North Wyke Farm Platform

Research case study no. 1

Testing the SPACSYS process-based model

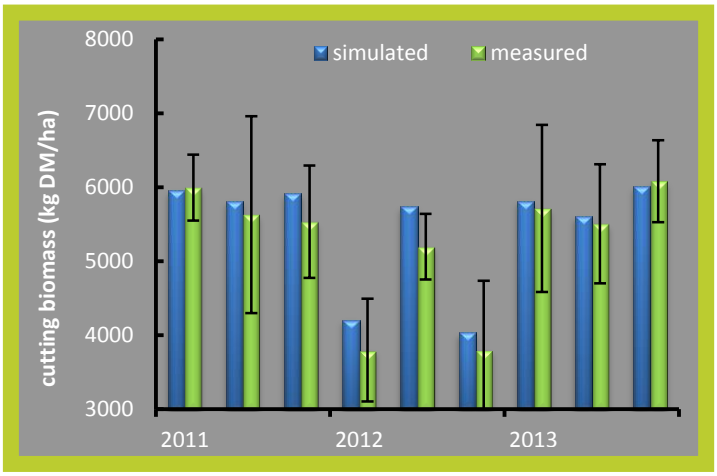
Lianhai Wu

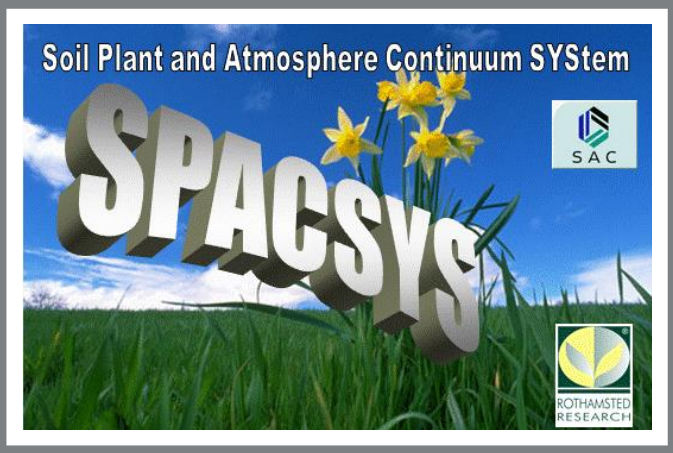
The NWFP is globally unique in that it provides a set of core data from the field to the farm scale to help the research community in better addressing key issues in sustainable agriculture and testing models that are capable of simulating the processes involved in the systems. The tested models can then be used to simulate how agro-ecosystems will respond to changes in the environment and management. Data, modelling and experiments can be brought together to help deliver maximum sustainable production per unit area whilst minimising negative impacts on other ecosystem services.

The SPACSYS model is a process-based, field scale, weather-driven and daily-time-step dynamic model to simulate plant growth and development, soil nitrogen and carbon cycling, water dynamics and heat transformation in multiple fields simultaneously. In the near future, its ability will be extended to link phosphorus cycling and to simulate animal growth rates.

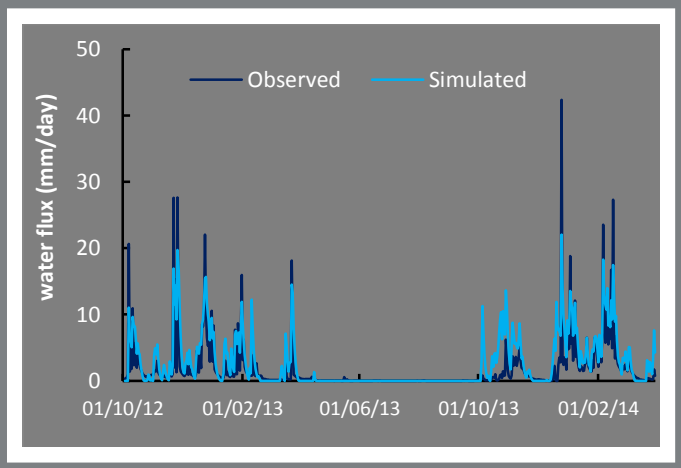
The datasets generated from the three contrasting treatments from the NWFP were used to validate the model in forage biomass removal, water loss from runoff and dynamics of soil water content. Soil physical and chemical properties based on field surveys conducted in 2012 and agronomic management interpreted from the farm records were used as inputs for simulation. A set of statistical methods was used to evaluate the performance of the model.

Simulated cutting biomass from the fields was compared with observed data (see Figure below). It shows that the simulated cutting biomass has good agreement with the sampled data when the samples were taken during the establishment period.





Simulated daily water fluxes were compared with observed data over the simulated period. The pattern of temporal dynamics matched very well (see Figure below, for flume 6 in the Golden Rove field, as an example). All the observed peak flow events are captured by the model.



The model simulated biomass removal, dynamics of soil water content and water fluxes collected at the flumes statistically well. Therefore, it is possible to use the model to investigate the impact of environmental and agronomic changes on production and ecosystem services of different livestock systems.

The three treatments on the NWFP were modelled. The simulation showed that the deep rooting grass in the reseeding treatment reduces N losses through leaching, runoff and gaseous emissions and water loss from runoff compared with those from the other two treatments. Our simulation demonstrated that the mixture of grass and legume could increase C fixation and N offtake, which would improve sward quality under the current management practices and potentially result in a higher level of livestock output.