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To link landscape pattern with soil erosion risk at watershed scale based on SPSM model in the loess hilly area

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Linking landscape patterns to specific ecological processes has been and will continue to be a key topic in landscape ecology. However, the traditional landscape pattern analysis by landscape metrics inspired by patch-matrix model (PMM) may be difficult to reach such a requirement, and thus landscape pattern analysis to denote the significance of ecological process is strongly hindered. To find conceptual and methodological innovations integrating ecological processes with landscape patterns is important. In this paper, we proposed a conceptual model, i.e., the source-pathway-sink model (SPSM) by defining the role of each landscape unit to a specific process before conducting landscape pattern analysis. The traditional landscape matrices derived from the patch-matrix model is visual- or geometrical-oriented but lack of linkage to ecological significance. The source-pathway-sink model is process-oriented, dynamic, and scale dependent. This model as a complementary to the patch-corridor-matrix model can provide a simple and dynamic perspective on landscape pattern analysis. Based on the SPSM model, a landscape index was developed in term of the process of soil erosion, and further testified by using on-site measurements. It was found the new landscape index based on SPSM is useful in evaluating the risk of soil erosion from landscape pattern at watershed. Finally, a case study was conducted in the loess hilly areas to define the risk area of soil erosion that will be useful for sustainable land use management and optimization in future.