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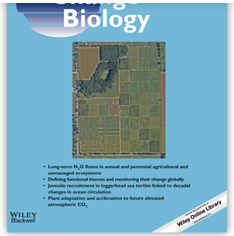

November 2016
Pages 3774-3788

Primary Research Article

# Modelling climate change impacts on viticultural yield, phenology and stress conditions in Europe

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First published: 02 June 2016 | https://doi.org/10.1111/gcb.13382 | VIEW METRICS



References Related Information

## Recommended

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Climate change impacts and adaptive strategies: lessons from the grapevine

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## Abstract

Viticulture is a key socio-economic sector in Europe. Owing to the strong sensitivity of grapevines to atmospheric factors, climate change may represent an important challenge for this sector. This study analyses viticultural suitability, yield, phenology, and water and nitrogen stress indices in Europe, for present climates (1980–2005) and future (2041–2070) climate change scenarios (RCP4.5 and 8.5). The STICS crop model is coupled with climate, soil and terrain databases, also taking into account $CO_2$ physiological effects, and simulations are validated against observational data sets. A clear agreement between simulated and observed phenology, leaf area index, yield and water and nitrogen stress indices, including the spatial differences throughout Europe, is shown. The projected changes highlight an extension of the climatic suitability for grapevines up to 55°N, which may represent the emergence of new winemaking regions. Despite strong regional heterogeneity, mean phenological timings (budburst, flowering, veraison and harvest) are projected to undergo significant advancements (e.g. budburst/harvest can be >1 month earlier), with implications also in the corresponding phenophase intervals. Enhanced dryness throughout Europe is also projected, with severe water stress over several regions in southern regions (e.g. southern Iberia and Italy), locally reducing yield and leaf area. Increased atmospheric $CO_2$ partially offsets dryness effects, promoting yield and leaf area index increases in central/northern Europe. Future biomass changes may lead to

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for stakeholders from the European winemaking sector.

## Supporting Information

| Filename | Description |
|---|---|
| gcb13382-sup-0001-Supinfo.pdf PDF document, 2 MB | **Table S1.** Main model components in STICS and methods of calculation following Moriondo *et al*. (**2015** ).<br>**Figure S1**. Location of the points used for the full 26-year model runs (from 1980 to 2005). The selected points correspond to widely known viticultural regions in Europe.<br>**Figure S2.** Comparison of STICS outputs for the selected points in Europe (Fig. S1): In the *x* axis, daily climatic normals (1980–2005) where used as STICS inputs, whereas in the y axis, individual daily annual climatic data was used as STICS inputs and the results were averaged afterwards.<br>**Figure S3.** Differences between future RCP8.5 (2041–2070) and recent-past (1980–2005) (a) annual mean daily temperature (°C) and (b) annual mean daily precipitation (mm).<br>**Figure S4.** Differences between future (2041–2070) and recent-past (1980–2005) phenological intervals (a) budburst–flowering, (b) flowering–veraison, (c) veraison–maturation and (d) budburst–maturation. |

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**Figure S5.** STICS model simulations for budburst, flowering, veraison and maturation over Europe under RCP4.5 and 8.5.

**Figure S6.** STICS model simulations for Leaf area index and yield

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