

# Preliminary assessment of sediment sources in the Lower Little Bow River watershed using Diffuse Reflectance Spectrometry



Agriculture and Agri-Food Canada

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## Background

The Lower Little Bow River watershed was one of the study sites in Agriculture and Agri-food Canada's Watershed Evaluation of BMPs (WEBs) program. The 55,664-hectare Lower Little Bow River Watershed is located within the Oldman River Basin in southwest Alberta (Figure 1). The Lower Little Bow River WEBs project focused on a micro-watershed (2,565 hectares) north of Lethbridge (Figure 2). Land use in the Lower Little Bow River watershed includes a wide range of agricultural activities and intensities such as cow-calf operations on native range, dryland farming, intensive irrigated row crop farming, and intensive livestock operations. Sediment in the river impairs water quality and is suspected of causing problems with farm irrigation systems which draw water from the river. There are several potential sources of sediment along the reach of the river studied in the WEBs project, and this research was undertaken to assess their importance.

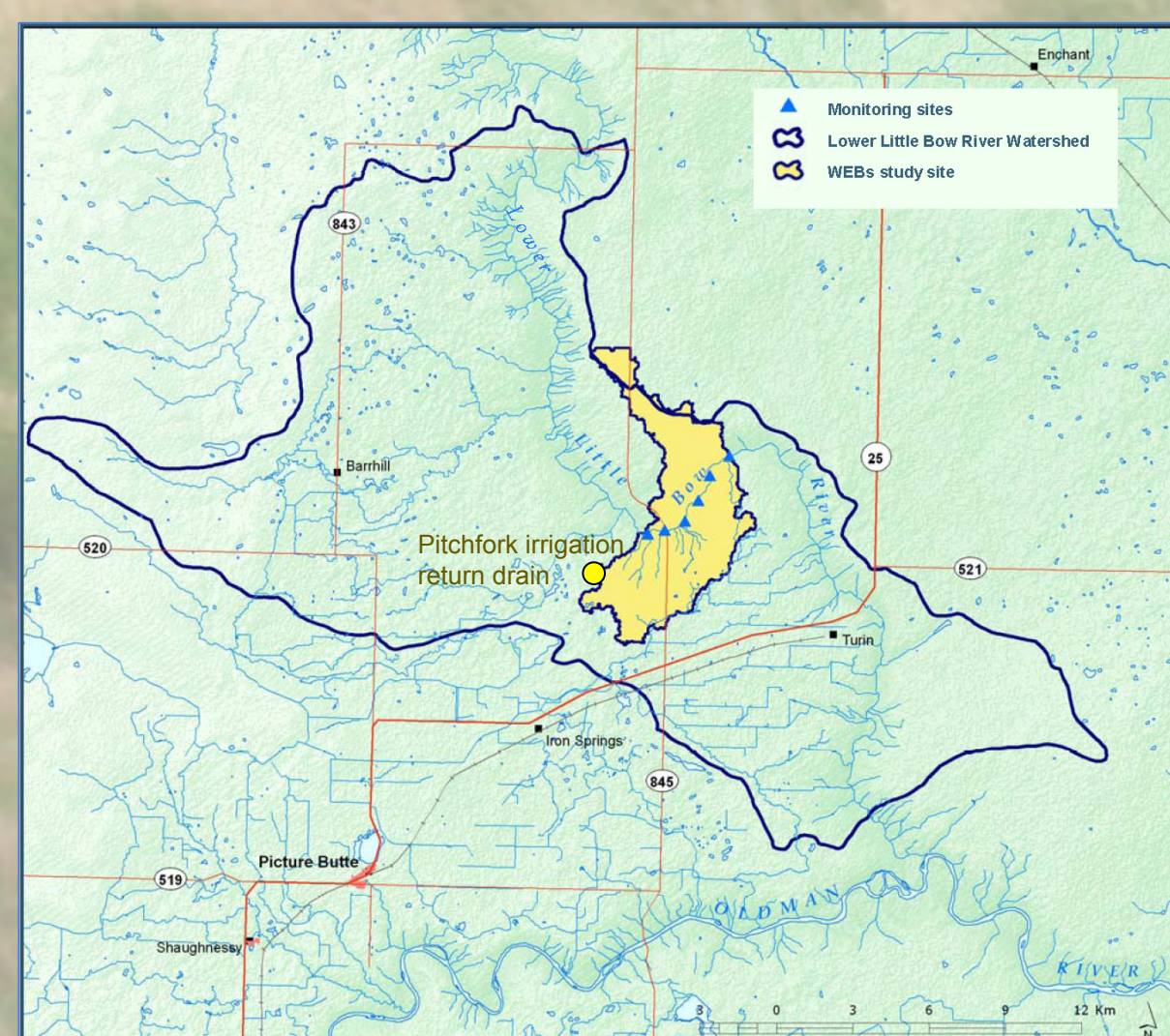


Figure 1. Lower Little Bow River watershed.

## Materials and Methods

- Suspended sediment samples were collected at several points along the studied reach of the river (Figure 2). These samples were collected in submersed, time-integrated sampling tubes (Figure 3) during the ice-free period of 2009 to 2012.
- Surface (0-10 cm) soil samples were collected from potential sediment sources in the watershed during 2012. Stream bank samples were also collected over the depth of exposed bank surfaces, as well as samples from cattle paths and a coulee.
- Samples were sieved through a 0.063-mm sieve, bagged and labelled appropriately for analysis.
- Soil and sediment samples were analyzed using diffuse reflectance spectrometry by a Spectroradiometer in the Centre for Earth Observation Science laboratory. (Figure 4).
- A program called Field Spec Pro® was used to determine the data points for the reflectance/wavelength from the spectroradiometer data.



Figure 3. Suspended sediment samplers.



Figure 4. Spectroradiometer.

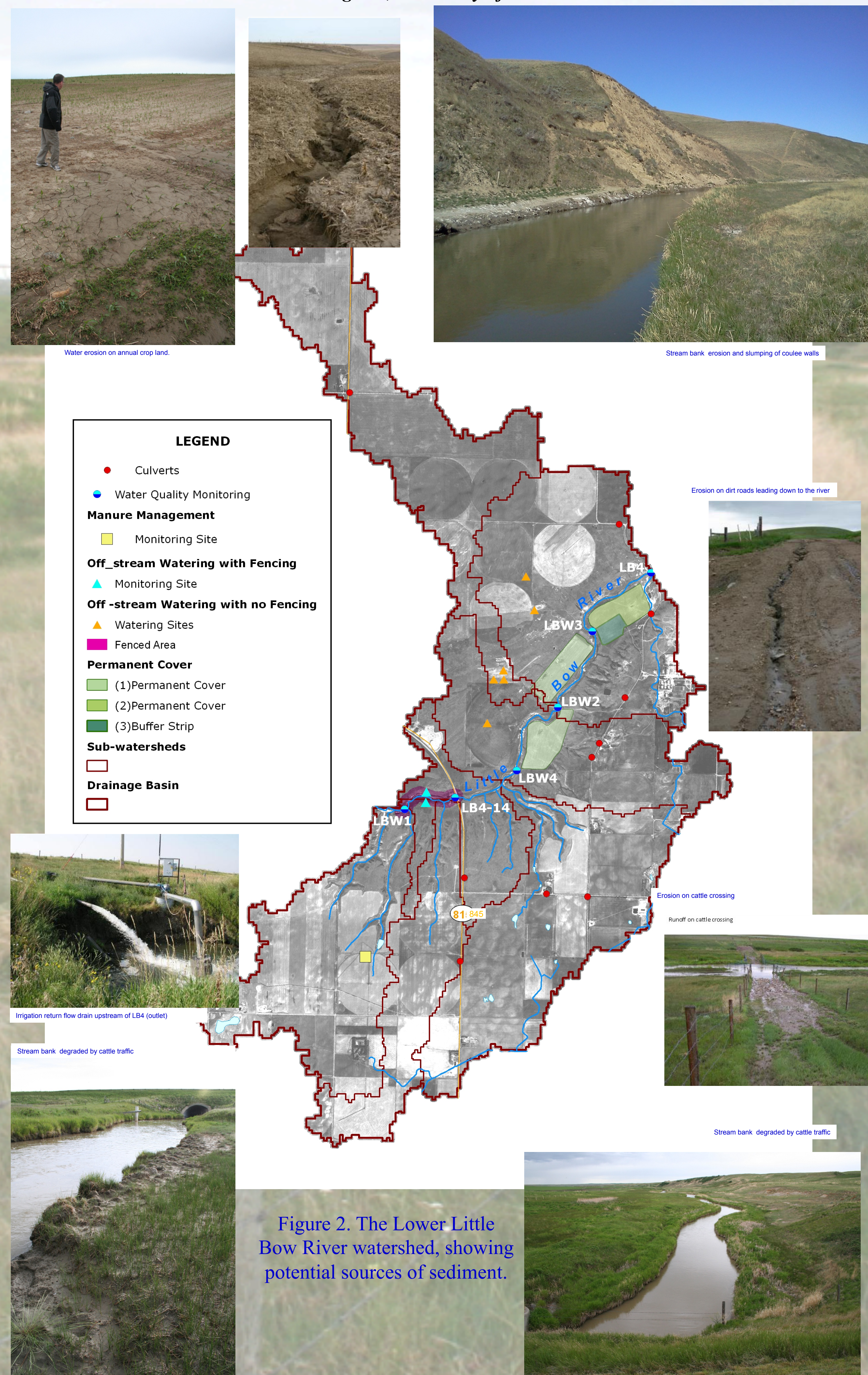


Figure 2. The Lower Little Bow River watershed, showing potential sources of sediment.

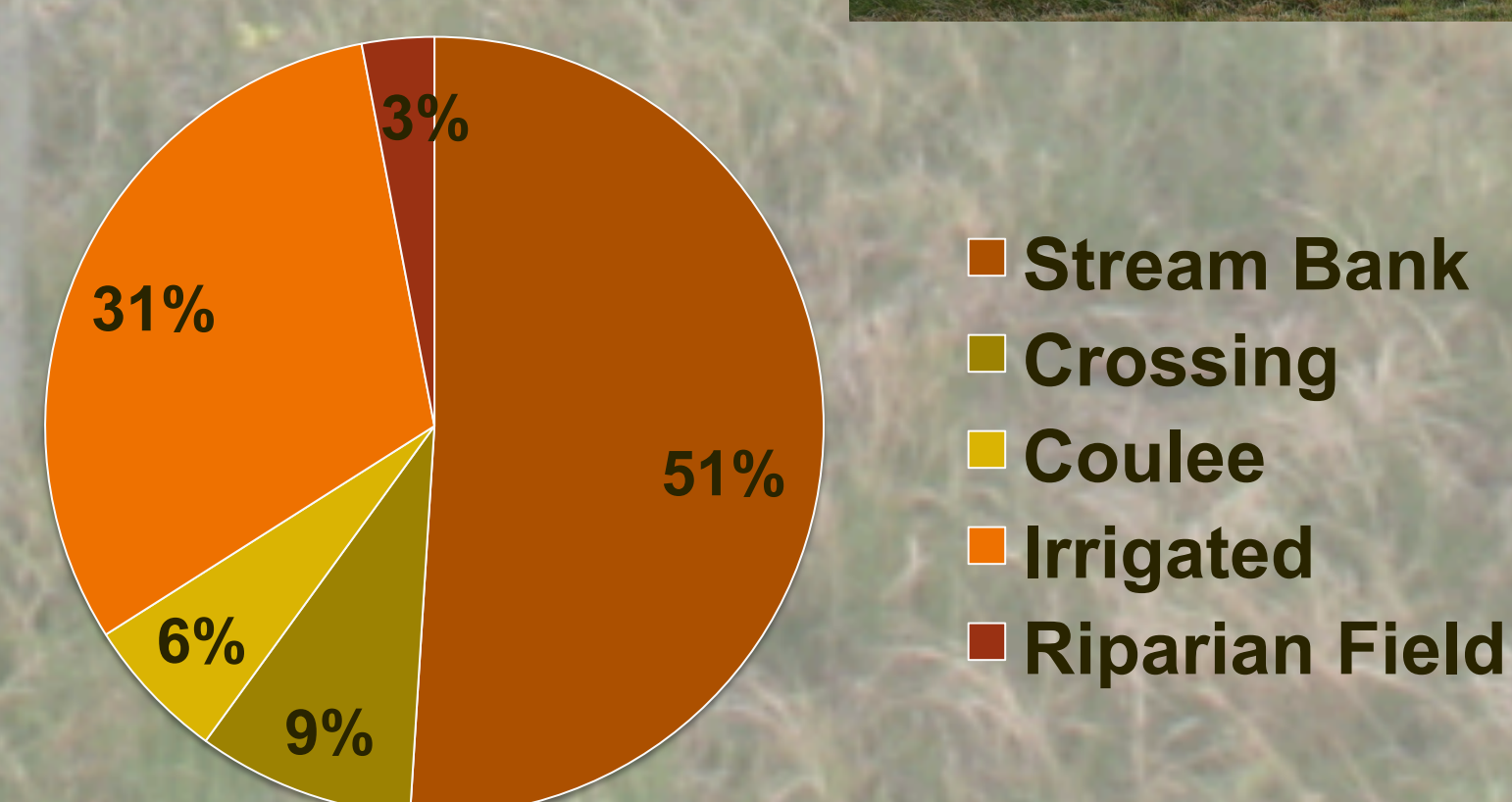


Figure 5. Averages for source proportion for the site LB4.

## Results and Discussion

The technique of using Diffuse Reflectance Spectrometry is a fast and efficient method. It involves capturing light wavelengths reflected off of soil and sediment samples, and using these wavelengths along with the reflectance to compute colour coefficients. From the samples taken from the three sites LB4, LBW4 and LB4-14 (Figure 2), it was readily found through this preliminary assessment, that majority of the suspended sediment within the Lower Little Bow Watershed comes from stream bank erosion as well as irrigated fields. Figure 6 demonstrates how distinctly through this method, colour fingerprinting can distinguish the different sources of the sediment. The suspended sediment in the watershed can be broken down by the different colours relating to the different sources, which can be seen in relative proportion within the suspended sediment. The use of this method and the results in this preliminary assessment both contribute to the fact that using Diffuse Reflectance Spectrometry for sediment and soil colour fingerprinting could be a very useful technique in studying watersheds for nutrient movement as well as management. This technique in combination with other techniques like the tracing of Cs137, could have the potential to yield results of very definitive fingerprinting data.

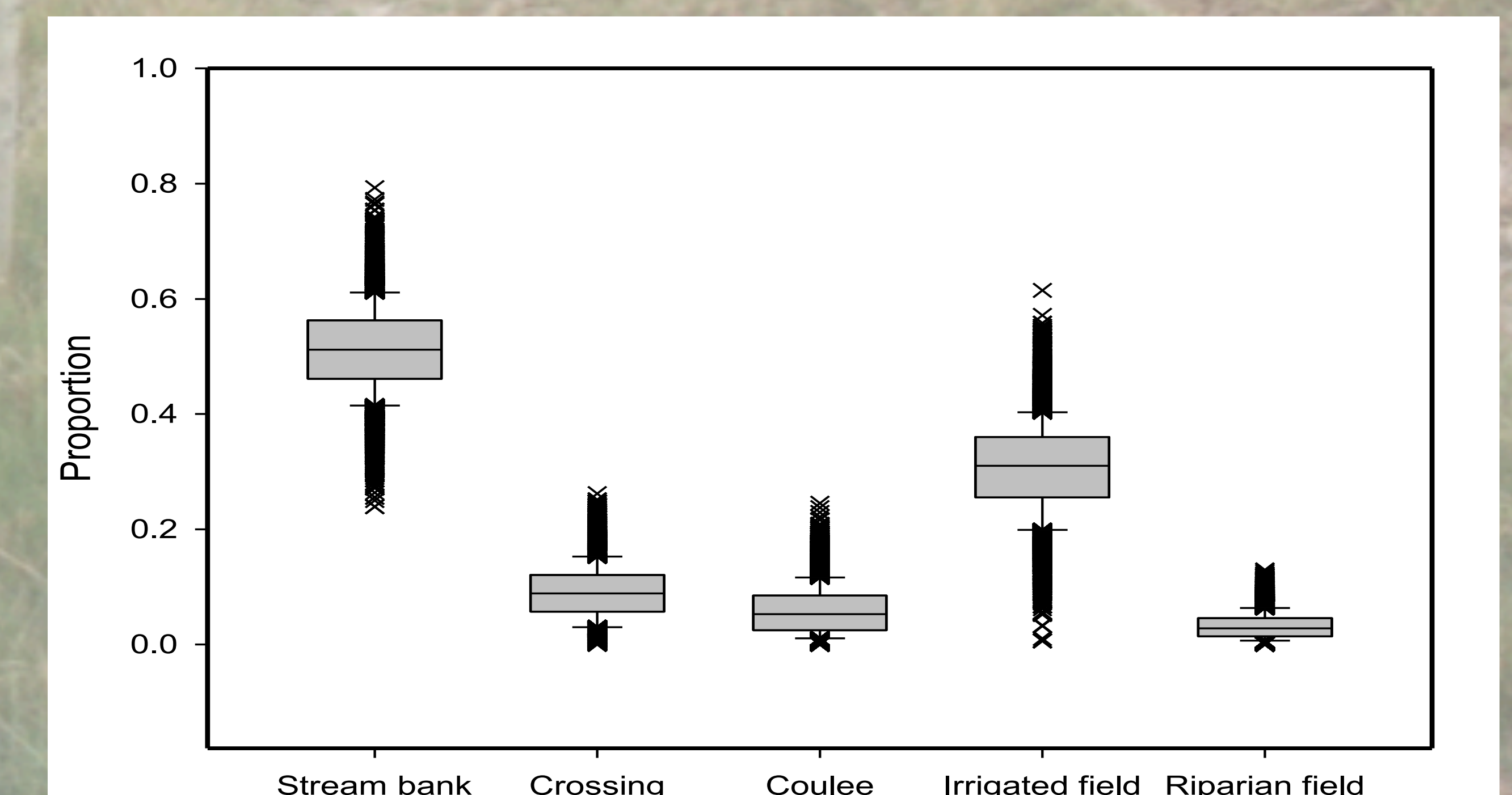


Figure 6. Sediment sources partition at LB4

## Preliminary Findings and Future Research

Through these initial findings it can be seen that the proportion of sources for the suspended sediment within the watershed is mainly contributed by stream bank erosion as well as run off from irrigated fields (Figure 5). The process of diffuse reflectance spectrometry is a technique that could allow fingerprinting of sediment and soil by colour. It is a fast and cost effective method compared to other methods for fingerprinting. Through the data found in this preliminary assessment, it can be proven as an efficient and precise method that may be more widely used to fingerprint sediment and soil in future practices.