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Harnessing Natural Variation to De-risk Bio-based Economies

Wellington Muchero

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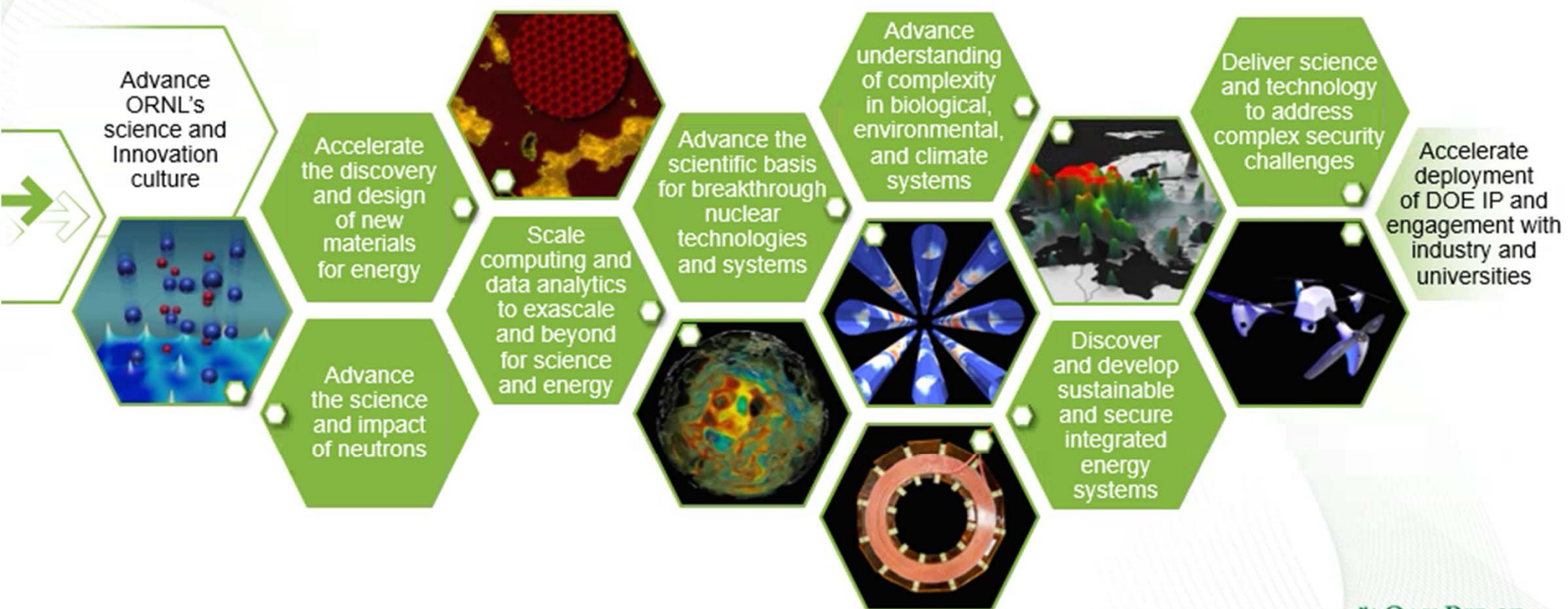
Harnessing natural variation to de-risk bio-based economies

National Lab Day
Butte, Montana (Oct 8th, 2019)

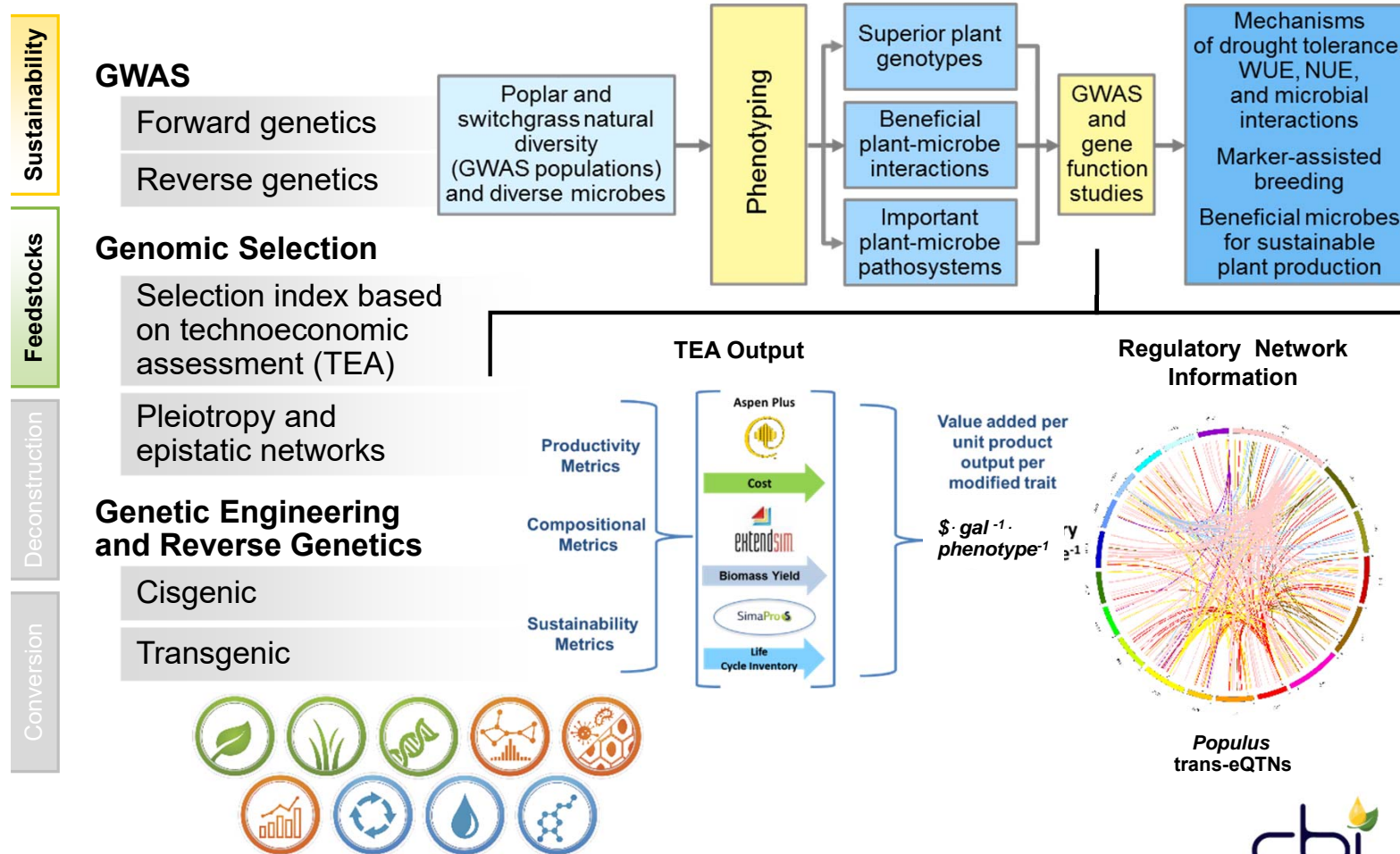
Wellington Muchero
Center for Bioenergy Innovation
Oak Ridge National Laboratory



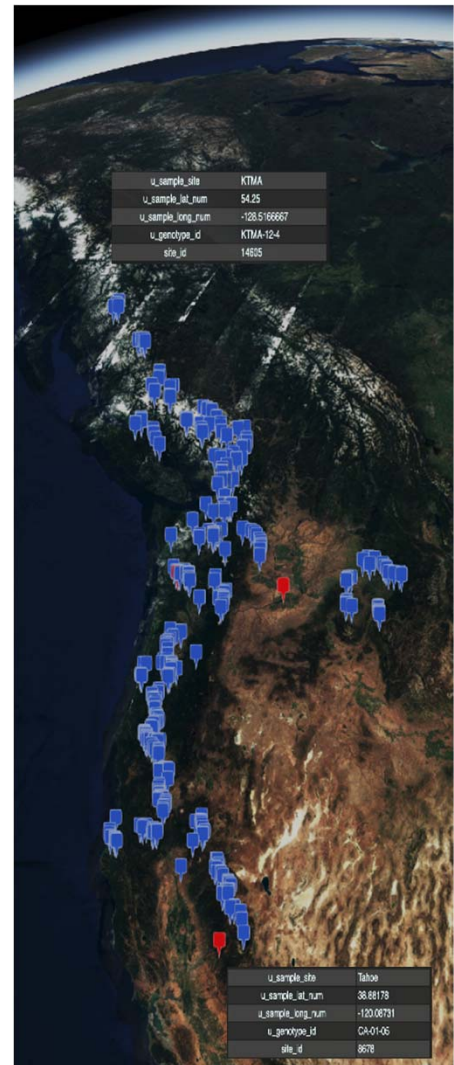
Our core capabilities position us to tackle compelling problems in science and technology



Disruptive methods to engineer elite feedstocks



The poplar GWAS mapping panel



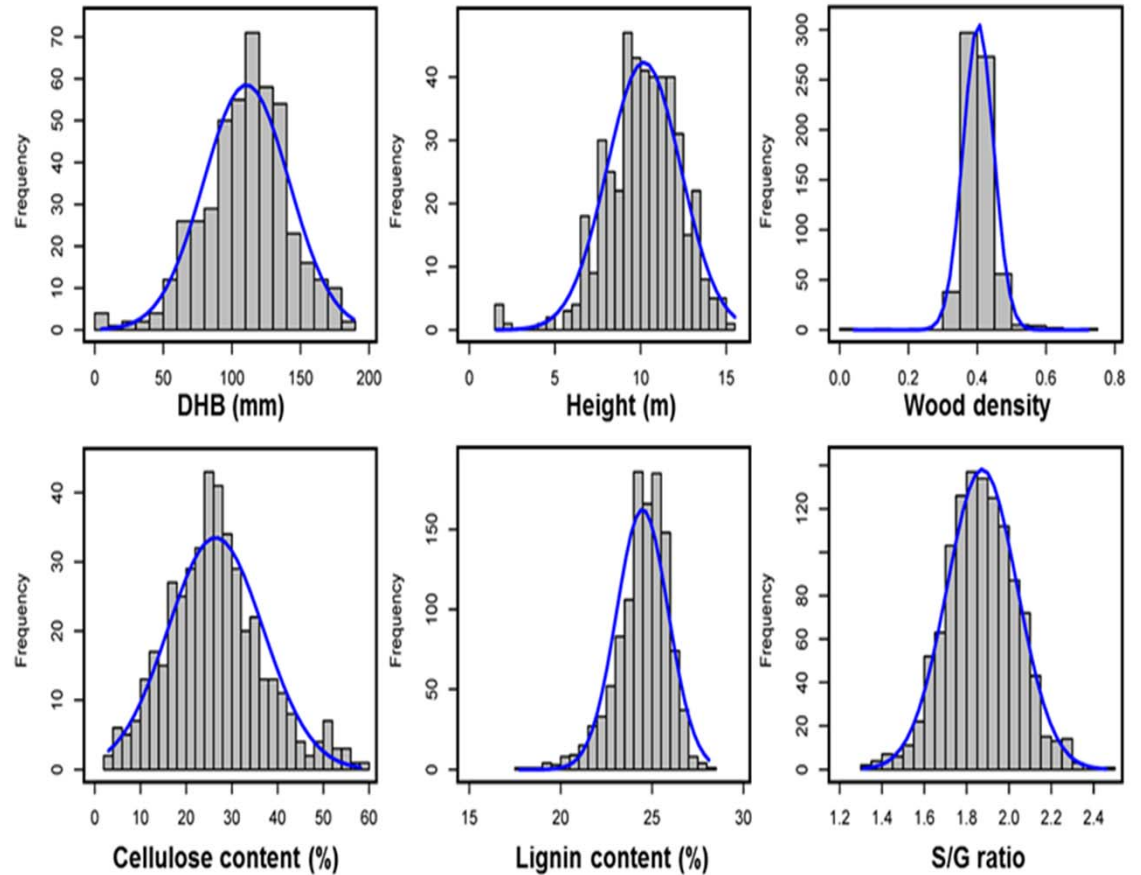
Clatskanie, OR (2009)
Coastal Mesic



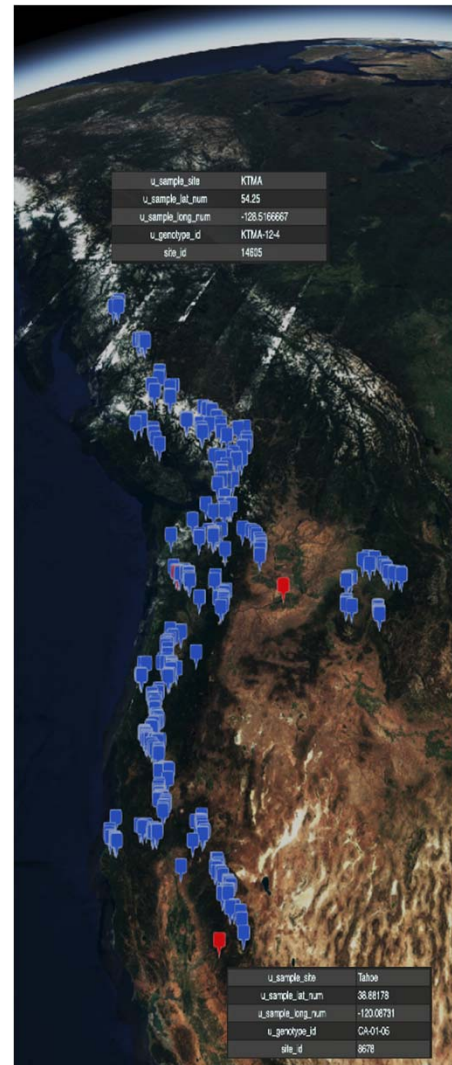
Corvallis, OR (2009)
Inland Mesic



Boardman, OR (2016)
Inland Xeric



The poplar GWAS mapping panel



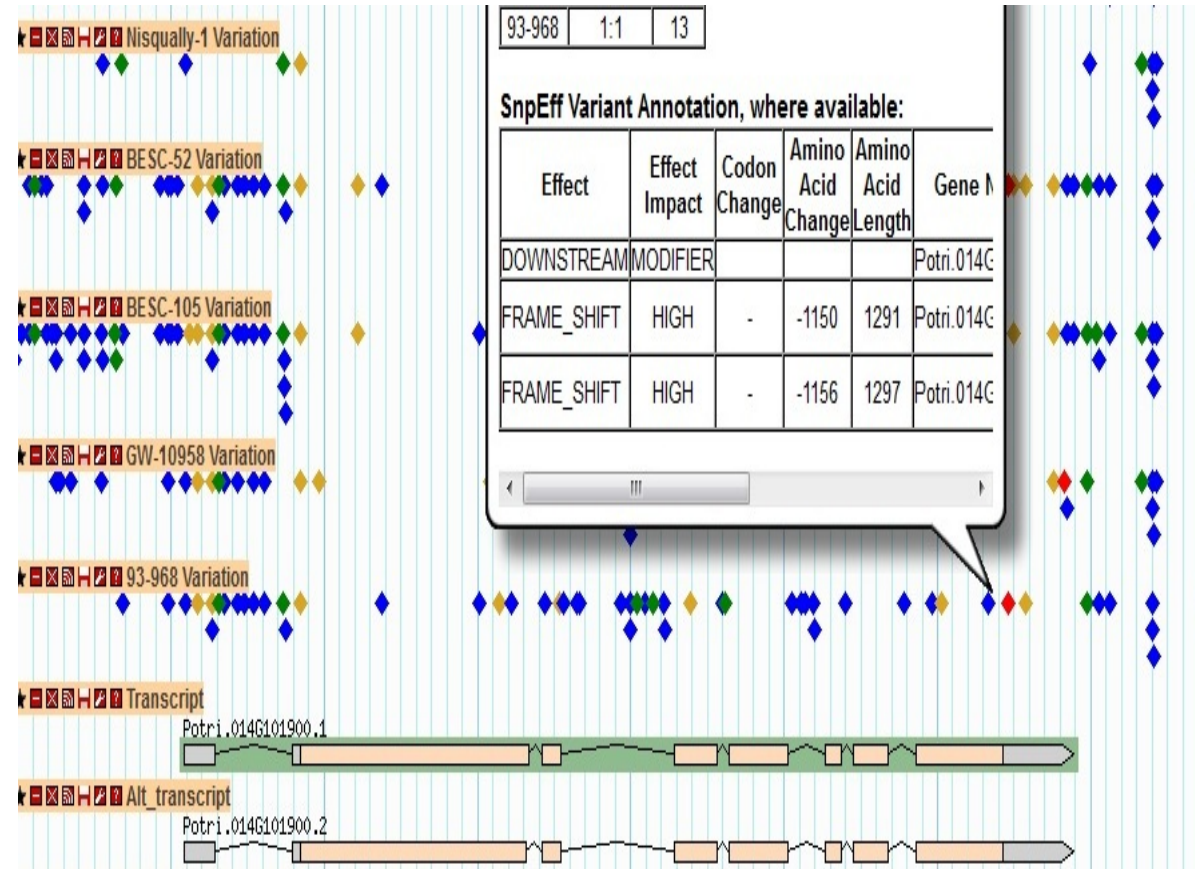
Clatskanie, OR (2009)
Coastal Mesic



Corvallis, OR (2009)
Inland Mesic



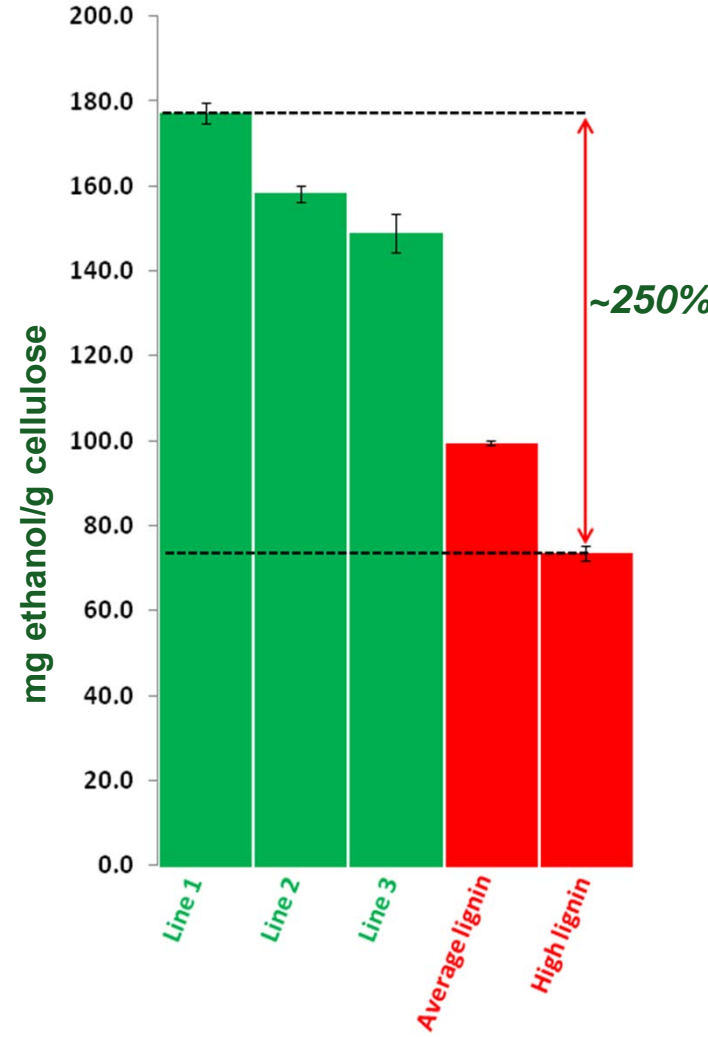
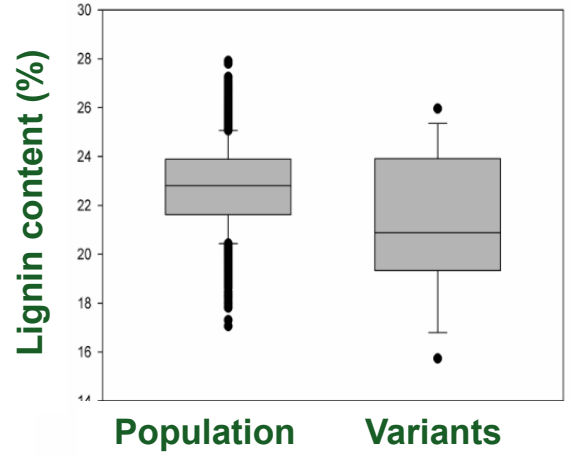
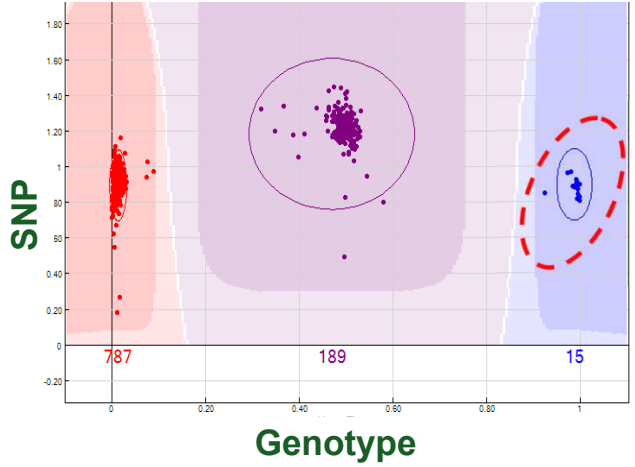
Boardman, OR (2016)
Inland Xeric



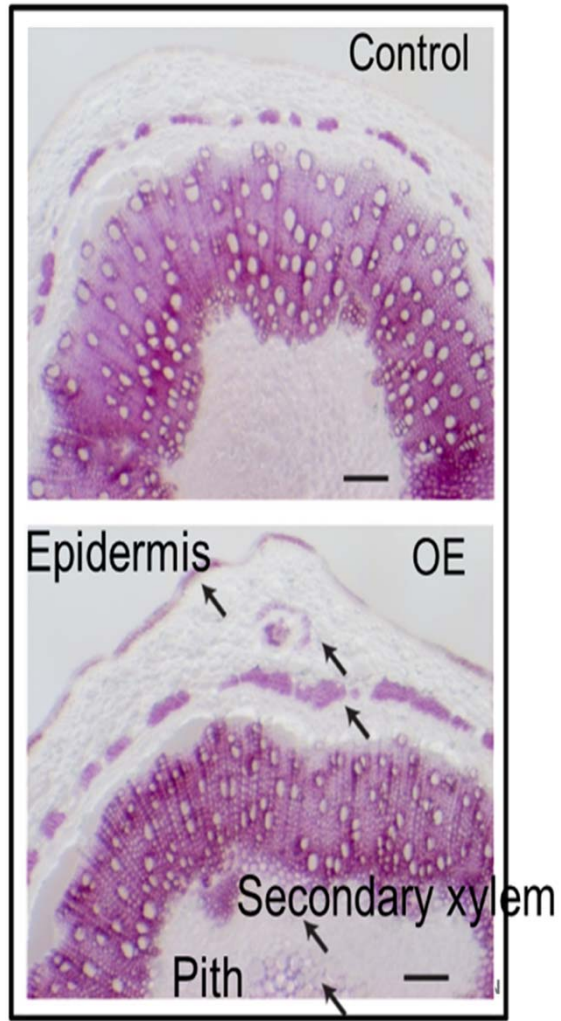
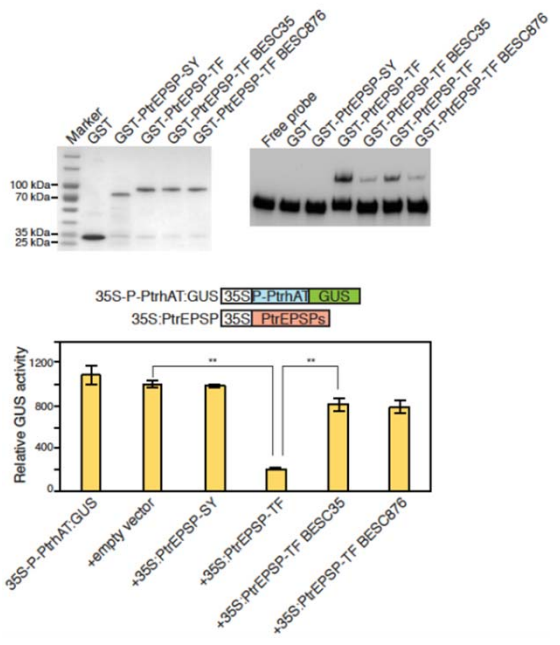
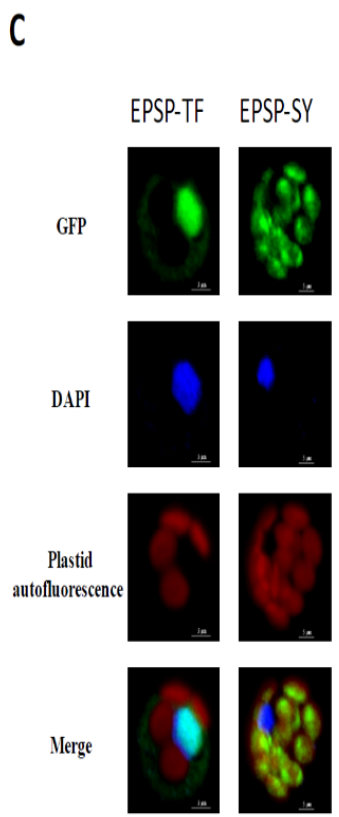
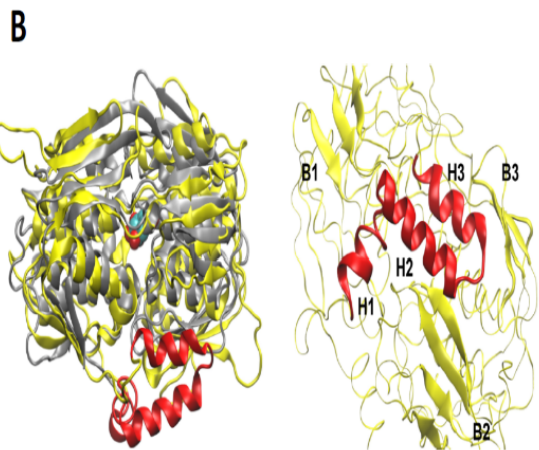
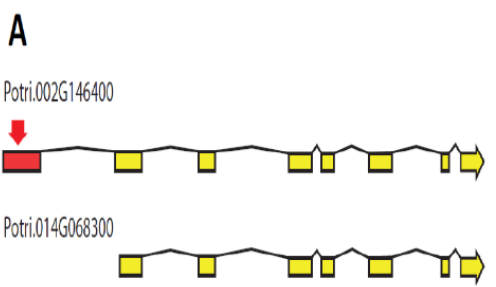
Intensively characterized & diverse biomass stock



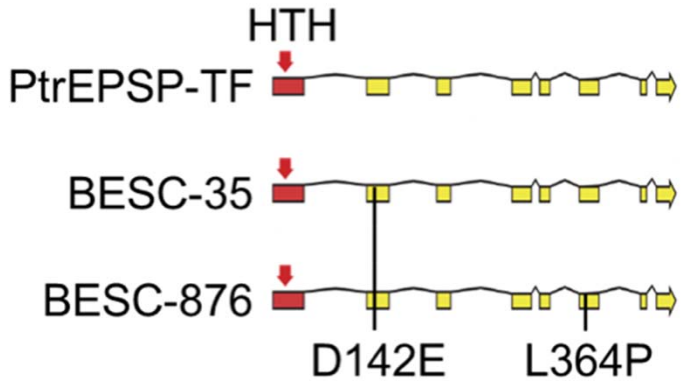
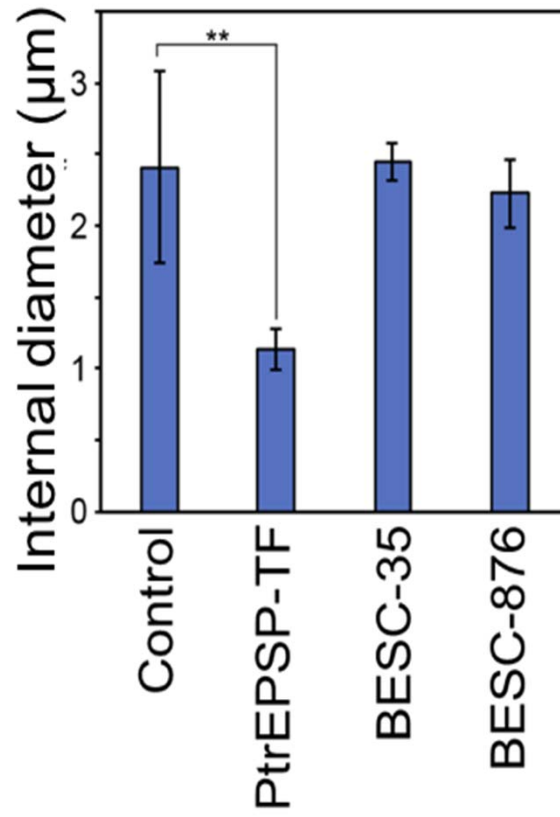
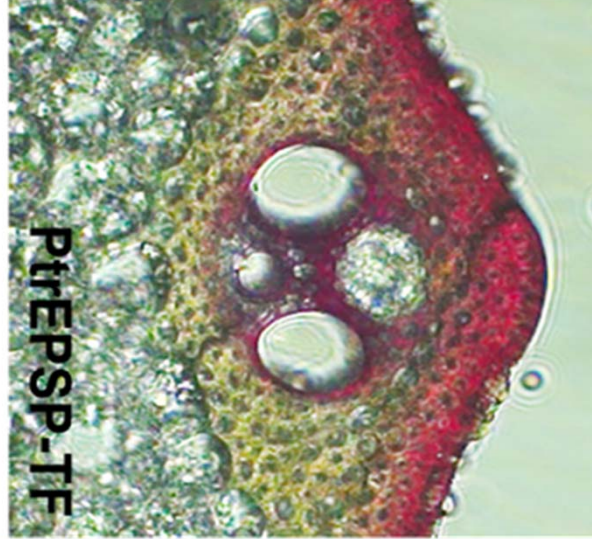
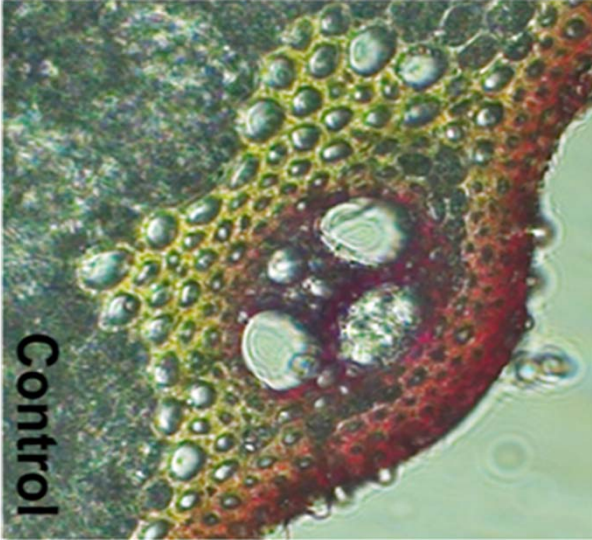
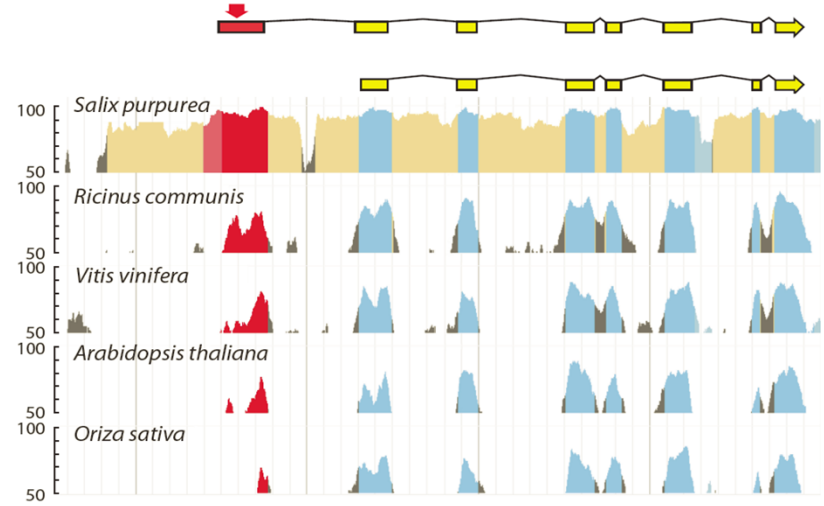
EPSP-sy variants exhibit reduced lignin content



EPSP-sy has regulatory activity to increase cell wall biosynthesis

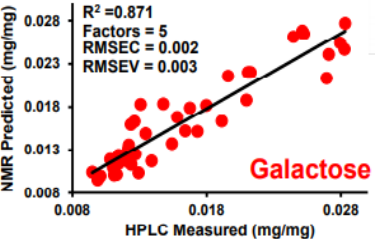
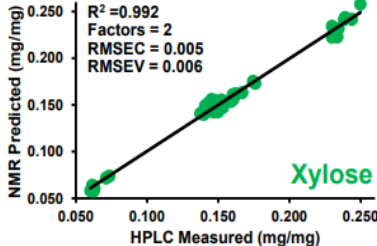
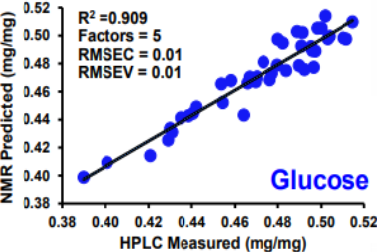


EPSP-sy has regulatory activity to increase cell wall biosynthesis

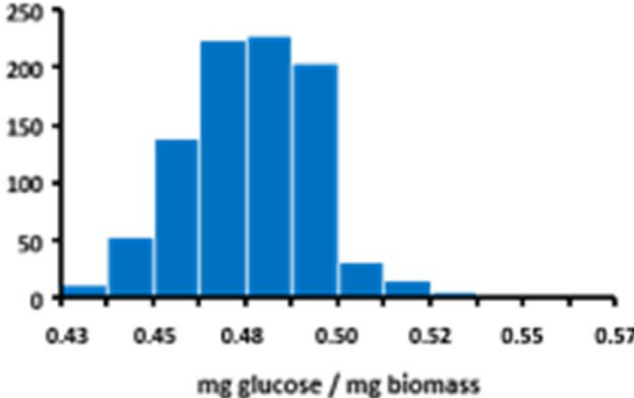
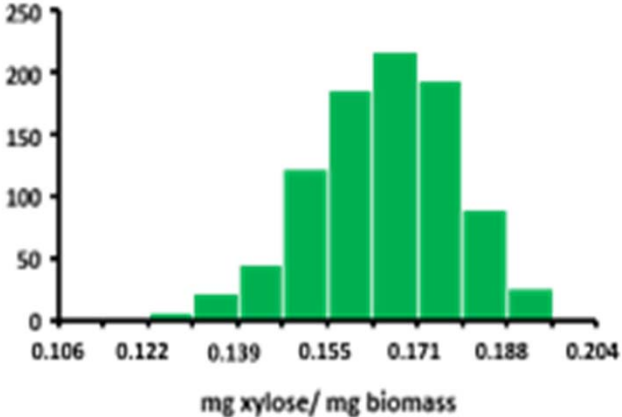
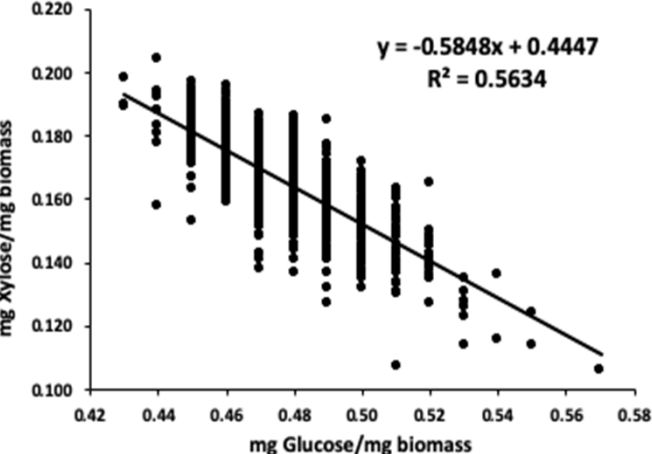


Revealing tradeoffs in glucose and xylose biosynthesis

NMR pipeline

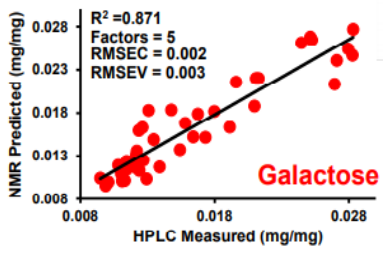
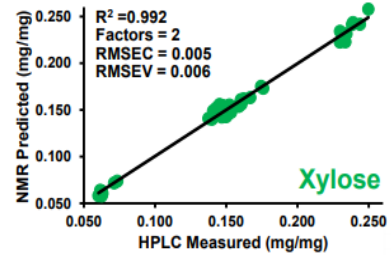
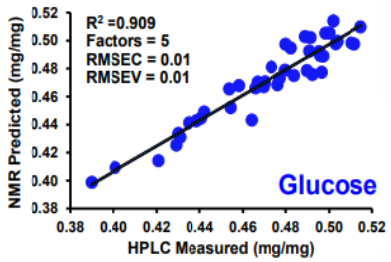


Population trends

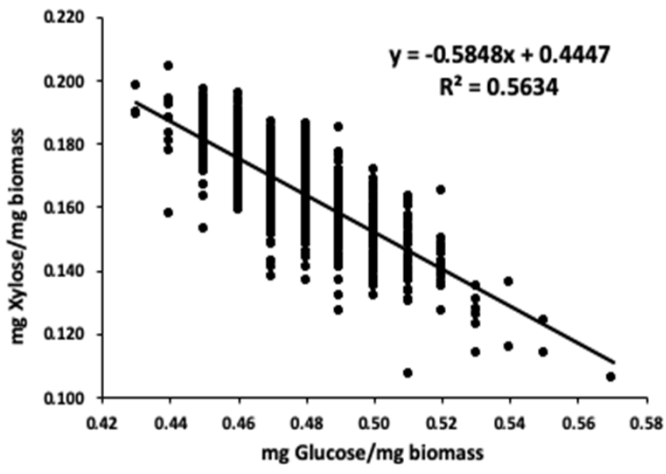


Revealing tradeoffs in glucose and xylose biosynthesis

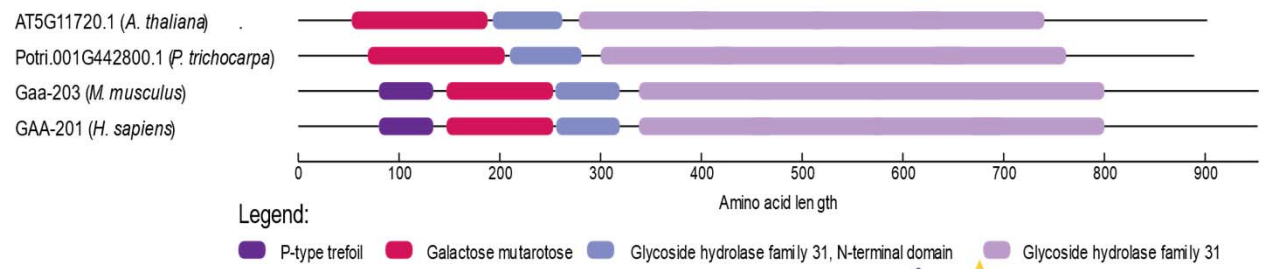
NMR pipeline



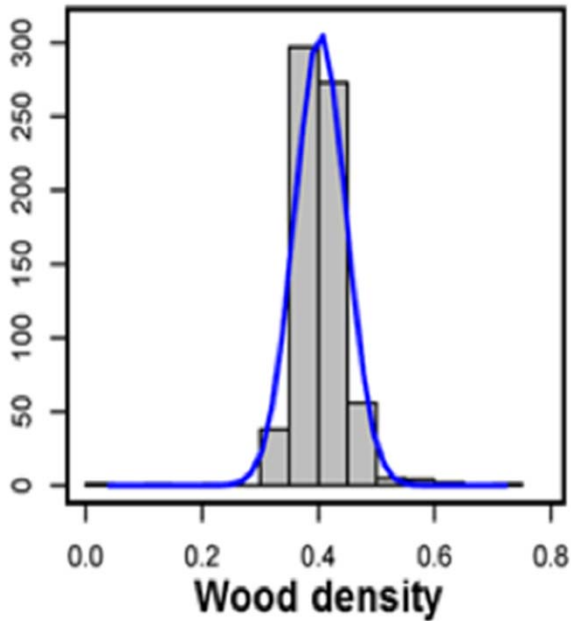
Population trends



Functional validation



Assessing impact of wood density on bioprocessing

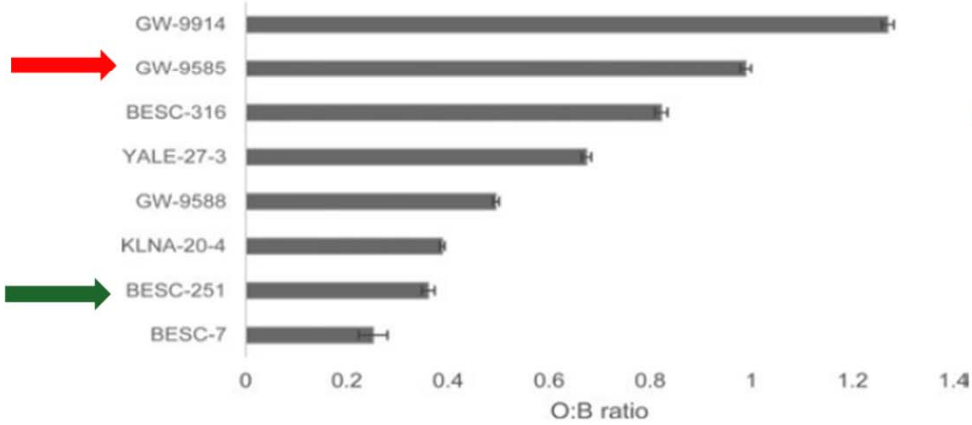


Assessing impact of wood density on bioprocessing

low density biomass		
	Clatskanie (g/cm ³)	Corvallis (g/cm ³)
→ GW-9585	0.32	0.33
BESC-316	0.33	0.35
GW-9914	0.34	0.35
GW-9588	0.34	0.35

high density biomass		
	Clatskanie (g/cm ³)	Corvallis (g/cm ³)
KLNA-20-4	0.50	0.53
YALE-27-3	0.50	0.50
→ BESC-251	0.47	0.53
BESC-7	0.50	0.50

Simons' Stain. During Simons' staining, accessibility differences are quantified with the ratio of the orange and blue dyes bound to the biomass, where higher O:B ratios are associated with higher accessibilities. Figure 1 describes the



SHF			CBP		
	ethanol yield (mg/g biomass)	SD ^a		ethanol yield (mg/g biomass)	SD ^a
BESC-7	24.24	0.24	BESC-7	0.17	0.04
KLNA-20-4	30.44	1.12	BESC-316	0.34	0.03
→ GW-9585	33.41	0.57	GW-9588	0.35	0.01
BESC-316	35.96	0.36	→ GW-9585	0.50	0.08
GW-9588	37.34	1.29	YALE-27-3	1.69	0.16
YALE-27-3	39.23	0.68	KLNA-20-4	1.81	0.33
→ BESC-251	39.52	0.11	GW-9914	2.68	0.59
GW-9914	61.83	2.61	BESC-251	2.77	0.89

^aSD: standard deviation.

Thank you!!



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