

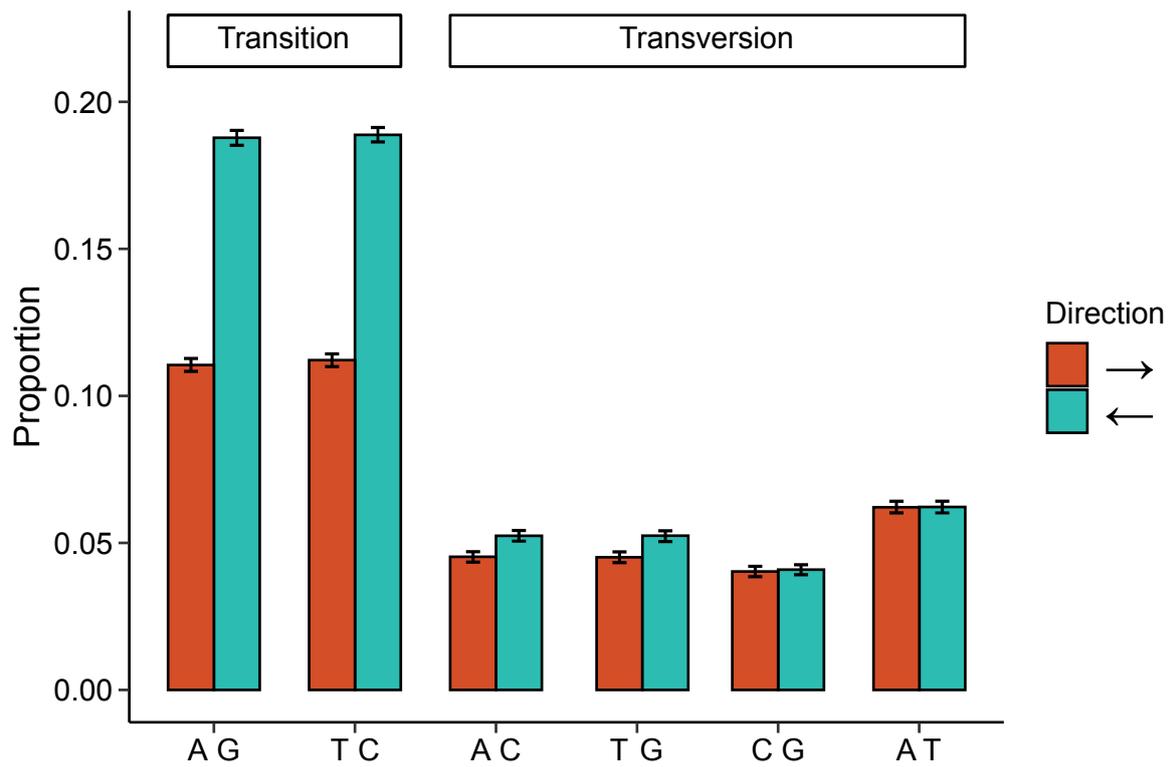
**Supplemental material for:**

**Biased gene conversion constrains adaptation in *Arabidopsis thaliana***

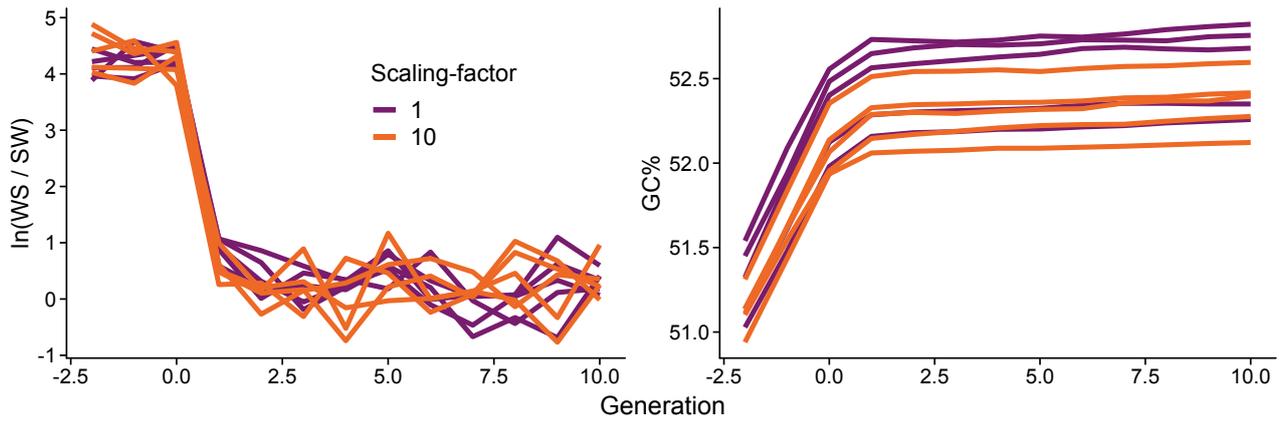
Tuomas Hämälä<sup>\*,1</sup> and Peter Tiffin<sup>\*</sup>

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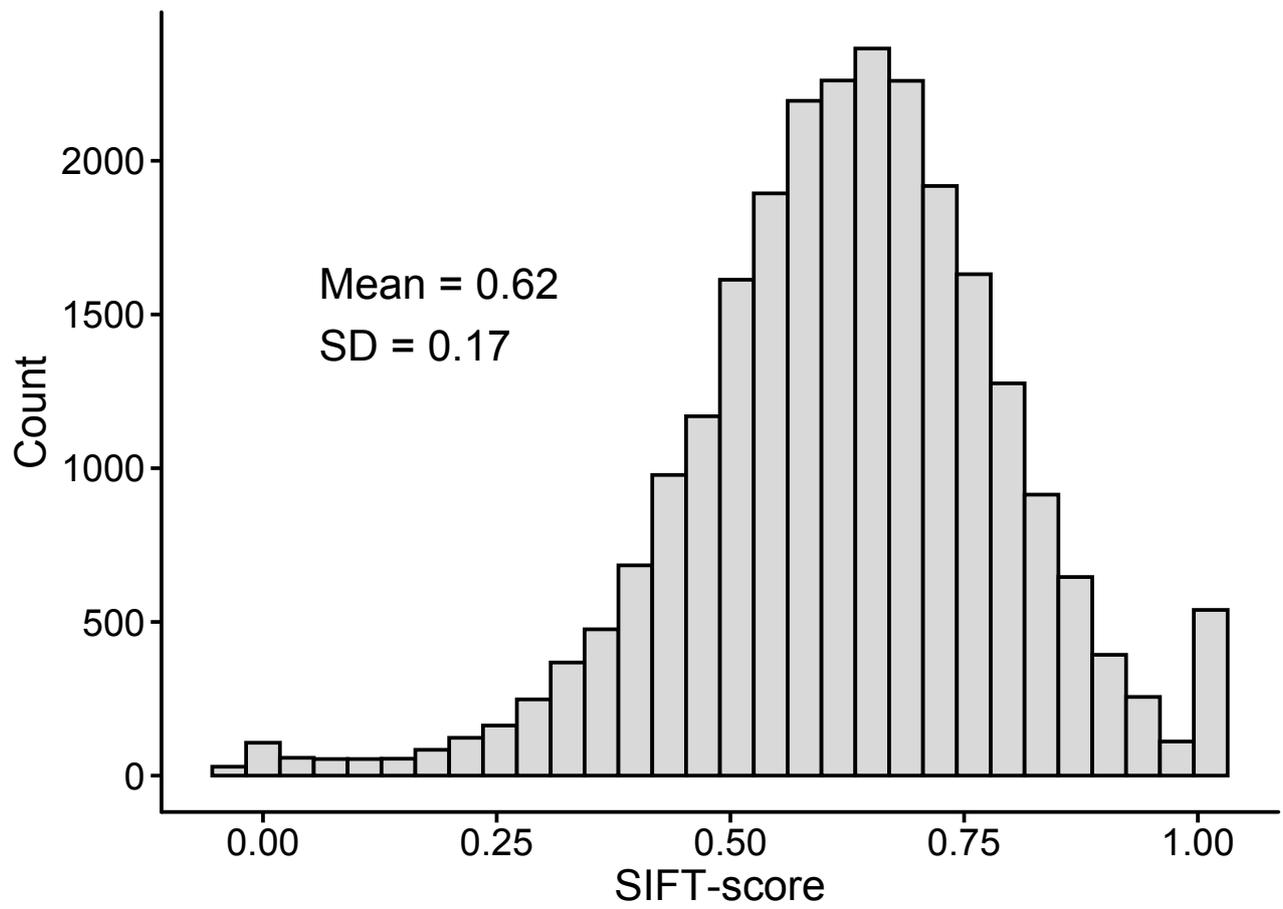
<sup>1</sup> [thamala@umn.edu](mailto:thamala@umn.edu)



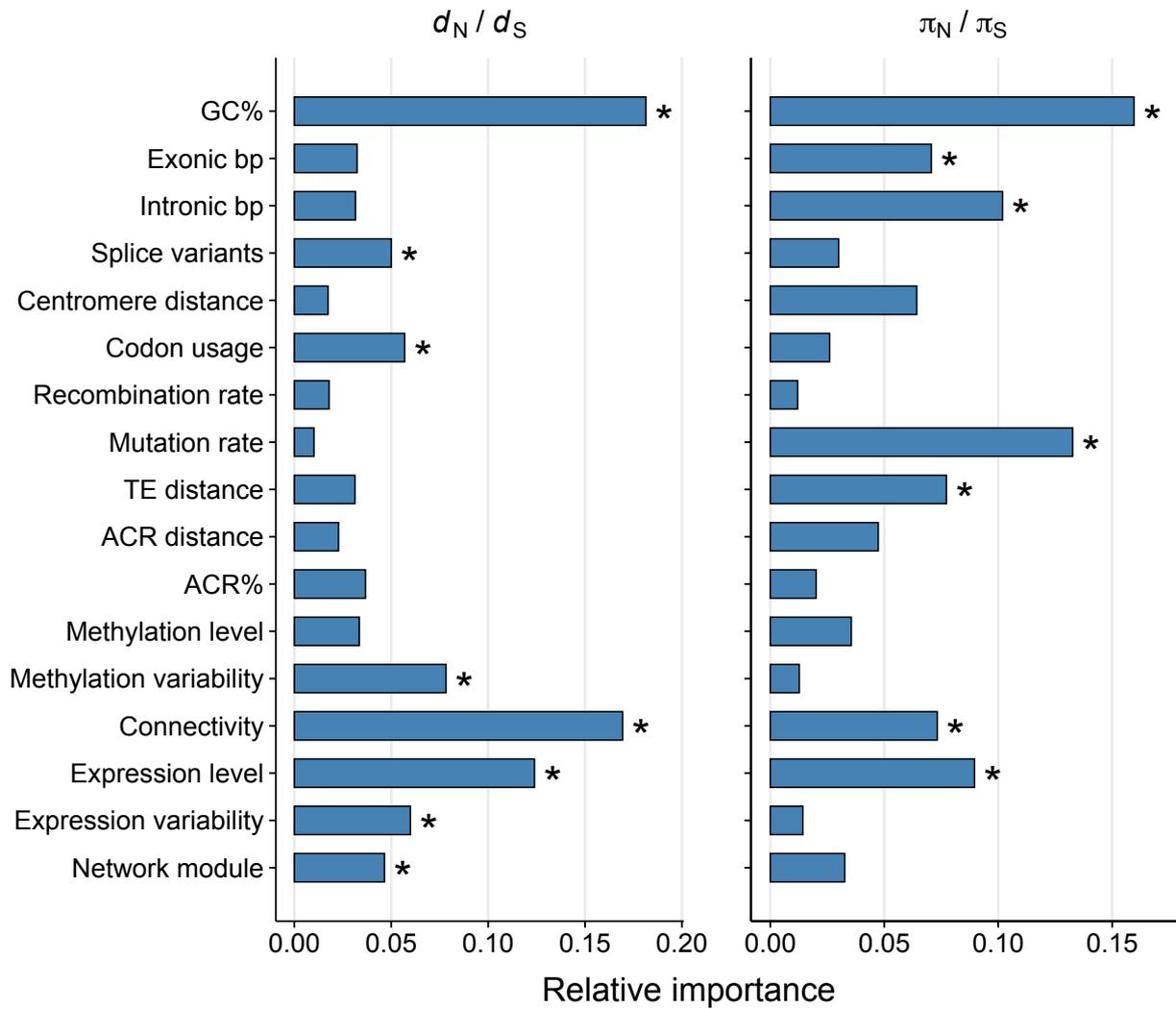
**Figure S1.** The proportion of different nucleotide changes from ancestral (*A. lyrata*, *C. rubella*, and *A. alpine*) to derived allele in *A. thaliana*. Colors show the direction of change (e.g. for “A G”, red is A → G and teal is A ← G). Error bars show 95% CIs.



**Figure S2.** The simulated extent of gBGC with scaled and unscaled parameters. Time in number of generations ( $\times 10^4$  for scaled,  $\times 10^5$  for unscaled) are shown in horizontal axes. At time zero, population switches to 5% outcrossing. Simulations were run with moderate gene conversion rate ( $2 \times 10^{-5}$  scaled,  $2 \times 10^{-6}$  unscaled) and 10% GC over AT repair bias.

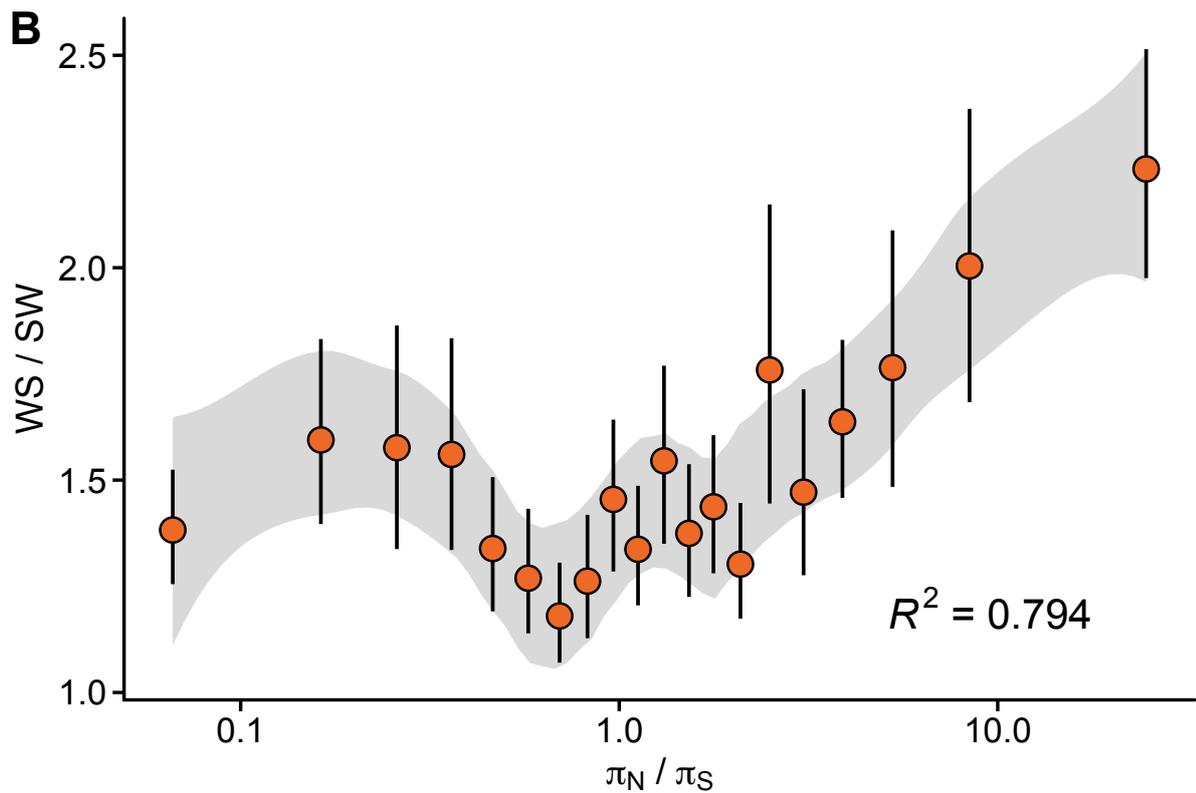
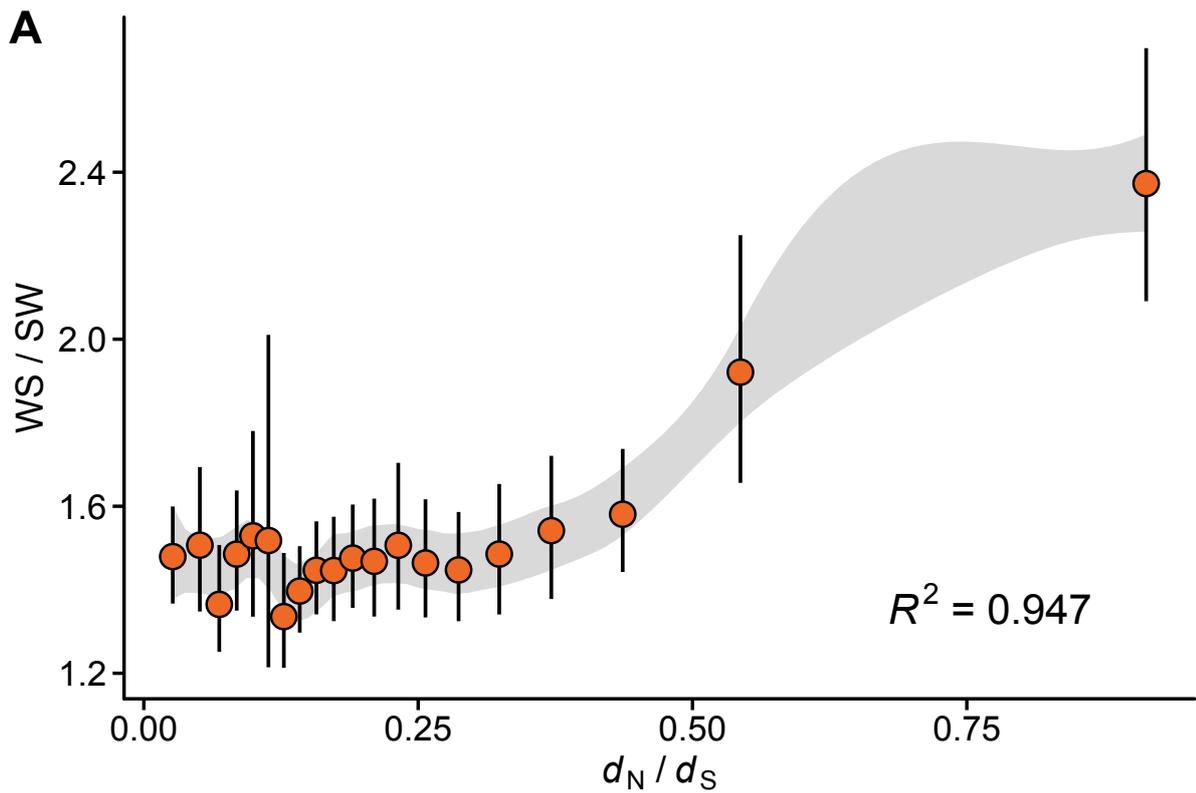


**Figure S3.** The genome-wide distribution of SIFT-scores.

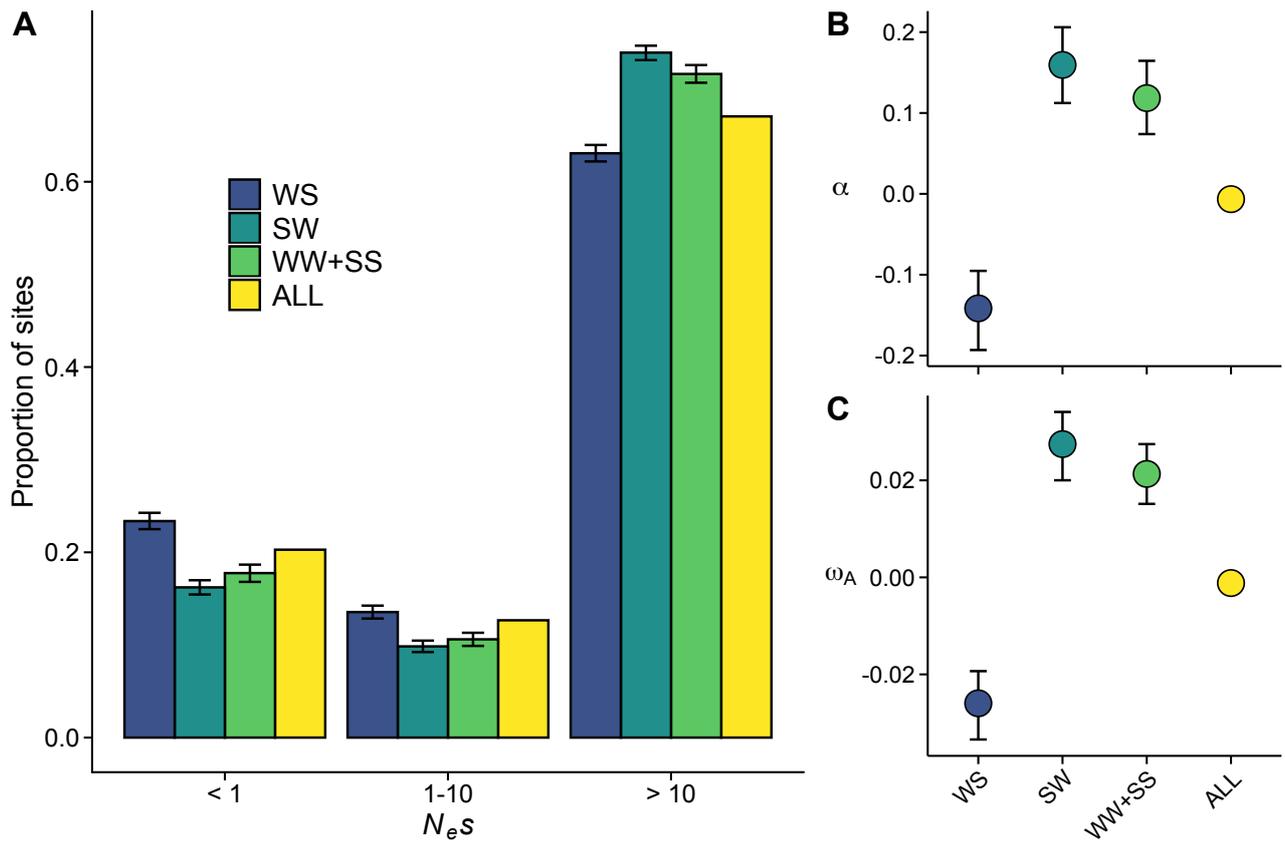


**Figure S4.** Variable importance from Extra-Trees models for  $d_N/d_S$  and  $\pi_N/\pi_S$ .

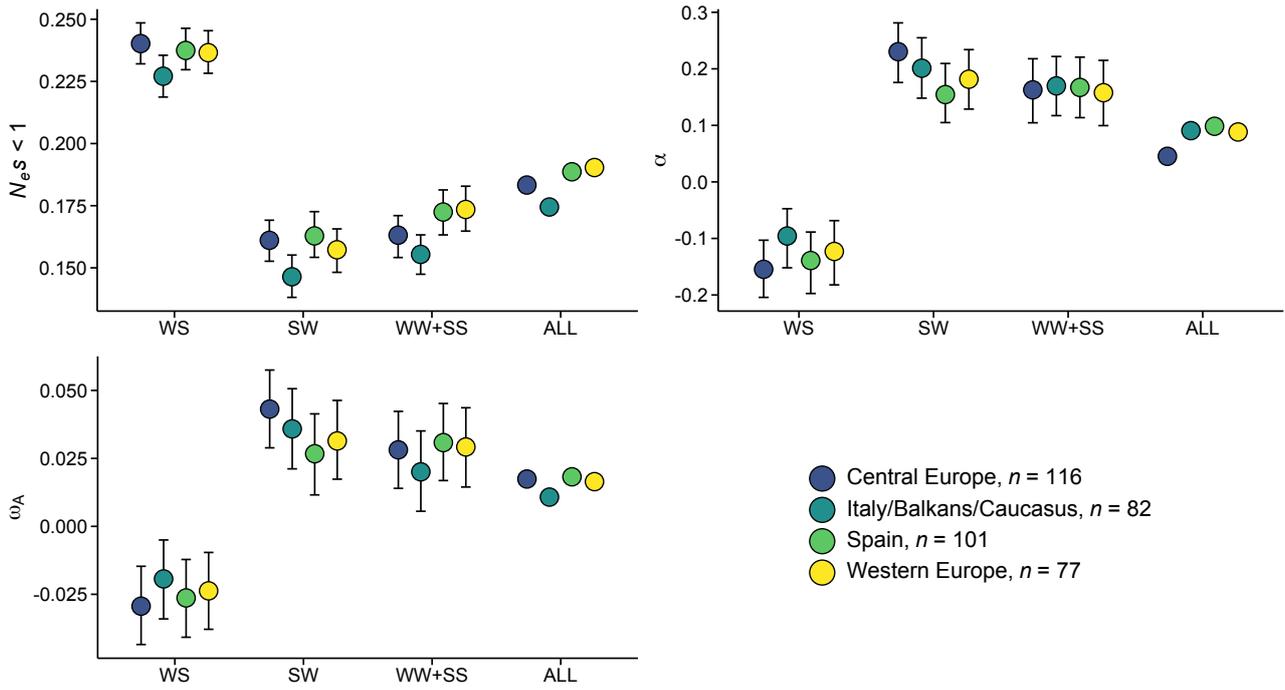
\*  $P < 0.05$  (Bonferroni corrected).



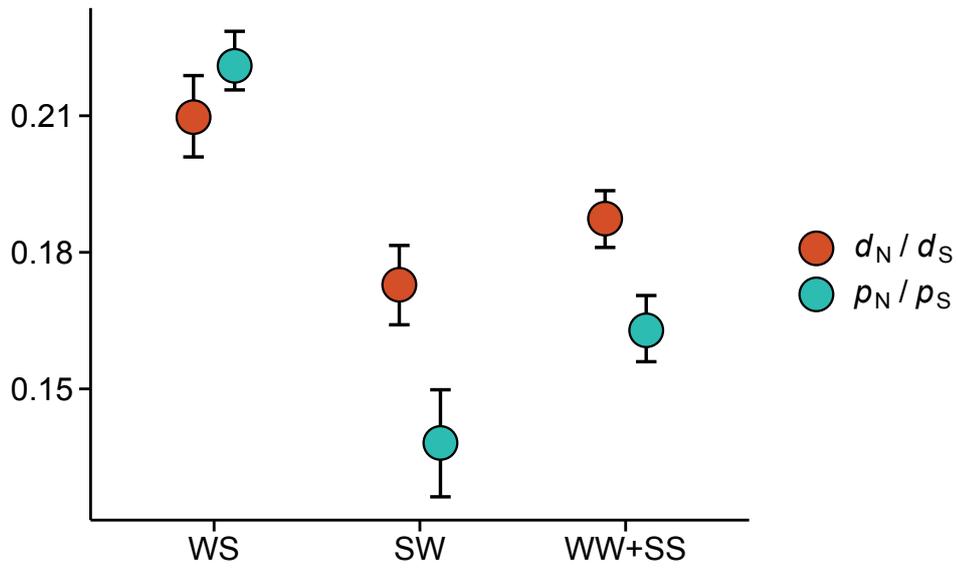
**Figure S5.** Relationship between WS/SW, a measure of gBGC, and  $d_N/d_S$  (A) and  $\pi_N/\pi_S$  (B). Data were split into 20 bins of equal size. Figure shows means (circles) and 95% CIs (error bars) estimated for each bin. Also shown are 95% CI and  $R^2$  for a loess-model (shaded area) fit on the binned data.



**Figure S6.** Apparent strength of negative and positive selection at different DAF-sites after removing hypermutable mGC sites. **A:** The distribution of fitness effects (DFE). Nonsynonymous sites were divided into three bins based on the strength of purifying selection ( $N_e s$ ): nearly neutral, intermediate, and highly deleterious, respectively. **B:** The proportion of sites fixed by positive selection ( $\alpha$ ). **C:** The rate of adaptive substitutions relative to the neutral mutation rate ( $\omega_A$ ). For all three figures, error bars show 95% CIs.



**Figure S7.** The proportion of nearly neutral mutations ( $N_{e}s < 1$ ), the proportion of sites fixed by positive selection ( $\alpha$ ), and the rate of adaptive substitutions relative to the neutral mutation rate ( $\omega_A$ ) for four largest admixture groups. Error bars show 95% CIs.



**Figure S8.**  $d_N/d_S$  and  $p_N/p_S$  at different DAF-sites for *A. thaliana*. Error bars show 95% CIs.

**Table S1.** Spearman's rank correlation between genomic features and measures of selective constraint.

Feature	$d_N/d_S$		$\pi_N/\pi_S$	
	Pairwise	Partial <sup>1</sup>	Pairwise	Partial <sup>1</sup>
GC%	-0.21*	-0.15*	-0.18*	-0.15*
Exonic bp	~0	~0	~0	~0
Intronic bp	-0.03*	~0	-0.04*	~0.04*
Splice variants	0.07*	0.07*	0.03	0.03
Centromere distance	0.02	0.02	0.07*	0.05*
Codon usage	0.07*	0.03*	0.07*	0.04*
Recombination rate	-0.02	-0.02	-0.07*	-0.05*
Mutation rate	~0	~0	-0.03*	~0
TE distance	0.01	~0	0.02	-0.01
ACR distance	0.11*	~0	0.10*	~0
ACR%	-0.12*	~0	-0.10*	0.01
Methylation level	-0.02*	~0	0.01	~0
Methylation variability	0.09*	~0	~0	~0
Connectivity	-0.18*	-0.04*	-0.10*	~0
Expression level	-0.31*	-0.18*	-0.23*	-0.15*
Expression variability	0.11	0.06*	0.08	0.02

<sup>1</sup>Partial correlation after controlling for all other features.

\* $P < 0.05$  (Bonferroni corrected).

**Table S2.** Relative importance and Spearman's rank correlation between genomic features and GC%.

Feature	Relative importance	Spearman's $\rho$	
		Pairwise	Partial <sup>1</sup>
Exonic bp	0.04*	0.13*	0.03*
Intronic bp	0.11*	-0.24*	-0.08*
Splice variants	0.05*	-0.18*	-0.10*
Centromere distance	0.04*	0.12*	0.03*
Codon usage	0.12*	-0.15*	-0.07*
Recombination rate	0.02*	-0.12*	-0.06*
Mutation rate	0.01*	-0.04*	-0.02
TE distance	~0	0.07*	0.03*
ACR distance	~0	-0.04*	0.06*
ACR%	0.06*	0.11*	0.06*
Methylation level	0.13*	-0.27*	-0.03*
Methylation variability	0.21*	0.26*	0.04*
Connectivity	0.03*	0.11*	0.02
Expression level	0.14*	0.20*	0.22*
Expression variability	0.04*	0.26*	0.03*

<sup>1</sup>Partial correlation after controlling for all other features.

\* $P < 0.05$  (Bonferroni corrected).