

KNOW YOUR CATCHMENT: The use of the River Styles Framework as a tool to support the development of coherent and strategic approaches to land and water management

A commentary by

Kirstie Fryirs, Professor in the Macquarie University, Australia

Gary Brierley, Professor at The University of Auckland, New Zealand

Mônica Marçal, Professor in the Postgraduate Program of Geography at UFRJ

Maria Naíse Peixoto, Professor in the Postgraduate Program of Geography at UFRJ

Many challenges must be addressed in the development and application of integrative approaches to land and water management. Coherent scientific guidance plays a fundamental role in this process – after all, fragmented science can only support fragmented management. As the scientific study of landforms and landscapes, geomorphology provides an integrative platform for these endeavours. The landscape is a dynamic, evolving template that reflects the cumulative imprint of geologic, climatic and anthropogenic impacts. In a sense, the landscape provides a platform to develop ‘common ground’ in discussions between agronomists, engineers, hydrologists, ecologists, water managers and geographers – among many practitioners. Unless we work together to develop and apply coherent approaches to land and water management, unsustainable outcomes result. This results in greater expense into the future – burdening future generations with problems that can be avoided (or minimized) through sensible and strategic actions taken today.

To demonstrate the potential use of a geomorphic approach to landscape analysis as a basis for land and water management applications, **Pos-Graduate Program of Geography (PPGG/UFRJ)** invited Professor Gary Brierley (University of Auckland, New Zealand) and A. Professor Kirstie Fryirs (Macquarie University, Australia) to run two one-day workshops that provided an “Introduction to Fluvial Geomorphology” and a four day professional short course in Rio de Janeiro and Recife in September 2017. Gary and Kirstie are co-developers of the River Styles Framework, outlined in their 2005 book: “Geomorphology and River Management: Application of the River Styles Framework” (see www.riverstyles.com). Their visit to Brazil was co-ordinated by Mônica Marçal and her research group at UFRJ, building directly upon research undertaken during her study leave visit to New Zealand in 2016 and a related publication on River Styles of the Macaé Catchment, 250 km east of Rio de Janeiro, that was published in the high profile journal ‘Applied Geography’ in 2017. The four day River Styles professional short course included site visits to the Macaé Catchment. These activities were followed by a postgraduate research workshop at the Federal University of Rio de Janeiro. The workshops were attended by around 120 people and the River Styles Short Course was attended by 34 people.

The River Styles Framework provides a coherent, open-ended approach to the geomorphic analysis of rivers. It includes analysis of river character, behaviour and pattern, interpretation of condition and recovery potential and an approach for setting visions, prioritisation and river conservation and rehabilitation. This approach has supported river management practices and decision-making for a wide range of applications in many parts of the world, including Australia, USA, Europe (through the Water Framework Directive), India and China. It has been used

specifically as part of programs that address concerns for sediment and water management, fish habitat assessment and protection of endangered species (i.e. conservation), rehabilitation design (particularly using vegetation and wood), to undertake forecasting of river futures and to prioritise river management activities and funding.

The workshops and short course would not have been possible without the sponsorship of the following organisations; Federal University of Rio de Janeiro - UFRJ (Postgraduate Program of Geography (PPGG/UFRJ), Energy Planning Program (PPE-COPPE/UFRJ), Nucleus in Ecology and Environmental Development of Macaé (NUPEM/UFRJ), the Brazilian Institute of Geography and Statistics (IBGE), and Institute of Geosciences (IGEO/UFRJ), and Department of Geography, University of Pernambuco (UFPE).

The River Styles Short Course is a hands-on learning experience with an attached accreditation framework. On Day 1, the River Styles Framework was introduced and the method for identifying and naming River Styles as part of Stage 1 of the framework taught. The remainder of the day was spent undertaking mapping and identification of River Styles for rivers in the Macaé Catchment. Analysis of the longitudinal pattern and controls on the character and behaviour of rivers along the Macaé River was also undertaken. On Day 2, these office-based exercises were completed in preparation for going to the field, and an assessment completed. Day 3 was spent in the field in the Macaé Catchment, undertake field-based analysis and interpretation of geomorphic units, river process and river behaviour. Four different River Styles were visited covering confined, partly confined, laterally unconfined with continuous channels and laterally unconfined with discontinuous channels styles. River Styles proformas were completed and handed in for assessment. At the start of Day 4 groups undertook analysis of river evolution and forecasting for the field examples and presented their work to the class. This was followed by an introduction to Stages 2 and 3 of the River Styles Framework, covering analysis of river condition and recovery potential. Stage 4 on applications of the River Styles Framework in river management was introduced using examples from around the world. A discussion session on how the framework could be used in Brazil and the opportunities for improved water, land and river management in Brazil marked the end of the course.

All River Styles Short Course participants undertook assessment as part of the course and have received Provisional River Styler status meaning they are now trained in the use of Stage 1 of the framework. These people are the first in Brazil to receive such training, providing an important opportunity for the use and development of River Styles work in many catchments and the basis for better use of geomorphic principles in land, water and river management in Brazil.

When asked to reflect upon contemporary river management issues in Brazil, participants at the workshops and short course identified the following concerns:

- Links between the community, managers, decision-makers and researchers
- Fragmented scientific information, much of which is unreliable
- Science links to management
- Lack of effective community engagement and participation
- Implementation of environmental laws
- Concerns for urban rivers, pollution and sanitation, living on floodplains, deforestation and agricultural/water management programs

When asked, "What can we do about it?", the following responses were received:

- Engender collective (societal) engagement

- Work together: Improve partnerships and education activities that link research and management in a more effective way, enhancing communication between researchers, managers and decision makers
- Respect the river: Work with nature
- Ensure management applications are designed and applied at the catchment scale
- Improve water quality and sanitation facilities
- Apply existing legislation more effectively

Some feedback on the most useful parts of the course were:

- “Actually the full course is important because all the sections are integrated, but the fieldwork was amazing and unique”
- “The application of fieldwork, we can see the theory in the reality”
- “The overview of fluvial geomorphology principles and their use”
- “The most useful part was the classification procedure of River Styles”
- “The fieldwork combined with exercises in class”
- “The field exercises were fantastic. We can link the theory and reasoning to what we see. We feel more confident in the possibilities for river management”

Practitioners provided the following comments on how they will use the River Styles Framework in the future:

- “To apply the methodology to Brazil rivers and with different characteristics and highlight zones that have different behaviour and need management for specific goals”
- “I will use to integrate important information along with catchment managers”
- “To assess river condition and trajectory of adjustments induced by extreme events and human recovery actions”
- “I will use the River Styles Framework in my academic development and professional activities with river management”
- “We can now, after expanding our vision, develop more networks with researchers and managers”

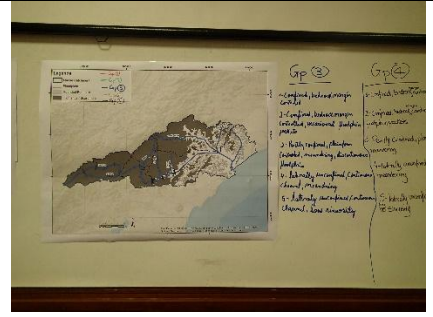
Engaging discussions and conversations during the visit emphasized the many opportunities for fundamental research contributions that can be generated by the talented resource base of young geomorphologists in Brazil. The increasing availability of high quality remotely sourced information, and use of emerging technologies to support effective place-based approaches to land and water management presents considerable opportunity to develop cost-effective programmes that reduce risk and protect socio-economic, cultural and environmental values. The key is to ‘get on with it’, ensuring that strategic planning frameworks are ‘in-hand’ so that we are ready to act when called upon to apply such practices. Just as importantly, it is vital for researchers, practitioners and decision-makers to work together to ‘make good things happen’.



Introduction to Fluvial Geomorphology workshop, Rio de Janeiro



Mapping River Styles on the short course



Analysis of patterns and controls on River Styles in Macaé catchment



Completing River Styles assessments in the field



Confined, bedrock margin controlled, occasional floodplain pockets, boulder bed River Style – Macaé catchment



Laterally unconfined, continuous channel, meandering, sand bed River Style – Macaé catchment



Identifying geomorphic units and interpreting river behaviour in the field – Macaé catchment



Partly confined, planform controlled, low sinuosity, terrace constrained, gravel bed River Style – Macaé catchment



Laterally unconfined, discontinuous channel, valley fill, fine-grained River Style – Macaé catchment



Presenting river evolution and forecasting of river futures in Macaé catchment



River Styles Short Course participants



Introduction to Fluvial Geomorphology workshop, Recife

All Photographs: Kirstie Fryirs