Ecohydrological Partitioning Heterogeneity Under Contrasting Urban Vegetation

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Introduction

Urban green spaces (UGS) can help mitigate hydrological impacts of urbanisation and climate change through precipitation infiltration, evapotranspiration and groundwater recharge. However, there is a need to understand how precipitation is partitioned by contrasting urban vegetation types in order to target UGS management for specific hydrological ecosystem services.

Study Objectives

1) To characterise temporal dynamics of key water balance components that reflect ecohydrological partitioning within an established UGS.

2) To identify dominant controls on the observed dynamics of this ecohydrological partitioning under contrasting vegetation types.

3) To apply insights from Objectives 1 and 2 to develop and apply a one-dimensional, relatively simple, ecohydrological model to estimate unobserved flux partitioning under the contrasting vegetation types.

Methodology

Within 150m^2 of the Cruickshank Botanical Garden at the University of Aberdeen we monitored, over one growing season and under five contrasting vegetation types (Fig.1), the following:

- Hydrometeorology;
- Shallow soil moisture;
- Deeper soil moisture;
- Isotopic variability of soil water;
- Sapflux (for all sites less the grassland)

Furthermore, we developed a new ecohydrological model to facilitate the daily estimation of evaporation, transpiration and groundwater fluxes.

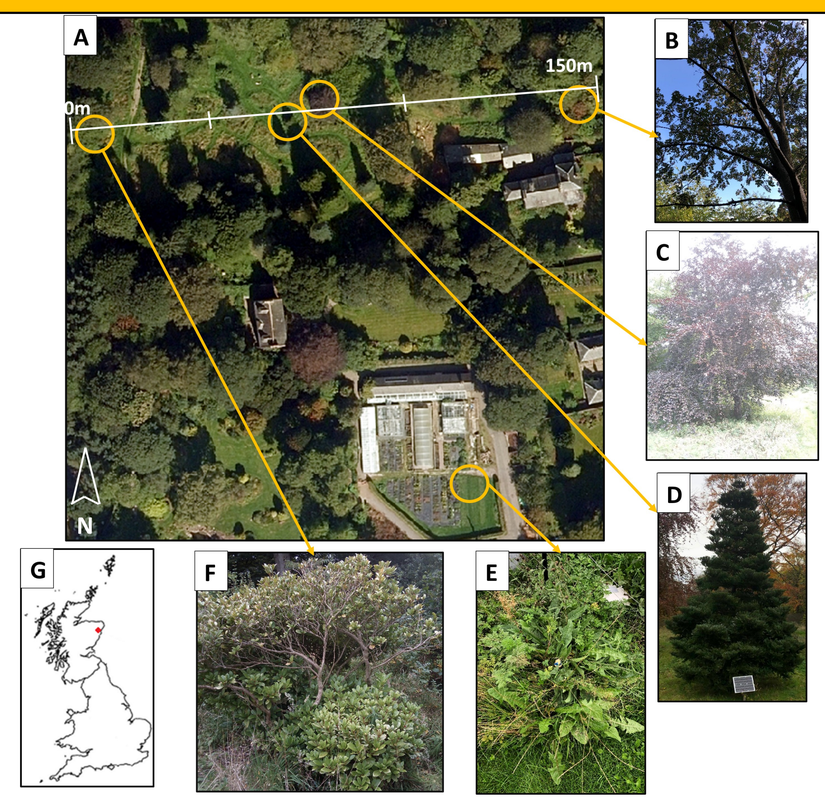

Fig. 1: *Overview of the study site (A) with locations of the smaller deciduous tree (B) larger deciduous tree (C), evergreen conifer (D), grassland (E) and evergreen shrub (F). Wider geographical reference given in G.*

Results

- Results evidenced clear inter-vegetation type differences in partitioning.
- Grassland soils experienced rapid drying in summer, whereas the larger deciduous site saw gradual drying.
- Soils beneath the Evergreen Conifer were least responsive to precipitation.
- Evapotranspiration estimates increased grassland (193mm)< evergreen shrub (214mm) < larger deciduous (224mm) < evergreen conifer (265mm).
- Median groundwater recharge was greatest below grassland (232mm) and least beneath the evergreen conifer (128mm).

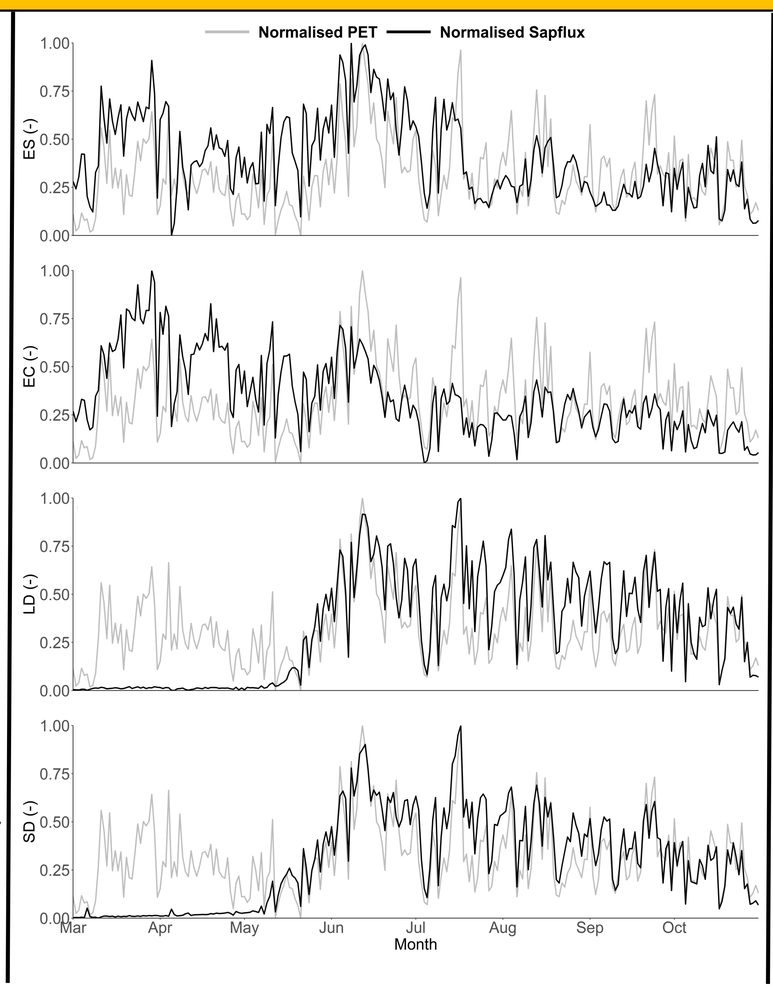

Fig. 2 (Left): *Normalised sapflux and normalised PET dynamics*

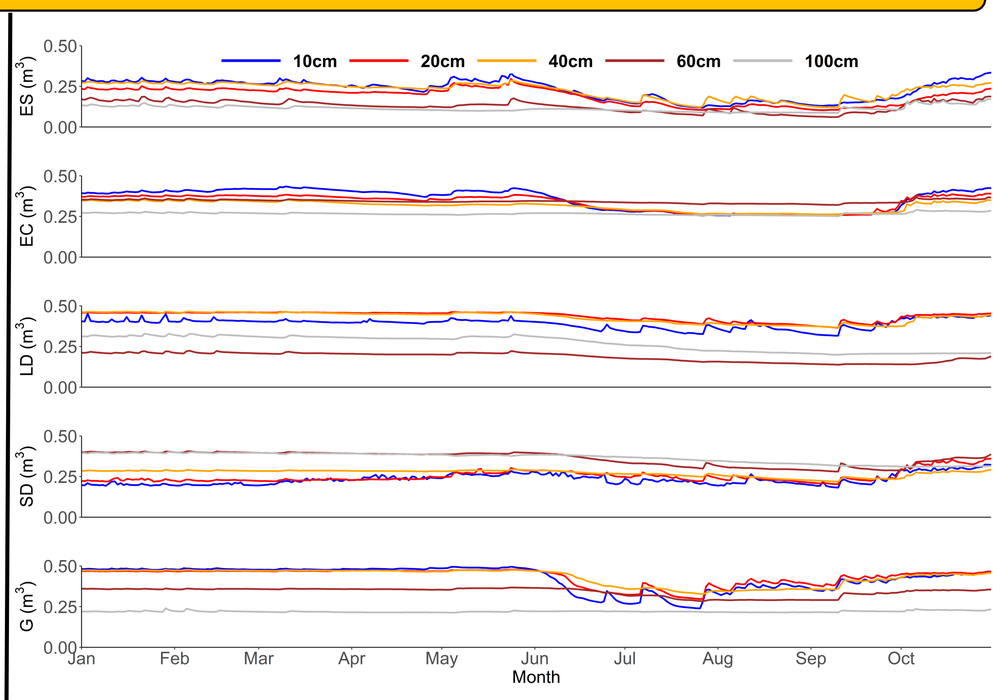

Fig.4 (Above): *Timeseries of soil volumetric water contents ES=Evergreen Shrub; EC=Evergreen Conifer; LD=Larger Deciduous; SD=Smaller Deciduous; G=Grassland*

Conclusions and Future Research

The study showed how integrating observed data with simple modelling can quantify heterogeneities in the ecohydrological partitioning of different UGS vegetation. This knowledge can be used when promoting climate and land use change resilience through encouragement of contrasting ecosystem service provision such as groundwater recharge and evapotranspiration. Future work should compare findings in geographically distinct settings.