15

INHERITANCE

Landforms are demonstrably of very different ages; their formation times and their longevity as parts of the landscape are contrasted both globally and within catchments or coastal zones. Available erosional energy (entropy) and resistance are unevenly distributed both spatially and over time, as a result of forcing factor incidence, erodible materials and environmental change. This produces a patchy and overprinted Earth surface on a variety of scales. These inherited forms and materials, interpreted as palimpsests and as patches, continue to influence active process systems.

Table 15.1 Palimpsests

Fluvial to glacial	U-shaped valleys Ice streams and convergence/divergence scour and depositional forms
Glacial/periglacial to fluvial	Numerous inherited forms in mid-latitudes, incl. moraines, hanging valleys, debris mantled slopes and diverted rivers
Fluvial/glacial to marine	Rias, fjords, estuaries
Marine to fluvial	Raised beaches, sub-aerial marine platforms, composite cliffs
Alternating fluvial/arid regimes	Arid palaeo-rivers and wadis, many laterites, pluvial lake shorelines

Table 15.2 Preserved patches in different geomorphological domains

Meandering river point bar sets	Everitt (1968), Hickin (1974)
Palaeo-river valleys and channels	Knox (1993), Sidorchuk et al. (2012), Blum et al. (2013)
River terraces	Pazzaglia and Brandon (2001), Lewin and Macklin (2003), Bridgland and Westaway (2008)
Beach ridges, spit recurves	Steers (1948)
Interfluve erosion surfaces	Johnson (1931), Baulig (1935), Wooldrige and Linton (1955), Brown (1960)
Glacier retreat phenomena	Clark et al. (2012)
Cratonic continental surfaces	Mabbutt (1971)

Table 15.3 Four interpretations of sensitivity as applied to river channel adjustment (the 4 types are explained in Downs and Gregory, 1995)

Sensitivity	**Interpretation and *units***	**Examples of application in fluvial system**
Ratio	Disturbing forces as ratio of resisting forces, *dimensionless*	Clear water erosion downstream of dams; channel change if disturbing force (e.g. storm event) exceeds resistance of channel perimeter
Proximity to thresholds	Imbalance of forces according to proximity to thresholds, *force*	Single thread to multi-thread channels; incised channels or channel erosion may be triggered
Recovery from change	Ability to recover from change in the balance of forces, *time, dimensionless (if expressed as ratio of recurrence interval: relaxation time)*	Channel capacities changed downstream of dams; recovery from impact of flood event or planform recovery following channel straightening
Rate of system response	Rate can be revealed by sensitivity analysis, *quantity – change per unit parameter alteration*	Degree to which short-term fluvial system behaviour conforms to longer-term trend; the singular nature of individual locations within fluvial systems which can be described by variations from general model

Table 15.4 The force-resistance balance, activity rates, and preservation potential within catchment systems

	Force	Resistance	Activity rate	Preservation potential
River	+	-	high	very low
Floodplain	-	-	low	low
Hillslope	□	+	intermediate	moderate
Interfluve	-	+	very low	high

For force and resistance, + represents high values, - low values, and the box the intermediate ones.

RELEVANT ARTICLES IN *PROGRESS IN PHYSICAL GEOGRAPHY:*

Church, M. (2010) The trajectory of geomorphology, *Progress in Physical Geography*, 34: 265–86.

D'Haen, K., Verstraeten, G. and Degryse, P. (2012) Fingerprinting historical fluvial sediment fluxes, *Progress in Physical Geography*, 36: 154–86.

Ebert, K. (2009) Terminology of long-term geomorphology: a Scandinavian perspective, *Progress in Physical Geography,* 33: 163–82.

Trimble, S.W. (2008) The use of historical artifacts in geomorphology, *Progress in Physical Geography*, 32: 3–29.

UPDATES

A useful special issue on 'patterns and rates of Cenozoic landscape change in orogenic and post-orogenic settings' edited by Yanni Gunnell was published in *Geomorphology* (2015) 233: 1–142. Eleven articles examined ancient landscapes in multiple tectonic settings across the world.

The present-day complexity of large river floodplains results in a large part from their inheritances from past environments, including climates and former sea levels. This is well documented in a recent study of part of the Po River system in northern Italy by Campo et al. (2016).

Campo, B., Amorosi, A. and Bruno, L. (2016) Contrasting alluvial architecture of late Pleistocene and Holocene deposits along a 120-km transect from the central Po Plain (northern Italy), *Sedimentary Geology*, 341: 265–75.

Inheritance as 'history' – including evolutionary pathways, stage of development, past disturbances, and initial conditions – is envisaged by Phillips (2017) as one of three sets of factors determining Earth surface system states. As noted above for Chapter 5, the others are 'laws' and 'place'. He suggests that his LPH triad framework is a helpful checklist for sorting out the factors determining specific landforms in which such factors may come together in unique combinations:

Phillips, J.D. (2017) Laws, place, history and the interpretation of landforms, *Earth Surface Processes and Landforms*, 42: 347–54.