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Editorial: Impact of anthropogenic disturbances on agroforestry ecosystems

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Editorial on the Research Topic
Impact of anthropogenic disturbances on agroforestry ecosystems

Water-related ecosystem services have been under increasing pressure induced by global warming, pollution, and changes in land cover and land use (e.g., urban sprawl, groundwater contamination, deforestation, etc.). There is a growing concern on the impact of human disturbances on water resources, which threaten social and economic stability worldwide (e.g., Loi et al., 2022; Qin et al., 2022; Tan et al., 2022). In arid and semi-arid regions of the world, the pressures on water resources increase during the growing season, when rainfall supply is minimal, and water demands for domestic use and irrigation are at a maximum rate (e.g., Fernández García et al., 2020).

To date, there is a lack of novel and holistic approaches to develop reliable scenario-based modeling projections to support suitable, cost-effective adaptation strategies to mitigate the negative consequences of climate and land use change on water-related ecosystem services. To this end, comprehensive hydrological modeling approaches in both data-rich (e.g., Bogena et al., 2018) and data-scarce environments (e.g., Daneshvar et al., 2021), scenario-driven simulations (e.g., Rahaman et al., 2022), and data-driven approaches (e.g., Kalu et al., 2022) are important to understand the land-atmosphere feedback and agroforestry ecosystem dynamics. However, model performance depends on data quality and availability (Shen et al., 2022). In this regard, data assimilation and innovative integration of cutting-edge ground- (e.g., *in-situ* sensor networks, Vereecken et al., 2022), proximal- (e.g., Bogena et al., 2022), and remote sensing-based (airborne, spaceborne) earth observation (e.g., Schönbrodt-Stitt et al., 2021) build the basis for enhancing the understanding of hydrological processes in response to a changing environment (e.g., Hung et al., 2022; Strebel et al., 2022).

This Research Topic features four articles, which are briefly introduced in the following:

Bijani et al. applied the POET (Population, Organization, Environment, and Technology) model and SWOT (Surface Water and Ocean Topography) analysis to find the best strategies to reduce and control the water conflict in the Doroodzan dam irrigation network in Fars Province, Iran. According to this study, a regular organization of water beneficiaries helps tackle increasing environmental degradation by reducing negative consequences on the agricultural ecosystem.

Kishawi et al. evaluated the impact of redcedar encroachment and climate change on the water balance in the Upper Middle Loup River watershed (4,954 km^2) in the Nebraska Sand Hills (USA) by using SWAT (Soil Water Assessment Tool). In this large-scale study, the comparison between the baseline scenario (2000–2019) and the most likely future scenario (2020–2099) indicates a warming pattern with a 4.1°C increase in temperature and a decrease in precipitation (P). Yet, the concurrent increase in carbon dioxide (CO_2) is likely to induce stomata closure by reducing potential (ET_p) and actual (ET_a) evapotranspiration losses. Projected P and ET_a are likely to decrease by 10 and 14% while recharge (R) and discharge (D) are expected to increase by 38 and 30%, respectively. On the basis of the Budyko framework, Lemaitre-Basset et al. (2022) showed that the effect of CO_2 atmospheric concentrations on the water balance limits both ET_p and ET_a under climate change.

Rahman et al. proposed a global-scale modeling application based on the assimilation of a remotely sensed vegetation product (Leaf Area Index, LAI) within the Noah Multi-Parameterization land surface model using an Ensemble Kalman Filter technique. This approach enhanced the estimation of transpiration and net ecosystem exchange across cropland, and to a higher extent across forests and woodlands. The findings of this study are useful in data-poor regions where ground observations are sparse and have the potential to improve the estimation of global carbon and energy cycles.

Robinson et al. assessed the impact of deforestation on in-stream dissolved organic carbon (DOC) and nitrate concentrations, their internal relationship, and those with stream discharge in the Wüstebach headwater catchment (38.5 ha), Germany. This approach was based on wavelet analysis that highlighted an increase in in-stream DOC concentrations, followed by an increase in nitrate ∼1 year later. The correlation between DOC and nitrate concentrations and discharge was likely altered due to the increased availability of soil nutrients induced by deforestation. This information provides new valuable insight for decision-making into such forest management interventions.

This Research Topic represents a step forward to develop functional (model-based) dynamic indicators of vulnerability and resilience of the agroecosystems subject to natural and anthropogenic disturbances. Such indicators will replace existing empirical and static indicators influenced by a certain degree of subjectivity. Maps of the above mentioned functional indicators will support sustainable and cost-efficient adaptation and mitigation strategies to tackle negative global changes and to ensure the provision of water-related ecosystem functions/services (Allocca et al., 2023).

Author contributions

PN led this Research Topic. RB was nominated as handling editor. PN, SS-S, HB, and ZA wrote the editorial. All authors contributed to the article and approved the submitted version.

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Conflict of interest

Authors RB and HB were employed by Agrosphere Institute, Forschungszentrum Jülich GmbH.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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