THE CHANGING WATER BUDGET OF QUINTO BASIN (RAVENNA, ITALY) , A COASTAL WATERSHED UNDER CLIMATE CHANGE.

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Abstract
The seasonal water budget of the Quinto Basin, a coastal watershed along the Adriatic sea in Italy, is calculated based on land use, under current and future climate conditions. Estimates of the future hydrologic surplus or deficit helps among others to understand whether salt water intrusion will be even a larger problem in the future than it is today, threatening both agricultural and natural ecosystems.
Keywords: Adriatic Sea, Coastal Processes, Global Change, Hydrology, Salinity

Introduction and study methods
We present the water budget of a small coastal watershed (The Quinto Basin, Ravenna, Italy) by calculating the seasonal evapotranspiration based on land use. For the farmland, wetlands, natural areas, pine forest and bare soil we use CROPWAT [1] with different crop factors to calculate the evapotranspiration (Etc). To reduce the number of calculations we selected the most common soils and crops (wheat, maize, alfalfa, peaches and grapes). Reed represents the vegetation in the wetlands. Open water evaporation on lakes and old quarries is also calculated [2]. The climate data used in this study is based on measurements from four local weather stations. For an estimate of future climate, the averaged output of fifteen GCM models, in two scenarios (A1b and A2) for the period 2079 - 2099 (IPCC, 2007) is used. In comparison with today, the minimum temperature will be higher whereas the maximum temperature is higher mostly in winter but will not increase considerably in summer. The total annual precipitation is thought to decrease from 635 mm to 619 mm (scenario A1b) or 596 mm (scenario A2) and relatively more rain will fall in winter. The humidity is predicted to be higher, the winds less strong in the future.

Results
The annual ETc values decrease under the future climate scenarios used for this study. However, since relatively more rain falls in winter (up to 64% for A2), the summer (April-September) water deficits increase considerably. Whether or not this results in an increase of irrigation requirement depends also on the soil type and planting date. All the crops on all types of soil will need more irrigation under A2 except Peaches and Wheat. Evaporation of open waters, wetlands and bare soil is decreasing since the futures higher humidity compensates for the higher temperatures.

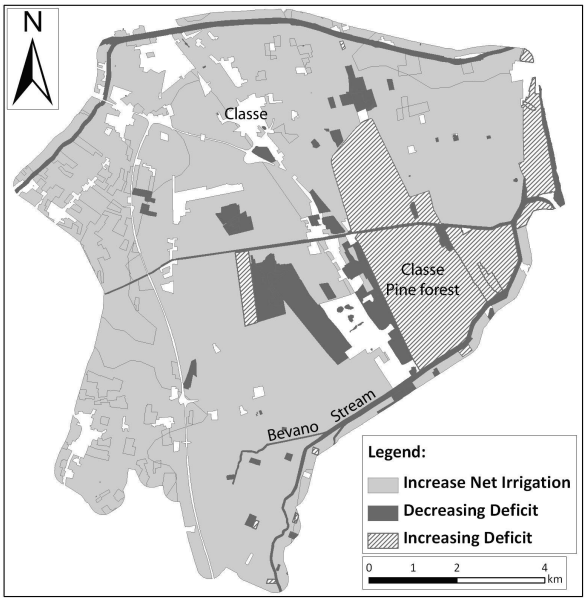

Fig. 1. The difference in annual net irrigation requirement between today and the future (scenario A2) for agricultural land, and the difference between current and future deficit (precipitation minus evapotranspiration) for the other areas.

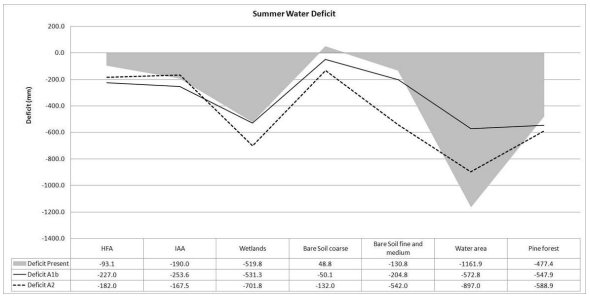

Fig. 2. Summer water deficit (mm) for present and for scenarios A1b and A2.

Discussion and conclusions
This study shows that air humidity and wind velocity has a large influence on (crop) evapotranspiration and evaporation of open water in the Quinto Basin. It is a parameter that is not often discussed in future climate studies but needs more attention. Summer water deficits will increase and therefore agricultural practices including planting dates should be reconsidered. Although we have an estimate of Pine tree transpiration, not much is known about current or future evapotranspiration of natural areas.

Acknowledgements This work is part of the WATERKNOW project funded by CIRCLEMED http://www.circle-med.net/ .

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