

Supplementary material for the paper “Empirical approach for modelling tree phenology in mixed forests using remote sensing”

Koffi Dodji Noumonvi, Gal Oblišar, Ana Žust and Urša Vilhar

This supplementary material contains the same format of figures as the main article. It consists of (i) boxplots of Errors (Modelled – Observed) for different species at different phenological stations; (ii) scatter plots of modelled versus observed start of season (SOS) for different species, all sites together; and (iii) scatter plots of modelled versus observed end of season (EOS) for different species, all sites together. These three (3) types of graph were performed for five (5) vegetation indices, namely MODIS leaf area index (LAI), MODIS enhanced vegetation index (EVI), MODIS normalized difference vegetation index (NDVI), Landsat 7 EVI and Landsat 7 NDVI. Note that slight methodological differences were applied for all the indices presented in the supplementary materials. This regards only the curve fitting. For all these vegetation indices, unlike for GPP (in the main article), only a Gaussian curve was fitted to each year of vegetation indices. The reason is that the double logistic functions performed very poorly for the vegetation indices because of either large data gaps in the time series, or noises preventing from retrieving a proper seasonality. Fitting only a Gaussian function was the best option for the vegetation indices.

The main article contains the same type of graphs for MODIS GPP, which is the remote sensing product used in the main article. However, root mean square errors (RMSE) resulting from graphs of this supplementary material were included in the main article as a table, and briefly discussed there.

1. SOS and EOS derived using MODIS LAI data

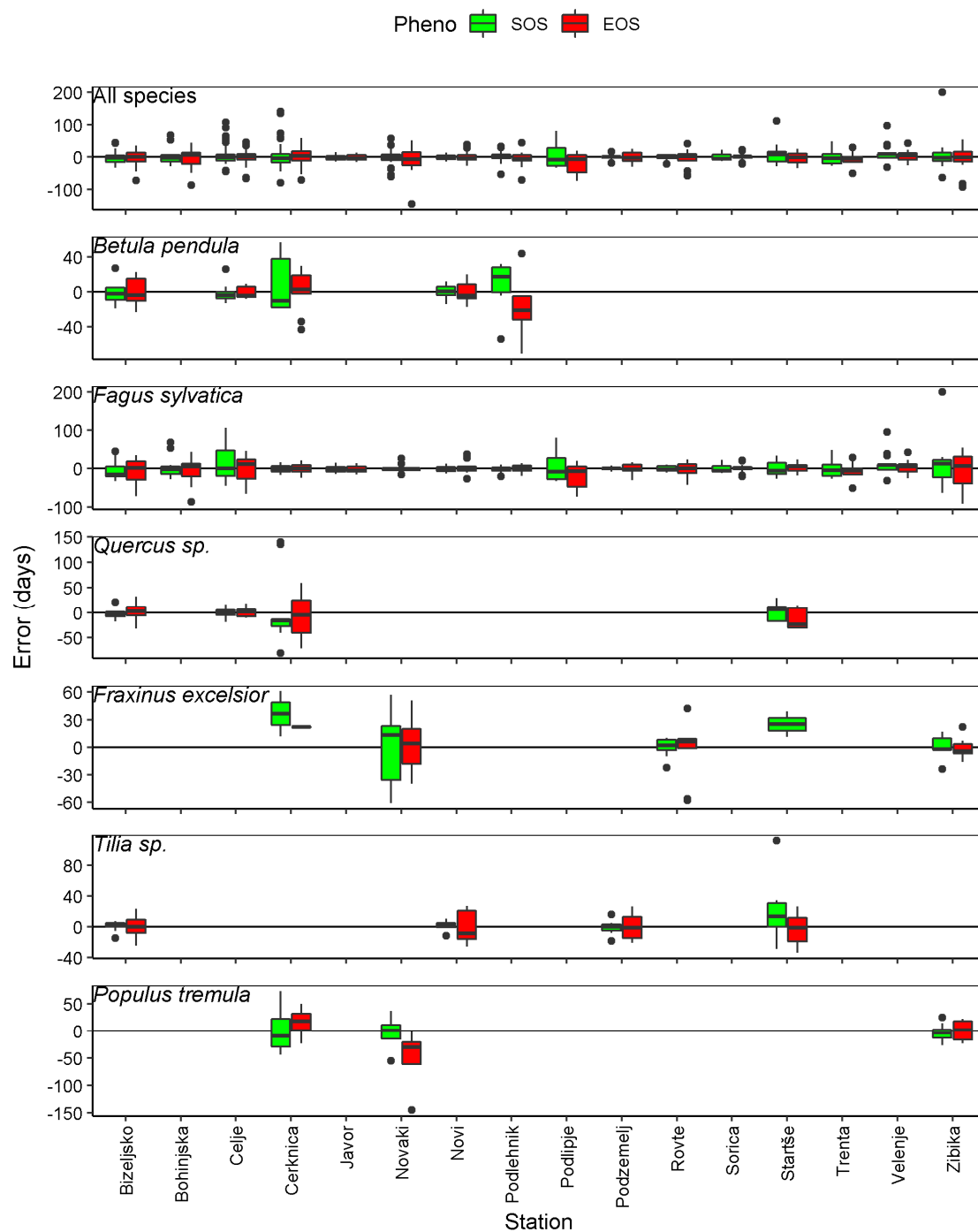


Figure S1. Error (Modelled – Observed) of SOS and EOS per site, all species and each species separately, using MODIS LAI.

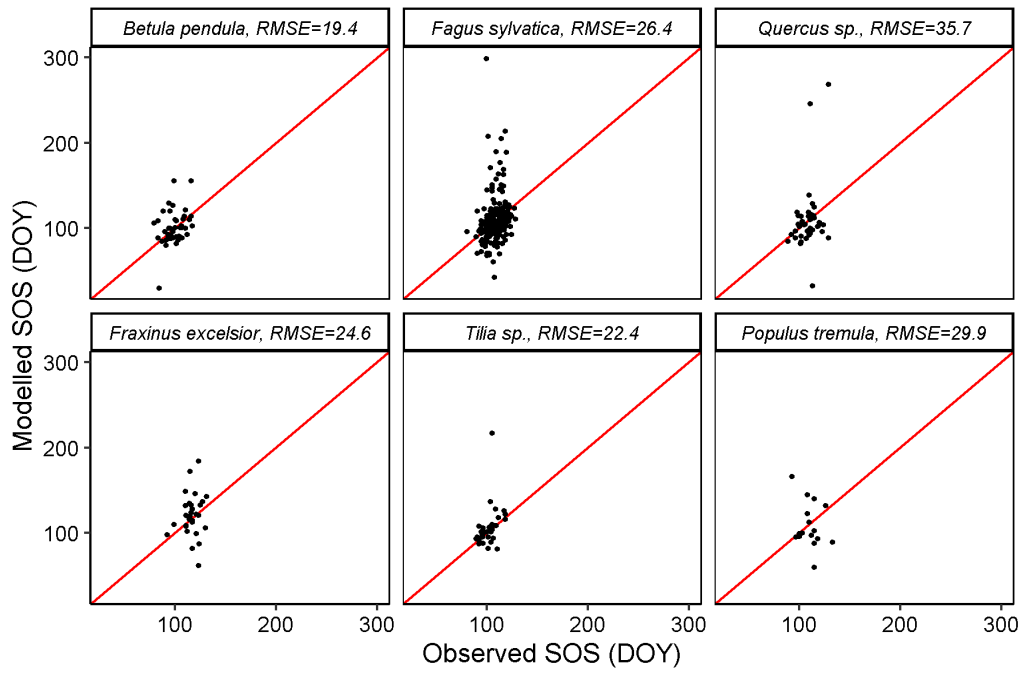


Figure S2. Modelled vs. observed SOS per species, all stations together, using MODIS LAI. The red lines are identity (1:1) lines for each panel.

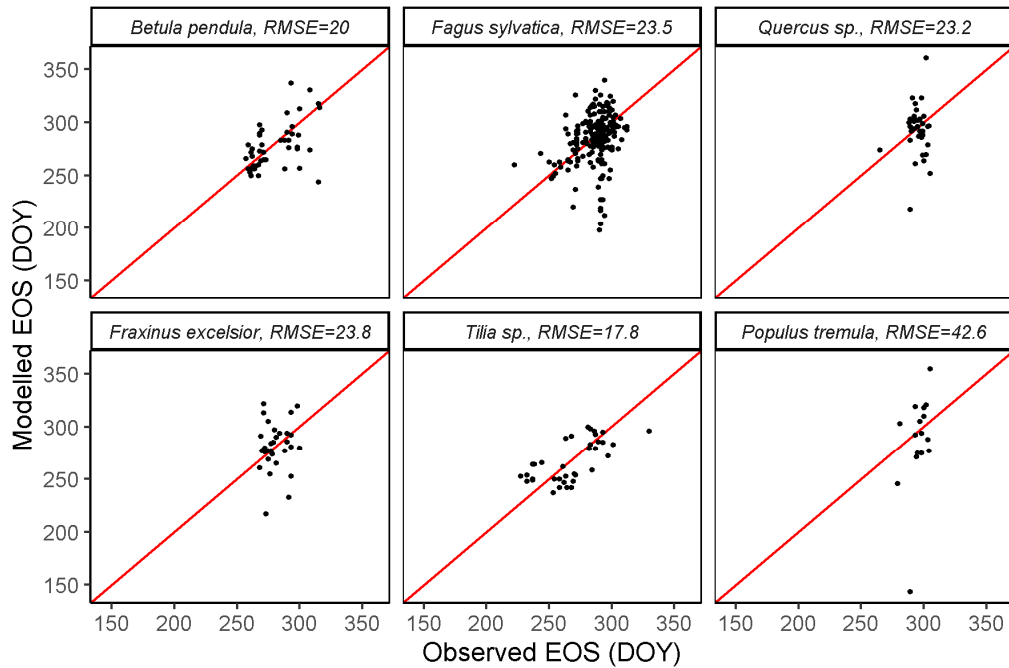


Figure S3. Modelled vs. observed EOS per species, all stations together, using MODIS LAI. The red lines are identity (1:1) lines for each panel.

2. SOS and EOS derived using MODIS EVI data

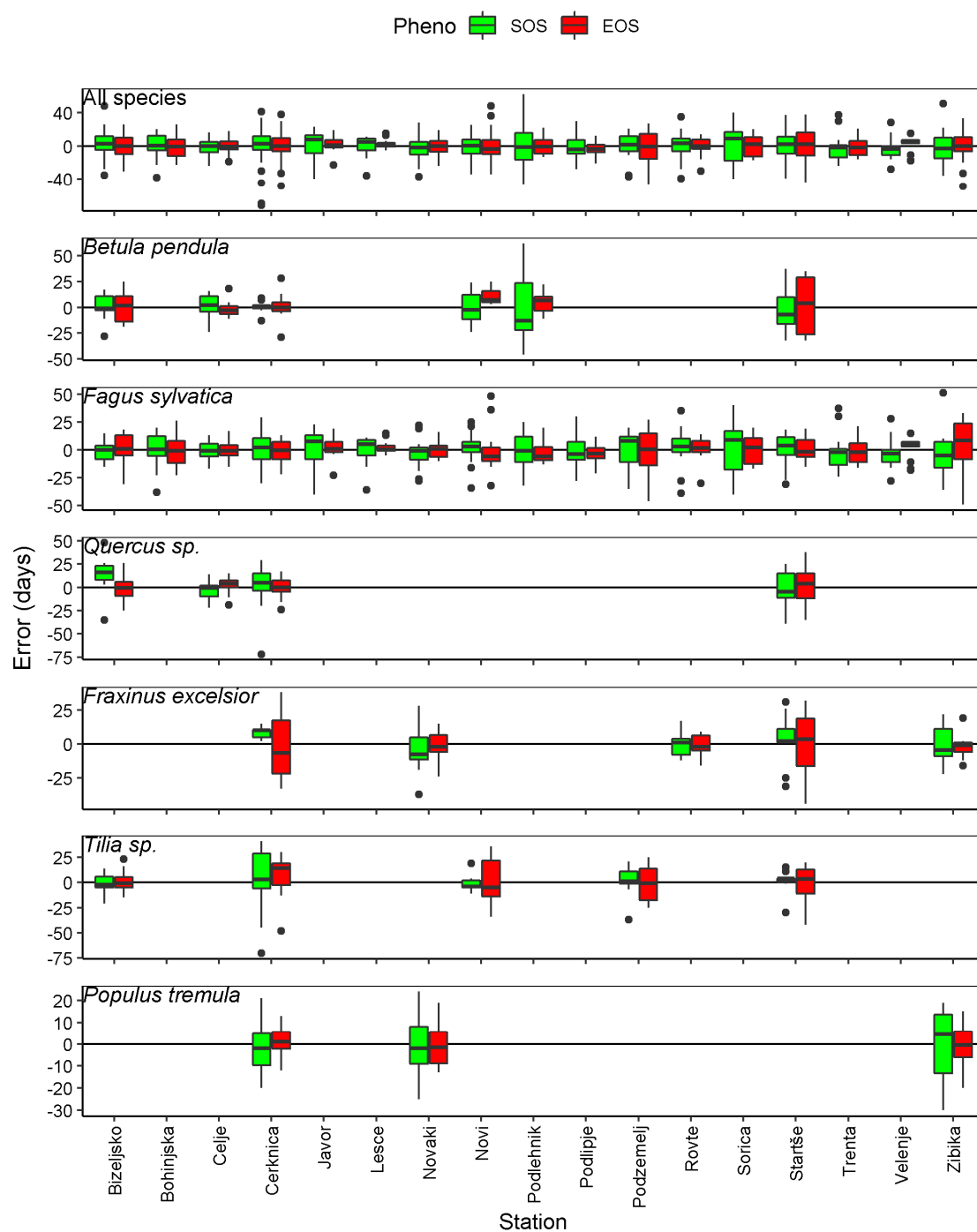


Figure S4. Error (Modelled – Observed) of SOS and EOS per site, all species and each species separately, using MODIS EVI.

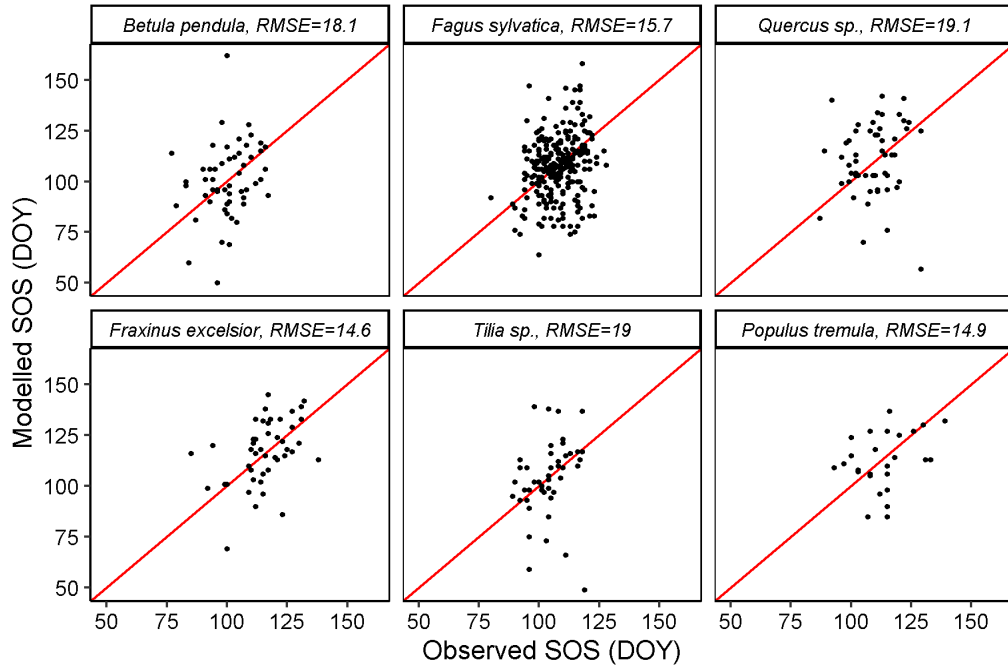


Figure S5. Modelled vs. observed SOS per species, all stations together, using MODIS EVI. The red lines are identity (1:1) lines for each panel.

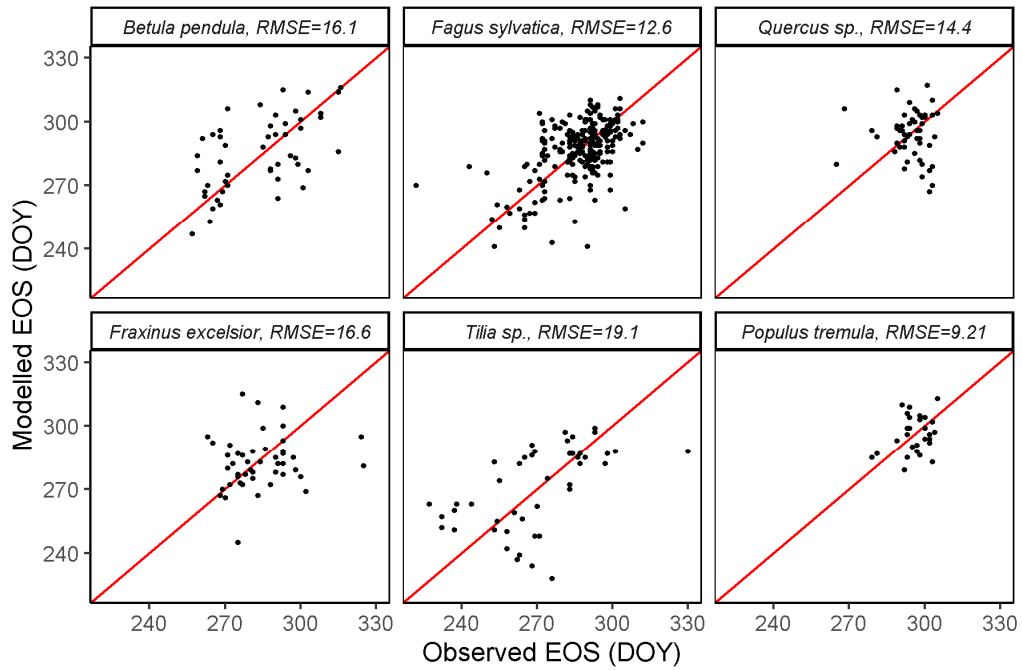


Figure S6. Modelled vs. observed EOS per species, all stations together, using MODIS EVI. The red lines are identity (1:1) lines for each panel.

3. SOS and EOS derived using MODIS NDVI data

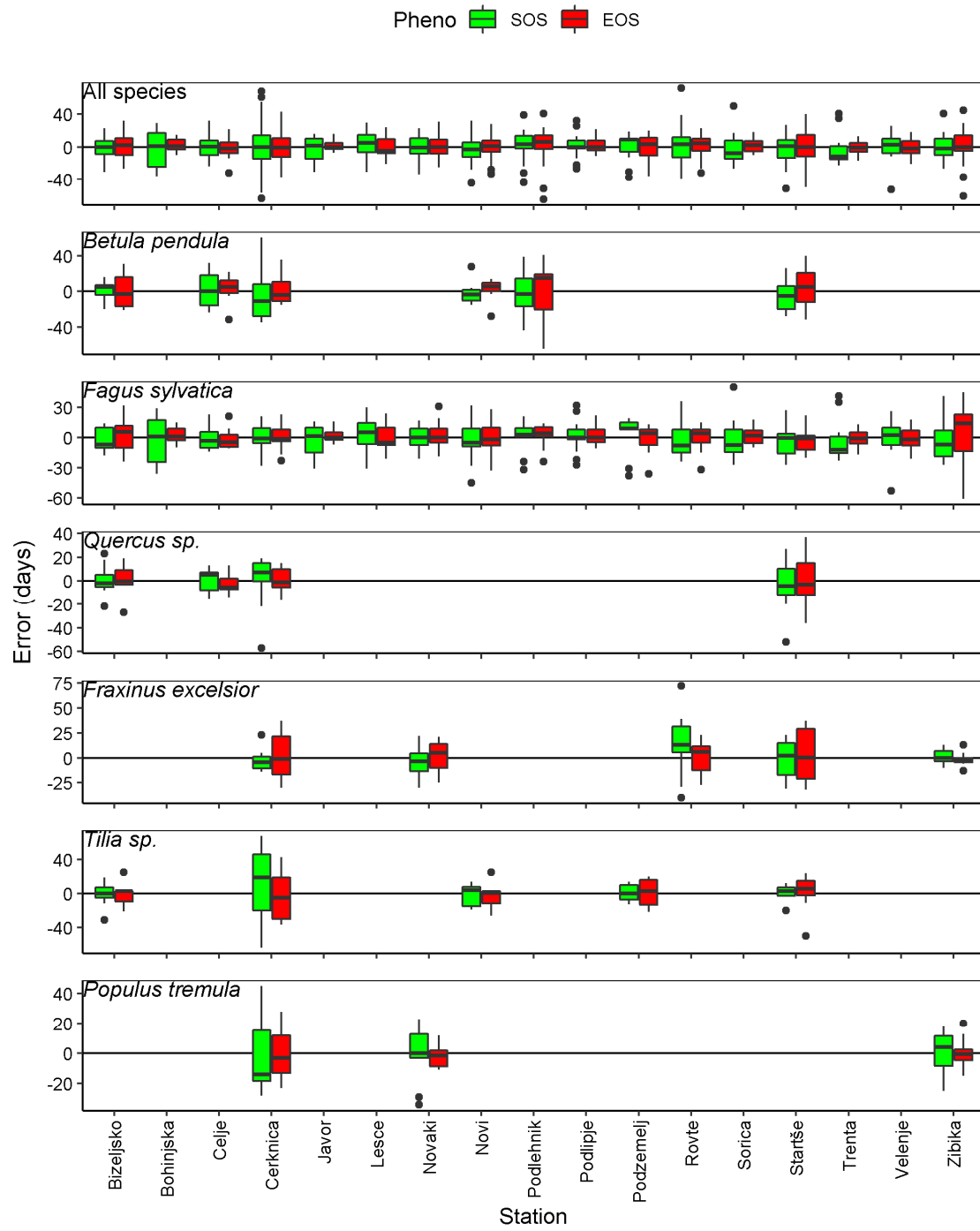


Figure S7. Error (Modelled – Observed) of SOS and EOS per site, all species and each species separately, using MODIS NDVI.

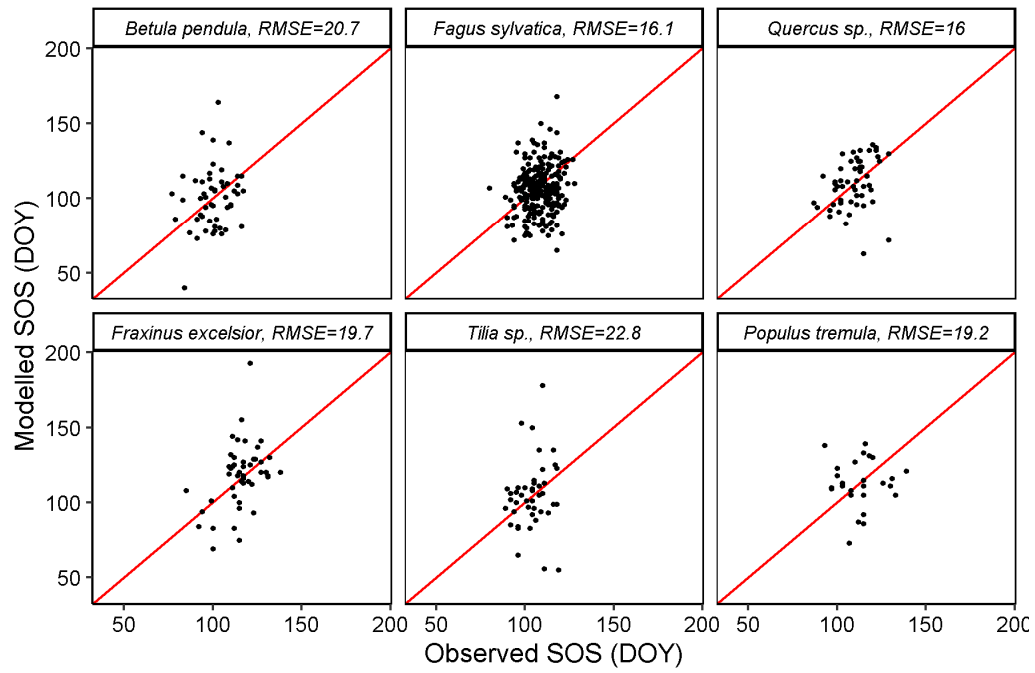


Figure S8. Modelled vs. observed SOS per species, all stations together, using MODIS NDVI. The red lines are identity (1:1) lines for each panel.

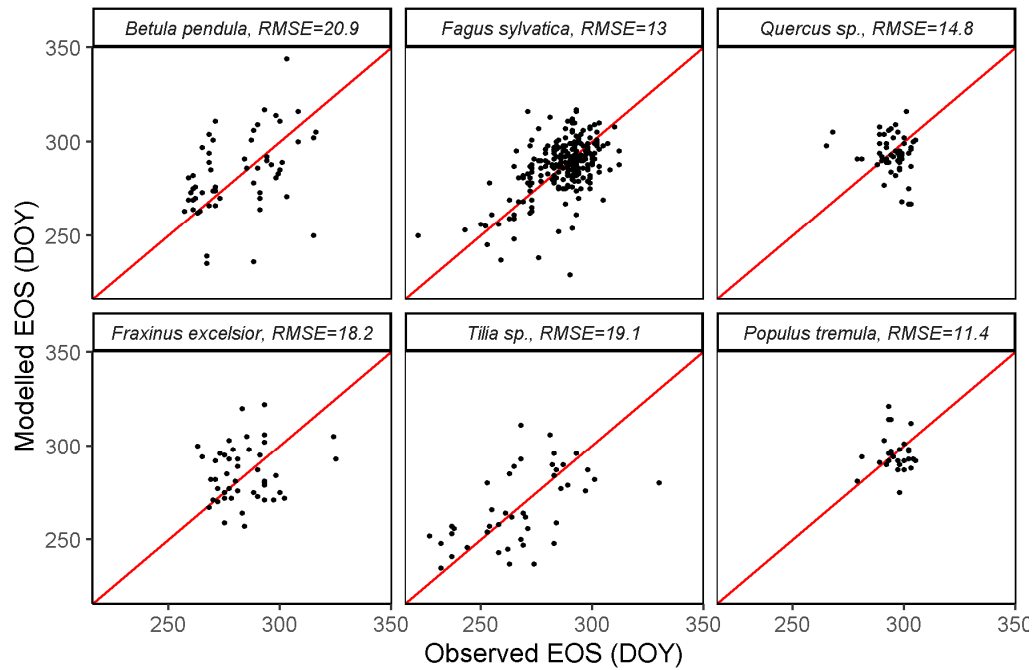


Figure S9. Modelled vs. observed EOS per species, all stations together, using MODIS NDVI. The red lines are identity (1:1) lines for each panel.

4. SOS and EOS derived using Landsat 7 EVI data

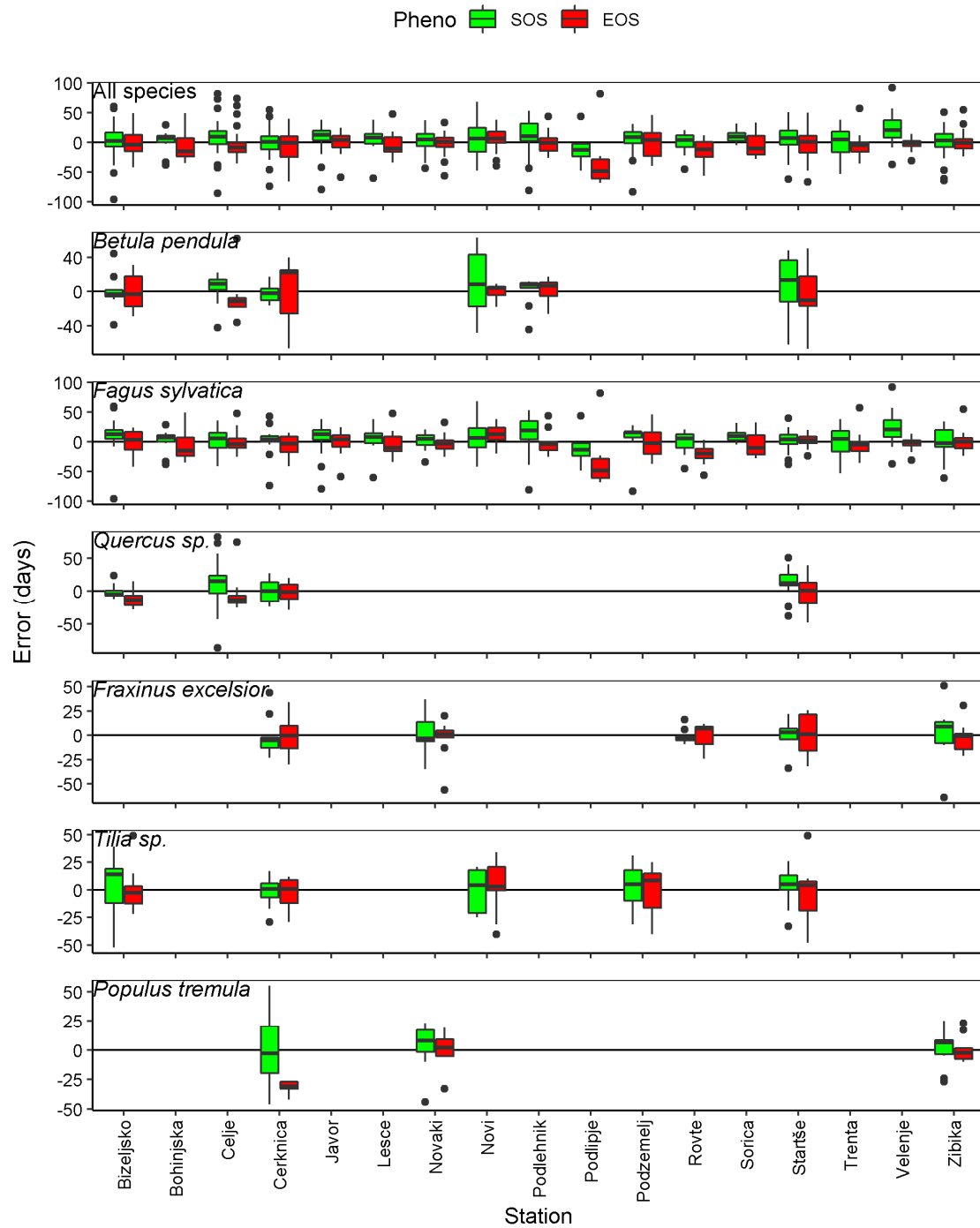


Figure S10. Error (Modelled – Observed) of SOS and EOS per site, all species and each species separately, using Landsat 7 EVI.

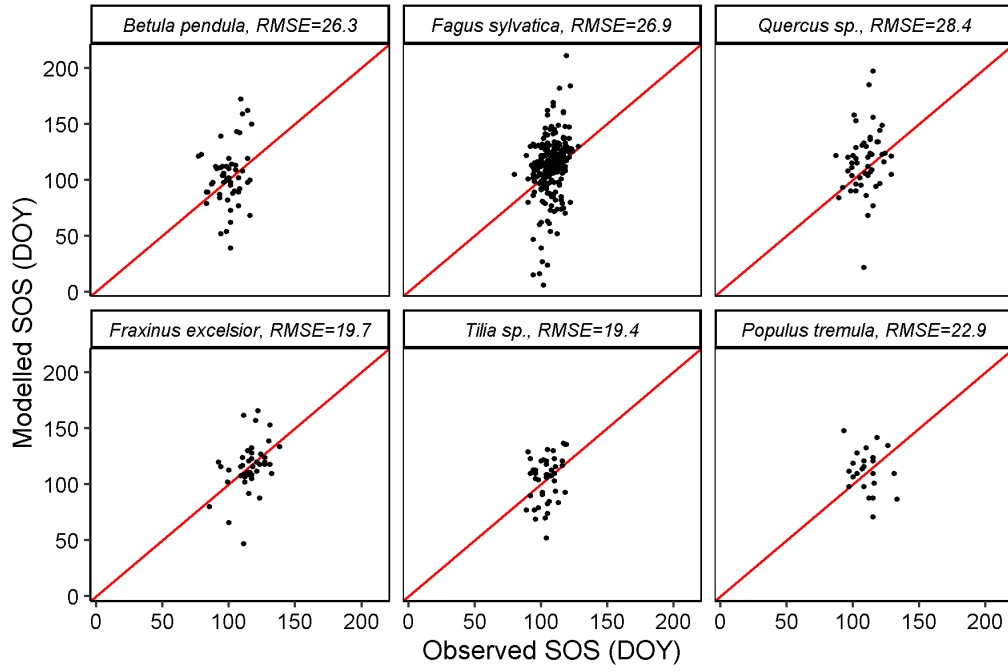


Figure S11. Modelled vs. observed SOS per species, all stations together, using Landsat 7 EVI. The red lines are identity (1:1) lines for each panel.

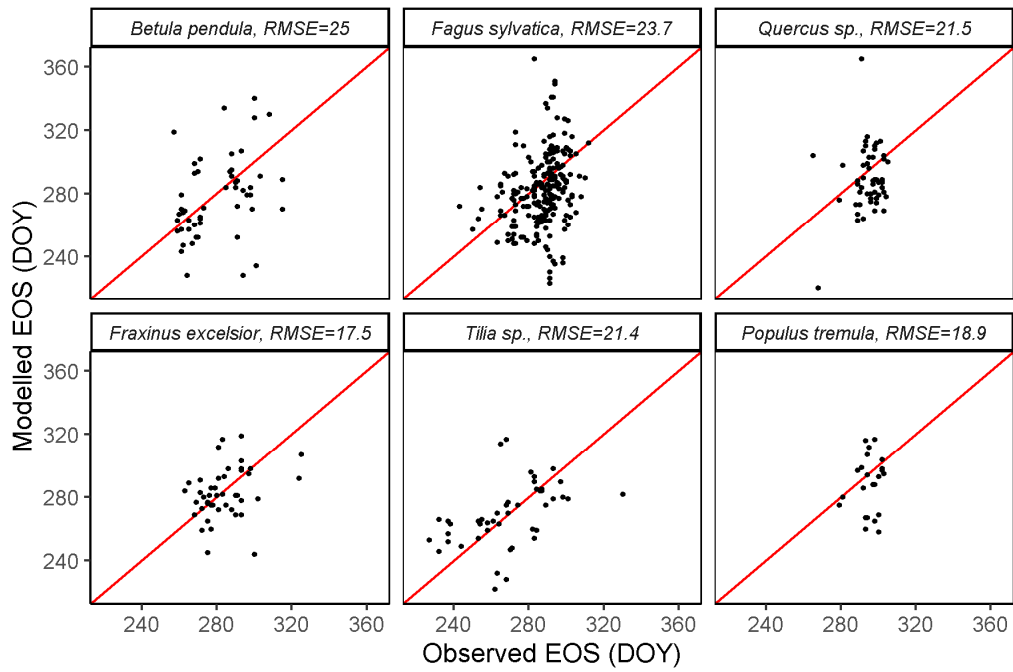


Figure S12. Modelled vs. observed EOS per species, all stations together, using Landsat 7 EVI. The red lines are identity (1:1) lines for each panel.

5. SOS and EOS derived using Landsat 7 NDVI data

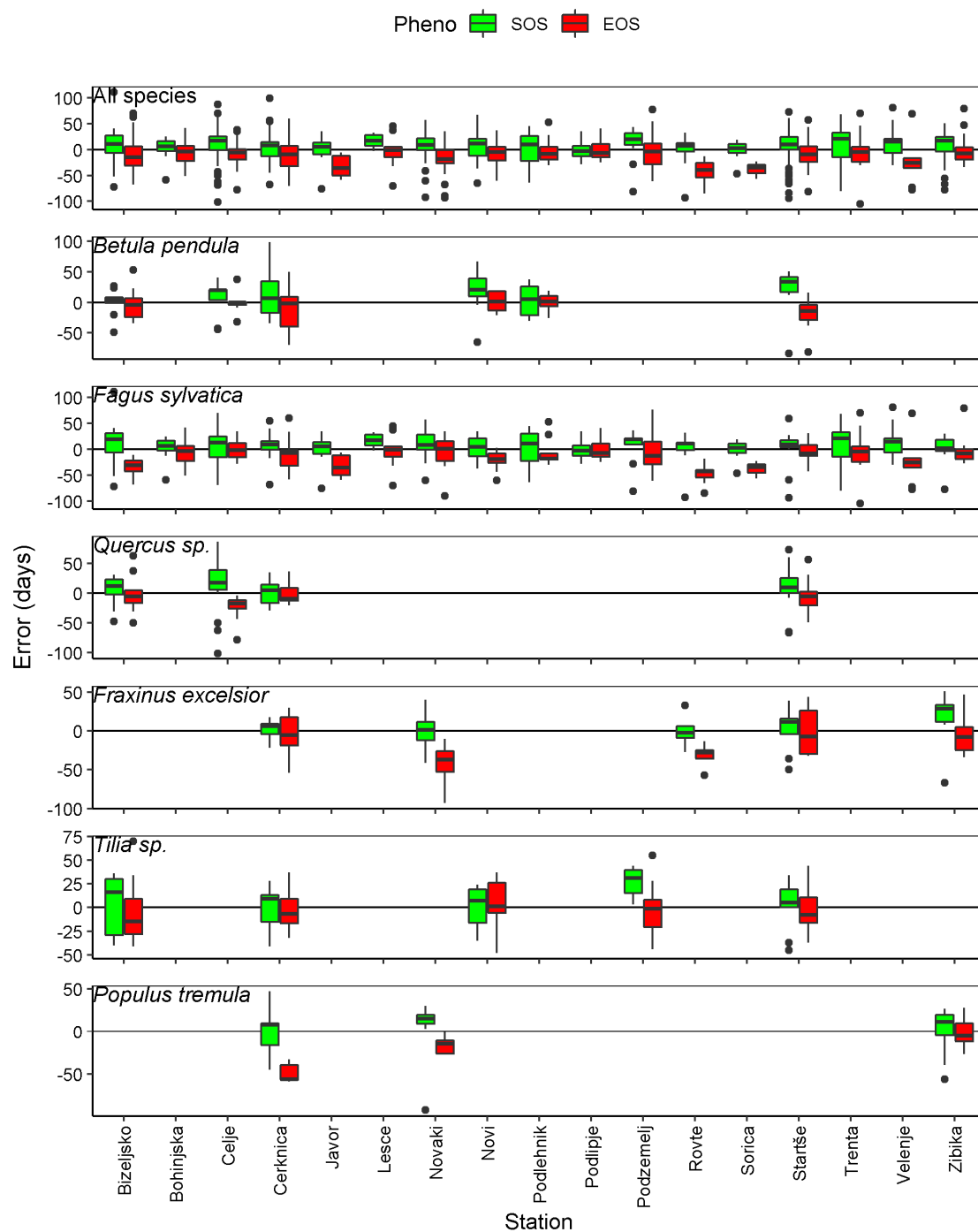


Figure S13. Error (Modelled – Observed) of SOS and EOS per site, all species and each species separately, using Landsat 7 NDVI.

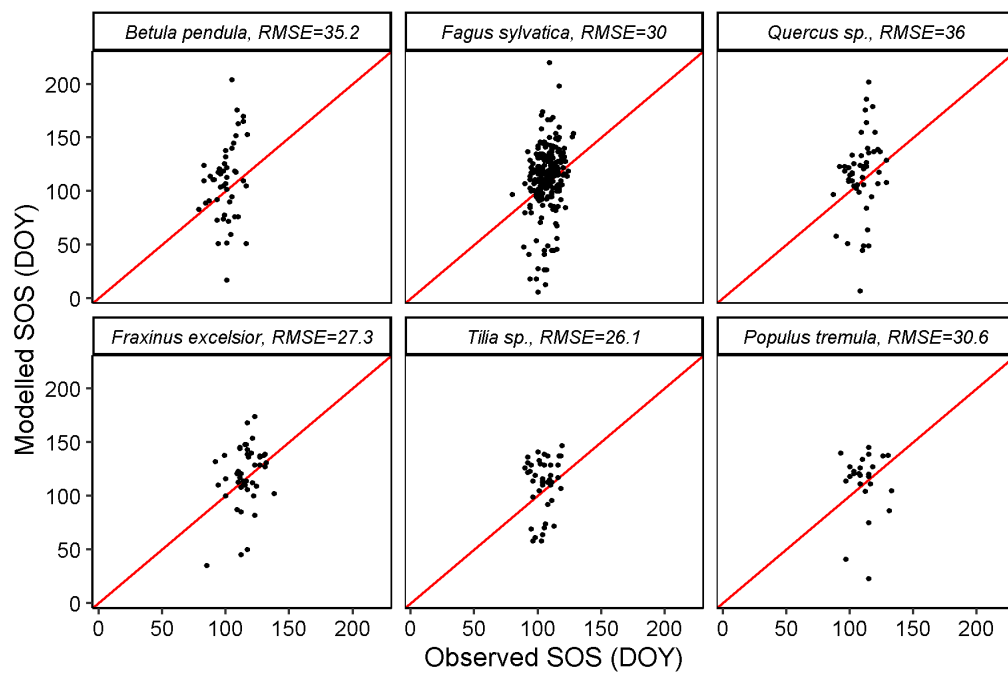


Figure S14. Modelled vs. observed SOS per species, all stations together, using Landsat 7 NDVI. The red lines are identity (1:1) lines for each panel.

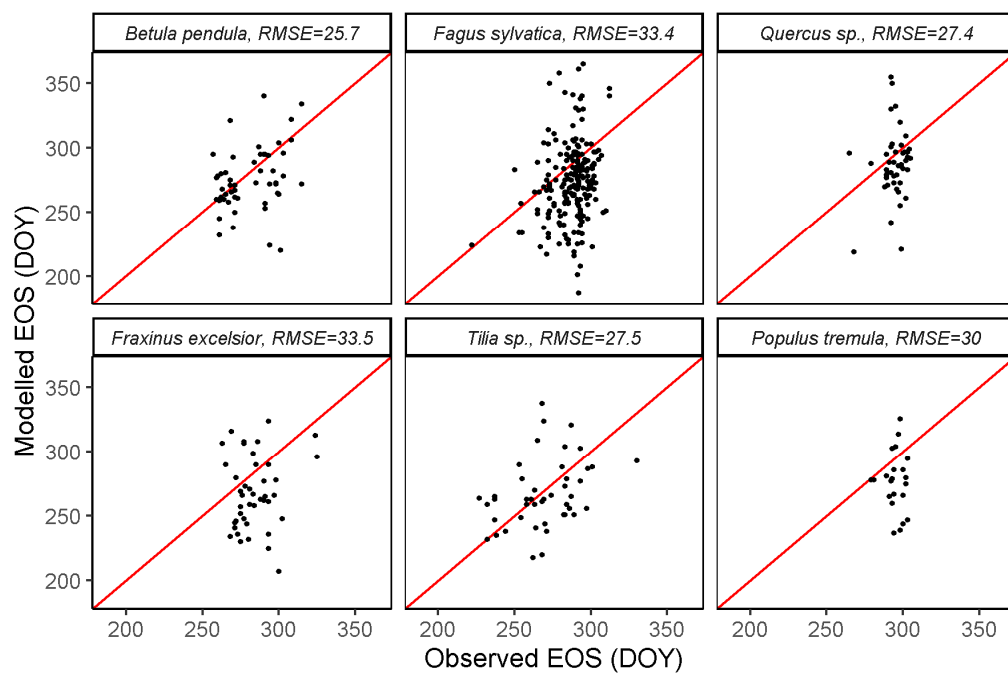


Figure S15. Modelled vs. observed EOS per species, all stations together, using Landsat 7 NDVI. The red lines are identity (1:1) lines for each panel.