1 SUPLEMENTARY INFORMATION

1.1. Validation: Observed EVI vs apparent phenology

In **Error! Reference source not found.** we show the linear regression that compares the observed and the apparent phenology values for all study sites. When using the mean values per date (**Error! Reference source not found.** top panel), it is easy to see that some models show low predictive power (i.e. $R^2 < 0.30$), and others show a moderate predictive power (i.e. $30 \leq R^2 \leq 50$). For example, Apparent phenology has a moderate agreement with observed EVI values in the sites where (Coupland et al., 2005), (Saenger and Moverley, 1985), and (Wilson and Saintilan, 2012) undertook their field campaigns (**Error! Reference source not found.**B/D/E). In sharp contrast, when the data are grouped by month (**Error! Reference source not found.** bottom panel), the Apparent phenology shows better predictive power across all sites, due to lower influence of daily fluctuations. For example, Apparent phenology for (Saenger and Moverley, 1985), (Coupland et al., 2005) and (Kristin N Metcalfe et al., 2011) have the highest R^2 values of all models i.e. 0.93, 0.90 and 0.90 respectively. The residuals of all the regressions (not shown) are randomly distributed, indicating that errors are stochastic and showing no signs of heteroscedasticity or non-linear associations between observed and predicted values. Importantly, These results suggest that in mangrove ecosystems GAMs may be better predictors of seasonal changes than inter-annual variations.

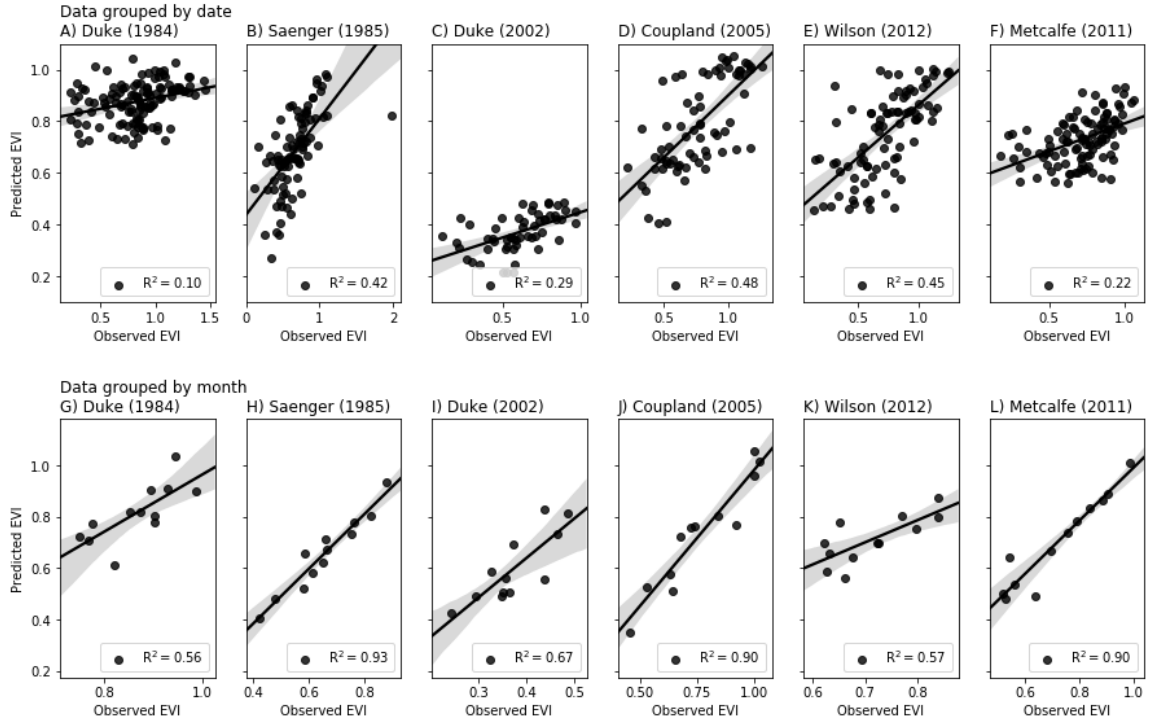

Figure S1. Observed EVI vs Apparent phenology for all sites. Top panel shows the linear regression of the mean observed EVI per date, while the bottom panel shows the linear regression of the monthly means of the model and EVI observations.

1.2. Cross-validation

We performed cross-validation on the images from the Gladstone region (1995-1999) using the 'performance metrics' tool from Prophet. In **Error! Reference source not found.** we show the Mean Absolute Error, where the red line represents the mean taken over a rolling window of the errors of the predictions for each horizon. In other words, Prophet generates a prediction for every horizon

(i.e. days into the future) in every pixel and such prediction generates an error. Overall, those errors are averaged and presented in **Error! Reference source not found.**. The typical error ranges between 0.175 and 0.230 approximately for predictions between one and four months into the future; these errors increase to 0.300 - 0.350 as the predictions reach six, seven and eight months into the future. However, the Mean Absolute Error decreases for predictions made between eight and ten months ahead, before rising again. In general, predictions made up to four months into the future have lower errors than those made for later dates.

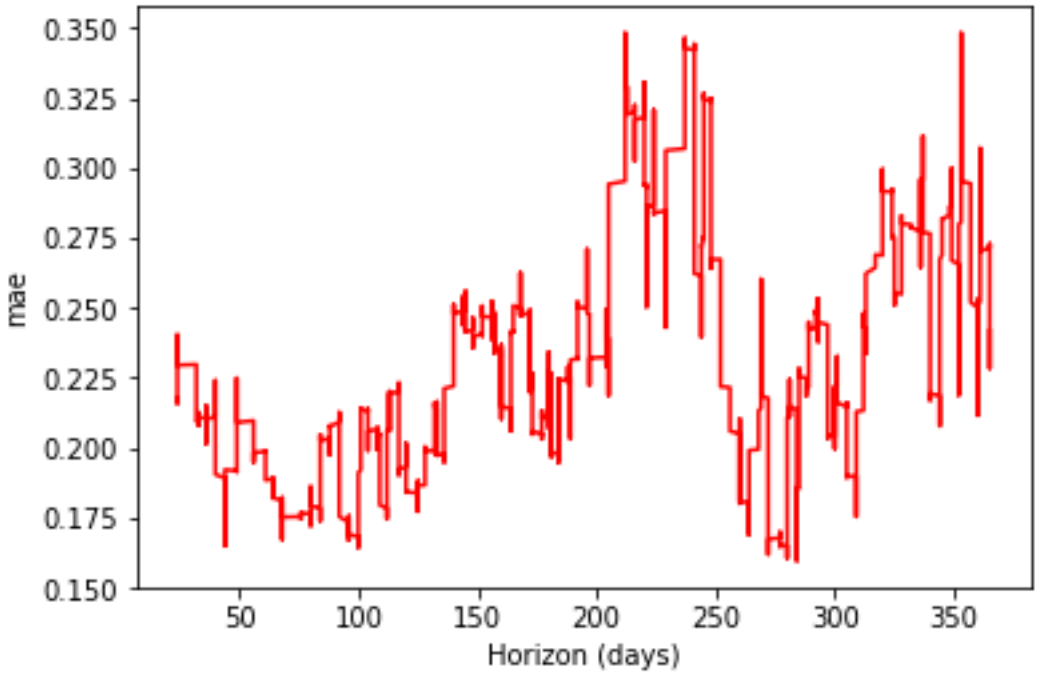

Figure S2. Mean Absolute error of the Cross-validation predictions of EVI.