



ON THE EVAPOTRANSPIRATION ESTIMATES OF TWO CONTRASTING AND HETEROGENOUS ECOSYSTEMS IN SARDINIA

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INTRODUCTION AND OBJECTIVES

SARDINIA ISLAND IS A REFERENCE FOR ECOHYDROLOGICAL STUDIES ON PAST AND FUTURE CLIMATE CHANGE EFFECTS, REPRESENTING TYPICAL CONDITIONS OF THE WESTERN MEDITERRANEAN SEA BASIN. ECOSYSTEMS ARE HETEROGENOUS, AND TREES OPTIMIZE THE USE OF WATER THROUGH THE ROOT SYSTEMS, UPTAKING WATER FROM THIS DEEP LAYERS.

Two micrometeorological towers have been installed in two different sites under a rocky layer of wild olive trees and C3 herbaceous that grow in a shallow under a rocky layer of BASALT, PARTIALLY FRACTURED (SOIL DEPTH 15 40 CM), WITH A TREE COVER PERCENTAGE OF 33% IN THE FOOTPRINT. INSTEAD, THE SECOND IS IN A MOUNTAINOUS FOREST SITE OF QUERCUS ILEX CHARACTERIZED BY STEEPER SLOPES AND ROCKY OUTCROPS (MEAN ANNUAL PRECIPITATION OF ABOUT 800 MM), AND TREE COVER PERCENTAGE OF 33% IN THE FOOTPRINT. INSTEAD, THE SECOND IS IN A MOUNTAINOUS FOREST SITE OF QUERCUS ILEX CHARACTERIZED BY STEEPER SLOPES AND ROCKY OUTCROPS (MEAN ANNUAL PRECIPITATION OF ABOUT 800 MM), AND TREE COVER PERCENTAGE OF 68% IN THE FOOTPRINT. IN BOTH SITES LAND SURFACE FLUXES AND CO2 FLUXES ARE ESTIMATED WITH WATER CONTENT REFLECTOMETERS, AND PERIODICALLY LEAF AREA INDEX (LAI) WERE ESTIMATED.

THE FOLLOWING OBJECTIVES ARE ADDRESSED:

- 1) POINTING OUT THE DYNAMICS OF LAND SURFACE FLUXES, SOIL MOISTURE AND CO2 FOR TWO CONTRASTING SITES;
- 2) ASSESS THE IMPACT OF VEGETATION DYNAMICS AND TYPE ON THE CO2 AND WATER BALANCE DYNAMICS;
- 3) EVALUATE THE SOIL EFFECT ON WATER AND ENERGY BUDGETS.

CASE STUDY: MARGANAI FOREST





THE MARGANAI FOREST, LOCATED IN SOUTH-WEST SARDINIA (ITALY), IS A LONG – TERM ECOSYSTEM RESEARCH (LTER) ITALIAN SITE AND A EUROPEAN SITE OF COMMUNITY IMPORTANCE (NATURA 2000), THAT INCLUDES FIVE MAIN FOREST MANAGEMENT UNITS MANAGED BY FO.RE.S.T.A.S.

THE AREA IS MOSTLY MOUNTAINOUS AND VARIED FROM THE MORPHOLOGICAL POINT OF VIEW: FROM GRANITIC TO LIMESTONE MOUNTAINS, THE SOIL DEPTH VARIES BETWEEN 10 CM TO 50 CM.

THE VEGETATION IS MAINLY COMPOSED BY HOLM OAKS (QUERCUS ILEX), CORK OAK (QUERCUS SAUBER) AND THE TYPICAL SPECIES OF MEDITERRANEAN MAQUIS SUCH AS: ARBUTUS UNENDO, PHILIREA LATIFOGLIA, PISTACIA LENTISCUS AND ERICA ARBOREA, ETC...

CASE STUDY: ORROLI



THE STUDY WAS PERFORMED IN A TYPICAL MEDITERRANEAN ECOSYSTEM IN ORROLI, SARDINIA (ITALY). THE VEGETATION IS DISTRIBUTED IN PATCHES OF WOODY VEGETATION (WILD OLIVES MAINLY) AND GRASS. SOIL DEPTH IS LOW AND SPATIALLY VARIES BETWEEN 10 TO 40 CM, WITHOUT ANY CORRELATION BETWEEN THE VEGETATION SPATIAL DISTRIBUTION.

GRASS VEGETATION COVERAGE CHANGE RADICALLY DURING THE DRY SEASON WHEREAS WOODY VEGETATION REMAINS APPROXIMATELY CONSTANT THROUGHOUT THE YEAR.



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TO MEASURE LANDSCAPE-ATMOSPHERE FLUXES OF ENERGY, WATER AND CARBON, A 10 M TOWER WAS INSTRUMENTED WITH CAMPBELL SCIENTIFIC CSAT3 SONIC ANEMOMETER, USED TO MEASURE WIND SPEED AND DIRECTION; LICOR LI-7500 CO2/H2O INFRARED GAS ANALYZER TO MEASURE GAS CONCENTRATION, FOR THE ESTIMATION OF LATENT HEAT (LE) AND SENSIBLE HEAT (H) FLUXES USING CORRELATION METHODS (E.G. BRUTSAERT, 1982).







SAP FLOW MEASUREMENTS



GARNIER-TYPE SENSORS WAS USED FOR SAP FLOW MEASUREMENTS. THE TEMPERATURE DIFFERENCE BETWEEN THE PROBES WAS RECORDED AND DERIVED TO OBTAIN SAP FLUX DENSITY JS (CM MIN-1) (GARNIER, 1985):

$$s = 0.714 \times \left(\frac{\Delta T_{\text{max}}}{\Delta T} - 1\right)^{1.231} \qquad \Delta T_{\text{MAX}} = \text{MAXIMUM TEMPERATURE DIFFERENCE} \\ \Delta T = \text{TEMPERATURE DIFFERENCE MEASURED}$$

$$V_s = 0.714 \times \left(\frac{\Delta T_{\text{max}}}{\Delta T} - 1\right)^{1.251}$$

TRANSPIRATION WAS RELATED WITH SAPWOOD AREA AS:

 $S_{T,vw} = J_s \times A_s$

the states



SAPWOOD AREA







PRESSURE DEFICIT (VPD); FIGURE 7), WE NOTE THAT WUE AT THE MIX-SHALLOW SITE TENDS TO BE HIGHER THAN AT THE FOREST SITE, ALTHOUGH A LARGE SCATTER OF WUE IS OBSERVED FOR BOTH SITES. THIS RESULT CONFIRMS THAT THE MIX-SHALLOW ECOSYSTEM IS THE MOST EFFICIENT (GAINING CARBON WHILE CONSERVING WATER) AS ATTRIBUTED TO THE DROUGHT-TOLERANT WILD OLIVE TREES.