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Editorial

Challenges and Successes in Identifying the Transfer and Transformation of Phosphorus from Soils to Open Waters and Sediments

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The anthropogenic loading of phosphorus (P) to water bodies continues to increase worldwide, in many cases leading to increased eutrophication and harmful algal blooms [1]. Determining the sources of P and the biogeochemical processes responsible for this increase is often difficult because of the complexity of inputs and pathways, which vary both in spatial and temporal scales [2]. In order to effectively develop strategies to improve water quality, it is essential to develop a comprehensive understanding of the relationship of P pools with biological uptake and cycling under varied soil and water conditions. A wide variety of processes, including changes in P speciation; transformations between organic and inorganic species; and the transfer between biotic and abiotic forms occur along the route from soils to open waters and to sediments until ultimate burial, and together increase the complexity of quantifying processes, cycling, or tracing sources [3–5]. In addition, climate-change-related effects and feedback thereof often exacerbate a number of processes, including the redox-mediated release of legacy P in sediments.

In this special issue, we invited research and review articles that address the topic of soil P processes involving transfer and transformation across the landscape, either presenting novel research methods or synergy among non-traditional research fields; a review of existing successes and failures with underlying causes; or data-driven recommendations on the various approaches necessary to mitigate P loss and achieve the tangible goal of improving water quality. This volume contains eight original research articles [6–13] and two review articles [14,15].

General contribution papers covered the various aspects of basic–applied research on mineral–P interaction and how these reactions impact P mobilization, bioavailability, transfer [7], and speciation of P in different soil matrices using advanced analytical methods. Some of these methods included the application of XANES [13] and field-based research related to stream bank legacy nutrients [8]; natural and anthropogenic eutrophication, and its relationship to climate change [12]; and the evaluation of the impact of P due to (i) grazing systems [11], (ii) weathering and vegetation [6], and soil and manure management practices [10]. Together, these contributions improved our current understanding of the reactions and processes that impact P concentration, speciation, cycling, loss, and transfer from agroecosystems.

The two review papers took a holistic approach to cover an expansive area of P transformation processes along the cropland–riparian–stream continuum [15] and the assessment of legacy P [14]. The first review paper provided a broader assessment of P transformation and highlighted various approaches to improve and assess the effectiveness of riparian buffer zones in cold climate agroecosystems and highlighted the need of connecting hydro-biogeochemical and hydro-climatic data for the risk assessment on P loss to open waters. The chronic issue of legacy P was highlighted [14] by synthesizing the current knowledge of the bioaccessibility of different P forms, the transformations of

legacy P, and by proposing research and management approaches for potentially tapping legacy P for crop production.

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