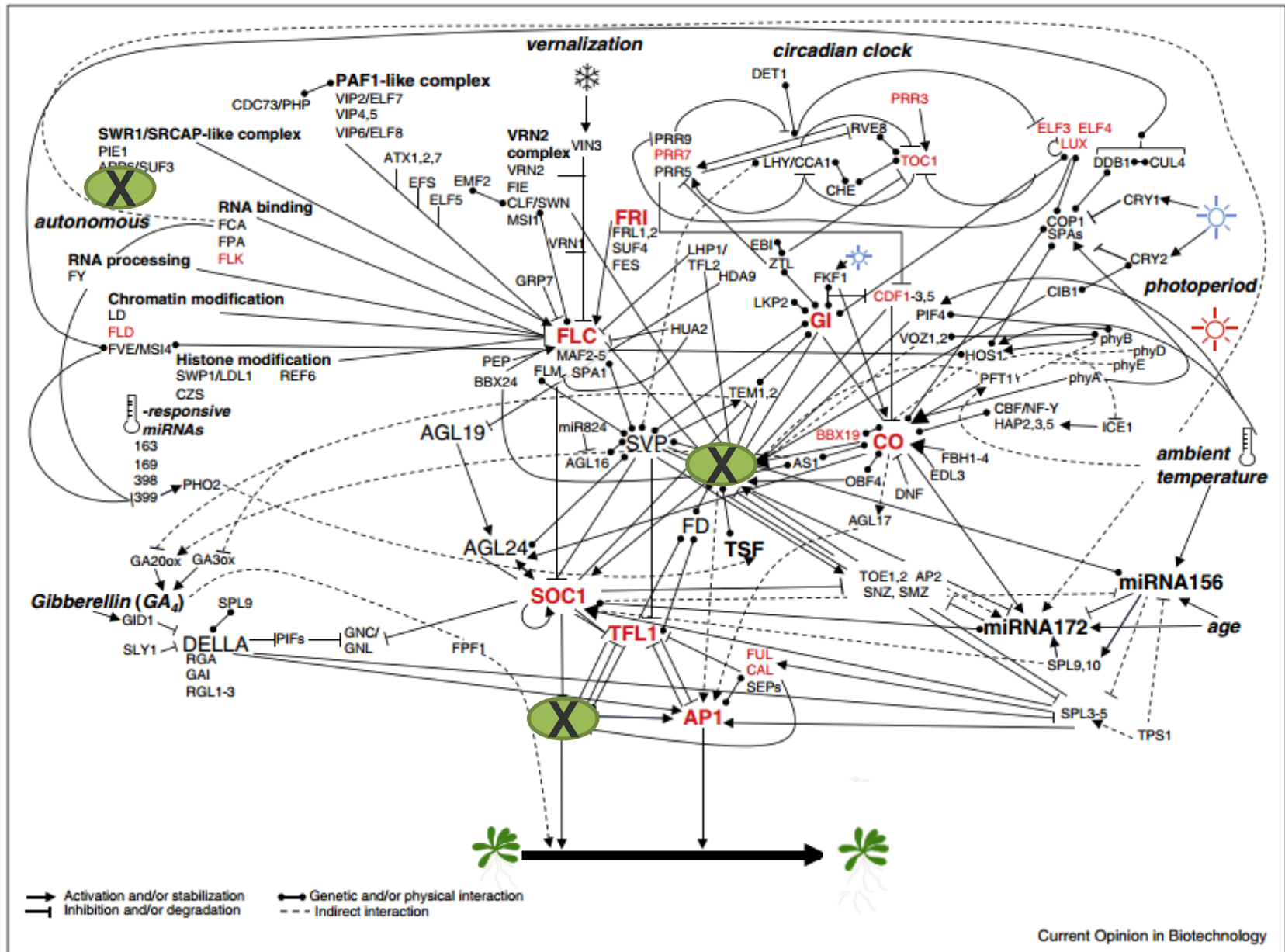


- No new wildings
- Boost growth - energy used for reproduction used for additional growth?



Navel Orange – natural mutation found Brazil 1820
All Navel Oranges derived from this original cutting

Engineered sterility





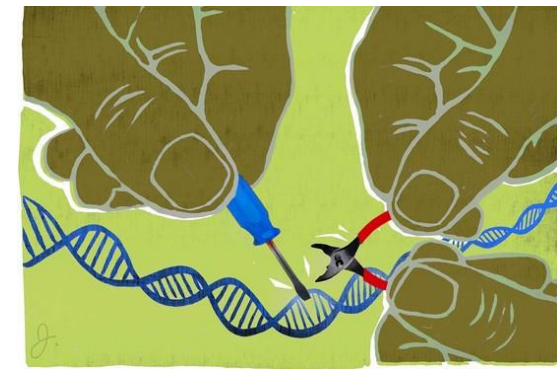
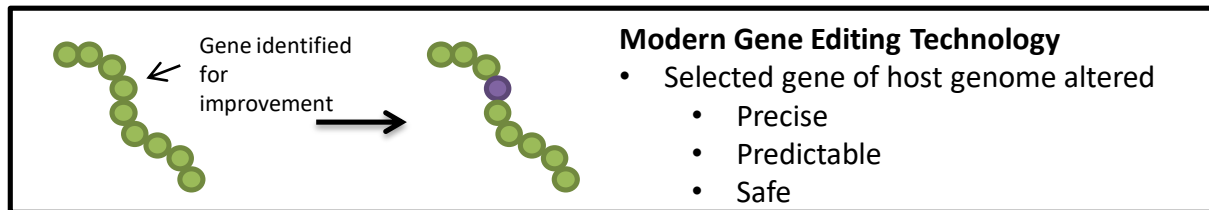
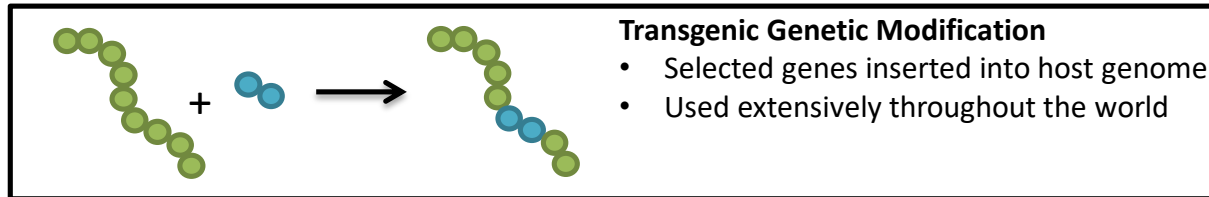
Do Conifers contain the genes that have been shown to cause sterility when engineered in other plants and do they do the same thing?

Do Conifers contain new/unknown genes that might be good targets for engineered sterility?



Can we edit these genes to produce non-wildling trees?

How to engineer sterility?



Gene editing

Edit (change) a gene that is already there

- New genes are not added
- Very precise – change only the gene you want
- Changes are of the same type as found using traditional mutagenesis
 - Cannot distinguish from a natural change
- Non-GMO in many jurisdictions – can be done without adding any DNA

Projects

Make Wood Not Love

Proof of concept

Rapid prototyping

Model species -Japanese red pine
(*Pinus densiflora*)

Produces cones when 3 years old

Small –all work indoors

Discover and test new genes



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Winning Against Wildings

Towards commercial release

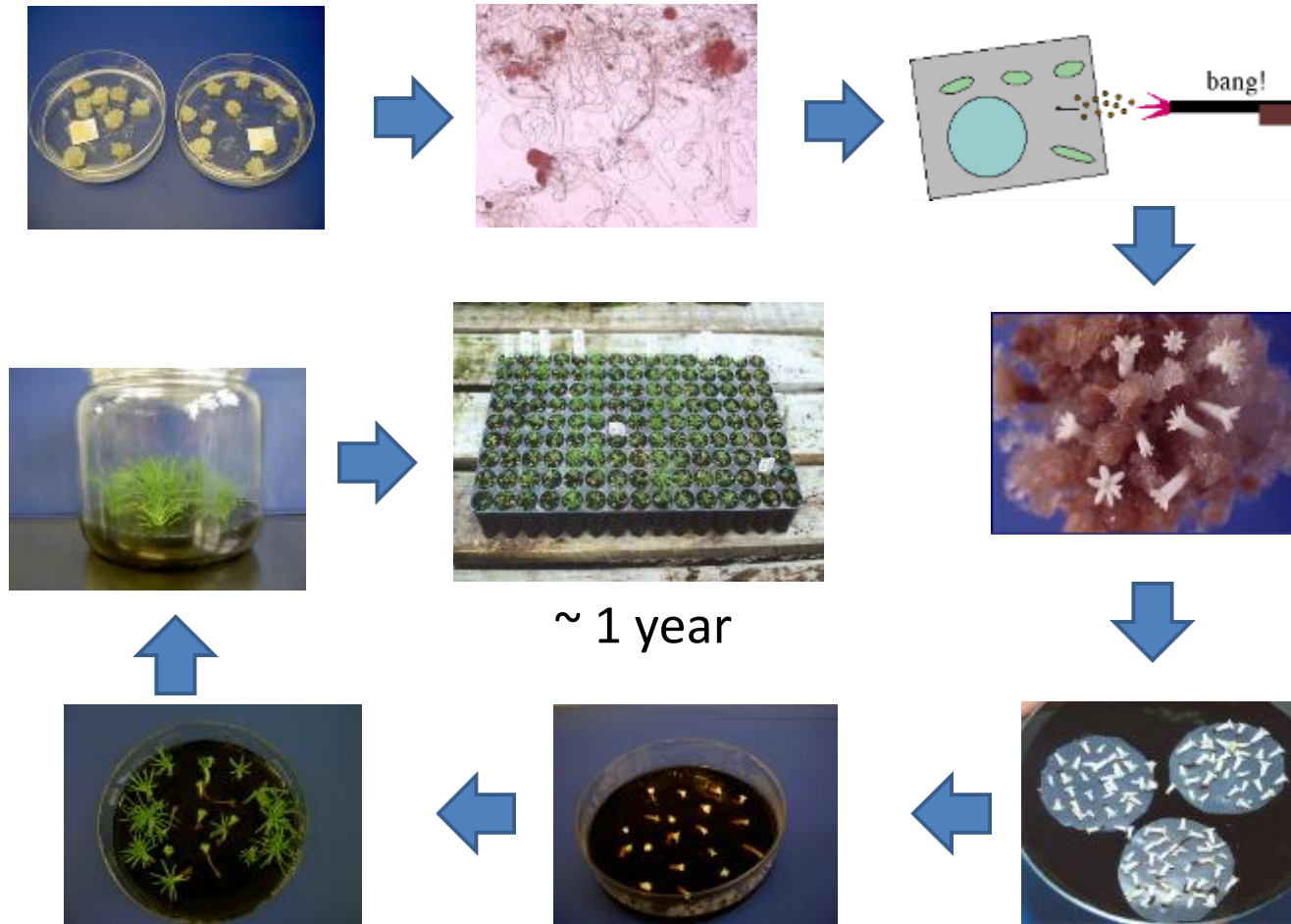
Implementation in Douglas fir

Conditional release



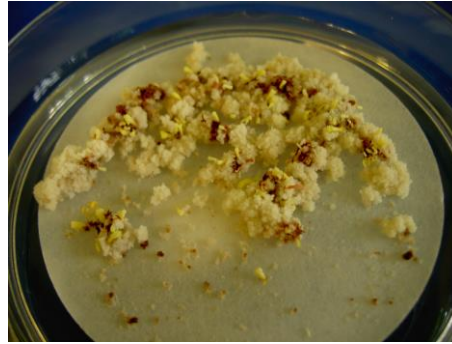
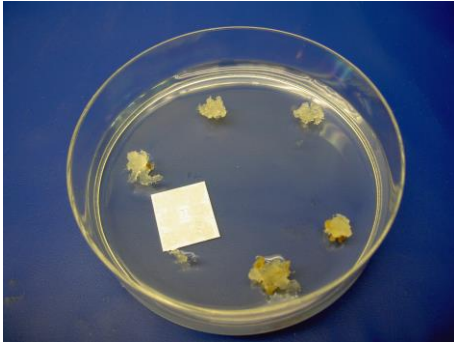
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Engineering of *Conifers*



Also the route to clonal propagation...

Good Progress developing tissue culture systems



Douglas fir

Finding genes and prototyping

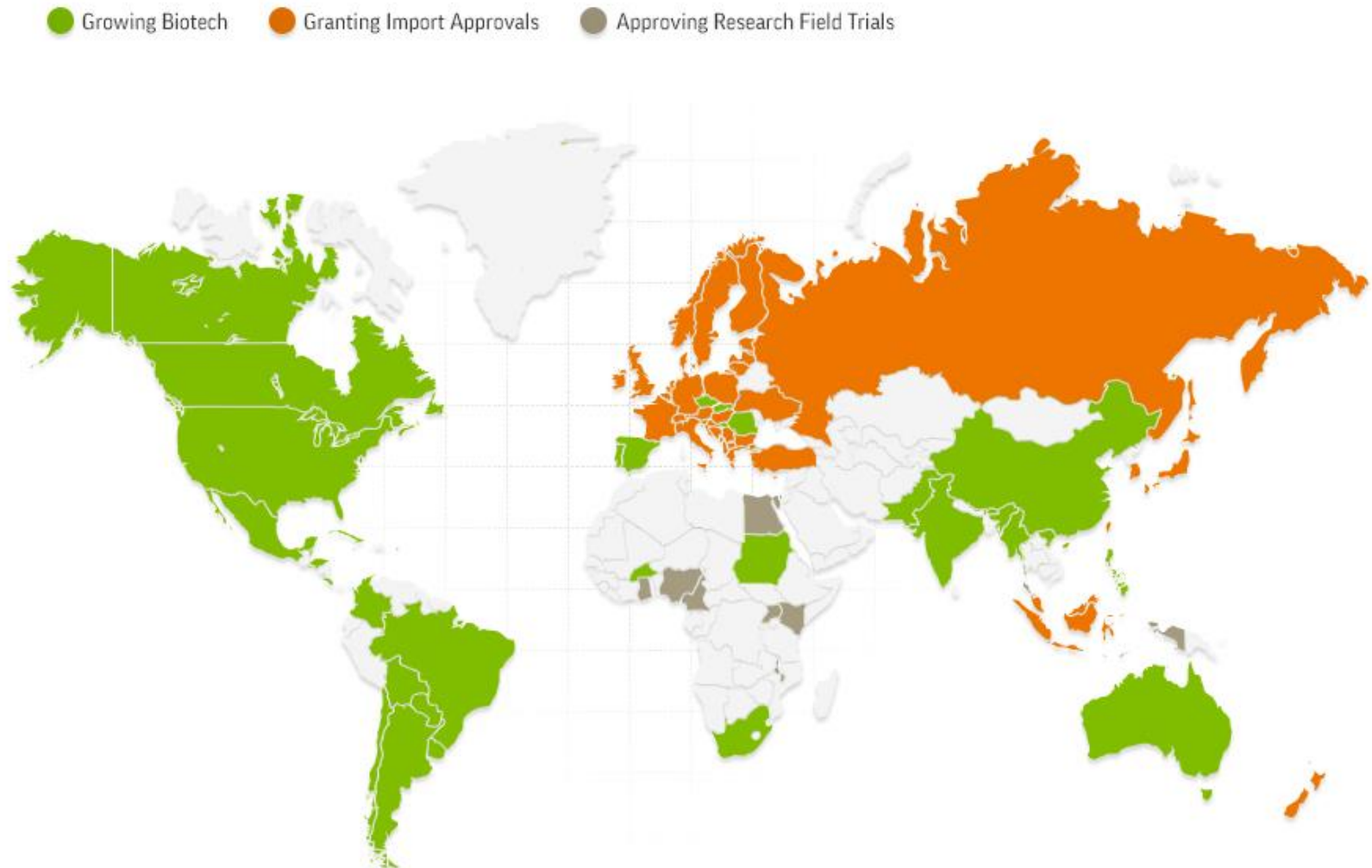
- Started experiments to look at which conifer genes are involved in reproduction



- Initial engineered plants (transgenic)



IN 2013, **27 COUNTRIES** WERE **GROWING BIOTECH CROPS**;
OTHERS ARE **SIGNIFICANT IMPORTERS**.





2015 FuturaGene's Eucalyptus approved for use in Brazil

SWEETREE TECHNOLOGIES
Innovators in Forest Biotechnology

(Sweden, Brazil, China)
Screened >1000 genes; 35 in field trials



Sterile mosquitoes
-disease control



High oleic soy



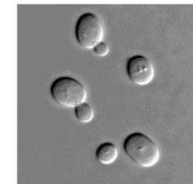
Innate™ Low acrylamide
potatoes approved 2015



Arctic
Apple
Approved
2015



**Historic 'living drug'
gets go-ahead**
August 2017



Yeast/bacteria
Enzymes – food,
washing powder,
Bio-plastic



Artemisinin - Malaria



ATryn Goats - antithrombin



Reactors:
Fuels,
chemicals



Aquadvantage salmon - Approved
April 2016 US, May 2016 Canada



Gene-edited CRISPR mushroom escapes US regulation
A fungus engineered with the CRISPR–Cas9 technique can be
cultivated and sold without further oversight.

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