

# Spatial dynamics of soil erosion impacts on food, water and energy security in a large Andean river basin, Chile



**Will Blake, Enrique Munoz-Arcos, Luis Ovando-Fuentealba, Jessica Kitch, Claire Kelly,  
Alfredo Del Valle and Claudio Bravo-Linares**



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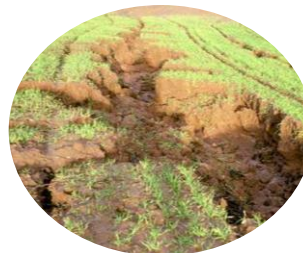




# Soil erosion, sediment pollution and the 'food, water, energy security nexus'

*water security, energy security and food security are inextricably linked ...*

*...actions in one area more often than not will have impacts in one or both of the others*







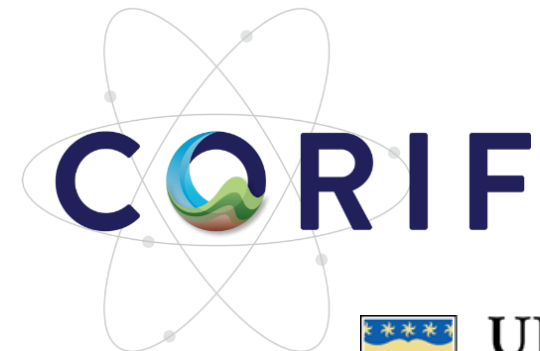
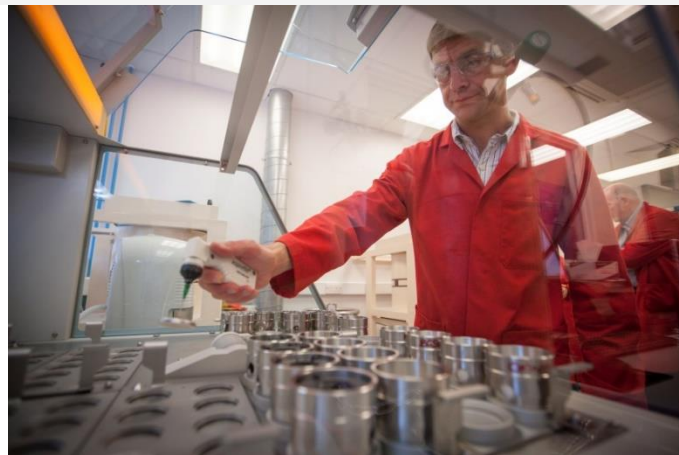
**River basins are complex, integrated human-environment systems**





# CONSOLIDATED RADIO-ISOTOPE FACILITY

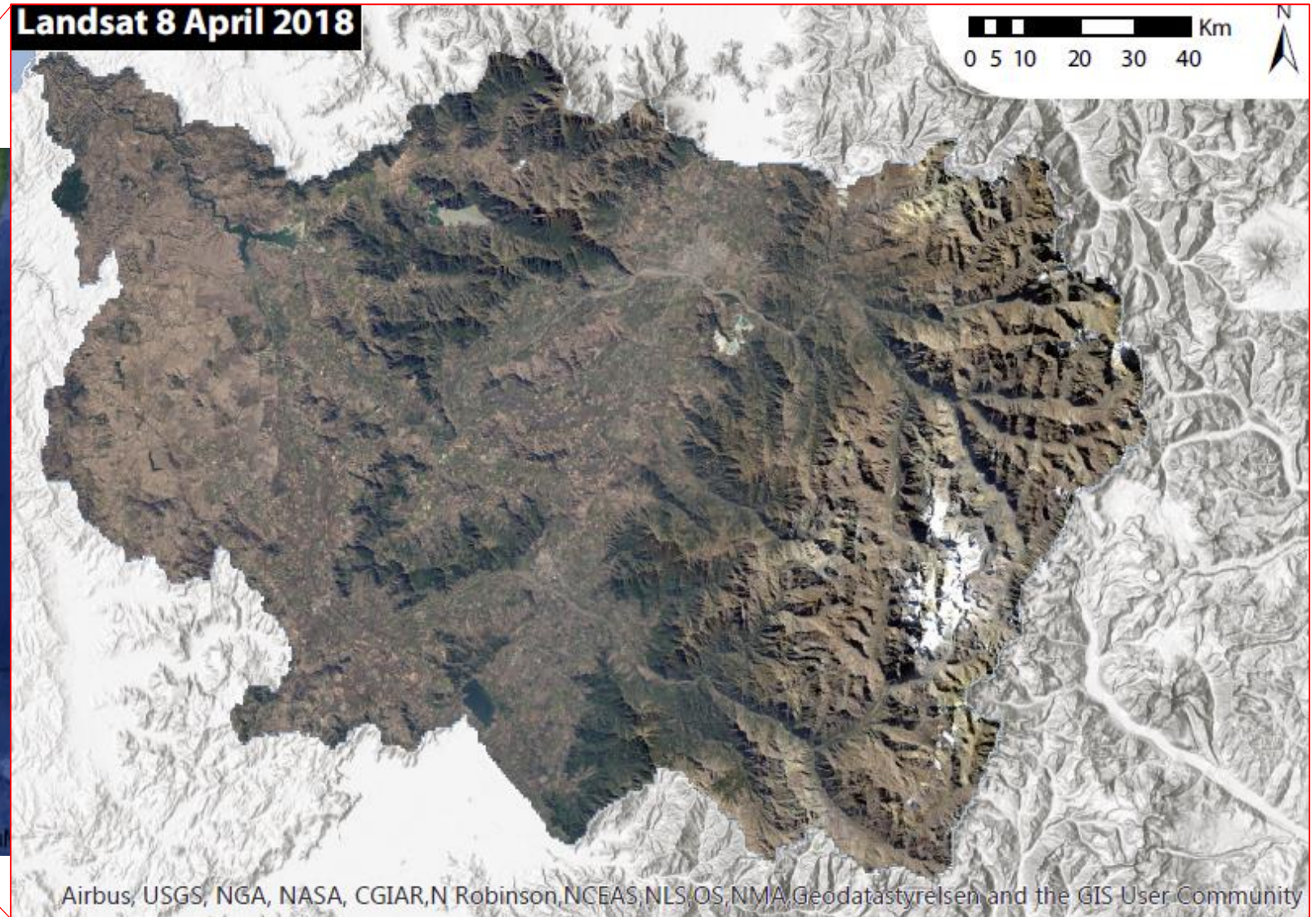
Environmental radioactivity and X-ray fluorescence (XRF) analysis



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## Rapel Basin, Central Valley, Chile

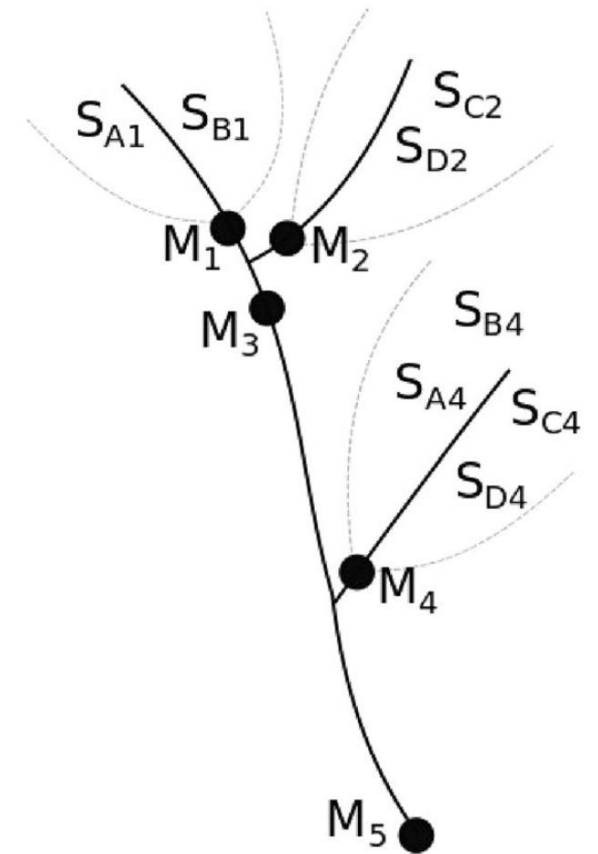


**Key ecosystem service provision: water, agriculture (grain and fruit) and hydropower**









- What are the main sources of sediment pollution?
- What other pollutants are associated with sediment?





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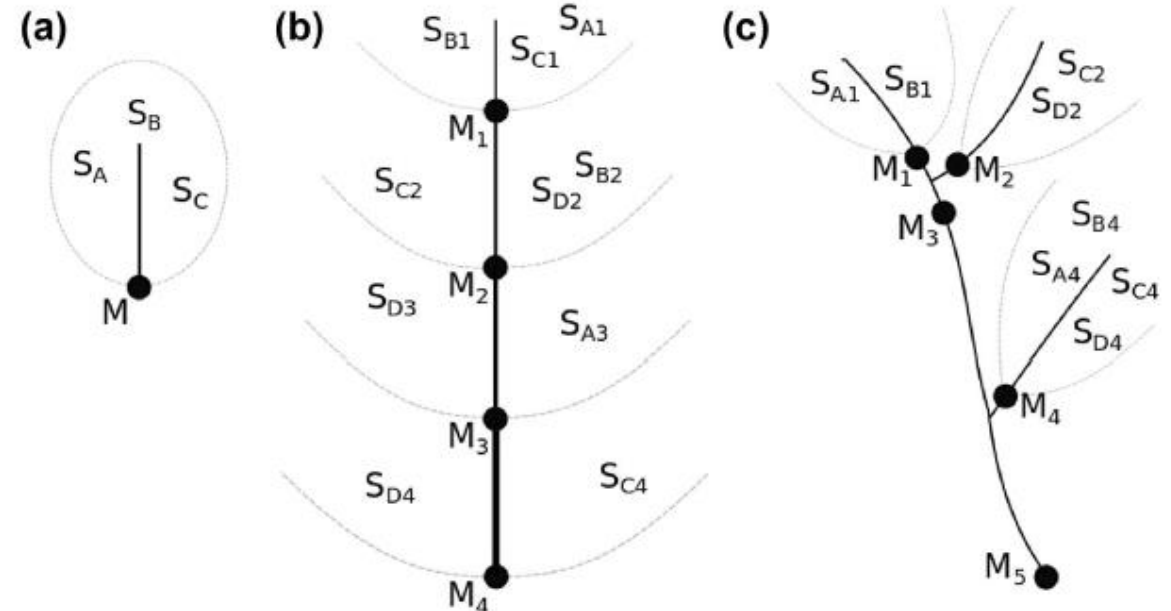
## A deconvolutional Bayesian mixing model approach for river basin sediment source apportionment

William H. Blake<sup>1</sup>, Pascal Boeckx<sup>2</sup>, Brian C. Stock<sup>3</sup>, Hugh G. Smith<sup>4</sup>, Samuel Bodé<sup>2</sup>, Hari R. Upadhyay<sup>2,13</sup>, Leticia Gaspar<sup>5</sup>, Rupert Goddard<sup>1</sup>, Amy T. Lennard<sup>6</sup>, Ivan Lizaga<sup>5</sup>, David A. Lobb<sup>7</sup>, Philip N. Owens<sup>8</sup>, Ellen L. Petticrew<sup>8</sup>, Zou Zou A. Kuzyk<sup>9</sup>, Bayu D. Gari<sup>10</sup>, Linus Munishi<sup>11</sup>, Kelvin Mtei<sup>11</sup>, Amsalu Nebiyu<sup>10</sup>, Lionel Mabit<sup>12</sup>, Ana Navas<sup>5</sup> & Brice X. Semmens<sup>3</sup>

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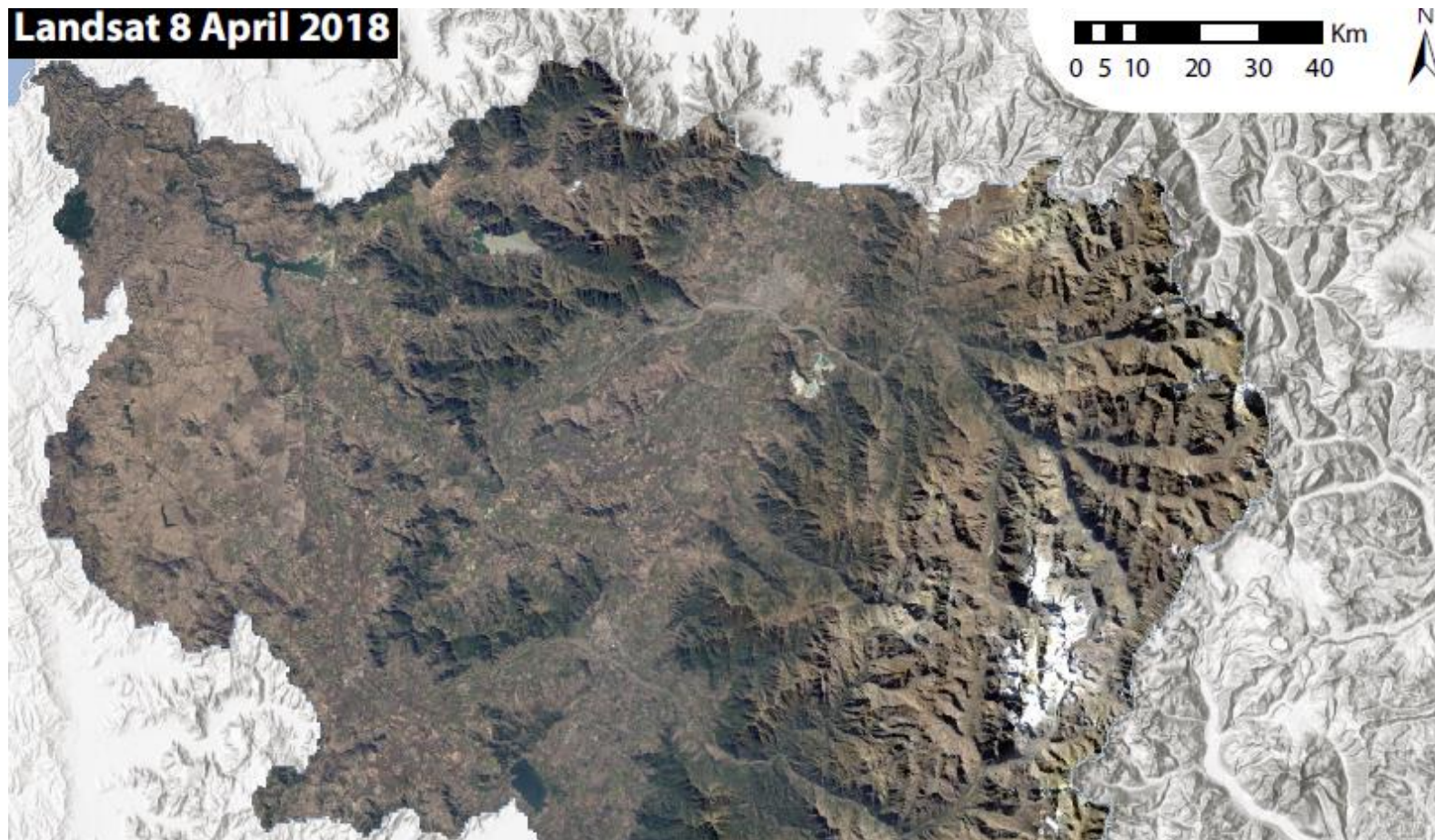
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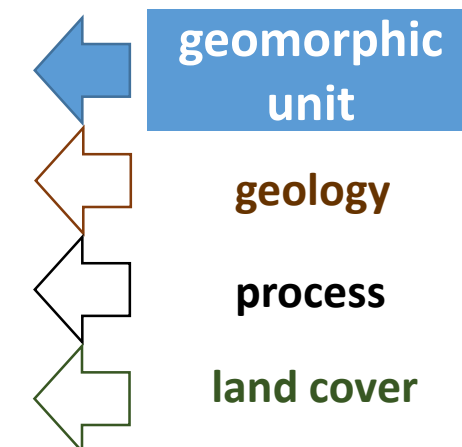
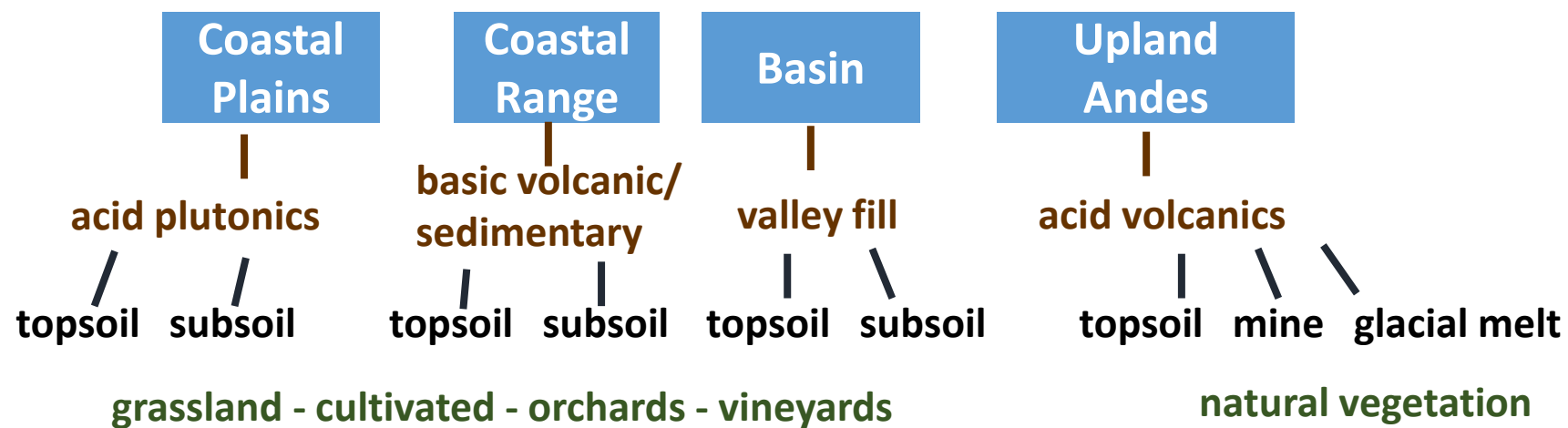
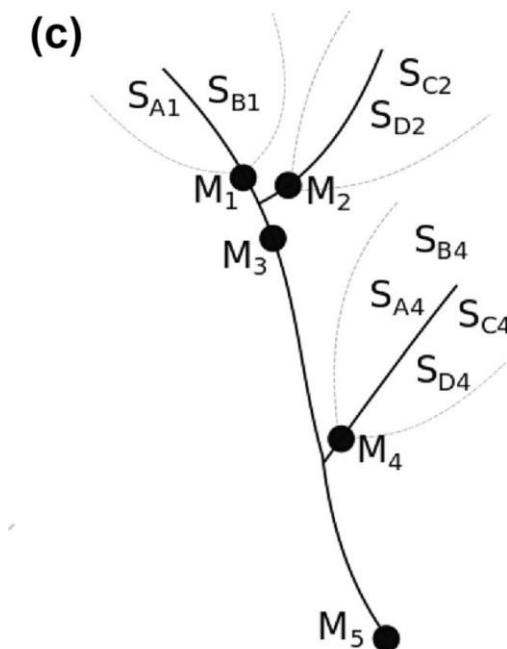




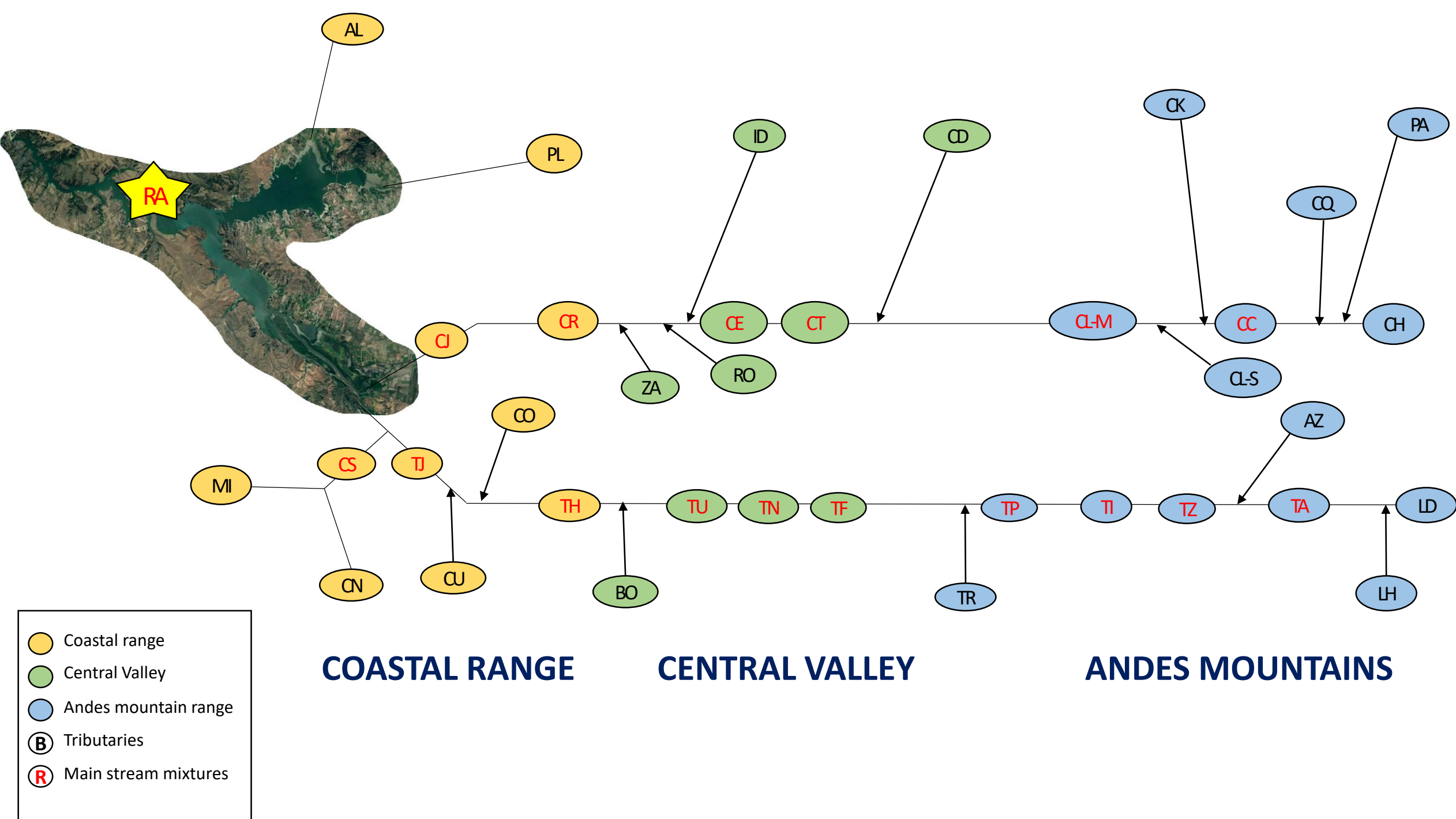
**Landsat 8 April 2018**



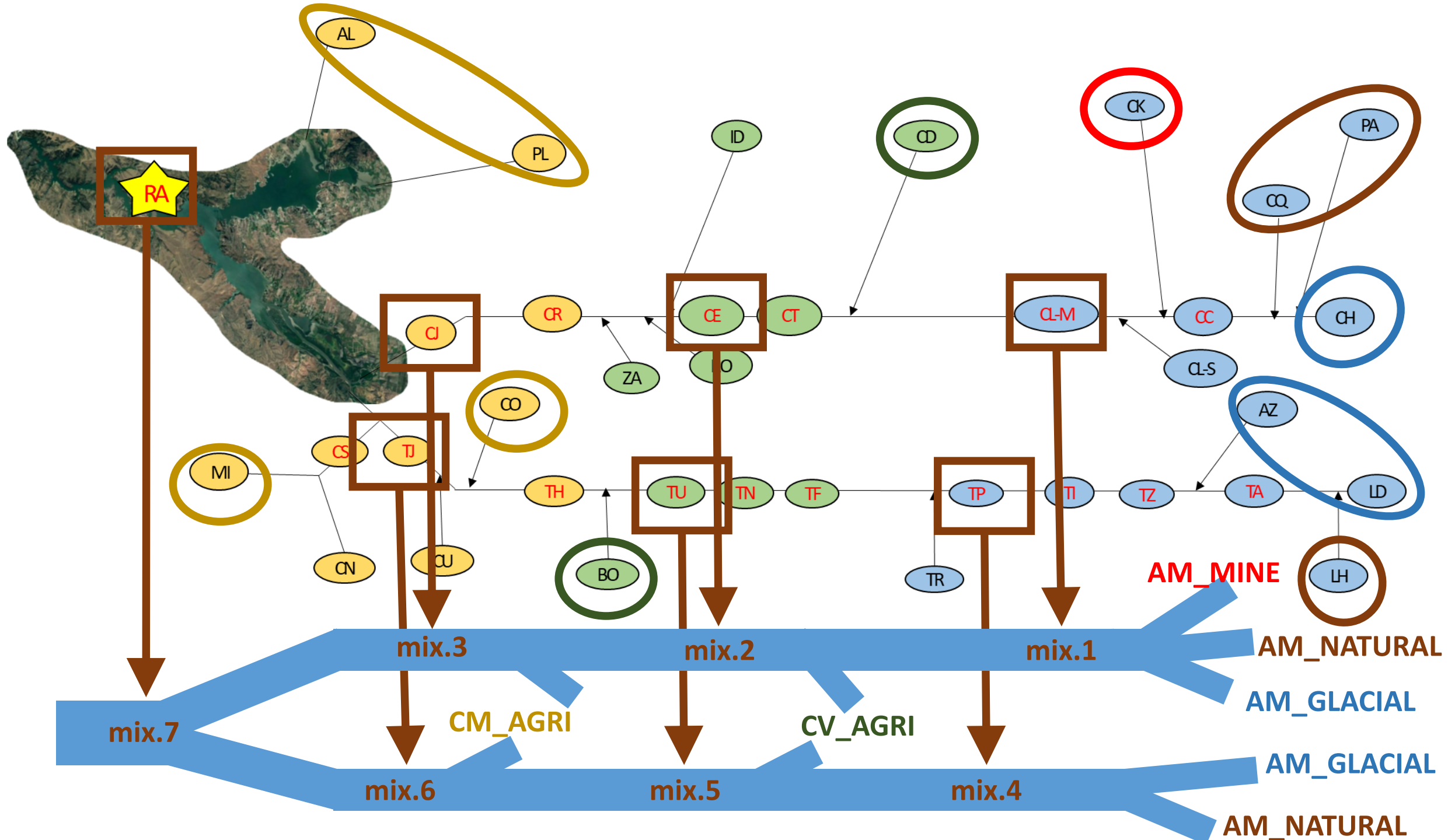
## Basis of sediment fingerprinting







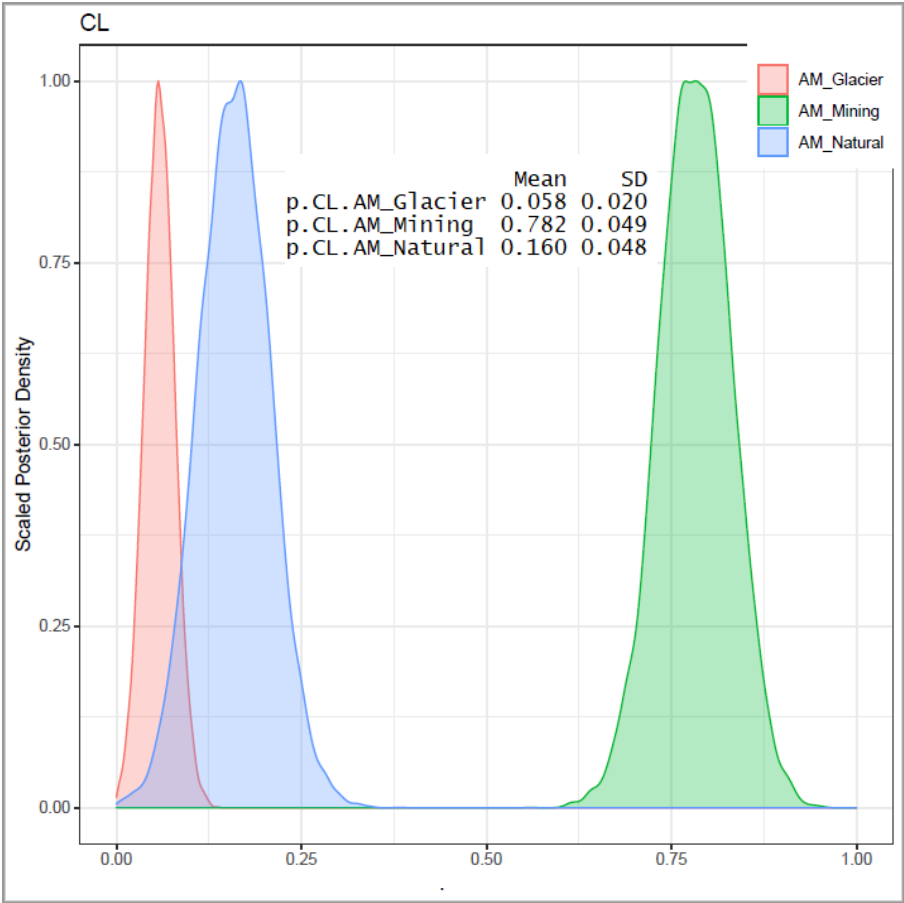




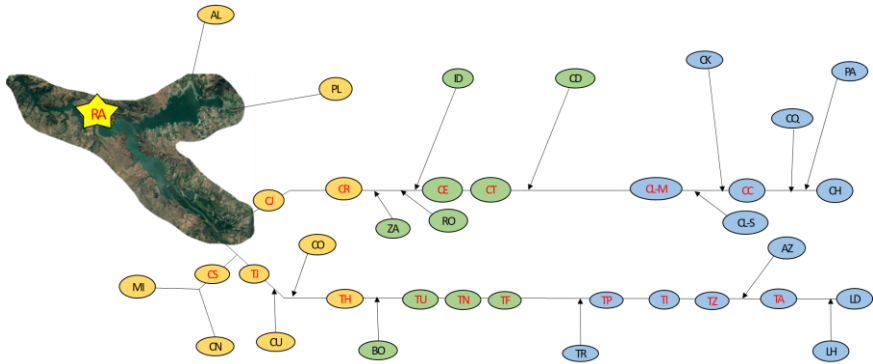
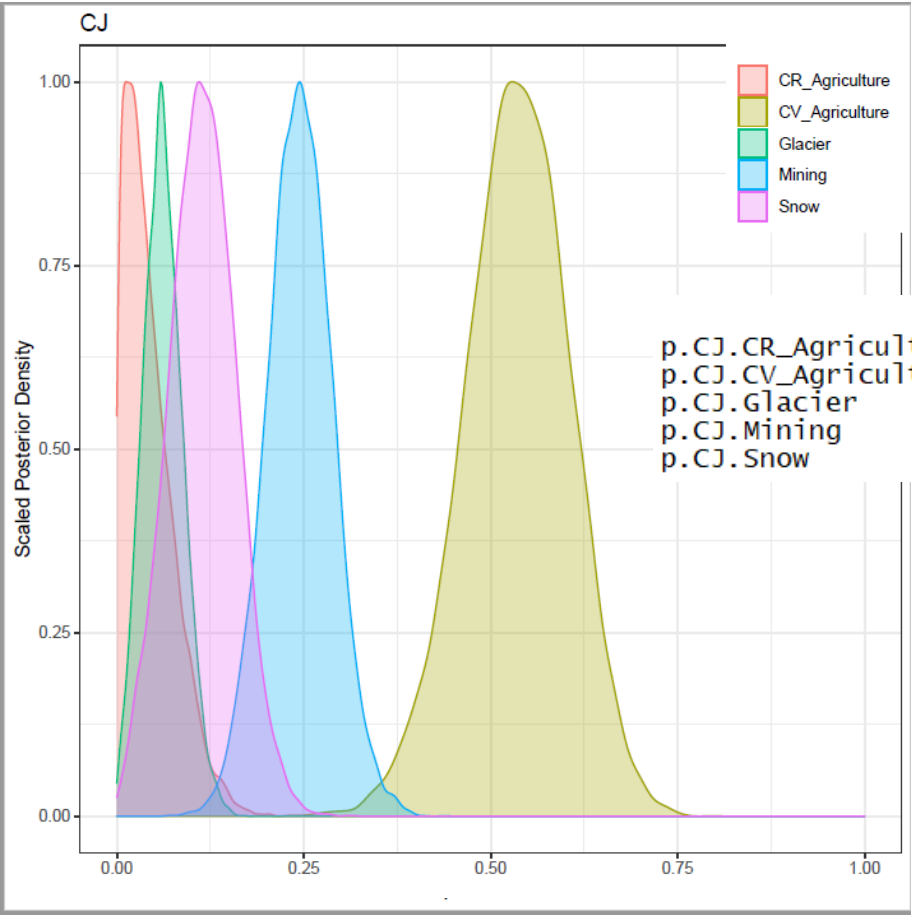


# Sediment source contributions: upper and lower basin

Upper catchment: mining dominated



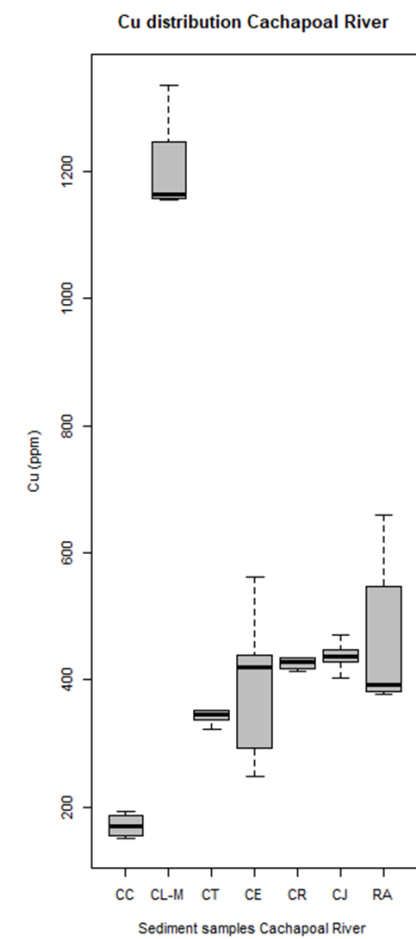
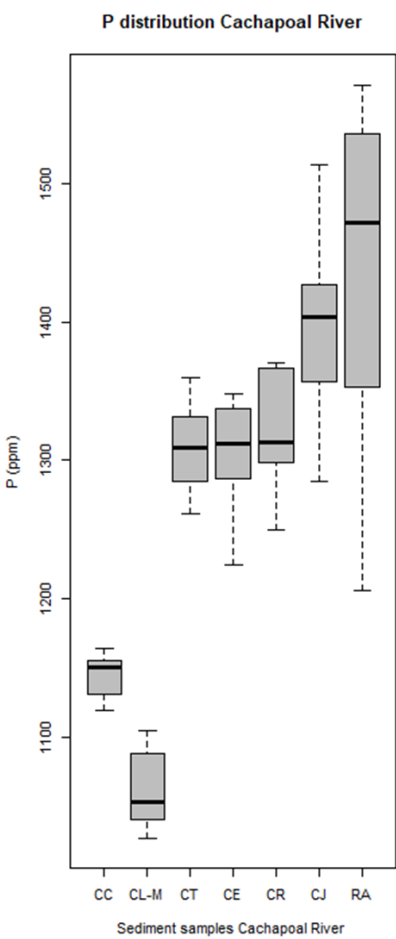
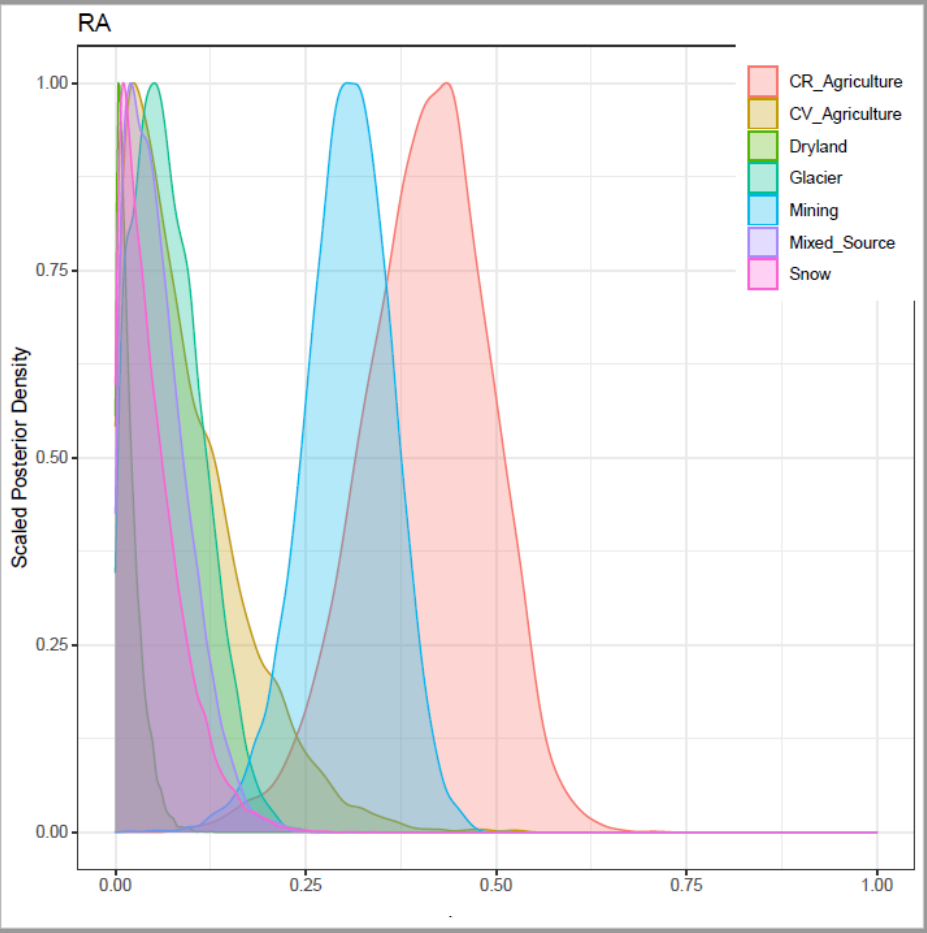
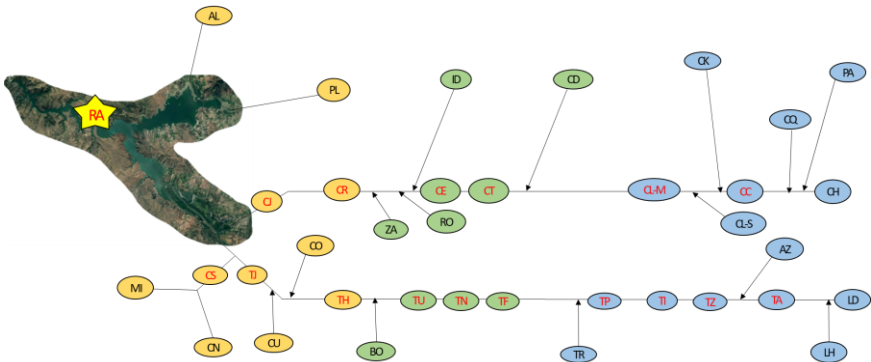
Lower catchment: agriculture dominated





# Sediment source contributions to hydropower lake and sediment-associated pollutants

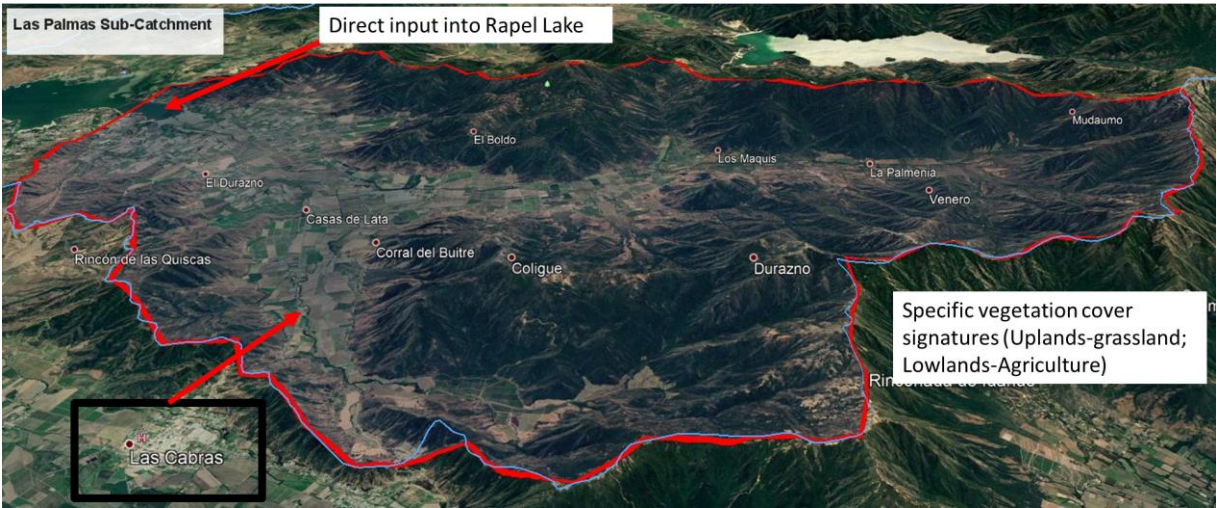
	Mean	SD
p.RA.CR_Agriculture	0.407	0.083
p.RA.CV_Agriculture	0.093	0.077
p.RA.Dryland	0.018	0.017
p.RA.Glacier	0.071	0.045
p.RA.Mining	0.305	0.057
p.RA.Mixed_Source	0.057	0.041
p.RA.Snow	0.049	0.042



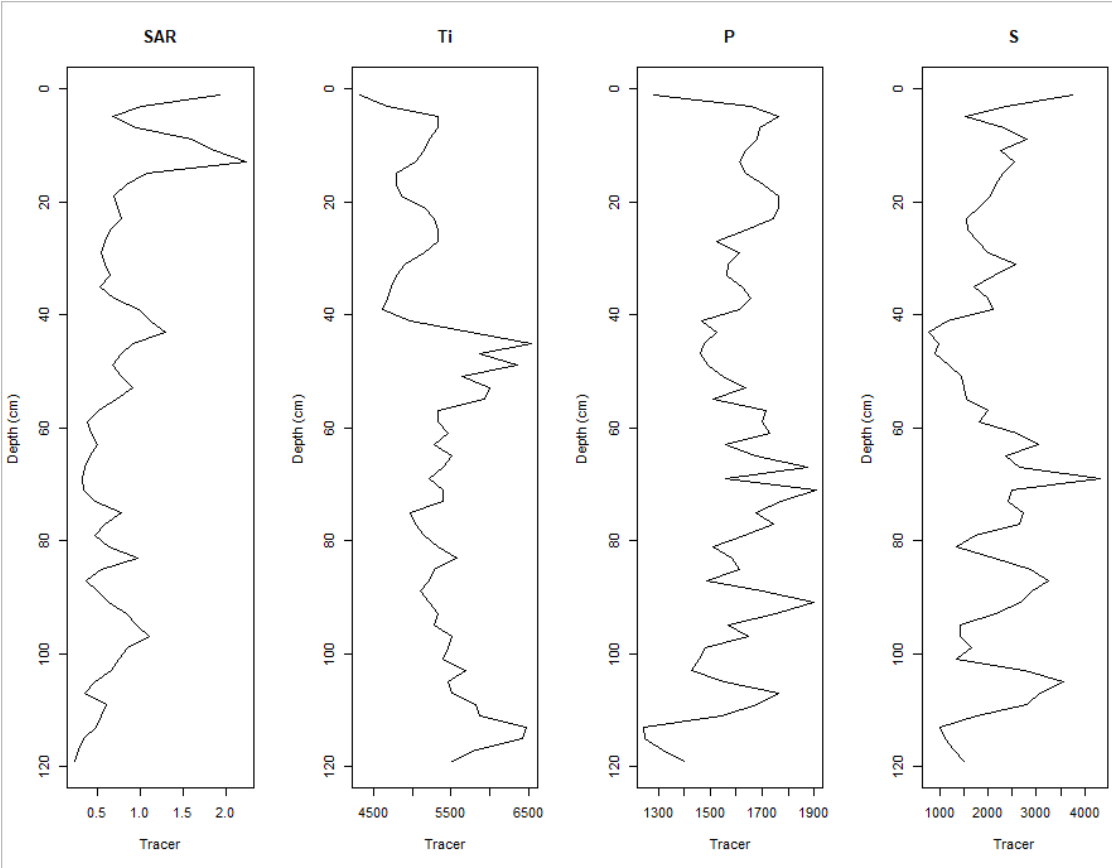
Complexity in signature development/mixing needs unravelling



# Next steps



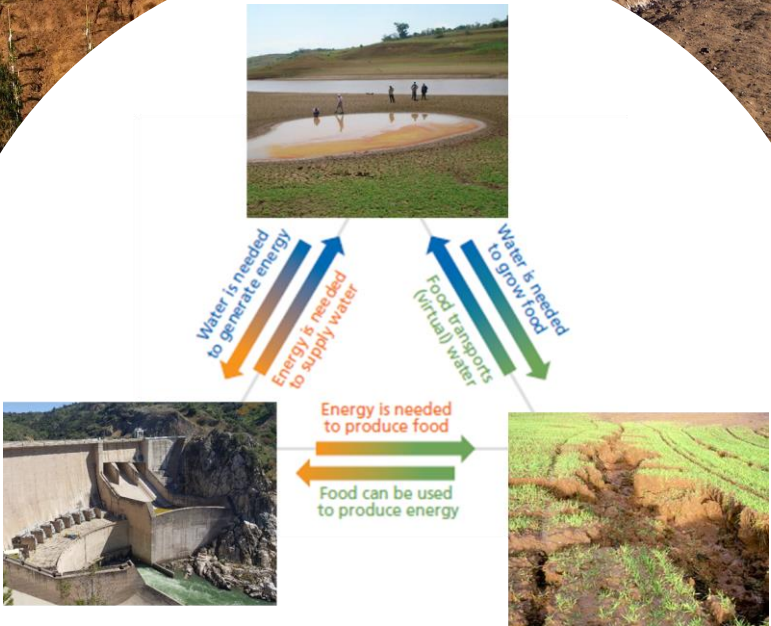
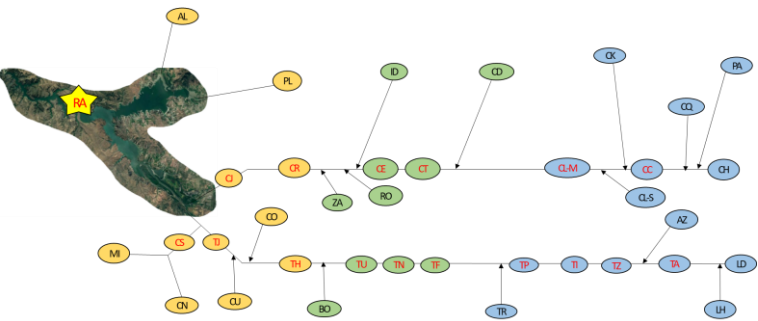
Connecting *hillslope to channel* in mixed land use  
Coastal Mountains catchment [CSSI/XRF]



Evaluate temporal dynamics of sediment and P  
contribution to lake sediment



Consideration of hillslope/source connectivity and residence  
time/transfer rates is critical within basin-wide diagnostics approach...





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