The Daisy Model Newsletter
Department of Plant and Environmental Sciences
University of Copenhagen

Daisy Newsletter no. 28

Figure 1. Foxes in my garden singing Christmas Carols or maybe dancing a winter waltz. We believe they are sisters and we have followed them for 1.5 years now.

Merry Christmas and Happy New Year from the Daisy-group at PLEN, UCPH

1 The Daisy code, v. 6.22

The version 6.22 is still the latest official release on all platforms.

The article by Plauborg et al. (2022) mentions a problem with bare soil evaporation. The default values in Daisy can be adjusted as shown in the example below:

```
(defcolumn "Column" default
    (Surface
      (EpFactor 1 []);
      (EpFactor_SWE  (0.0 [pF] 1.0  []) (1.0 [pF] 1.0
[]) (2.0 [pF] 1.0 []) (2.5 [pF] 0.3  []) (3.0 [pF] 0.1 [])
(4.0 [pF] 0.1 []) (5.0 [pF] 0.1 [])))
```

2 Courses

We expect the Daisy PhD-course to run again in 2020. More information will follow when the timing has been decided. In addition, a course on Soil and Crop System Model – Data Fusion is planned for the end of August 2022 in cooperation between UCPH, UHOH, SLU, BOKU and WUR.

3 Events

On 5th of Nov. we held the **1st Daisy Workshop** at UCPH with a three key note speakers and many interesting presentations, posters and discussions. The program and the presentations can be found here. We thoroughly enjoyed meeting all of you and hope you did too. I believe we managed without any Covid19-infections. The event was also a delayed celebration of the 30 years birthday of Daisy.

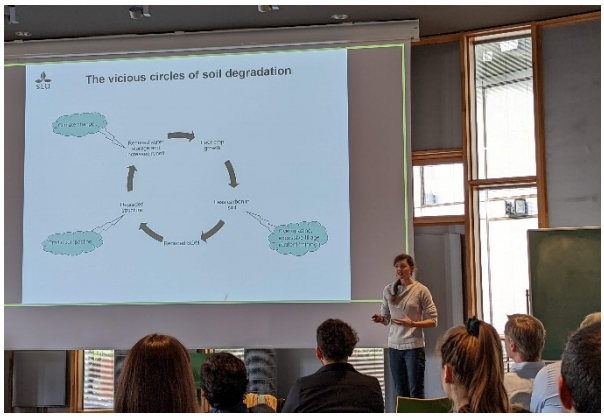

Figure 2. Katharina Meurer, SLU, was the first keynote speaker.

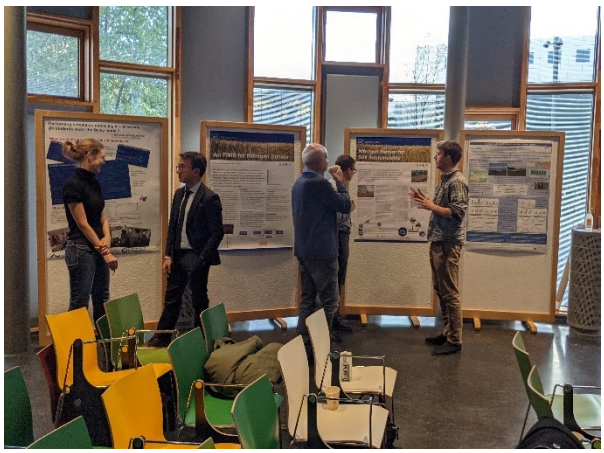

Figure 3. Discussions during a break.

Due to the workshop, the **Daisy lunch meeting** presentations were cancelled for the rest of the year. We expect to start again by the end of January 2022.

On 19th Nov. Saghar Motarjemi defended her **PhD thesis** at Foulum, Dept. of Agroecology, Aarhus University. The title of the PhD is "Water transport and fate of nitrogen in artificially drained agricultural loamy fields located in temperate regions".

Figure 4. Some of us enjoyed a nice dinner after the official workshop program.

4 Recent articles where Daisy has been used

The list includes two 2022-articles already available on-line.

Konrad et al. have analyzed required abatement measures required in Danish catchments in order to reach water framework directive targets for coastal waters. Agricultural and wastewater measures are included in the analysis, as the marginal costs of measures in agriculture have increased considerably. Waste water treatment abatement measures were only found to be relevant in two coastal catchments, where they mainly serve as a supplement due to insufficient potential for agricultural land in rotation to provide all the N load reductions. Furthermore, the pressure on agricultural land to reduce nutrient loads was very high in some catchments, implying that abatement measures such as land retirement where abatement costs are high enters the optimal solution due to their high level of effectiveness. Recommendations and average costs vary across catchments, indicating that results are not easily translated to generic national-level policy design. Interestingly, some catchments could not make the targets, even if all land was taken out of agriculture, somehow questioning the realism of the targets (Editors comment). Daisy was only used to calculate percolation for use in the NLES-model.

Motarjemi (2021)'s PhD includes three papers, of which one has been mentioned in an earlier Newsletter, one concerns prediction of drainage amounts based on machine learning and one (not yet published) describing measurements and modelling at a well drained and a poorly drained site in Tokkerup, Zealand. The last paper indicate that the division between N in drainage and denitrification may not be reliably described in Daisy.

Plauborg et al. (2022) investigated the possibility of reducing water use and N-leaching when growing potato using drip irrigation and nitrogen fertigation. Daisy was calibrated and validated on a 2-year experiment including two irrigation regimes and five N-fertigation levels. The calibrated model simulated LAI evolution, crop growth, N uptake and final tuber dry matter and N yield satisfactorily with discrepancies between the simulated and measured variables when simulations were evaluated treatment by treatment, demonstrating demonstrated that the calibrated Daisy model could be used as a DSS

tool for the optimal irrigation and fertigation of *Folva* and Sava potato cultivars. Compared to the experimental data the same tuber dry matter yield was simulated with substantial savings 30–55% and 35–50% of irrigation water and N fertilizer, respectively. Results indicated an overestimation of bare soil evaporation, and inconsistences in the simulated effects of water and N stresses on the crop.

Rashid et al. (2021-corrected proof) evaluated the performance of agricultural practices at field scale by a range of Daisy modelled scenario analyses to estimate N leaching from Danish cropping systems, representing 20 crop rotations, 3 soil types, 2 climates and 3–4 levels of manure (slurry)-to-fertilizer ratios, but with same available N, and (ii) appraise mitigation potential of on-farm measures (i.e. catch crops, early sowing of winter cereals) to reduce N leaching. Simulated average N leaching over 24 years ranged from 16 to 85 kg N/ha/y for different crop rotations. Rotations with a higher proportion of spring crops were more prone to leaching than rotations having a higher proportion of winter cereals and semi-perennial grass-clover leys. Undersown and autumn sown catch crops were effective mitigation measures, but effectiveness depended on their place and frequency of occurrence in a rotation.

5 Other articles

The articles of Alam and Wowra are both reviews/overview of approaches and models used in the respective fields. Daisy is mentioned in both articles but not used for analyses.

6 References

6.1 Daisy

Konrad, M.T, Hansen, L.B., Levin, G., Blicher-Mathiesen, G., Andersen, H.E., Martinsen, L. and Hasler, B. (2022). Targeted regulation of nitrogen loads: A national, cross-sectoral analysis. Ecological Economics, 193, 107278. https://doi.org/10.1016/j.ecolecon.2021.107278.

Motarjemi, S.K. (2021). Water transport and fate of nitrogen in artificially drained agricultural loamy fields located in temperate regions. PhD Dissertation. Dept of Agroecology, Faculty of Technical Sciences, Aarhus University.

Plauborg, F., Motarjemi, S.K., Nagy, D., and Zhou, Z. (2022). Analysing potato response to subsurface drip irrigation and nitrogen fertigation regimes in a temperate environment using the Daisy model. Field Crops Research, 276, 108367 https://doi.org/10.1016/j.fcr.2021.108367

Rashid, M.A., Bruun, S., Styczen, M.E., Ørum, J.E., Borgen, S.K.., Thomsen, I.K., and Jensen, L.S. (2021). Scenario analysis using the Daisy model to assess and mitigate nitrate leaching from complex agro-environmental settings in Denmark. Science of The Total Environment. 15118. https://doi.org/10.1016/j.scitotenv.2021.151518

6.2 Other articles of general interest

Alam, M. J. and Dutta, D. (2021): Modelling of Nutrient Pollution Dynamics in River Basins: A Review with a Perspective of a Distributed Modelling Approach. Geosciences 11, 369. https://doi.org/10.3390/geosciences11090369.

Wowra, K., Zeller, V. and Schebek, L. (2021): Nitrogen in Life Cycle Assessment (LCA) of agricultural crop production systems: Comparative analysis of regionalization approaches. Science of the Total Environment 763, 143009. https://doi.org/10.1016/j.scitotenv.2020.143009.