

Channel Complexity Synthesis

Goal

The goal of this report is to synthesize previous TRRP efforts to evaluate channel complexity and make recommendations that will improve our understanding and better achieve programmatic goals, thereby offering a more comprehensive framework for evaluating and measuring complexity to guide future TRRP management actions. This report will also identify outstanding needs, questions, opportunities, and uncertainties related to complexity. Specific recommendations will include:

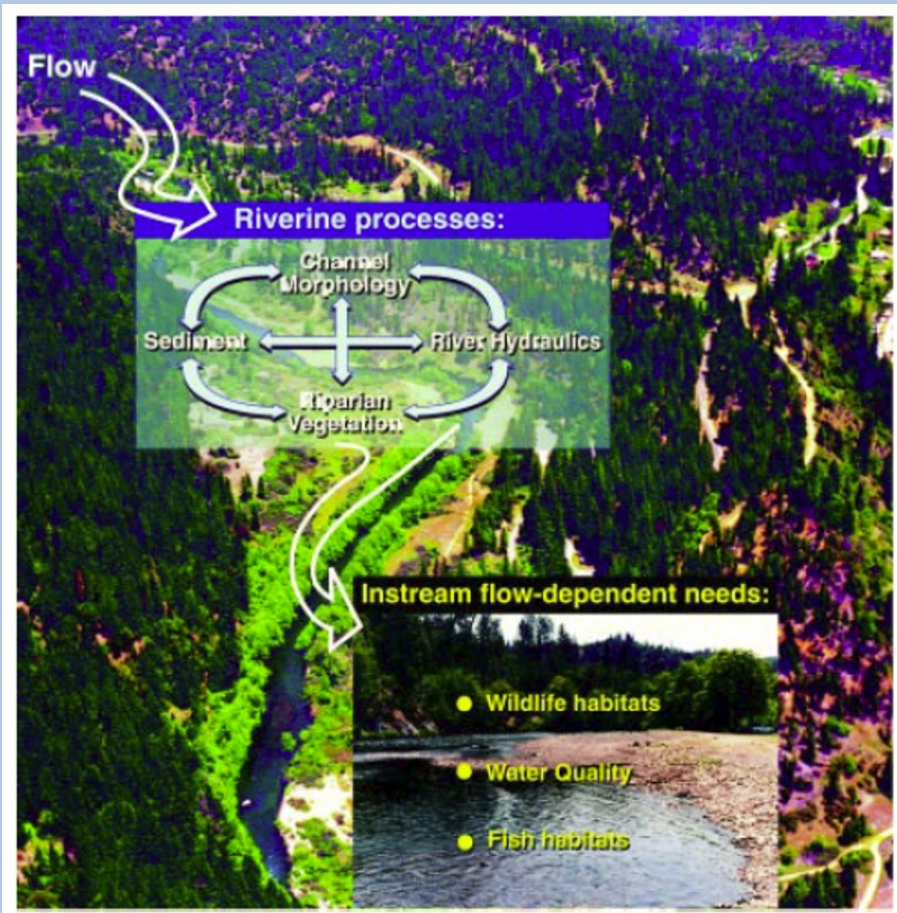
- Refinements to existing conceptual models, including an updated definition of channel complexity, adding additional specificity to existing objectives, and better defining performance measures and effectiveness criteria,
- Refinements to management actions, and
- Refinements to science and work plans.

The recommendations, if followed, will allow the TRRP to better monitor and track the effects of future management actions relative to their ability to achieve increased levels of complexity and ultimately contribute to the restoration of the Trinity River.

The Desirable but Undefinable

- Throughout many founding documents channel complexity is listed as a goal or target condition but it is never defined in any of them.
- One of the most thorough attempts was in the Integrated Habitat Assessment (2015) in which single regression analyses were used to evaluate different physical traits to physical habitat conditions.
- Most attempts looked at the wetted channel at various flows but the proposed channel complexity in the proposal was quickly dismissed as too simple a view

Trinity River Flow Evaluation Study

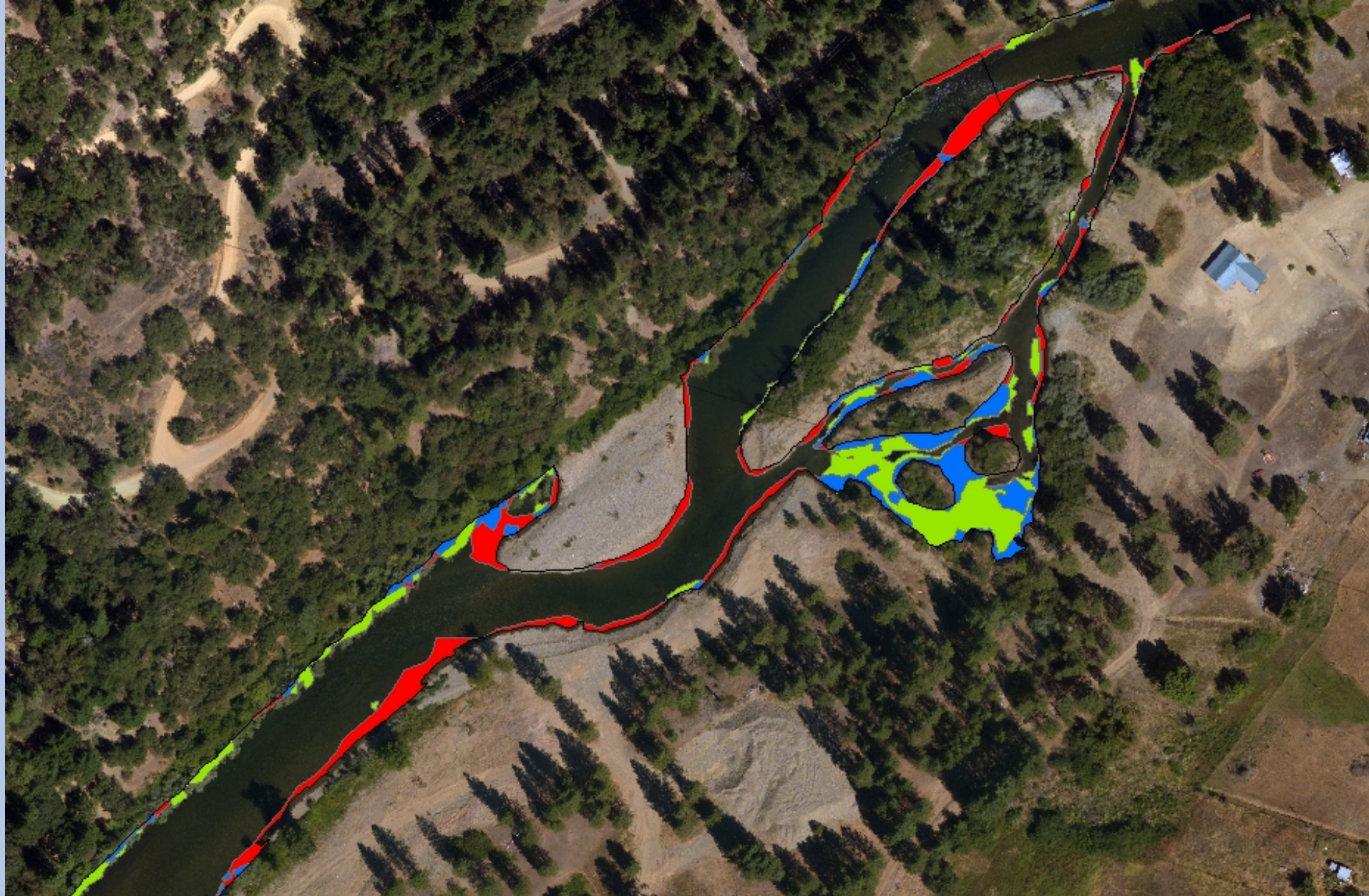


Objective - a dynamic restored channel. The TRFE utilized a simple alternate bar sequence to illustrate multidisciplinary, system-scale ideas and reach a broad audience. Increasing channel sinuosity of a single thread river and increasing local sediment storage would help recover instream habitat by increasing depth, velocity, substrate and topographical diversity over a wide range of flows. Any change that moved the simplified away from a straight rectangular pattern was essentially more complex habitat. In the TRFE, channel complexity was not presented as a metric; instead it was an objective to achieve.

Lowden Meadows



Lowden Meadows



Trinity River Flow Evaluation Study

- several notable gaps related to management actions that the TRRP has worked to better define, largely through implementation-related considerations, such as the role of large wood, target future riparian conditions, alcoves, secondary channels, and other off-channel habitat features that have been widely incorporated into contemporary channel rehabilitation.
- Additionally, efforts to relate physical measures of channel complexity features to a key species and a single life stage have repeatedly failed to provide the ecological “magic bullet” that unlocks the ever-pursued formula for recovery of a pre-TRD Chinook fishery.

Buffington et al 2014

Predictive numeric models now used by site designers to assess potential future salmonid rearing habitat availability and geomorphic response have supported the evolution of channel rehabilitation site objectives, which have become more specific over time (Buffington et al. 2014). Phase 2 sites designed and implemented in the years since the Phase 1 review have continued on a trajectory of increasingly extensive earth work, including adjusting the mainstem alignment, and substantial large wood structures strategically placed as key geomorphic and habitat features.

$$\text{complexity} = \frac{\text{edge length (m)}}{\sqrt{\text{wetted channel area (m}^2\text{)}}}$$

Corridor Complexity

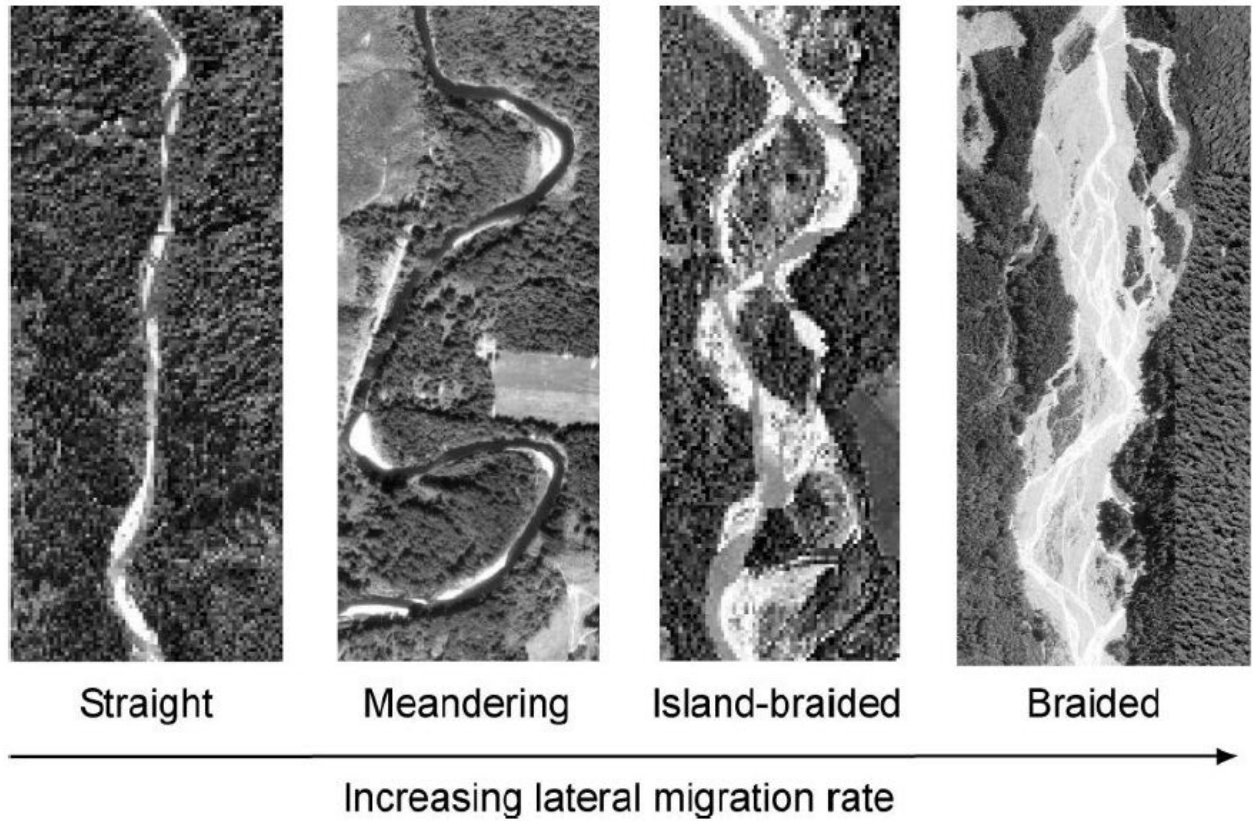
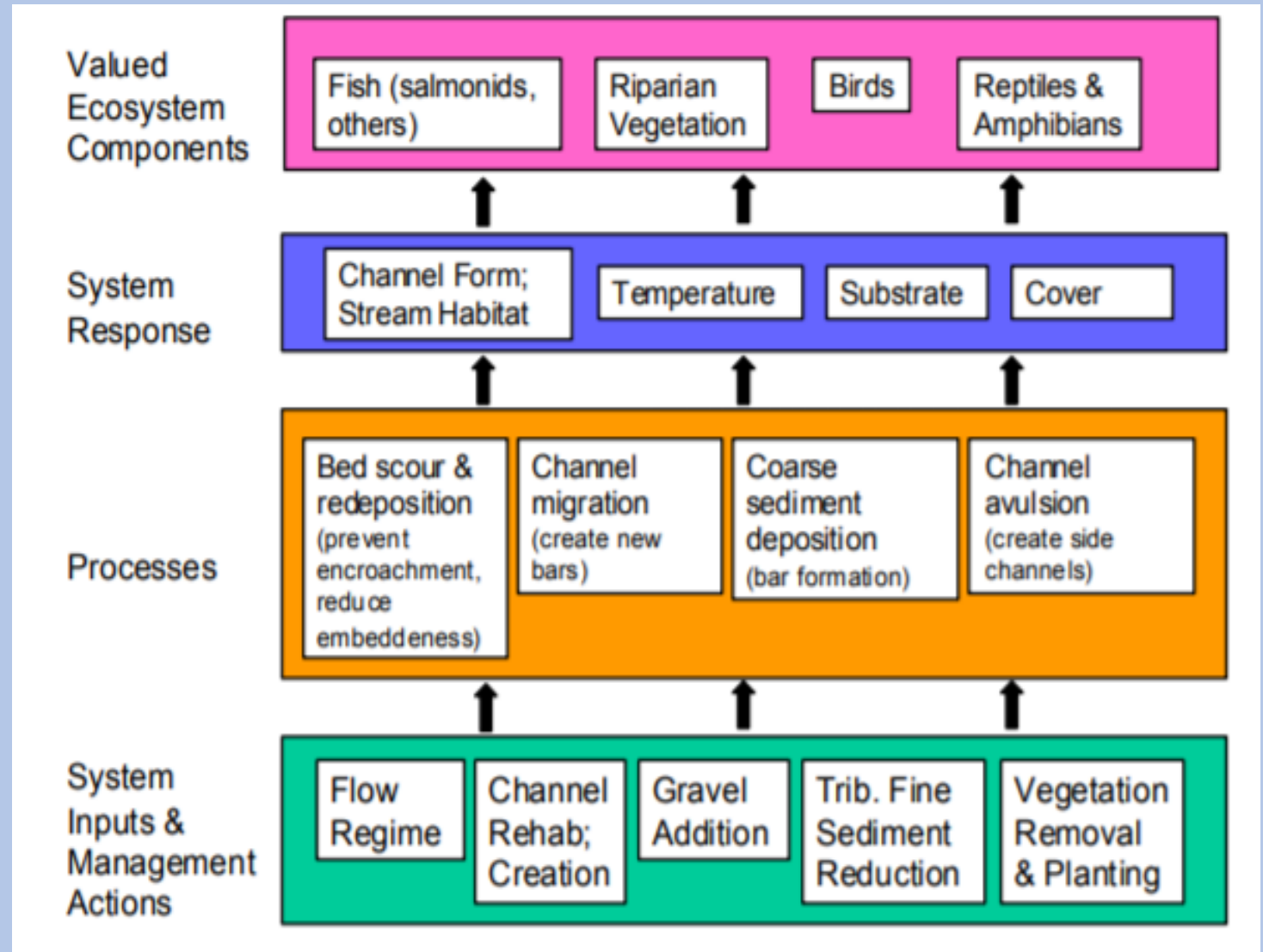


Figure 2. Examples of channel patterns in forested mountain river systems (from Beechie et al. 2006b).

Backgrounder 2009



River Corridor Complexity Framework		
Sources of Complexity (Matter and Energy Flux)		Water, Sediment, Nutrients, Wood, Food, Carbon, Heat
Structural Complexity (Physical Features)		Valley geometry, Channel XS, Long Profile, Geomorphic Features, Mesohabitats, Substrate Grain Size
Functional Complexity (Process and Response variables)	Biologic	Species (flora and fauna), Food (primary and secondary production), Bioenergetics
	Hydro-Geomorphic	Hydraulics (w,d,v), Sediment Transport (fine or coarse), Hyporheic Exchange, Scour and Deposition, Wood Routing
Metrics	Spatial	Richness (# of types), Frequency (# within each type), Configuration (spatial arrangement of types), Range (dispersion within types)
	Temporal	Short-term Trajectories of Change, Long-term Evolution and Shifts
Constraints		Natural River Confinement, Managed Flows and Sediment Supply, Risk of Bridge Scour