

# Interaction in Landscape Pattern and Hydrological Process Indices:

## A Systematic Review

Xiaodi WANG<sup>1</sup>, Yufei SUN<sup>1</sup>, Danyun JIN<sup>1</sup>, Steffen NIJHUIS<sup>2</sup>, Ziyang HE<sup>1</sup>, Yixuan LI<sup>1</sup>, Jiaying ZHOU<sup>1</sup>, Liang XIONG<sup>1,\*</sup>

<sup>1</sup> Department of Landscape Architecture, College of Horticulture, China Agricultural University, Beijing 100193, China

<sup>2</sup> Department of Urbanism, Faculty of Architecture and the Built Environment, Delft University of Technology, Delft 2628 BL, The Netherlands

### \*CORRESPONDING AUTHOR

**Address:** No. 2 Yuanmingyuan West Road, Haidian District, Beijing 100193, China

**Email:** xiongliang@cau.edu.cn

**EDITED BY** Yuting GAO, Xidong MA

**Supplementary Table 1: The pairs of landscape pattern and hydrological process indices**

Paper No.	Temporal scale (years)	Spatial scale (km)	Landscape pattern indices	Hydrological process indices	Correlation
6	10 ~ 100	100 ~ 1,000	Wetland area	Runoff	Positive
6	10 ~ 100	100 ~ 1,000	Wetland area	Runoff	Positive
6	10 ~ 100	100 ~ 1,000	The front of the delta	Runoff	Positive
6	10 ~ 100	100 ~ 1,000	The end of the delta	Runoff	Positive
6	10 ~ 100	100 ~ 1,000	The Amu Darya River Delta	Runoff	Positive
7	10 ~ 100	100 ~ 1,000	Total area change of the wetland	Decreasing trend of annual rainfall	Positive
7	10 ~ 100	100 ~ 1,000	Total area change of the wetland	Annual evaporation	Negative
11	0 ~ 1	0 ~ 100	Grassland area	Average precipitation	Positive
11	0 ~ 1	0 ~ 100	Saline-alkaline land area	Precipitation	Negative
20	10 ~ 100	0 ~ 100	Patch density	Runoff depth	Positive
20	10 ~ 100	0 ~ 100	Largest patch	Runoff depth	Negative
20	10 ~ 100	0 ~ 100	Landscape shape	Runoff depth	Positive
20	10 ~ 100	0 ~ 100	Mean Euclidian nearest-neighbor distance	Runoff depth	Negative
20	10 ~ 100	0 ~ 100	Contagion	Runoff depth	Positive
20	10 ~ 100	0 ~ 100	Interspersion and juxtaposition	Runoff depth	Negative
20	10 ~ 100	0 ~ 100	Aggregation	Runoff depth	Negative
20	10 ~ 100	0 ~ 100	Landscape division	Runoff depth	Positive
20	10 ~ 100	0 ~ 100	Splitting	Runoff depth	Positive
20	10 ~ 100	0 ~ 100	Shannon's diversity	Runoff depth	Positive
20	10 ~ 100	0 ~ 100	Shannon's evenness	Runoff depth	Positive
25	10 ~ 100	0 ~ 100	Urbanization rate	Flood volume	Positive

25	10 ~ 100	0 ~ 100	Urbanization rate	Peak flow	Positive
30	1 ~ 10	0 ~ 100	Largest patch	Stream flow	Negative
30	1 ~ 10	0 ~ 100	Edge density	Base flow	Positive
30	1 ~ 10	0 ~ 100	Perimeter-area ratio distribution	Hydrological flows	Unrelated
30	1 ~ 10	0 ~ 100	Interspersion and juxtaposition	Stream flow	Positive
30	1 ~ 10	0 ~ 100	Interspersion and juxtaposition	Direct flows	Positive
30	1 ~ 10	0 ~ 100	Patch COHN	Hydrological flows	Positive
30	1 ~ 10	0 ~ 100	Aggregation	Base flow	Negative
30	1 ~ 10	0 ~ 100	Shannon's evenness	Base flow	Positive
30	1 ~ 10	0 ~ 100	Shannon's diversity	Base flow	Positive
30	1 ~ 10	0 ~ 100	Shannon's evenness	Stream flow	Positive
30	1 ~ 10	0 ~ 100	Shannon's diversity	Stream flow	Positive
30	1 ~ 10	0 ~ 100	Patch richness density	Base flow	Negative
38	0 ~ 1	0 ~ 100	Annual landscape connectivity	Catchment flow	Positive
48	10 ~ 100	0 ~ 100	Impervious surface	The basin water cycle	Negative
48	10 ~ 100	0 ~ 100	Connectivity	Discharge	Positive
48	10 ~ 100	0 ~ 100	Patch density	Soil conservation	Negative
48	10 ~ 100	0 ~ 100	Shannon evenness	Soil conservation	Negative
48	10 ~ 100	0 ~ 100	Splitting	Soil conservation	Negative
48	10 ~ 100	0 ~ 100	Shannon evenness	Soil conservation	Negative
48	10 ~ 100	0 ~ 100	Mean patch area	Soil conservation	Positive
48	10 ~ 100	0 ~ 100	Patch cohesion	Soil conservation	Positive
48	10 ~ 100	0 ~ 100	Proportion of cultivated land patches	The water network	Positive
48	10 ~ 100	0 ~ 100	Largest patch	The water network	Positive
48	10 ~ 100	0 ~ 100	Patch aggregation	The water network	Positive
48	10 ~ 100	100 ~ 1,000	Number of patches	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Landscape shape	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Largest patch	Water yield	Negative
48	10 ~ 100	100 ~ 1,000	Largest patch	Runoff	Negative
48	10 ~ 100	100 ~ 1,000	Largest patch	Soil erosion modulus	Negative
48	10 ~ 100	100 ~ 1,000	Perimeter area fractal dimension	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Perimeter area fractal dimension	Runoff	Positive
48	10 ~ 100	100 ~ 1,000	Perimeter area fractal dimension	Soil erosion modulus	Positive
48	10 ~ 100	100 ~ 1,000	Perimeter area fractal dimension	Sediment concentration	Positive
48	10 ~ 100	100 ~ 1,000	Interspersion and juxtaposition	Water yield	Negative
48	10 ~ 100	100 ~ 1,000	Interspersion and juxtaposition	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Interspersion and juxtaposition	Runoff	Negative
48	10 ~ 100	100 ~ 1,000	Interspersion and juxtaposition	Runoff	Positive
48	10 ~ 100	100 ~ 1,000	Shannon's diversity	Soil erosion modulus	Negative
48	10 ~ 100	100 ~ 1,000	Shannon's evenness	Soil erosion modulus	Negative
48	10 ~ 100	100 ~ 1,000	Shannon's diversity	Soil erosion modulus	Positive
48	10 ~ 100	100 ~ 1,000	Shannon's evenness	Soil erosion modulus	Positive
48	10 ~ 100	100 ~ 1,000	Largest patch	Water yield	Negative
48	10 ~ 100	100 ~ 1,000	Aggregation	Water yield	Negative
48	10 ~ 100	100 ~ 1,000	Contiguity	Water yield	Negative
48	10 ~ 100	100 ~ 1,000	Cohesion	Water yield	Negative

48	10 ~ 100	100 ~ 1,000	Edge density	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Perimeter area fractal dimension	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Landscape division	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Landscape shape	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Shannon's evenness	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Shannon's diversity	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Modified Simpson's evenness	Water yield	Positive
48	10 ~ 100	100 ~ 1,000	Largest patch	Runoff	Negative
48	10 ~ 100	100 ~ 1,000	Contiguity	Runoff	Negative
48	10 ~ 100	100 ~ 1,000	Largest patch	Soil erosion modulus	Negative
48	10 ~ 100	100 ~ 1,000	Interspersion and juxtaposition	Soil erosion modulus	Negative
48	10 ~ 100	100 ~ 1,000	Interspersion and juxtaposition	Rainfall	Negative
57	10 ~ 100	0 ~ 100	Mean patch size	The standard deviation of flood peak flow	Positive
57	10 ~ 100	0 ~ 100	Maximum patch size	The standard deviation of flood peak flow	Positive
57	10 ~ 100	0 ~ 100	Aggregation	The standard deviation of flood peak flow	Positive
57	10 ~ 100	0 ~ 100	Area of arable	The flood peak coefficient of variation	Negative
57	10 ~ 100	0 ~ 100	Mean patch size	The flood peak coefficient of variation	Negative
57	10 ~ 100	0 ~ 100	Maximum patch size	The flood peak coefficient of variation	Negative
57	10 ~ 100	0 ~ 100	Aggregation	The flood peak coefficient of variation	Negative
66	1 ~ 10	0 ~ 100	Woodlands	Base flow	Negative
66	1 ~ 10	0 ~ 100	Paddy field	Base flow	Positive
66	1 ~ 10	0 ~ 100	Residential area	Stream flow	Positive
66	1 ~ 10	0 ~ 100	Tea fields	Catchment hydrological flows	Unrelated
66	1 ~ 10	0 ~ 100	Ponds	Catchment hydrological flows	Unrelated
66	1 ~ 10	0 ~ 100	Landscape configuration	Hydrograph	Positive
77	1 ~ 10	0 ~ 100	Agricultural land-generic	Runoff	Positive
77	1 ~ 10	0 ~ 100	Forest-mixed	Runoff	Negative
77	1 ~ 10	0 ~ 100	Forest-mixed	Sediment	Negative
77	1 ~ 10	0 ~ 100	Agricultural land-generic	Sediment	Positive
77	1 ~ 10	0 ~ 100	Pasture	Sediment	Positive
77	1 ~ 10	0 ~ 100	Residential-low density	Sediment	Positive
77	1 ~ 10	0 ~ 100	Agricultural land-generic	Surface runoff	Positive
77	1 ~ 10	0 ~ 100	Pasture	Surface runoff	Positive
77	1 ~ 10	0 ~ 100	Residential-low density	Surface runoff	Positive
77	1 ~ 10	0 ~ 100	Range grasses	Surface runoff	Positive
77	1 ~ 10	0 ~ 100	Residential	Surface runoff	Positive
77	1 ~ 10	0 ~ 100	Agricultural land-generic	Water and soil conservation	Positive
77	1 ~ 10	0 ~ 100	Pasture	Water and soil conservation	Positive
77	1 ~ 10	0 ~ 100	Residential-low density	Water and soil conservation	Positive

77	1 ~ 10	0 ~ 100	Degree of irregularity in the landscape shape	Runoff	Negative
77	1 ~ 10	0 ~ 100	Degree of irregularity in the landscape shape	Sediment	Negative
88	10 ~ 100	0 ~ 100	Fragmentation	The water network	Negative
88	10 ~ 100	0 ~ 100	Component fragmentation	The water network	Negative
88	10 ~ 100	0 ~ 100	Swamp fragmentation	The water network	Positive
89	10 ~ 100	0 ~ 100	Change of marsh area	Precipitation	Positive
90	10 ~ 100	0 ~ 100	Largest patch	Discharge	Negative
90	10 ~ 100	0 ~ 100	Edge density	Discharge	Positive
90	10 ~ 100	0 ~ 100	Patch density	Discharge	Positive
90	10 ~ 100	0 ~ 100	Splitting	Discharge	Positive
90	10 ~ 100	0 ~ 100	Patch cohesion	Discharge	Positive
90	10 ~ 100	0 ~ 100	Shannon's diversity	Discharge	Positive
90	10 ~ 100	0 ~ 100	Aggregation	Discharge	Negative
90	10 ~ 100	0 ~ 100	Patch cohesion	Discharge	Negative
90	10 ~ 100	0 ~ 100	Largest patch	Discharge	Negative
90	10 ~ 100	0 ~ 100	Area of wetland landscape	Runoff	Positive
90	10 ~ 100	0 ~ 100	Area of wetland landscape	Sediment discharge	Positive
90	10 ~ 100	0 ~ 100	Area of the reed marsh	Annual runoff	Positive
93	10 ~ 100	0 ~ 100	Meadow	Annual runoff	Positive
93	10 ~ 100	0 ~ 100	Tidal wetland	Annual runoff	Positive
93	10 ~ 100	0 ~ 100	Area of the reed marsh	Sediment discharge	Positive
93	10 ~ 100	0 ~ 100	Meadow	Sediment discharge	Positive
93	10 ~ 100	0 ~ 100	Tidal wetland	Sediment discharge	Positive
106	10 ~ 100	0 ~ 100	Aggregation	Flooding	Negative
106	10 ~ 100	0 ~ 100	Green space ratio	Flooding	Negative
106	10 ~ 100	0 ~ 100	Patch density	Flooding	Positive
106	10 ~ 100	0 ~ 100	Patch richness	Flooding	Positive
106	10 ~ 100	0 ~ 100	Impervious surface ratio	Flooding	Positive
106	10 ~ 100	0 ~ 100	The proportion of vegetation greenness	Sediment discharge	Negative
106	10 ~ 100	0 ~ 100	The proportion of vegetation greenness	Water yield	Negative
114	10 ~ 100	100 ~ 1,000	Fragmentation metrics	Runoff	Positive
116	1 ~ 10	0 ~ 100	Contagion	Sediment	Negative
116	1 ~ 10	0 ~ 100	Contagion	Surface runoff	Negative
116	1 ~ 10	0 ~ 100	Patch cohesion	Sediment	Negative
116	1 ~ 10	0 ~ 100	Aggregation	Surface runoff	Negative
116	1 ~ 10	0 ~ 100	Splitting	Sediment	Positive
116	1 ~ 10	0 ~ 100	Patch density	Rainfall	Positive
116	1 ~ 10	0 ~ 100	Patch density of grassland	Water yield	Negative
116	1 ~ 10	0 ~ 100	Patch density of forest	Water yield	Negative
116	1 ~ 10	0 ~ 100	Patch density of cultivated land	Water yield	Negative
116	1 ~ 10	0 ~ 100	Aggregation	Water yield	Positive
116	1 ~ 10	0 ~ 100	Aggregation	Sediment	Positive
116	1 ~ 10	0 ~ 100	Aggregation	Water yield	Negative

116	1 ~ 10	0 ~ 100	Aggregation	Sediment	Negative
116	1 ~ 10	0 ~ 100	Average drainage area	Catchment peak runoff depth	Negative
116	10 ~ 100	0 ~ 100	Forest land area	Average value of peak flow	Positive
116	10 ~ 100	0 ~ 100	Proportion of landscape of farmland	Sediment discharge	Positive
116	10 ~ 100	0 ~ 100	Mean patch size of farmland	Sediment discharge	Positive
116	10 ~ 100	0 ~ 100	Landscape pattern of farmland	Sediment discharge	Positive
116	10 ~ 100	0 ~ 100	Proportion of landscape of plantation	Sediment discharge	Positive
116	10 ~ 100	0 ~ 100	Mean patch size of plantation	Sediment discharge	Positive
116	10 ~ 100	0 ~ 100	Landscape pattern of plantation	Sediment discharge	Positive
116	10 ~ 100	0 ~ 100	Proportion of landscape of settlement	Sediment discharge	Positive
116	10 ~ 100	0 ~ 100	Mean patch size of settlement	Sediment discharge	Positive
116	10 ~ 100	0 ~ 100	Landscape pattern of settlement	Sediment discharge	Positive
116	10 ~ 100	0 ~ 100	Proportion of landscape of farmland	Water yield	Positive
116	10 ~ 100	0 ~ 100	Mean patch size of farmland	Water yield	Positive
116	10 ~ 100	0 ~ 100	Landscape pattern of farmland	Water yield	Positive
116	10 ~ 100	0 ~ 100	Proportion of landscape of plantation	Water yield	Positive
116	10 ~ 100	0 ~ 100	Mean patch size of plantation	Water yield	Positive
116	10 ~ 100	0 ~ 100	Landscape pattern of plantation	Water yield	Positive
116	10 ~ 100	0 ~ 100	Proportion of landscape of settlement	Water yield	Positive
116	10 ~ 100	0 ~ 100	Mean patch size of settlement	Water yield	Positive
116	10 ~ 100	0 ~ 100	Landscape pattern of settlement	Water yield	Positive
116	10-101	0 ~ 100	Proportion of landscape of grassland	Water yield	Negative
116	10 ~ 100	0 ~ 100	Mean patch size of grassland	Water yield	Negative
116	10 ~ 100	0 ~ 100	Landscape pattern of grassland	Water yield	Negative
116	10 ~ 100	0 ~ 100	Proportion of landscape of natural vegetation	Water yield	Negative
116	10 ~ 100	0 ~ 100	Mean patch size of natural vegetation	Water yield	Negative
116	10-101	0 ~ 100	Landscape pattern of natural vegetation	Water yield	Negative
116	10 ~ 100	0 ~ 100	Proportion of landscape of grassland	Sediment discharge	Negative
116	10 ~ 100	0 ~ 100	Mean patch size of grassland	Sediment discharge	Negative
116	10 ~ 100	0 ~ 100	Landscape pattern of grassland	Sediment discharge	Negative
116	10 ~ 100	0 ~ 100	Proportion of natural vegetation	Sediment discharge	Negative
116	10-101	0 ~ 100	Mean patch size of natural vegetation	Sediment discharge	Negative
116	10 ~ 100	0 ~ 100	Landscape pattern of natural vegetation	Sediment discharge	Negative
116	10 ~ 100	0 ~ 100	Number of patch of natural vegetation	Water yield	Negative
116	10 ~ 100	0 ~ 100	Number of patch of natural farmland	Water yield	Negative
116	10 ~ 100	0 ~ 100	Number of patch of natural vegetation	Sediment discharge	Negative

116	10-101	0 ~ 100	Number of patch of natural farmland	Sediment discharge	Negative
116	10 ~ 100	0 ~ 100	Area-weighted mean shape of natural vegetation	Water yield	Negative
116	10 ~ 100	0 ~ 100	Area-weighted mean shape of natural vegetation	Sediment discharge	Negative
148	1 ~ 10	0 ~ 100	Landscape metrics	Discharge and groundwater levels	Positive
157	10 ~ 100	100 ~ 1,000	High-coverage grassland	Evapotranspiration	Positive
157	10 ~ 100	100 ~ 1,000	Alpine cold desert	Runoff	Positive
157	10 ~ 100	100 ~ 1,000	Low-coverage grassland	Runoff	Positive
157	10 ~ 100	100 ~ 1,000	Alpine cold desert	Base flow	Positive
157	10 ~ 100	100 ~ 1,000	Alpine cold desert	Evapotranspiration	Negative
157	10 ~ 100	100 ~ 1,000	Low-coverage grassland	Evapotranspiration	Negative
157	10 ~ 100	100 ~ 1,000	Bare land	Runoff	Negative
157	10 ~ 100	100 ~ 1,000	High-coverage grassland	Runoff	Negative
157	10 ~ 100	100 ~ 1,000	Mid-coverage grassland	Base flow	Negative
157	10 ~ 100	100 ~ 1,000	High-coverage grassland	Base flow	Negative

**Supplementary Table 2: The screened articles**

<b>Paper No.</b>	<b>Title</b>
1	A procedure for quantifying runoff response to spatial and temporal changes of impervious surface in Qinhuai River basin of southeastern China
2	Prediction of wetland hydrogeomorphic type using morphometrics and landscape characteristics
3	Exploring the hydromorphological response to human pressure in Tagus River (1946–2014) by complementary diagnosis
4	Assessment of changes in oasis scale and water management in the arid Manas River Basin, north western China
5	Driving forces analysis of reservoir wetland evolution in Beijing during 1984–2010
6	Spatial and temporal variation and driving factors of wetland in the Amu Darya River Delta, Central Asia
7	Quantifying driving forces of urban wetlands change in Beijing City
8	Influences of land use changes on the dynamics of water quantity and quality in the German lowland catchment of the Stör
9	Dynamic characteristics and responses of ecosystem services under land use/land cover change scenarios in the Huangshui River Basin, China
10	The influence of wastewater subsidy, flood disturbance and neighbouring land use on current and historical patterns of riparian vegetation in a semi-arid watershed
11	Hydroclimate-driven changes in the landscape structure of the terminal lakes and wetlands of the China's Heihe River Basin
12	Modifying the Jackson index to quantify the relationship between geology, landscape structure, and water transit time in steep wet headwaters
13	Changes in the landscape structure of a southeastern Wyoming riparian zone following shifts in stream dynamics
14	Changes in the landscape structure of the Nagara River Basin, central Japan
15	Critical reviews in environmental science and technology
16	Bacterial structures and ecosystem functions in glaciated floodplains: Contemporary states and potential future shifts
17	Connecting precipitation inputs and soil flow pathways to stream water in contrasting boreal catchments
18	Regionalizing time of concentration using landscape structural patterns of catchments
19	The influence of damming on landscape structure change in the vicinity of flooded areas: Case studies in Greece and the Czech Republic
20	Evaluating landscape metrics for characterising hydrological response to storm events in urbanised catchments

21	Water occurrence in the two largest lakes in China based on long-term Landsat images: Spatiotemporal changes, ecological impacts, and influencing factors
22	Ecosystem services: From policy to practice
23	Hydrographic and landscape description of a river basin based on GIS- and geographic data
24	Agent-based modelling of the evolution of hydro-sedimentary connectivity: The case of flash floods on Arable Plateaus
25	Assessing the effects of urban landscape area and pattern change on flood events in Qinhuai River Basin, China
26	Dynamic surface water distributions influence wetland connectivity within a highly modified interior landscape
27	Landscape structure in the Pirapó, Paranapanema 3 and 4 Hydrographic Unit, in the state of Paraná, Brazil
28	Landscape structure and climate influences on hydrologic response
29	Hydro-geomorphic metrics for high resolution fluvial landscape analysis
30	Assessment of landscape retention water capacity and hydrological balance in traditional agricultural landscape (model area Liptovská Teplička Settlements, Slovakia)
31	Control of diffuse P-pollutants by multiple buffer/detention structures by Yuqiao Reservoir, North China
32	Ecohydrological interactions in a degraded two-phase mosaic dryland: Implications for regime shifts, resilience, and restoration
33	Agricultural landscape evolution and structural connectivity to the river for matter flux, a multi-agents simulation approach
34	Landscape structure and use, climate, and water movement in the Mekong River basin
35	Influences of vegetation disturbance on hydrogeomorphic response following wildfire
36	Habitat restoration along the River Rhine in The Netherlands: Putting ideas into practice
37	Concentration-discharge relations in the critical zone: Implications for resolving critical zone structure, function and evolution
38	Hydrologic connectivity between landscapes and streams: Transferring reach- and plot-scale understanding to the catchment
39	Analysis of the landscape change at River Basin scale based on SPOT and TM fusion remote sensing images: A case study of the Weigou River Basin on the Chinese Loess Plateau
40	Evaluation of slopes delivery to catchment sediment budget for a low-energy water system: A case study from the Lingèvres Catchment (Normandy, Western France)
41	Analysis of the influence of the water balance process on the change of landscape patterns in the upper reaches of the Yangtze River
42	Landscape quality based upon diversity, coherence and continuity Landscape planning at different planning-levels in the River area of The Netherlands
43	An approach to maintaining hydrological networks in the face of land use change
44	Assessment of land use changes through an indicator-based approach: A case study from the Lamone river basin in Northern Italy
45	HESS Opinions: Hydrologic predictions in a changing environment: Behavioral modeling
46	Mimicking nature to reduce agricultural impact on water cycles: A set of mimetrics
47	Using hydrological connectivity to detect transitions and degradation thresholds: Applications to dryland systems
48	Landscape structure and historical processes along diked European Valleys: A case study of the Arc/Isère confluence (Savoie, France)
49	Regionalizing flood magnitudes using landscape structural patterns of catchments
50	Design of active debris flow mitigation measures: a comprehensive analysis of existing impact models
51	Ecohydrological research of lake-watershed relations in diversified landscape (Masurian Lakeland, Poland)
52	Development of a landscape indicator to evaluate the effect of landscape pattern on surface runoff in the Haihe River Basin
53	Spatial-temporal assessment and modeling of ecological security based on land-use/cover changes (case study: Lavasanat watershed)
54	A landscape hydrology approach to inform sustainable water resource management under a changing environment. A case study for the Kaleya River Catchment, Zambia

55	Effect of increasing of water level during the middle of dry season on landscape pattern of the two largest freshwater lakes of China
56	Impacts of landscape patterns on ecosystem services value: A multiscale buffer gradient analysis approach
57	Urban spatial configuration and functional runoff connectivity: Influence of drainage grid density and landscape metrics
58	Landscape pattern evolution processes of wetlands and their driving factors in the Xiong'an New Area of China
59	Effects of landscape pattern on hydrological processes in the central subtropical hilly agricultural catchments
60	Impact of short-term hydrological components on landscape pattern of waterbird habitat in floodplain wetlands
61	Landscape patterns and topographic features affect seasonal river water quality at catchment and buffer scales
62	Responses of landscape pattern of China's two largest freshwater lakes to early dry season after the impoundment of Three-Gorges Dam
63	The effects of landscape pattern evolution on runoff and sediment based on SWAT model
64	Combining catastrophe technique and regression analysis to deduce leading landscape patterns for regional flood vulnerability: A case study of Nanjing, China
65	Effect of different slope landscape patterns on spatial and temporal variations of soil water runoff and sedimentation in Xiaolangdi Reservoir area
66	Landscape composition or configuration: Which contributes more to catchment hydrological flows and variations?
67	Landscape patterns changes and relation to water infiltration of Krueng Peusangan Watershed in Aceh
68	Monitoring spatial and temporal dynamics of flood regimes and their relation to wetland landscape patterns in Dongting Lake from MODIS time-series imagery
69	Modeling land use change impacts on hydrology and the use of landscape metrics as tools for watershed management: The case of an ungauged catchment in the Philippines
70	10-years land use changes decrease landscape integrity in a Brazilian hydrographic basin
71	Quantifying effects of urban land-use patterns on flood regimes for a typical urbanized basin in eastern China
72	Evaluation of river longitudinal connectivity based on landscape pattern and its application in the middle and lower reaches of the Yellow River, China
73	Changes of wetland landscape patterns in Dadu River catchment from 1985 to 2000, China
74	Impact of climate variability and landscape patterns on water budget and nutrient loads in a peri-urban watershed: A coupled analysis using process-based hydrological model and landscape indices
75	Coupled analysis on landscape pattern and hydrological processes in Yanhe watershed of China
76	Investigating the dynamics of wetland landscape pattern in Beijing from 1984 to 2008
77	Response of variation of water and sediment to landscape pattern in the Dapoling watershed
78	Land use change in Naoli River Basin and its eco-environment effects during 1954-2005
79	Pattern-process relationships in surface hydrology: Hydrological connectivity expressed in landscape metrics
80	Impacts of land use change scenarios on hydrology and land use patterns in the Wu-Tu watershed in Northern Taiwan
81	Landscape fragmentation for flood prevention: GIS and hydrological modelling approach assessing forested landscape
82	Spatiotemporal variations and underlying mechanism of the floodplain wetlands in the meandering Yellow River in arid and semi-arid regions
83	Riparian responses to extreme climate and land-use change scenarios
84	Influence of landscape pattern evolution on soil conservation in a red soil hilly watershed of southern China
85	Measuring dynamic changes in the spatial pattern and connectivity of surface waters based on landscape and graph metrics: A case study of Henan Province in central China
86	The control of land-use patterns for stormwater management at multiple spatial scales
87	Changes in vegetation and landscape patterns with altered river water-flow in arid west China
88	Ecological effects of surface water evolution in the Yellow River Delta
89	Characteristics and driving factors of marsh changes in Zhalong wetland of China
90	Landscape- and climate change-induced hydrological alterations in the typically urbanized Beiyun River basin, Beijing, China

91	Analyzing spatial variance of urban waterlogging disaster at multiple scales based on a hydrological and hydrodynamic model
92	Dynamic landscapes and the driving forces in the Yellow River Delta wetland region in the past four decades
93	Influence of hydrology process on wetland landscape pattern: A case study in the Yellow River Delta
94	Doing ecohydrology backward: Inferring wetland flow and hydroperiod from landscape patterns
95	Effect of urban green space changes on the role of rainwater runoff reduction in Beijing, China
96	Discharge competence and pattern formation in peatlands: A meta-ecosystem model of the everglades ridge-slough landscape
97	Spatiotemporal dynamics of landscape pattern and hydrologic process in watershed systems
98	Sensitivity analysis of relationships between hydrograph components and landscapes metrics extracted from digital elevation models with different spatial resolutions
99	Framework and tools for agricultural landscape assessment relating to water quality protection
100	Landscape patterns shape wetland pond ecosystem function from glacial headwaters to ocean
101	The role of river morphodynamic disturbance and groundwater hydrology as driving factors of riparian landscape patterns in Mediterranean rivers
102	Temporal and spatial variation and stability of the oasis in the Sangong River Watershed, Xinjiang, China
103	Linking metrics of landscape pattern to hydrological process in a lotic wetland
104	Resource partitioning in two sympatric species of subterranean termites, <i>Reticulitermes flavipes</i> and <i>Reticulitermes hageni</i> (Isoptera: Rhinotermitidae)
105	Beyond impervious: Urban land-cover pattern variation and implications for watershed management
106	Spatial characteristics and driving factors of urban flooding in Chinese megacities
107	Impact of landscape pattern changes on hydrological ecosystem services in the Beressa watershed of the Blue Nile Basin in Ethiopia
108	Spatial and temporal dynamics of base flow in semi-arid montane watersheds and the effects of landscape patterns and topography
109	Integrating landscape metrics and hydrologic modeling to assess the impact of natural disturbances on ecohydrological processes in the Chenyulan Watershed, Taiwan
110	Visualising and quantifying the variability of hydrological state in intermittent rivers
111	Shifting ground: Landscape-Scale modeling of biogeochemical processes under climate change in the Florida everglades
112	an ecohydrological framework to explain shifts in vegetation organization across climatological gradients
113	How do spatial factors of green spaces contribute to flood regulation in urban areas? A systematic mapping approach
114	Modeling landscape hydrological response to spatial-temporal land use/cover changes
115	Landscape metrics as predictors of hydrologic connectivity between Coastal Plain forested wetlands and streams
116	Riverscapes downstream of hydropower dams: Effects of altered flows and historical land-use change
117	Coupled local facilitation and global hydrologic inhibition drive landscape geometry in a patterned peatland
118	Spatial configurations of land cover influence flood regulation ecosystem services
119	Exploring the linkage between urban flood risk and spatial patterns in small urbanized catchments of Beijing, China
120	A study on wetland landscape pattern and its change process in Huang-Huai-Hai (3H) Area, China
121	Representation of landscape variability and lateral redistribution processes for large-scale hydrological modelling in semi-arid areas
122	Study on landscape dynamics and driving mechanisms of the Shudu Lake Catchment Wetlands in Northwest Yunnan
123	Analysis of landscape fragmentation processes and driving forces in wetlands in arid areas: A case study of the middle reaches of the Heihe River, China
124	Developing wetland landscape insecurity and hydrological security models and measuring their spatial linkages
125	Historical land use and hydrology. A case study from eastern Noord-Brabant
126	Measuring the past 20 years of urban-rural land growth in flood-prone areas in the developed Taihu Lake watershed, China
127	Design flood estimation and utility of high-resolution calibration data in small, heavily-urbanized catchments

128	Monitoring and predicting land-use changes and the hydrology of the urbanized Paochiao watershed in Taiwan using remote sensing data, urban growth models and a hydrological model
129	Hydrologic and landscape changes in the Middle Ebro River (NESpain): Implications for restoration and management
130	Landscape indicators of human impacts to riverine systems
131	Variation in hydrochory among lakes and streams: Effects of channel planform, roughness, and currents
132	Sensitivity and performance analyses of the distributed hydrology–soil–vegetation model using geomorphons for landform mapping
133	Landscape scale modeling of the potential effect of groundwater-level declines on forested wetlands in the New Jersey Pinelands
134	Expansion of landscape characterisation methods within the hydrogeological landscape framework: Application in the Australian capital territory
135	Is there a geomorphic expression of interbasin groundwater flow in watersheds? Interactions between interbasin groundwater flow, springs, streams, and geomorphology
136	Vegetation differentiation in the patterned landscape of the central Everglades: Importance of local and landscape drivers
137	Response of runoff towards land use changes in the Yellow River Basin in Ningxia, China
138	Linking vegetation cover patterns to hydrological responses using two process-based pattern indices at the plot scale
139	Spatiotemporal dynamic of surface water bodies using Landsat time-series data from 1999 to 2011
140	Quantifying hydrologic controls on local- and landscape-scale indicators of coastal wetland loss
141	Continuous monitoring of the spatio-temporal patterns of surface water in response to land use and land cover types in a Mediterranean lagoon complex
142	Spatial variation in sediment connectivity of small watershed along a regional transect on the Loess Plateau
143	Unexpected ecotone dynamics of a sand dune vegetation complex following water table decline
144	Incorporating temporal and spatial variations of groundwater into the construction of a water-based ecological network: A case study in Denko County
145	Spatio-temporal extraction of surface waterbody and its response of extreme climate along the upper Huaihe River
146	Reconstruction of a century of landscape modification and hydrologic change in a small urban watershed in Pittsburgh, PA
147	Fragmentation and changes in hydrologic function of tiger bush landscapes, south-west Niger
148	A landscape approach to advance intermittent river ecology
149	Impact of land use on water quality in the upper Nisa catchment in the Czech Republic and in Germany
150	Spatial and temporal patterns of land loss in the Lower Mississippi River Delta from 1983 to 2016
151	Determination of spatiotemporal changes in Erzurum plain wetland system using remote sensing techniques
152	Hydrochemistry, water quality and land use signatures in an ephemeral tidal river: Implications in water management in the southwestern coastal region of Bangladesh
153	Health assessment for mountainous rivers based on dominant functions in the Huaijiu River, Beijing, China
154	Relationships between landscape patterns and hydrological processes in the subtropical monsoon climate zone of southeastern China
155	Typical vegetation dynamics and hydrological changes of Dongting Lake wetland from 1985 to 2020
156	Identifying and mapping potential groundwater-dependent ecosystems for a semi-arid and semi-humid area in the Weihe River, China
157	Quantifying the impact of landscape changes on hydrological variables in the alpine and cold region using hydrological model and remote sensing data
158	Impact of land cover change on the water environment of wetland ecosystem
159	Key coastal landscape patterns for reducing flood vulnerability
160	Analysis of the causes of wetland landscape patterns and hydrological connectivity changes in Momoge National Nature Reserve based on the Google Earth Engine Platform
161	Response of a typical muddy coastal wetland landscape pattern to hydrogeomorphic processes
162	Not just an arid landscape problem: Springflow declines in a region with high rainfall
163	Putting space into modeling landscape and water quality relationships in the Han River basin, South Korea

164	Wetlandscape hydrologic dynamics driven by shallow groundwater and landscape topography
165	Wetness index based on landscape position and topography (WILT): Modifying TWI to reflect landscape position
166	Ecohydrological function of vegetation patches in semi-arid shrublands of central Mexico
167	Temporal-spatial changes about the landscape pattern of water system and their relationship with food and energy in a mega city in China
168	Influence of relief characteristics and landscape connectivity on sediment redistribution in small agricultural catchments in the forest-steppe landscape zone of the Russian Plain within European Russia
169	Analysing the sensitivity of Hungarian landscapes based on climate change induced shallow groundwater fluctuation
170	Locating spatial opportunities for Nature-based Solutions: A river landscape application
171	Interflow is not binary: A Continuous shallow perched layer does not imply continuous connectivity
172	Influence of landscape heterogeneity on water available to tropical forests in an Amazonian catchment and implications for modeling drought response
173	Forensic hydrology: What function tells about structure in complex settings
174	Modeling the spatiotemporal variability in subsurface thermal regimes across a low-relief polygonal tundra landscape
175	Landscape controls on spatiotemporal discharge variability in a boreal catchment
176	Hydrologic impacts of subsurface drainage at the field scale: Climate, landscape and anthropogenic controls
177	Surface water network structure, landscape resistance to movement and flooding vital for maintaining ecological connectivity across Australia's largest river basin
178	Response of vegetation pattern to different landform and water-table depth in Hailiutu River basin, northwestern China
179	Incorporation of multi-scale spatial autocorrelation in soil moisture–landscape modeling
180	Landscape and weather controls on fine-scale calcareous fen hydrodynamics
181	Landscape-hydrological regularities of runoff formation within the Lake Baikal watershed basin
182	Assessing the water needs of riparian and wetland vegetation in the western United States
183	Analysis on the responses of flood storage capacity of Dongting Lake to the changes of landscape patterns in Dongting Lake area
184	Hydrologic processes in the different landscape zones of Mafengou River basin in the alpine cold region during the melting period
185	Quantifying the role of climate and landscape characteristics on hydrologic partitioning and vegetation response
186	El crecimiento urbano en las cuencas de la región Andes de Venezuela y su articulación con el recurso agua
187	Evolution characteristics of landscape patterns and the response of surface runoff in a rapid urbanization area: Focus on the Chang–Zhu–Tan Metropolitan Area of China
188	Impact of greenspaces and water bodies on hydrological processes in an urbanizing area: A case study of the Liuxi River Basin in the Pearl River Delta, China
189	Ecohydrological optimization of pattern and processes in water-limited ecosystems: A trade-off-based hypothesis
190	Ground and surface temperature variability for remote sensing of soil moisture in a heterogeneous landscape
191	Automated catena-based discretization of landscapes for the derivation of hydrological modelling units
192	Exploring the signature of climate and landscape spatial variabilities in flash flood events: Case of the 8–9 September 2002 Cévennes-Vivarais catastrophic event
193	Landscape pattern and eco-hydrological characteristics at the upstream of Minjiang River, China
194	Landscape position, local environmental factors, and the structure of molluscan assemblages of lakes
195	Lake landscape position: Relationships to hydrologic connectivity and landscape features
196	Testing quantitative soil-landscape models for predicting the soil hydromorphic index at a regional scale
197	A tracer-based assessment of hydrological pathways at different spatial scales in a mesoscale Scottish catchment
198	A hydrological approach to landscape planning: The framework concept elaborated from a hydrological perspective