# Regime changes in competing floating-submerged plant ecosystems

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Pristine coastal shallow systems are considered as dominated by extensive meadows of seagrass species, which are assumed to take advantage of nutrient supply from sediment. An increasing nutrient input is thought to favour in a first phase phytoplankton and/or epiphytic micro-, macroalgae as well as opportunistic ephemeral macroalgae that coexist with seagrasses. The primary cause of shifts and succession in the macrophyte community are nutrients added to water, mainly nitrogen and phosphorus.

In an attempt to quantify these aspects to and to analyse better the type of regime shift occurring in these ecosystems according with non-linear dynamical systems theory, we have developed a basic model that accounts for the competition between Zostera marina (submerged plants) and Ulva (floating plants) using existing developed and validated models[1–4]. To deal with the ability of seagrass to survive in low nutrient conditions, we have also included the dynamics of inorganic nitrogen (nitrates and ammonium) in the water column as well as in the sediments[5]. As it is, the model does not take into consideration several important aspects that may influence the outcome of the simulations such as organic nutrient dynamics, oxygen which in some cases is the limiting factor, phytoplankton, zooplankton and bacteria dynamics, and the interactions between Ulva rigida and aquaculture activities.

The 0D results shown a general agreement with the experimental results reported in literature concerning thresholds of nutrient concentrations at which a regime shift occurred[7]. Furthermore, the model is quite sensitive to water temperature increases. Successively, the regime shift model has been coupled with a 3D hydrodynamic (physical) COHERENS model[6] and a watershed model[7] for Thau lagoon (France). Scenarios considering an increase of nutrients due to the enlarge population living at the watershed, carried out by Valette et al (2005), have been used for assessing the probability of the occurrence of a regime shift in Thau lagoon .

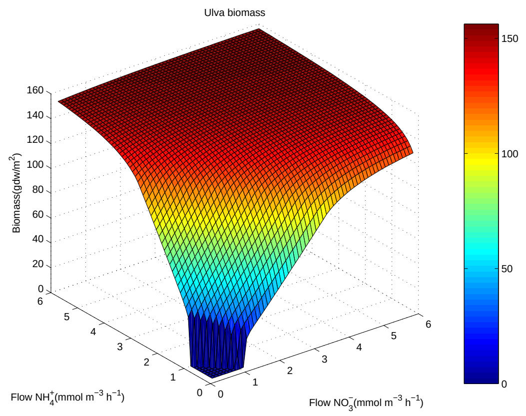


Figura 1. Ulva annual mean biomass as a function of nitrate and ammonium inflows ($mmolm^{-3}h^{-1}$).

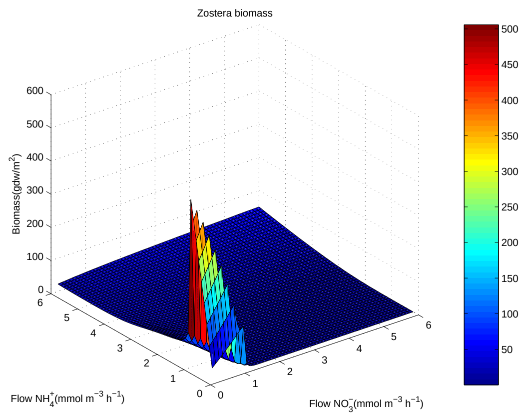


Figura 2. Zostera annual mean biomass as a function of nitrate and ammonium inflows ($mmolm^{-3}h^{-1}$).

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