**FIGURE CAPTIONS**

**Main text**

**Figure 1**. Fig. 1. a) Schematic representation of the relationship between species richness (X-axis) and phylogenetic diversity (Y-axis). Each point represents a geographic grid cell with color representing residual phylogenetic diversity: in red, the cells with more distantly related species (high PD) and in blue more closely related (low PD) than would be predicted by the number of species that these regions harbor. b) Different scnearios produced by different combinations of speciation, extinction, and dispersal.

**Figure 2**. Fig. 2. Geographic distribution of areas with the 10% lowest (in blue) and highest (in red) residual PD for terrestrial vertebrates. The phylogenetic relationships of species present in focal regions, together with the density plot of recent speciation rates (DR) of those species, are also shown to illustrate the evolutionary differences of regions with high and low residual PD. Silhouettes extracted from 'phylopic' (www.phylopic.org).

**Figure 3**. Fig. 3. Relationship between recent speciation rates (DR rates) and residual PD for all four clades of terrestrial vertebrates. The grey cloud of points in the background of each plot shows results for the four vertebrate groups combined.

**Figure 4**. Fig. 4. Differences in recent speciation rates (DR rates) between areas of 10% lowest (in blue) and highest (in red) residual PD.

**Figure 5**. Fig. 5. Climatic space (mean annual temperature vs. annual precipitation) occupied by regions of 10% highest (in red) and lowest (in blue) residual PD for each vertebrate clade.

**Supplementary Material**

**Supplementary Figure 1**. Maps of residual phylogenetic diversity (PD) for all terrestrial vertebrate clades.

**Supplementary Figure 2**. Violin plots of recent speciation (DR) rates in the different focal areas identified as centers of high and low residual PD for all terrestrial vertebrate clades.

**Supplementary Figure** **3**. Pairwise differences in DR rates (effect size Z) between specific regions of high and low residual PD, colored by taxa group. Left: differences between pairs of regions of low residual PD. Center: differences between regions of high residual PD and regions of low residual PD. Right: differences between pairs of regions of high residual PD.

**Supplementary Figure 4**. Lineage-through-time (LTT) plots for amphibian lineages in the different focal regions of low (in blue) and high (in red) residual PD.

**Supplementary Figure 5**. Lineage-through-time (LTT) plots for bird lineages in the different focal regions of low (in blue) and high (in red) residual PD.

**Supplementary Figure 6**. Lineage-through-time (LTT) plots for mammal lineages in the different focal regions of low (in blue) and high (in red) residual PD.

**Supplementary Figure 7**. Lineage-through-time (LTT) plots for squamate lineages in the different focal regions of low (in blue) and high (in red) residual PD.

**Supplementary Figure 8**. Relationship of annual precipitation (in mm) with residual PD in all tetrapod clades.

**Supplementary Figure 9**. Relationship of mean temperature (in ºC) with residual PD in all tetrapod clades.

**Supplementary Figure 10**. Relationship of precipitation seasonality and residual PD in all tetrapod clades.

**Supplementary Figure 11**. Relationship of temperature seasonality and residual PD in all tetrapod clades.

**Supplementary Figure 12**. Relationship of net primary productivity (NPP) and residual PD in all tetrapod clades.

**Supplementary Figure 13**. Relationship of terrain roughness index (TRI; a measurement of topographic complexity) and residual PD in all tetrapod clades.

**Supplementary Figure 14**. Climatic space defined by precipitation seasonality and temperature seasonality for all tetrapod clades, showing the geographic grid cells with the 10% lowest (in blue) and highest (in red) residual PD.

**Supplementary Figure 15**. Climatic space defined by net primary productivity (NPP) and terrain roughness index (TRI) for all tetrapod clades, showing the geographic grid cells with the 10% lowest (in blue) and highest (in red) residual PD.

**Supplementary Figure 16**. Latitudinal pattern of species richness (in the X-axis) and residual PD (in the color gradient) for all tetrapod clades.