

The River Styles Framework

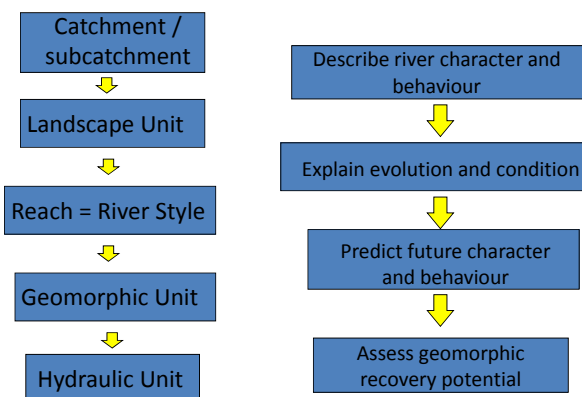
Gary Brierley and Kirstie Fryirs
... with comments, extensions by Joe Wheaton

www.riverstyles.com

Trade Mark and Accreditation

- River Styles® Framework is Trade Marked through AccessMQ (framework to be applied by a provisional/accredited River Styler)
 - Provisional River Styler (= passed River Styles® Short Course)
 - Accredited River Styler (= River Styles® report reviewed and passed)

A nested hierarchy of spatial and temporal linkages

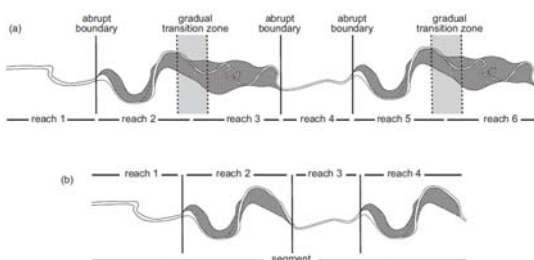


Stage One: Identifying and interpreting River Styles

- River Styles are differentiated on the basis of:
 - Valley-setting
 - Channel planform
 - Channel and floodplain geomorphic units
 - Bed material texture
- Each River Style has a distinctive set of attributes

Identification of reach boundaries

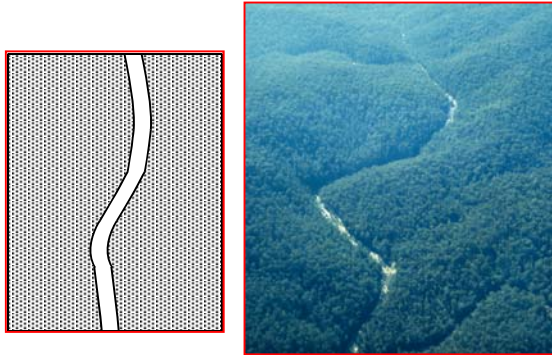
- Each reach (River Style) has a distinguishing set of attributes
- Boundaries between River Styles reflect
 - wholesale change in river character and behaviour (differing assemblage of geomorphic units)
 - may be distinct or gradual
 - alternating patterns may occur
- May coincide with tributary confluences, changes in slope or valley confinement, etc



Valley-setting

- **Confined** ... Absent or isolated pockets of floodplain
- **Partly-confined** ... Discontinuous pockets of floodplain
 - **Laterally-unconfined** ... Continuous floodplains along both banks
 - With continuous channels
 - With discontinuous/absent channels

Confined valley-setting



Upper Tantawangalo Creek

Partly-confined valley-setting



Bellinger River

Laterally-unconfined valley-setting



British Columbia

Measures of channel planform

- number of channels
 - single, multichannelled or no channel
- sinuosity
 - the amount of meandering exhibited by a stream channel, i.e. channel 'bendiness'
 - $S = L/\lambda$
 - L = length of stream along thalweg,
 - λ = length of valley along axis
- lateral stability of channel
 - ability of the channel to adjust its position on the valley floor (lateral migration, thalweg shift, avulsion)

(a) Number of channels	(b) Sinuosity	(c) Lateral stability
single	Degrees of sinuosity (modified from Schumm, 1985)	Meander growth and shift
up to 3 (wandering)	1 - 1.05 (straight)	extension / increasing amplitude
3 (braided)	1.05 - 1.30 (low sinuosity)	translation / downstream progression
3 (anastomosing / anabranching)	1.31 - 3.0 (sinuous / meandering)	rotation
discontinuous or absent	Types of sinuosity (from Church, 1992)	neck cutoffs
	sinuous	chute cutoffs
	irregular meanders (passive)	Avulsive behaviour
	regular meanders	1st order avulsion
	tortuous meanders	2nd order avulsion
	confined pattern	3rd order avulsion
		wholesale shift
		reoccupation
		subunit shift
		Degree of braiding (from Schumm, 1985)
		< 5%
		5 - 34%
		35 - 65%
		> 65%
		Character of braiding (from Schumm, 1985)
		mostly bars
		bars and islands
		mostly islands
		diverse shape
		mostly islands
		long and narrow

Measures of planform
(from Brierley & Fryirs, 2005)

Geomorphic units

- The building blocks of rivers
- Form-process associations
 - specific relationship between individual landforms and the set of processes that produces them
 - means to interpret river behaviour, evolution and condition
- 4 categories:
 - instream sculpted (pg 83)
 - instream depositional (mid-channel) (pg 87)
 - instream depositional (bank-attached) (pg 94)
 - floodplain (pg 110)
- Distinct channel and floodplain assemblages for different River Styles

Instream sculpted or erosional units

Waterfall Cascade Pool

Decreasing slope, energy and grain size continuum

These units are often forced

Instream geomorphic units: Depositional features found in mid-channel locations

Boulder mound Longitudinal bar Diagonal bar Linguoid bar

Decreasing sediment load continuum

Other mid-channel geomorphic units

Island Bedrock core bar Sand or gravel sheet

Instream geomorphic units: Depositional features found in bank-attached locations

Point bar Lateral bar Bench

Floodplain geomorphic unit assemblages

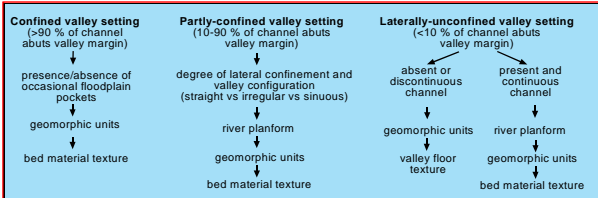
floodchannel levee crevasse splay backswamp

Bed material texture

	Class name	Grain size (mm)	Grain size (phi (ϕ))
Grain size (Wentworth scale)	Bedrock		
	Boulder	≥ 256	≤ -9
Measure b-axis	Cobble	64 - 256	-6 to -9
	Gravel	2 - 64	-1 to -6
Termed fine-grained	Sand	0.062 - 2	4 to -1
	Silt	0.004 - 0.062	8 to 4
	Clay	≤ 0.004	≥ -8

Identification of River Styles

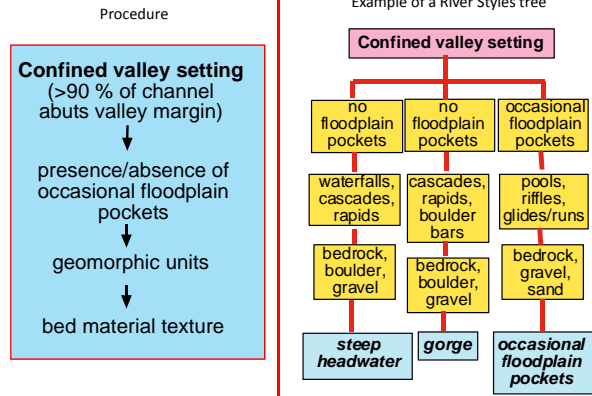
- Using air photos and the River Styles procedural tree, break the river course into sections based on:
 - Valley-setting** (channel-valley margin relationship)
 - Channel planform** (number and sinuosity of channels, lateral stability of channel)
 - Instream and floodplain **geomorphic units**
 - Bed material texture** (if visible)
- Specific procedures are used to identify River Styles in each valley setting



Confined valley-setting River Styles

(>90% of the channel margin abuts the valley margin)

Example of a River Styles tree



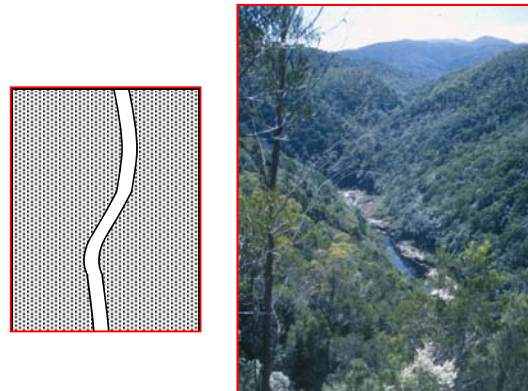
Steep headwater River Style

(Broughton Creek, Shoalhaven catchment)



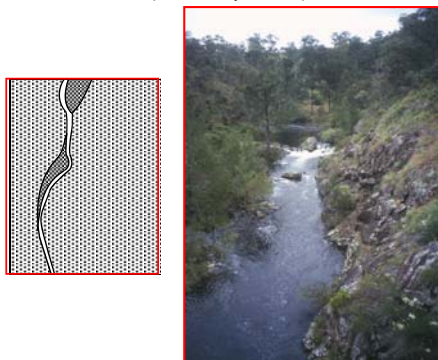
Gorge River Style

(Franklin River, Tasmania)



Confined valley with occasional floodplain pockets River Style

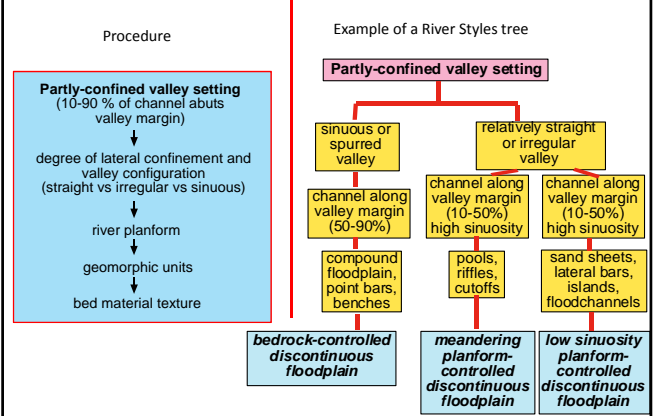
(Macleay River)



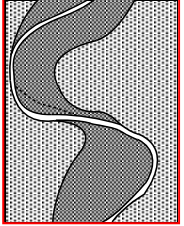

Partly-confined valley-setting River Styles

(10-90% of the channel margin abuts the valley margin)

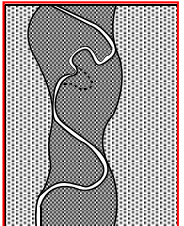

Example of a River Styles tree



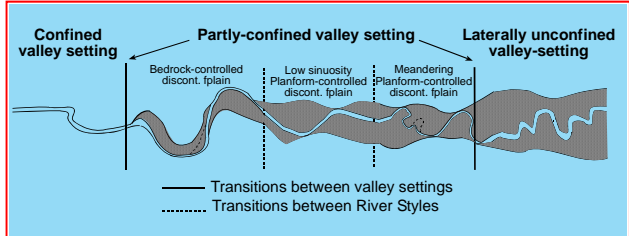
Partly-confined valley with bedrock-controlled discontinuous floodplain River Style (Clarence River)

Partly-confined valley with planform-controlled discontinuous floodplain River Style (Oxley River, Tweed catchment)

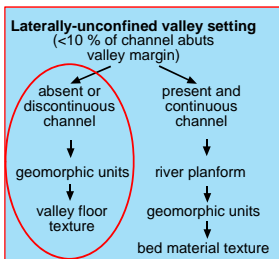
Partly confined continuum



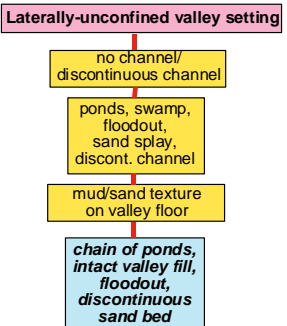
Fryirs & Brierley, 2010

Laterally-unconfined valley-setting River Styles (discontinuous channel)

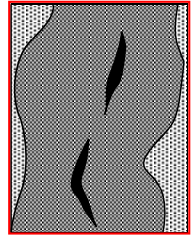

Procedure



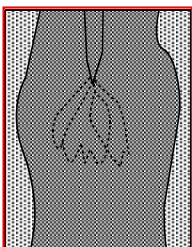

Example of a River Styles tree



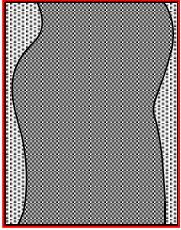

Chain-of-ponds River Style (Murrumbateman Creek, Southern Tablelands, NSW)

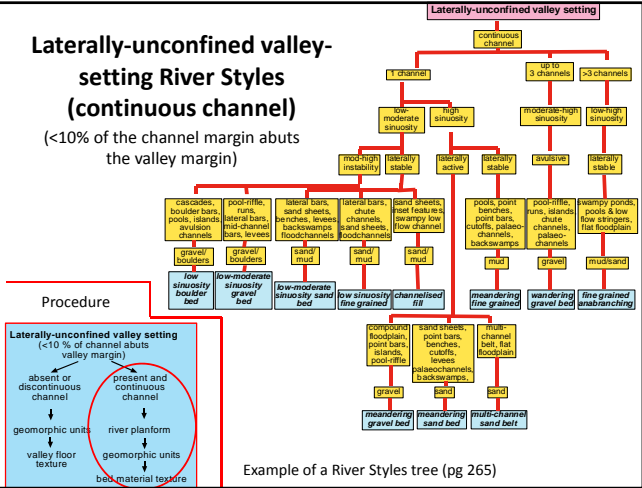
Floodout River Style (White Cliffs, Western NSW)

Intact valley fill River Style (Frogs Hollow Creek, Bega catchment)

Laterally-unconfined valley-setting River Styles (continuous channel) (<10% of the channel margin abuts the valley margin)



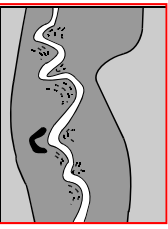

Procedure

Laterally-unconfined valley setting (<10% of channel abuts valley margin)

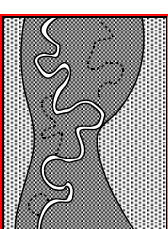

- absent or discontinuous channel
 - geomorphic units
 - valley floor texture
- present and continuous channel
 - river planform
 - geomorphic units
 - bed material texture

Example of a River Styles tree (pg 265)

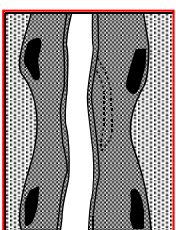

Meandering sand bed River Style (British Columbia)


Meandering fine grained River Style (Mann catchment, North Coast NSW)

Low sinuosity sand bed River Style (Bega River, NSW)

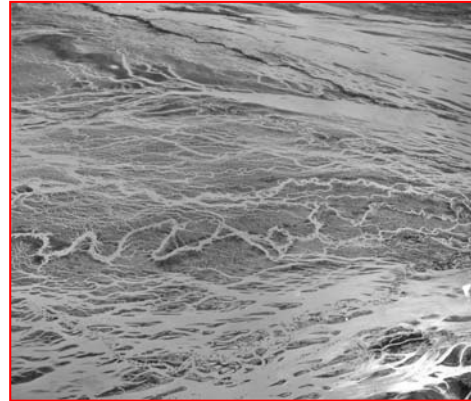
Wandering gravel bed River Style (Waiau River, New Zealand)

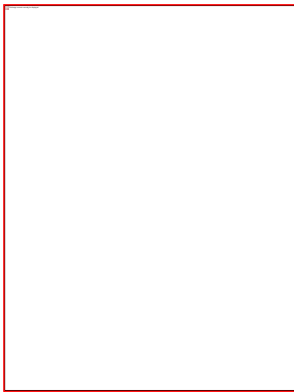
Braided River Style
(Rakaia River, New Zealand)



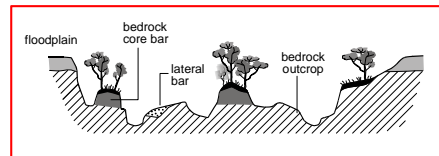
Anastomosing River Style
(Cooper Creek, central Australia)



Anabranching River Style
(Western NSW)



Bedrock anastomosing River Style
(Sabie River, South Africa)



Alluvial (laterally-unconfined) continuum

- Boulder bed (fans)
- Braided
- Wandering
- Meandering active (often sand-bed)
- Meandering passive (often fine-grained)
- Low sinuosity (straight)
- Anastomosing

Questions?

- How would you characterize these rivers?
- How do these rivers adjust/ behave?
- How sensitive to disturbance are these rivers?



Time for something a little different ... a rivers quiz!

Gary's river quiz

Type of river	Photograph #
Discontinuous watercourse (Chain of Ponds, swamp)	
Confined valley setting - (bedrock) river	
Braided river	
Passive meandering river (fine-grained)	
Anastomosing river	
Braided-anabranching river	
Wandering gravel-bed river	
Partly-confined valley with bedrock-controlled floodplain pockets	
Active meandering river (sand-bed)	
Confined valley setting - gorge	