



GREENWOOD  
RESOURCES

*A Resource That Lasts Forever™*

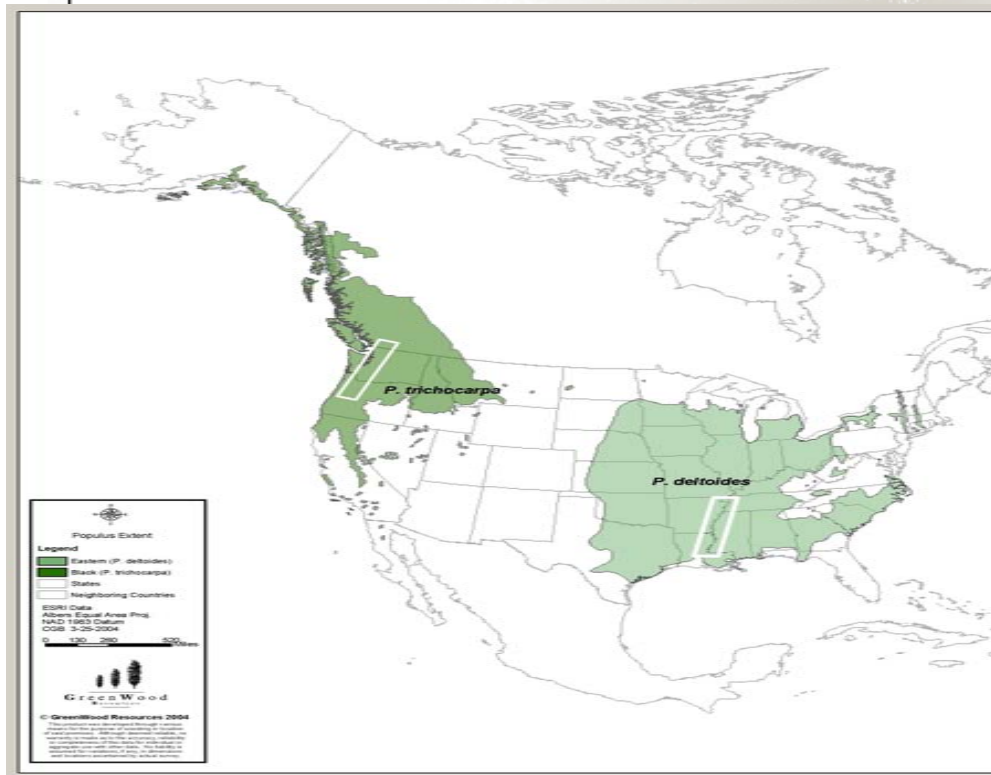


# GreenWood Resources Tree Improvement Protocol





# GWR's Breeding Stock

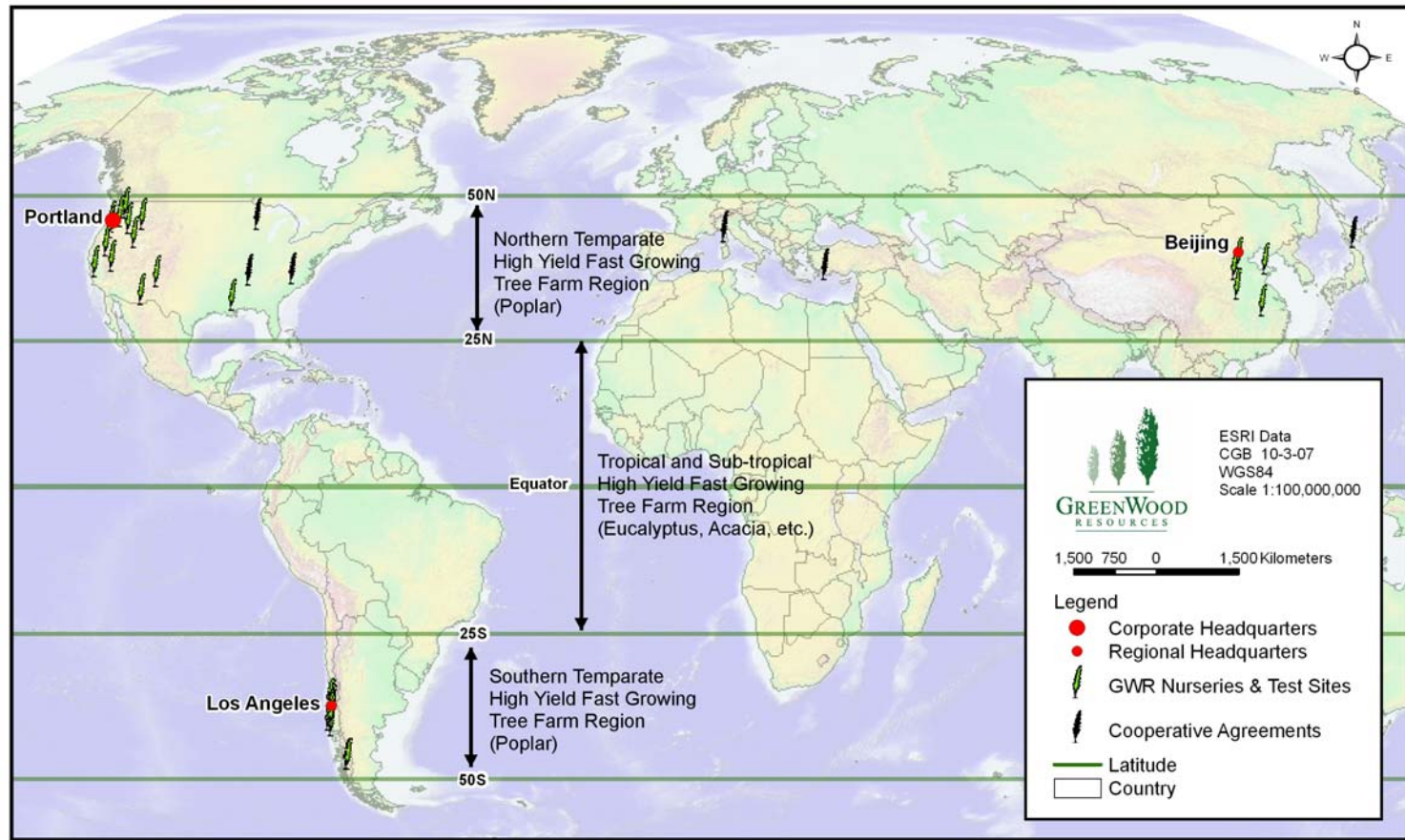


GWR has extensive research facilities located in Oregon and Mississippi where we breed both improved parent material and their hybrid offspring from our private nursery stock.

Our breeding program is internationally recognized for its collections of *Populus trichocarpa*, *P. deltoides* and *P nigra*.



# Plant Material Testing and Development



Since 2002 the company has conducted cooperative breeding and testing programs with research universities, government entities and private companies throughout the US, Chile, China, Turkey, Japan and Italy.

Since spring 2006 the company has developed its own tree improvement nurseries in China and Chile to complement its existing US based tree improvement effort.





# Parental Selection



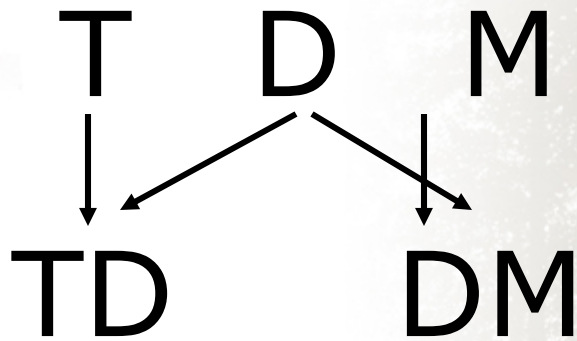
GWR has collected parent material for more than 20 years and is now using second generation parent stock in its hybrid work.

Parent trees are originally selected for their outstanding growth and wood characteristics, resistance to disease and wind firmness.

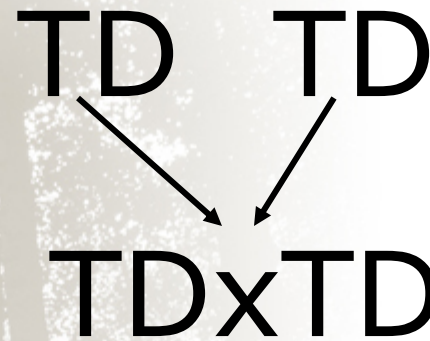
GWR is building on its *P. trichocarpa*, *deltoides*, *nigra* and *maximowiczii* programs by creating global breeding partnerships with other organizations for the world wide poplar industry.



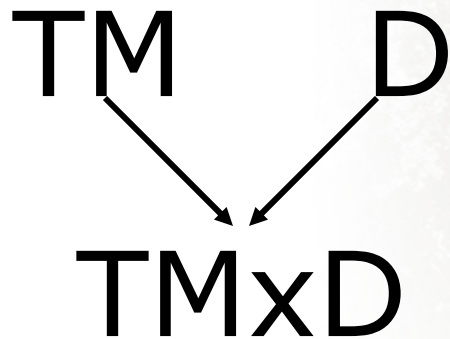
# Hybridization Strategies



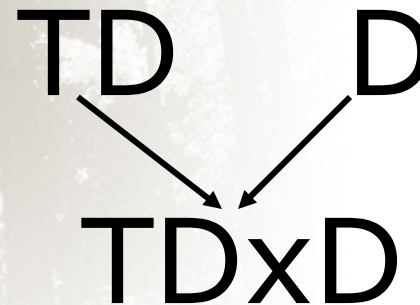
**First Generation Hybridization**



**Second Generation Hybridization**



**Three-Way Hybridization**



**Backcrossing**



# Hybridization



Hybridization is conducted under controlled conditions in a greenhouse where pedigree identification is strictly maintained and guarded.

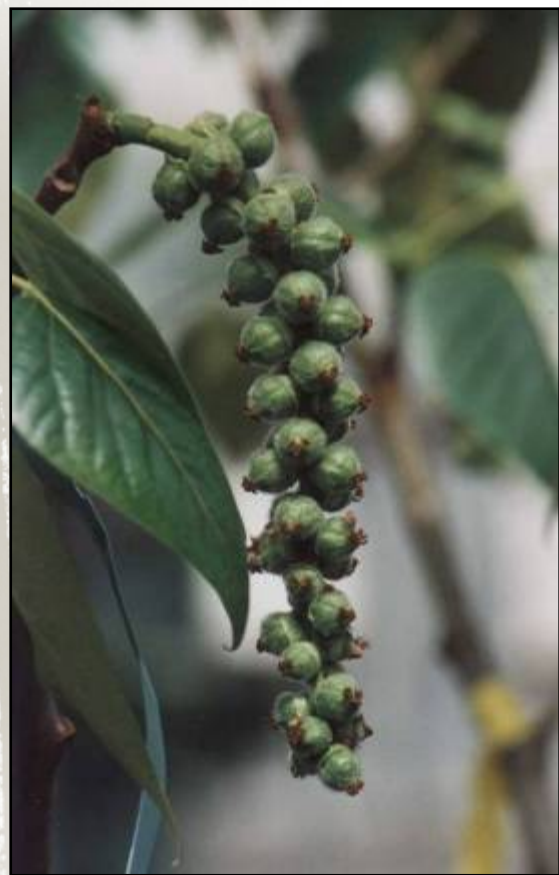


# Hybridization



Every cross is carefully labeled and documented to record and follow our most effective crossings.

GWR now produces about 4000 crosses each year to put into trials.





# Nursery



The new hybrids are propagated and carefully moved from the greenhouse to the nursery fields where they begin their screening process.





# Screening



The best varieties from the nursery are moved into the first of several stages of a clonal testing protocol that continues through refinement and final verification.

Varieties are initially screened for two years to monitor disease susceptibility.



# Refinement



The best clones to pass through screening are refined for their growth rate, stem form, and wood quality superiority.

Pest resistance is closely monitored throughout all three stages of the testing protocol.



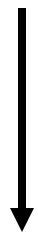
## Scale Up



1



1000



1,000,000

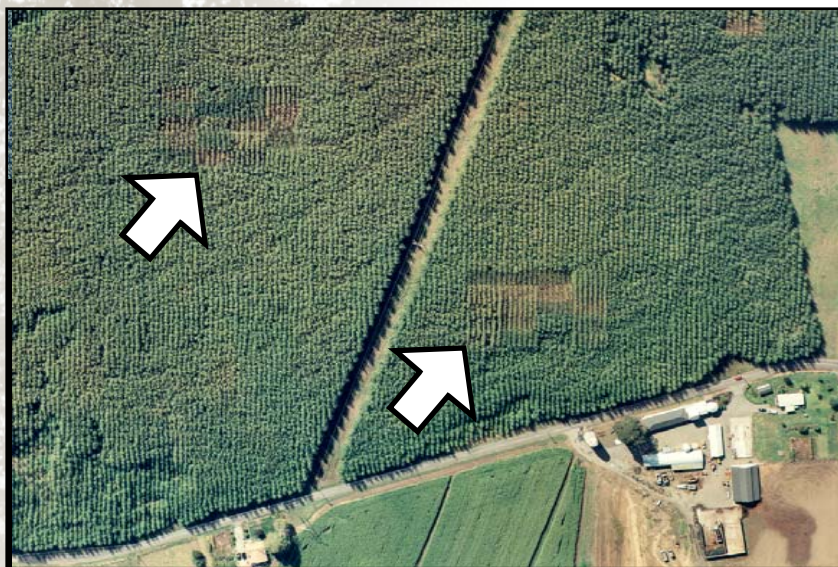
The nature of poplar allows for rapid and massive propagation. Limited cuttings of a single variety can be scaled up into millions of genetically identical trees in short order.



# Verification



Each selected variety is tested under operational conditions where its yield potential is measured at several different locations and environmental conditions.





# Breeding, refinement & selection process

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	Refinement	Scale Up	Verification								Deployment		
2	Refinement	Scale Up	Verification								Deployment		
3	Refinement		Scale Up	Verification								Deployment	
4	Refinement			Scale Up	Verification								
5	Screening	Refinement			Scale Up	Verification							
6	Screening	Refinement				Scale Up	Verification						
7	Nursery	Screening	Refinement				Scale Up	Verification					
8	Hybridize	Nursery	Screening	Refinement				Scale Up	Verification				
9	Parental Selection	Hybridize	Nursery	Screening	Refinement				Scale Up	Verification			
10		Parental Selection	Hybridize	Nursery	Screening	Refinement				Scale Up	Verification		
11			Parental Selection	Hybridize	Nursery	Screening	Refinement				Scale Up	Verification	
12				Parental Selection	Hybridize	Nursery	Screening	Refinement				Scale Up	
13					Parental Selection	Hybridize	Nursery	Screening	Refinement				
14						Parental Selection	Hybridize	Nursery	Screening	Refinement			
15							Parental Selection	Hybridize	Nursery	Screening	Refinement		
16								Parental Selection	Hybridize	Nursery	Screening	Refinement	
17									Parental Selection	Hybridize	Nursery	Screening	Refinement
18										Parental Selection	Hybridize	Nursery	Screening
19											Parental Selection	Hybridize	Nursery
20												Parental Selection	Hybridize
21													Parental Selection

Begun in the mid-1980s, Greenwood Resources' intensive breeding, refinement and selection process will continue to produce advanced hybrids in perpetuity.





## Yield Information



GWR has seen a 10% - 15% increase in biomass yield each rotation as a result directly attributed to our breeding program.

We have increased our yields, while decreasing the risk of failure due to diseases, pests and wind damage.