Supplementary Materials

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The results of feature selection, correlation analysis, variable importance, PC algorithm, and models' performances for each signature are as follows:

1 Baseflow Index (baseflow_index)

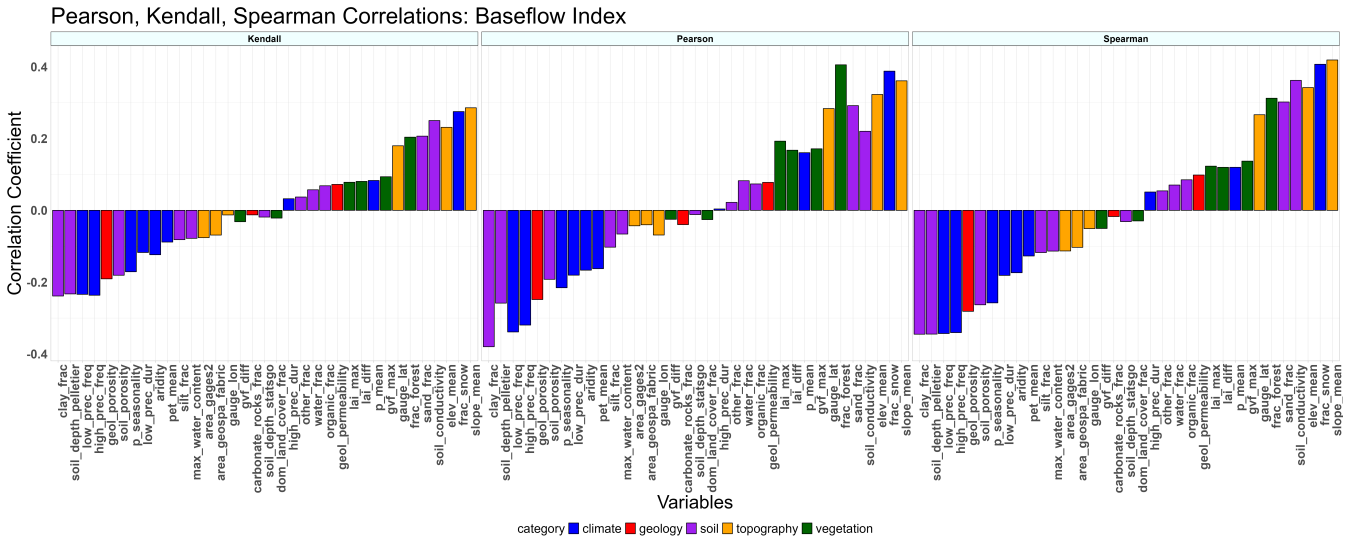

Fig S 1. Correlation analysis between catchment and climate attributes and baseflow index

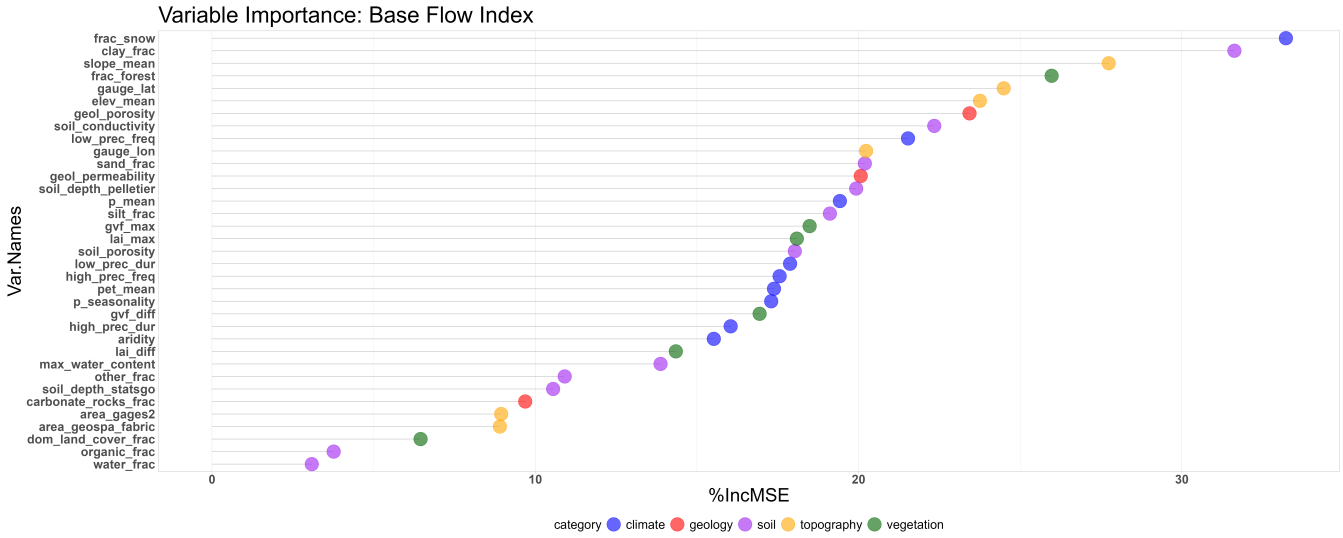

Fig S 2. Random forest variable importance analysis between catchment and climate attributes and baseflow index

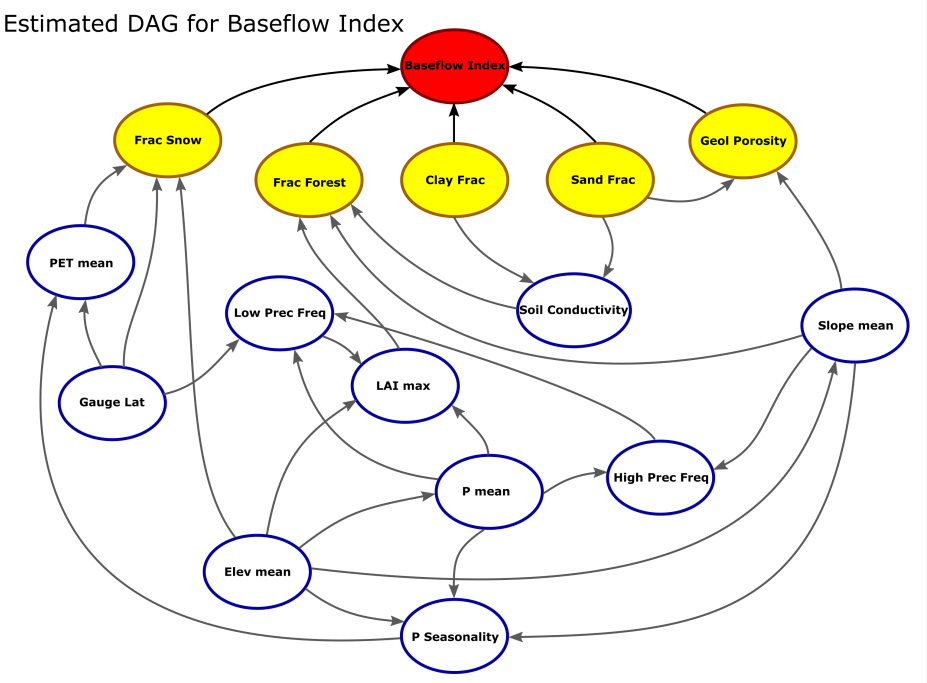

Fig S 3. Directed acyclic graph and selected variables for baseflow index.

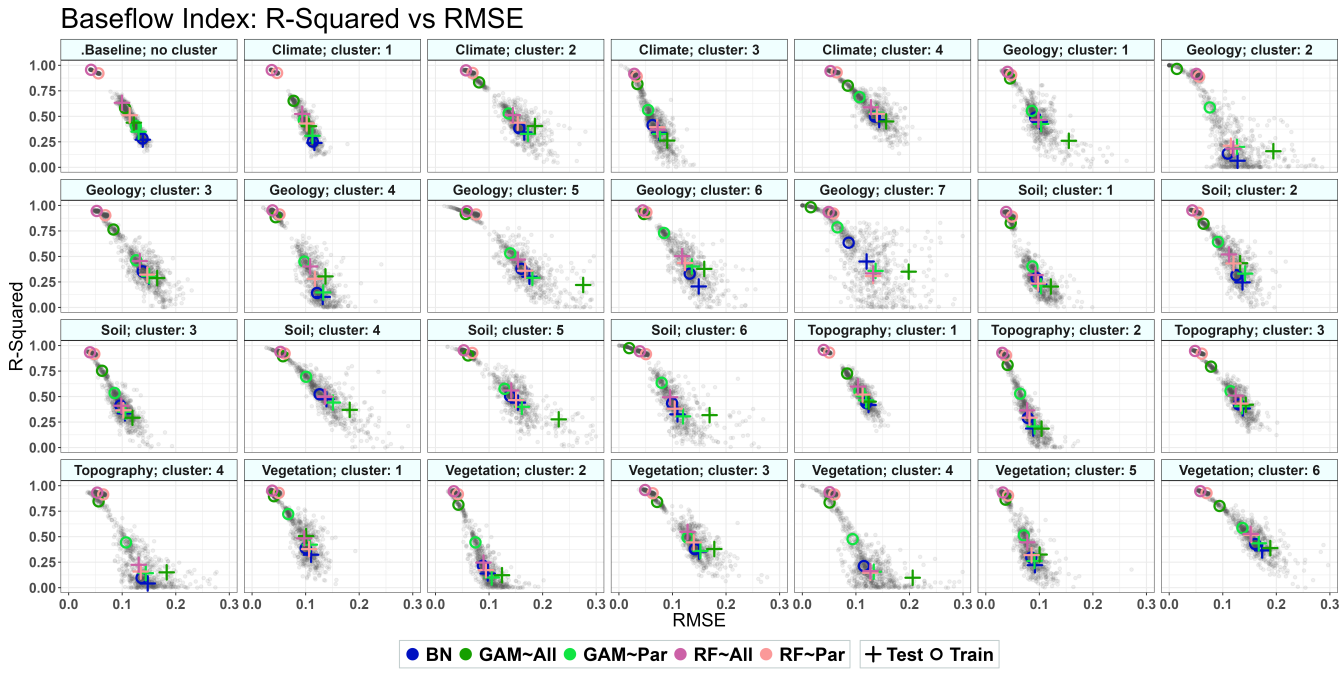

Fig S 4. R squared vs RMSE in each cluster for all models for baseflow index.

2 High Flow Duration (high_q_dur)

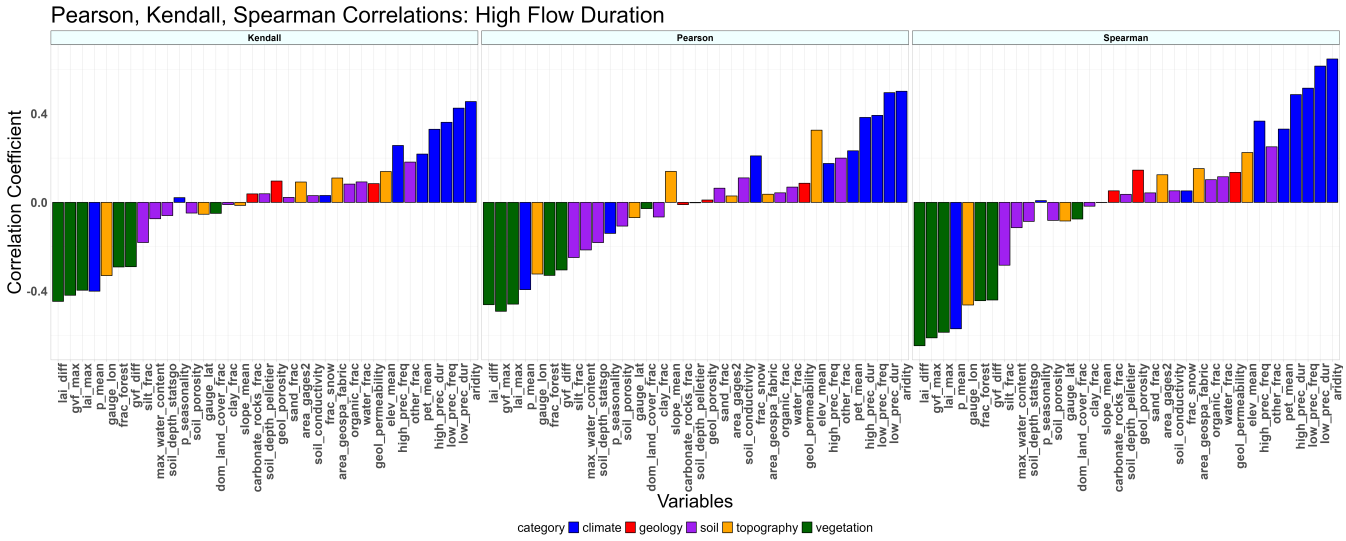

Fig S 5. Correlation analysis between catchment and climate attributes and high flow duration

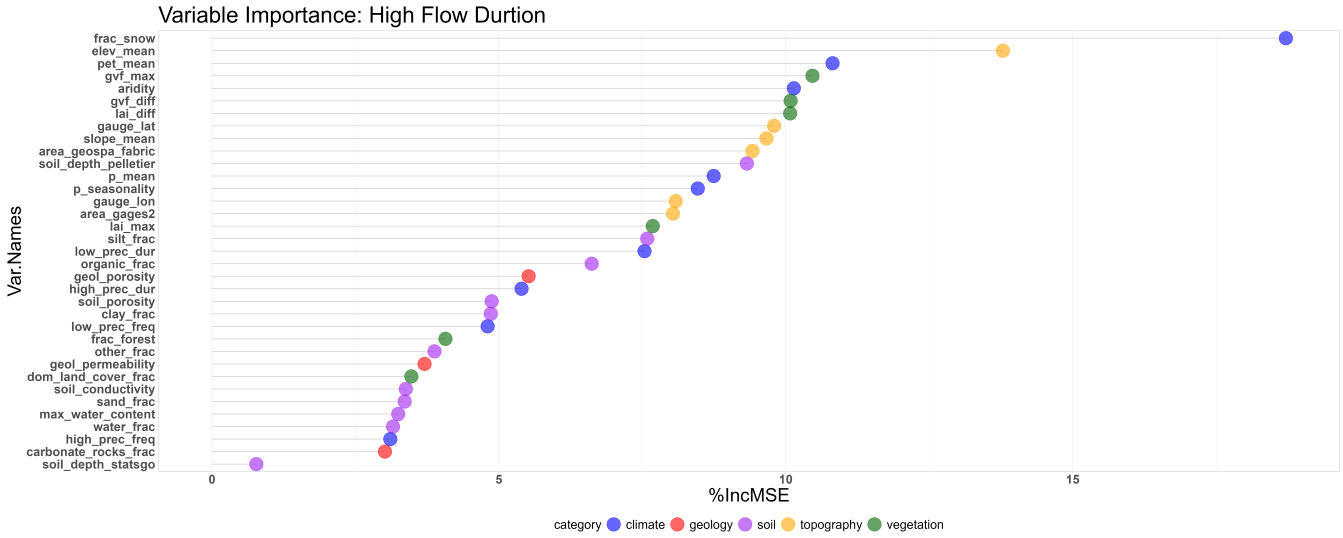

Fig S 6. Random forest variable importance analysis between catchment and climate attributes and high flow duration

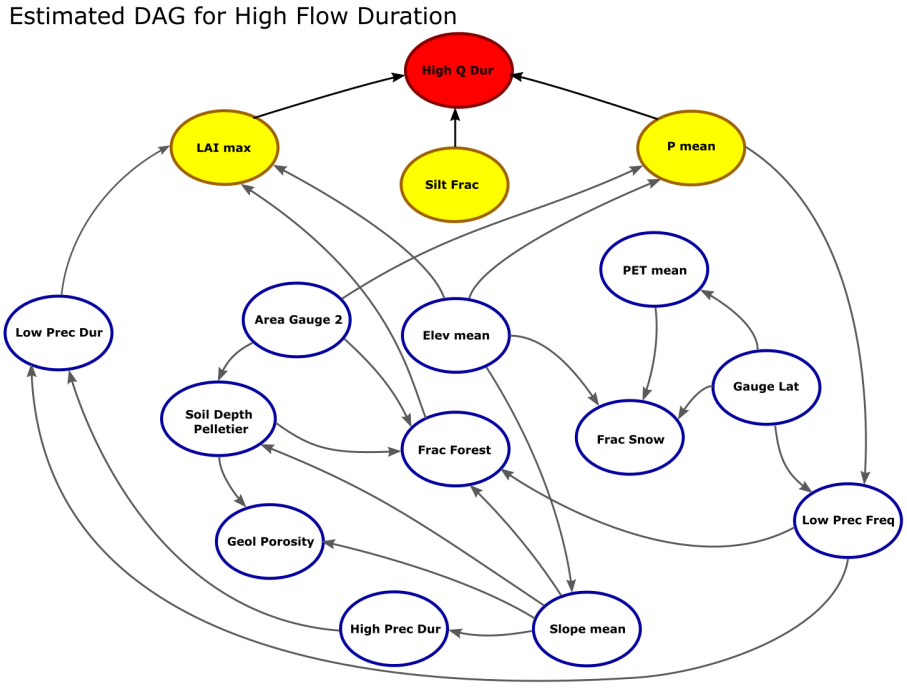

Fig S 7. Directed acyclic graph and selected variables for high flow duration

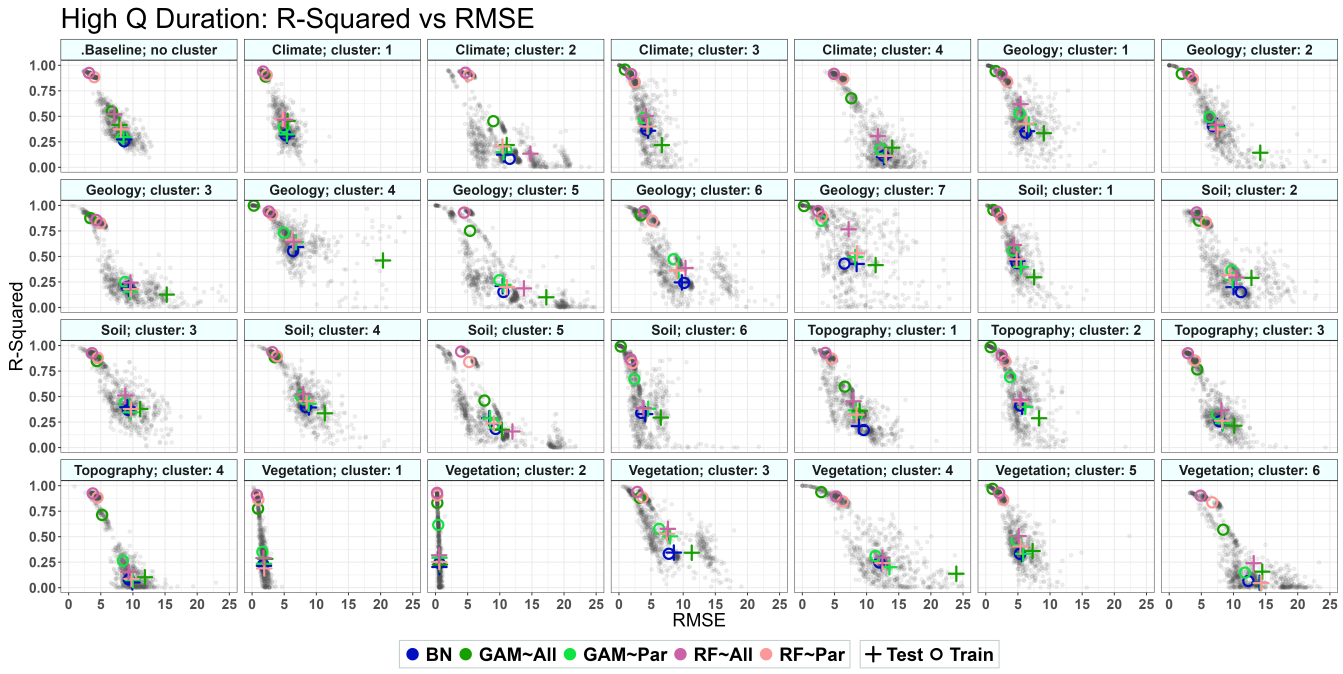

Fig S 8. R squared vs RMSE in each cluster for all models for high flow duration.

3 High Flow Frequency (high_q_freq)

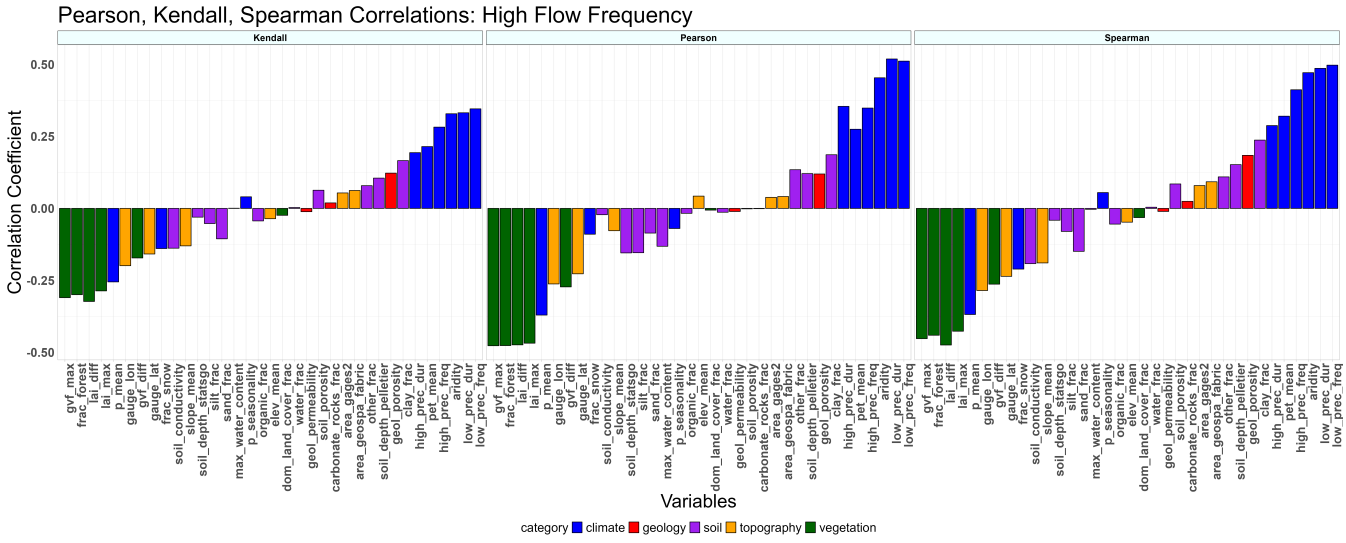

Fig S 9. Correlation analysis between catchment and climate attributes and high flow frequency

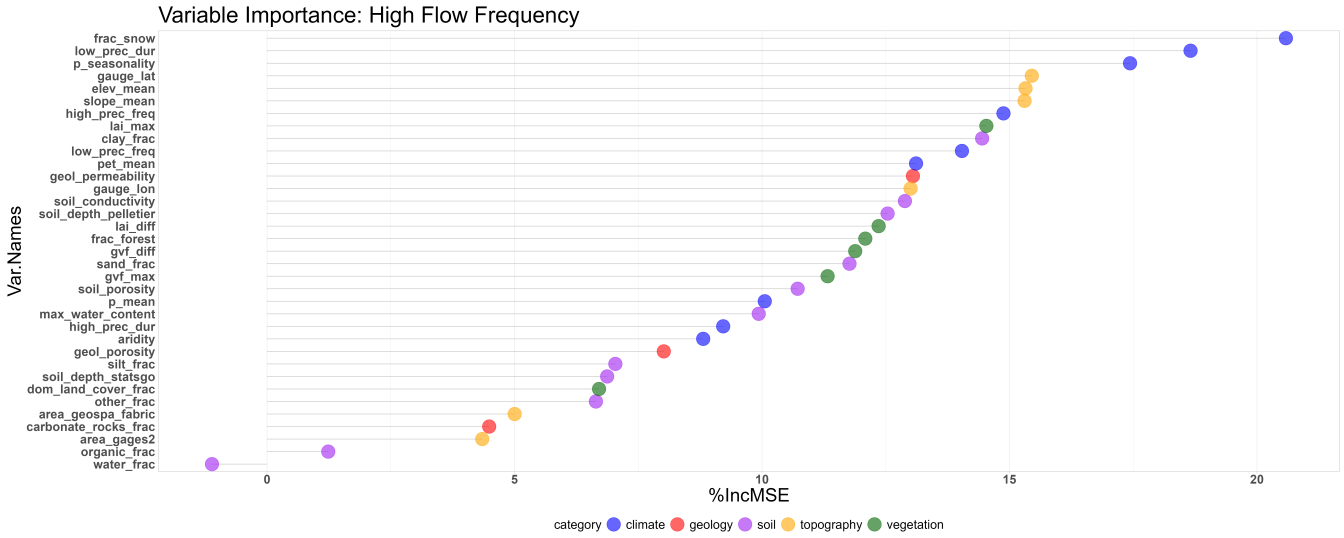

Fig S 10. Random forest variable importance analysis between catchment and climate attributes and high flow frequency

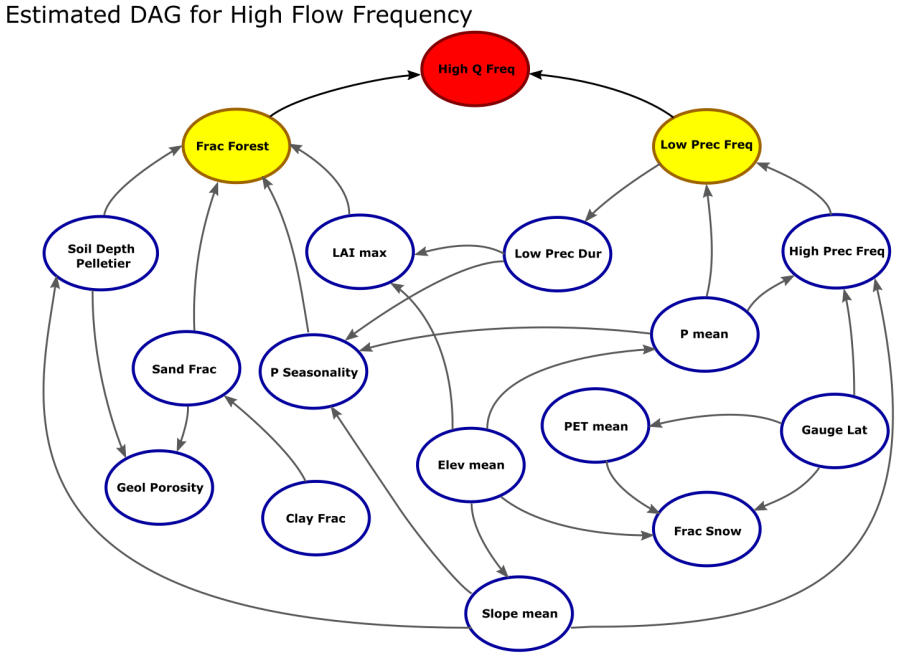

Fig S 11. Directed acyclic graph and selected variables for high flow frequency

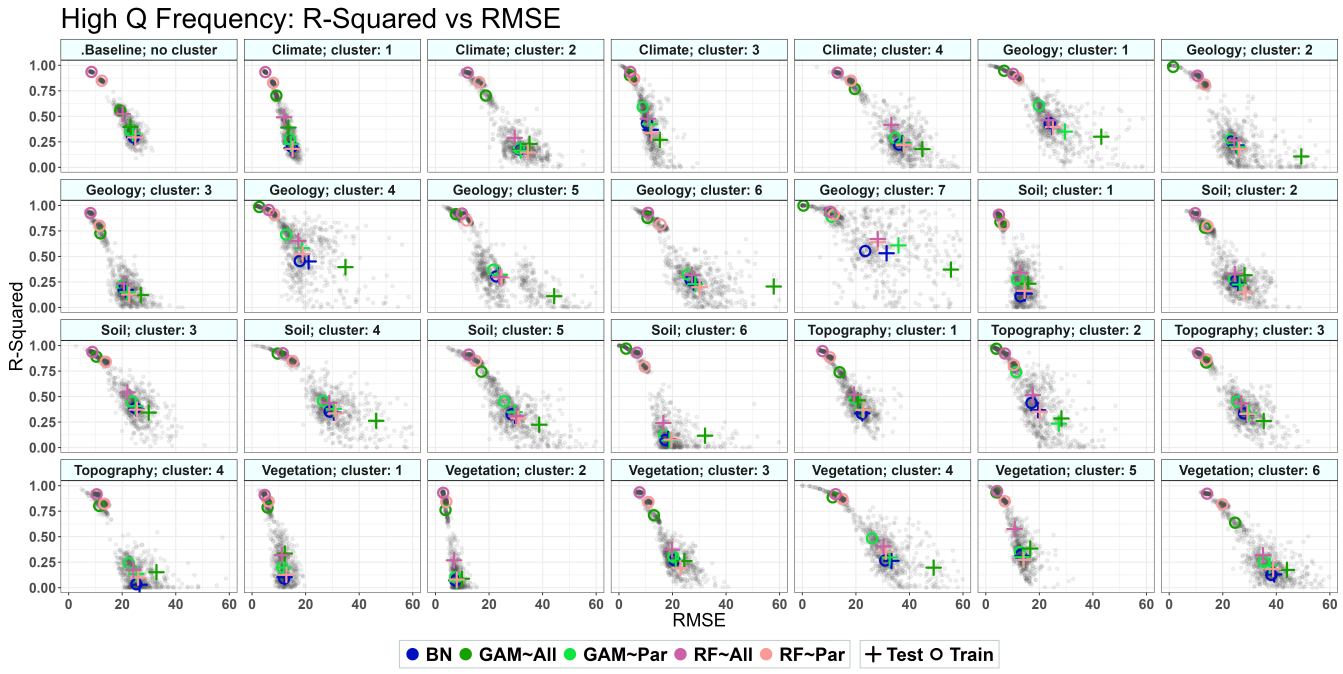

Fig S 12. R squared vs RMSE in each cluster for all models for high flow frequency.

4 Low Flow Duration (low_q_dur)

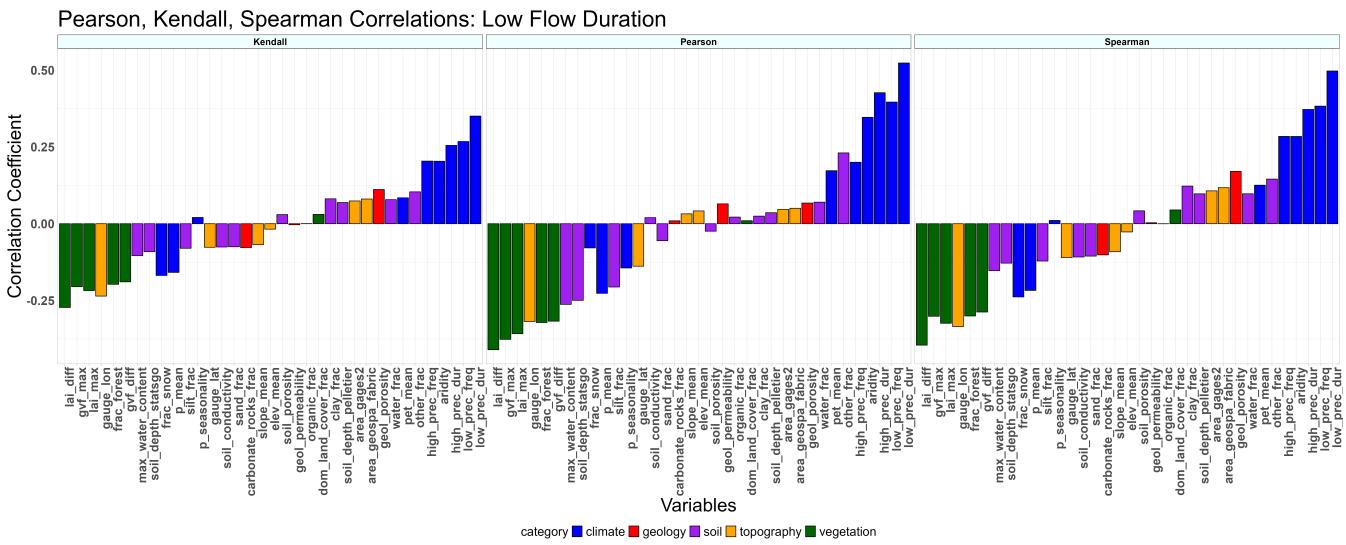

Fig S 13. Correlation analysis between catchment and climate attributes and low flow duration

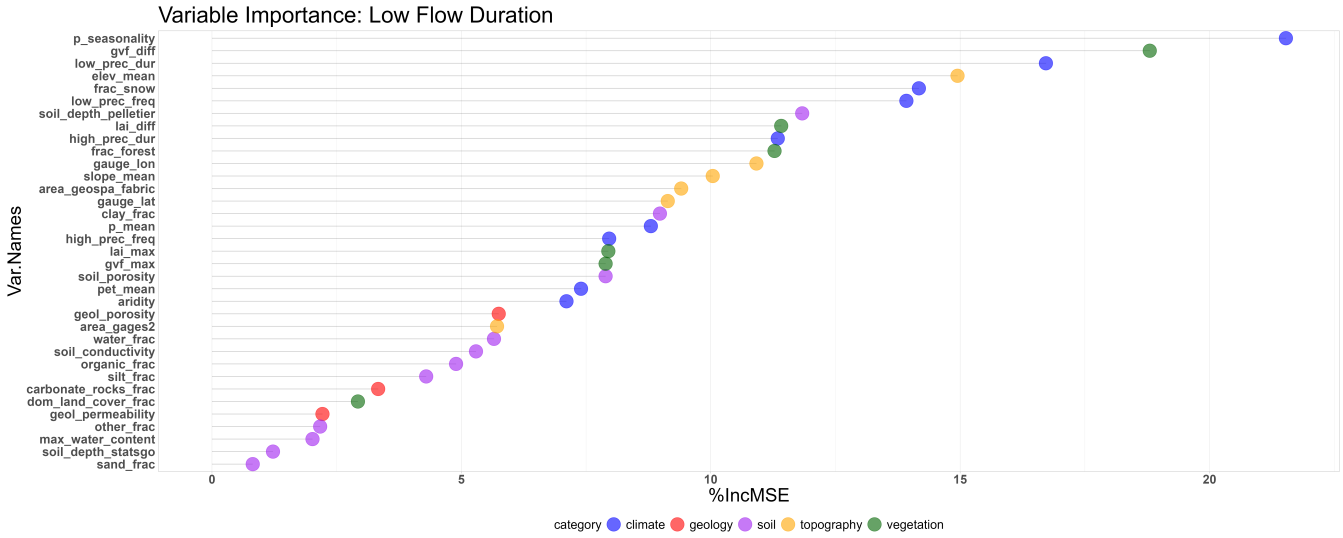

Fig S 14. Random forest variable importance analysis between catchment and climate attributes and low flow duration

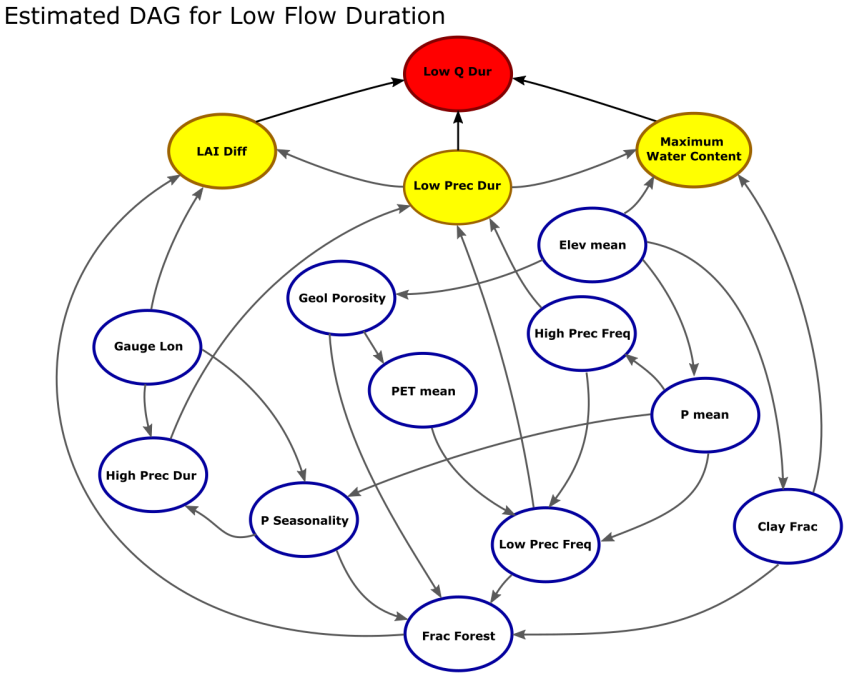

Fig S 15. Directed acyclic graph and selected variables for low flow duration

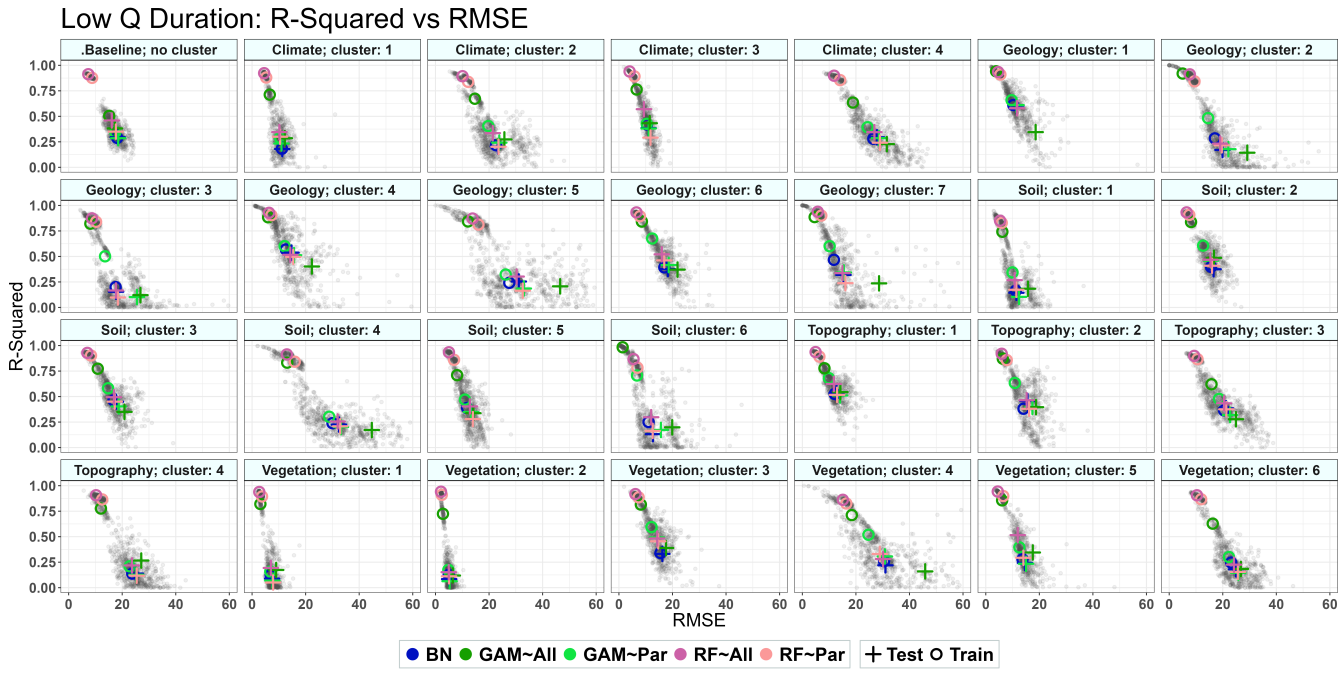

Fig S 16. R squared vs RMSE in each cluster for all models for low flow duration.

5 Low Flow Frequency (low_q_freq)

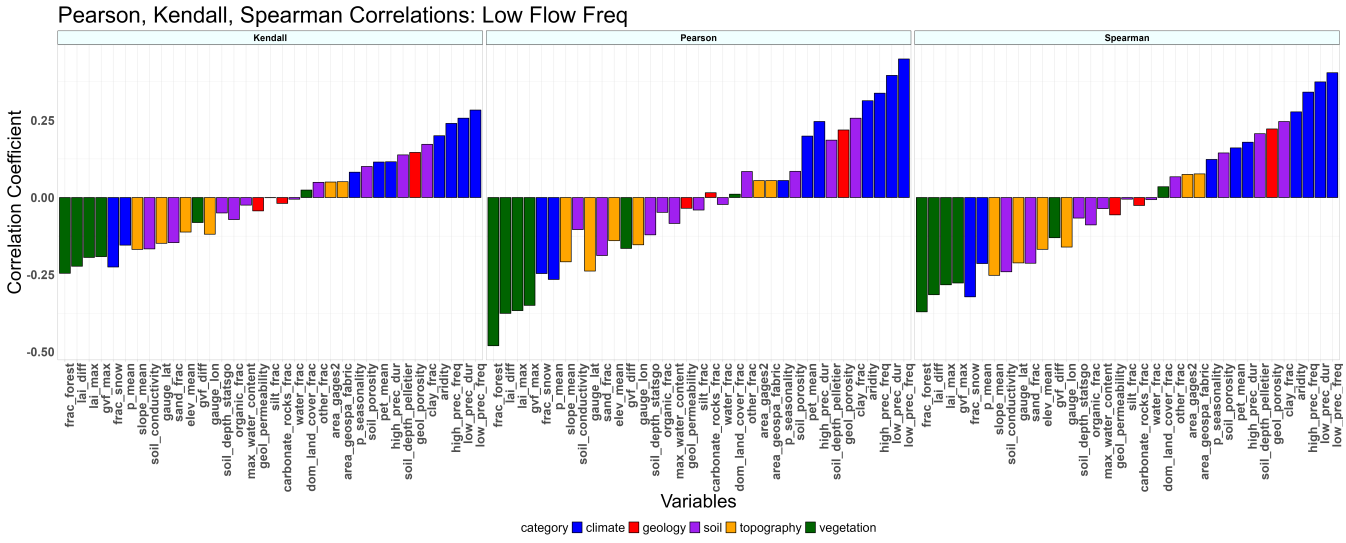

Fig S 17. Correlation analysis between catchment and climate attributes and low flow frequency

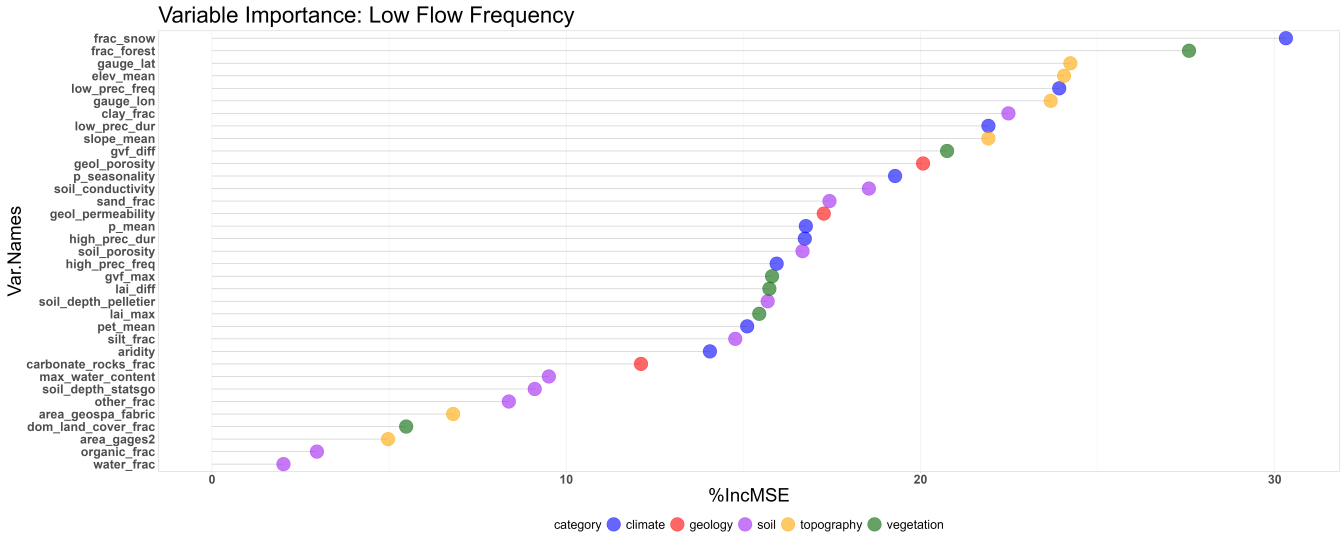

Fig S 18. Random forest variable importance analysis between catchment and climate attributes and low flow frequency

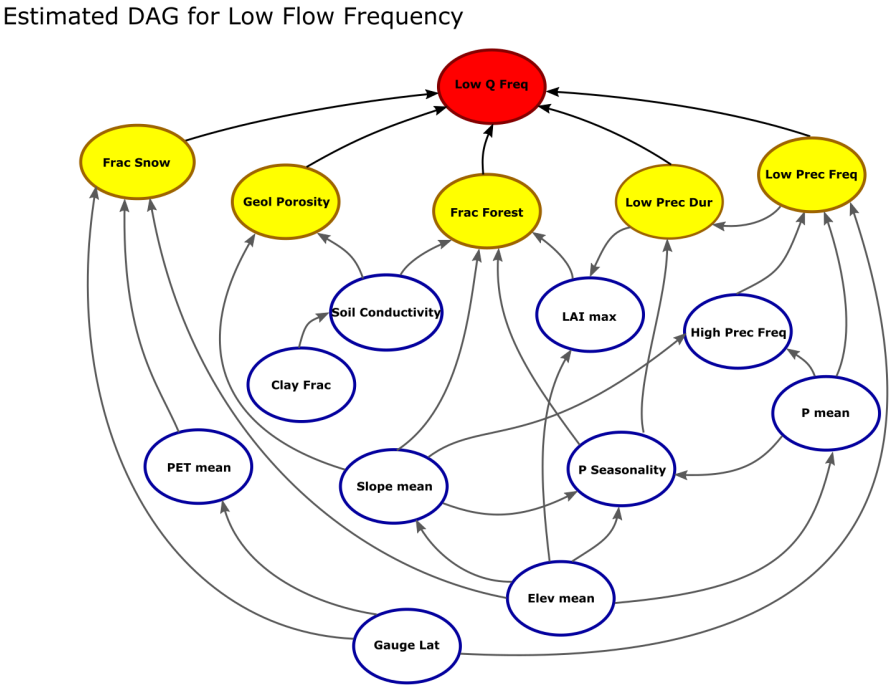

Fig S 19. Directed acyclic graph and selected variables for low flow frequency

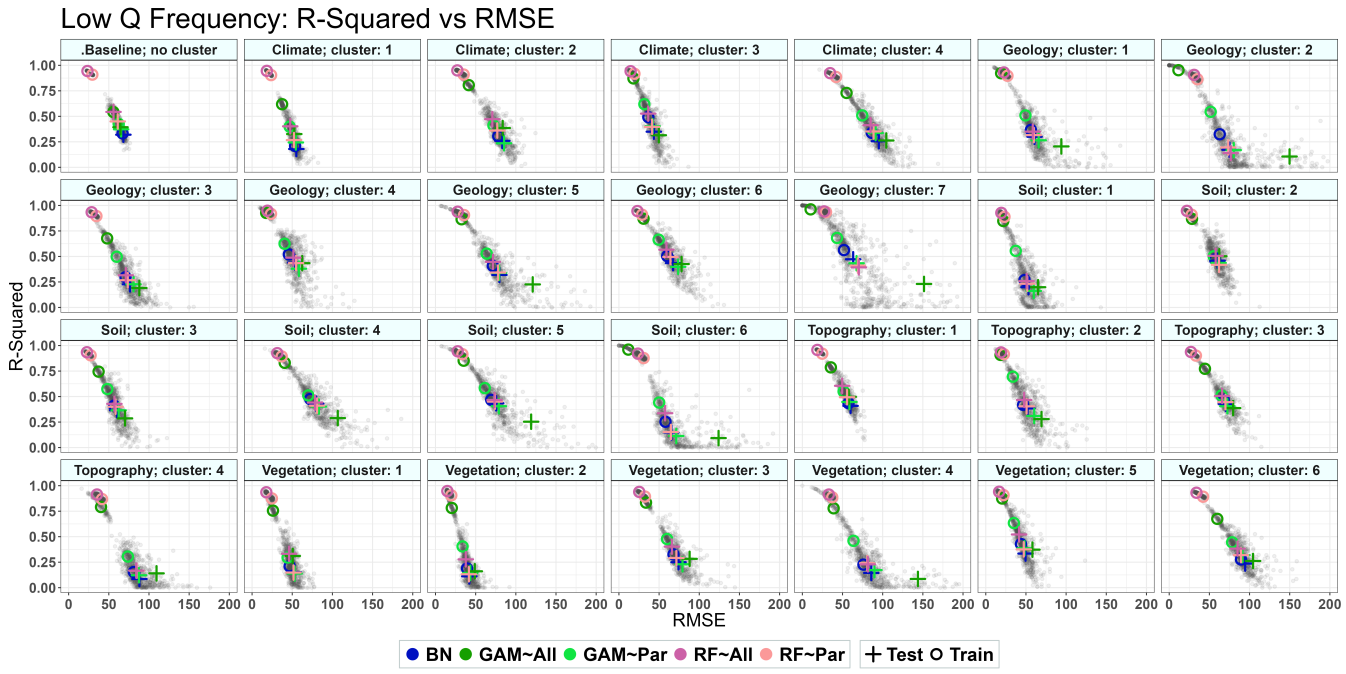

Fig S 20. R squared vs RMSE in each cluster for all models for low flow frequency.

6 Mean Daily Discharge (q_mean)

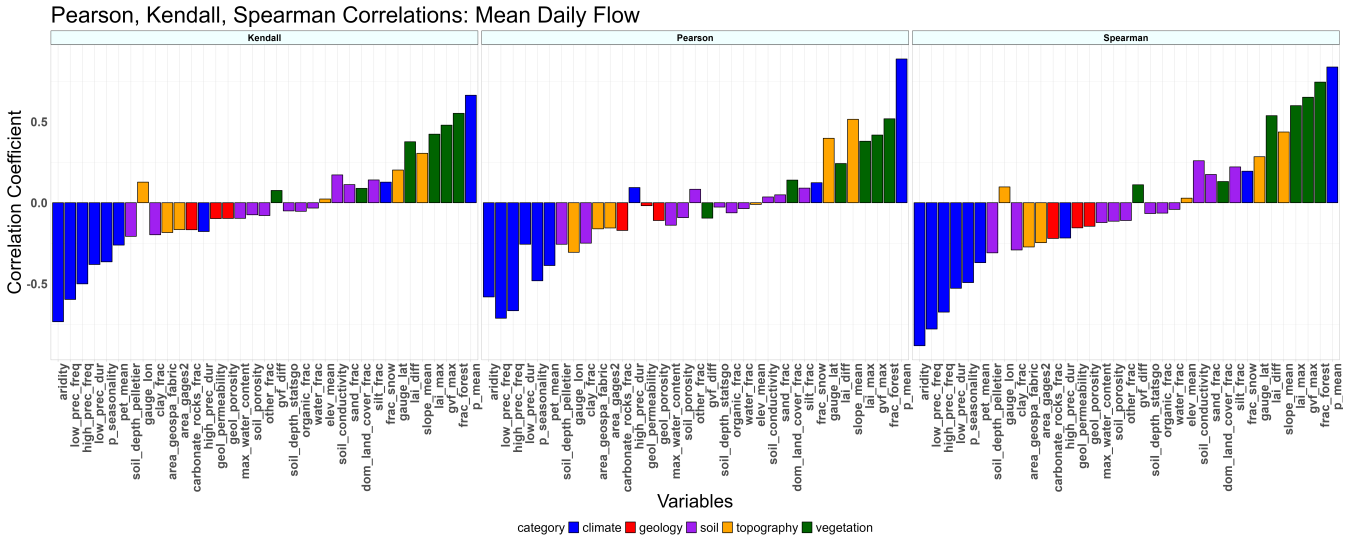

Fig S 21. Correlation analysis between catchment and climate attributes and mean daily flow

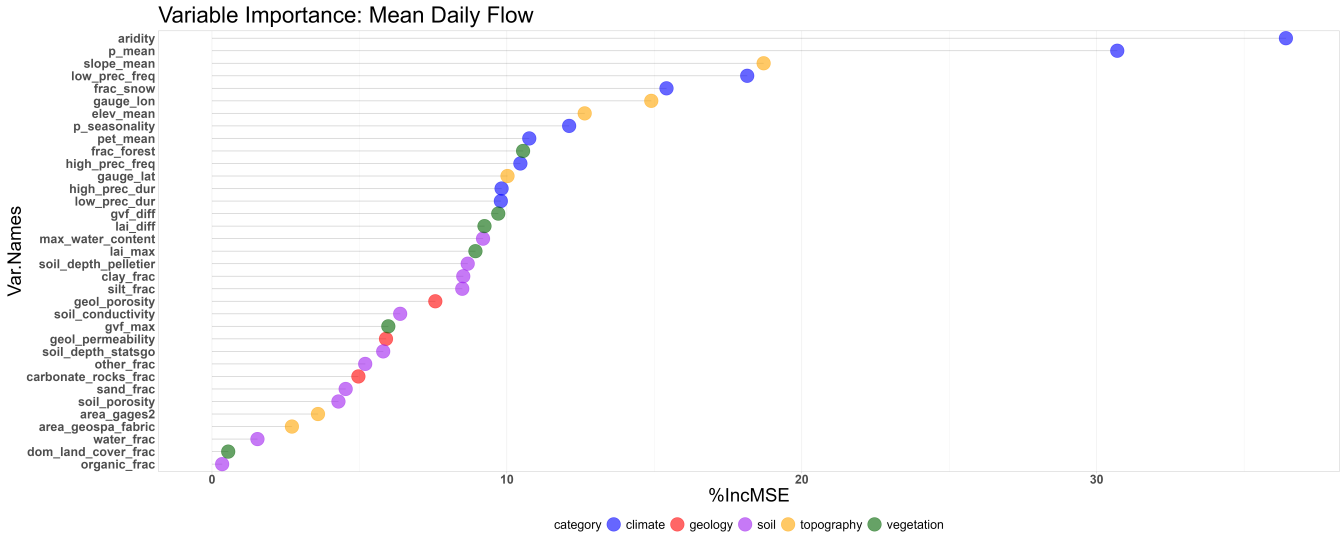

Fig S 22. Random forest variable importance analysis between catchment and climate attributes and mean daily flow

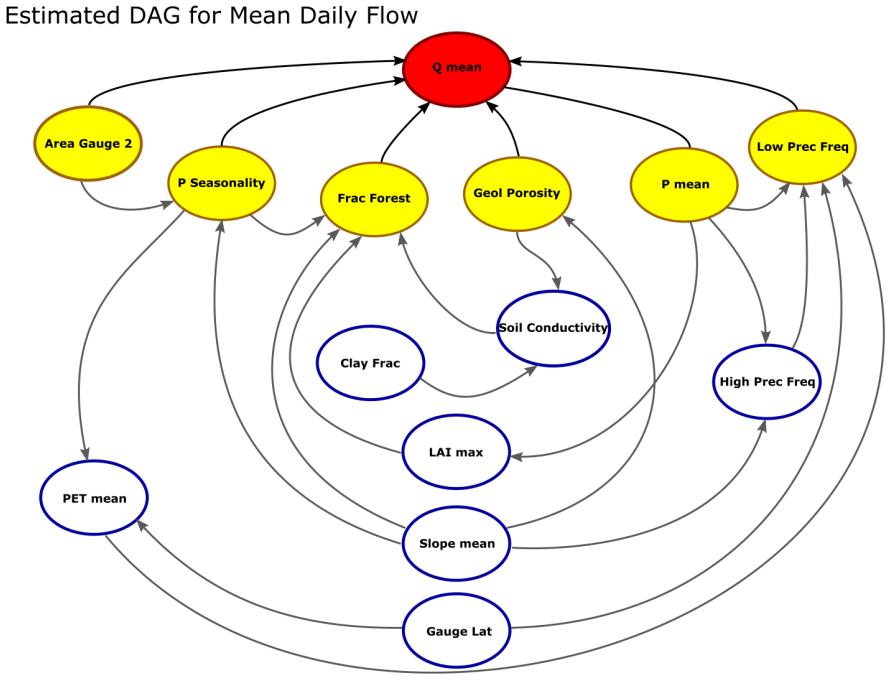

Fig S 23. Directed acyclic graph and selected variables for mean daily flow

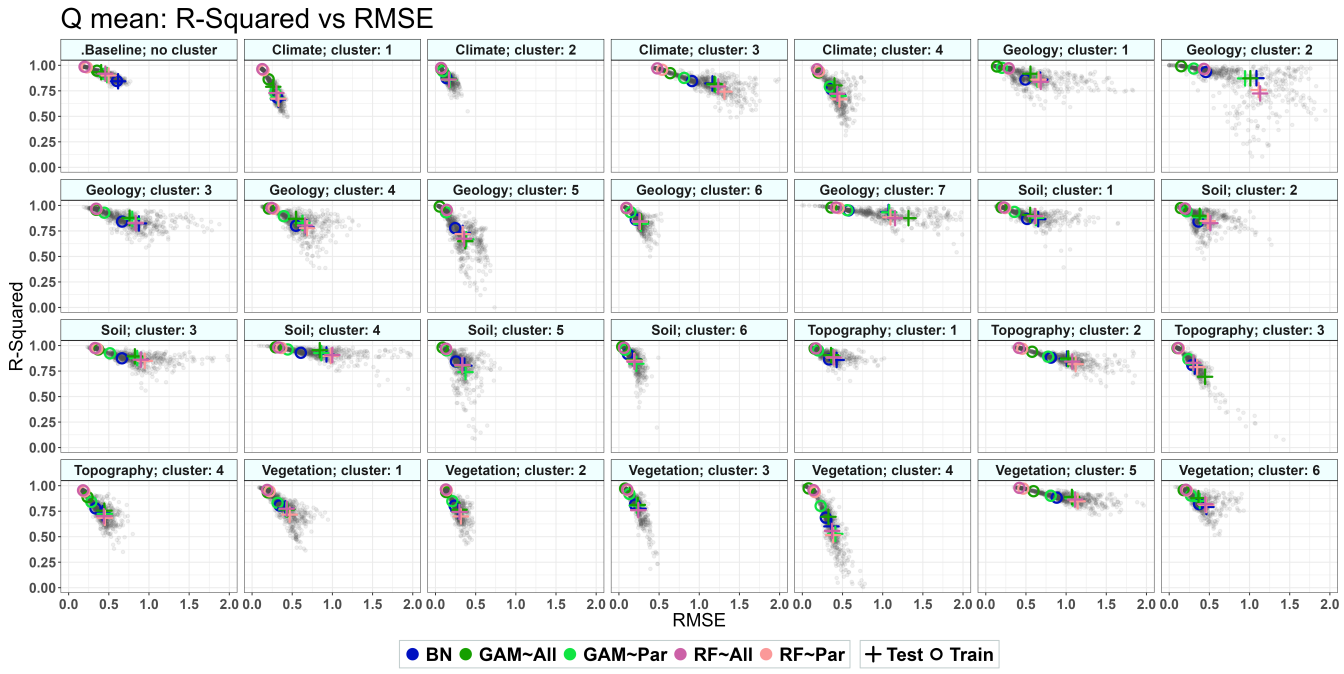

Fig S 24. R squared vs RMSE in each cluster for all models for mean daily flow.

7 Low Flow (Q5)

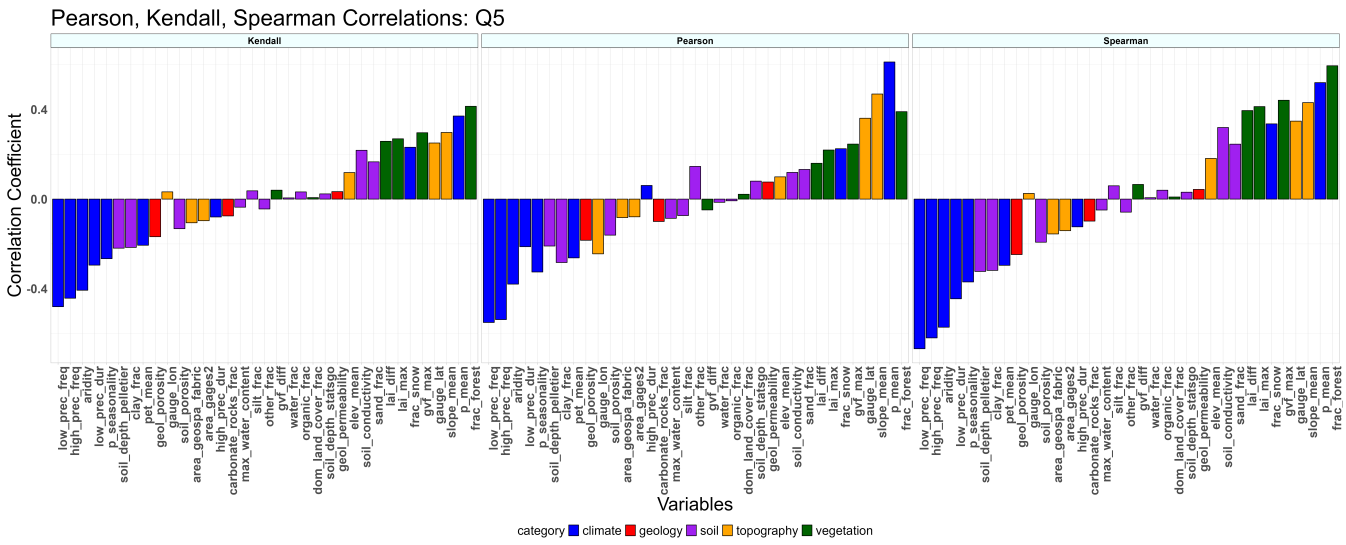

Fig S 25. Correlation analysis between catchment and climate attributes and low flow

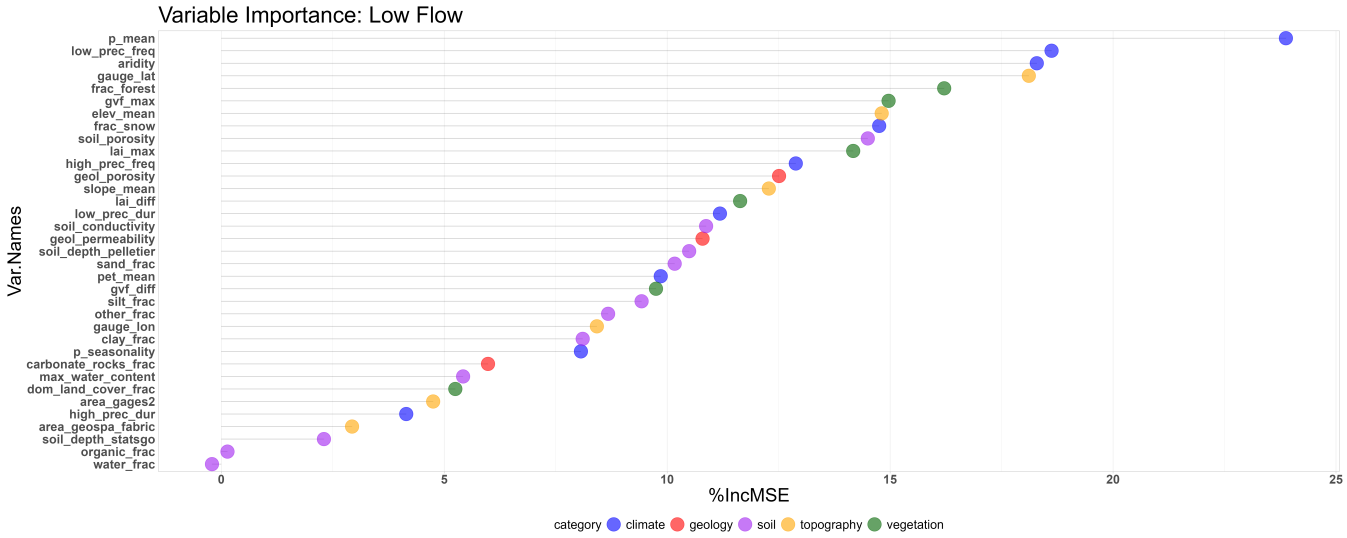

Fig S 26. Random forest variable importance analysis between catchment and climate attributes and low flow

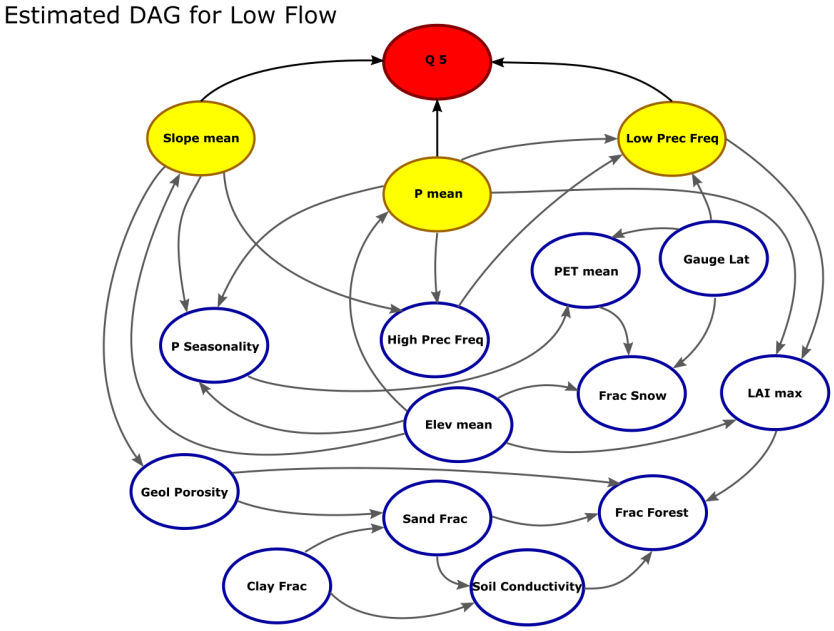

Fig S 27. Directed acyclic graph and selected variables for low flow

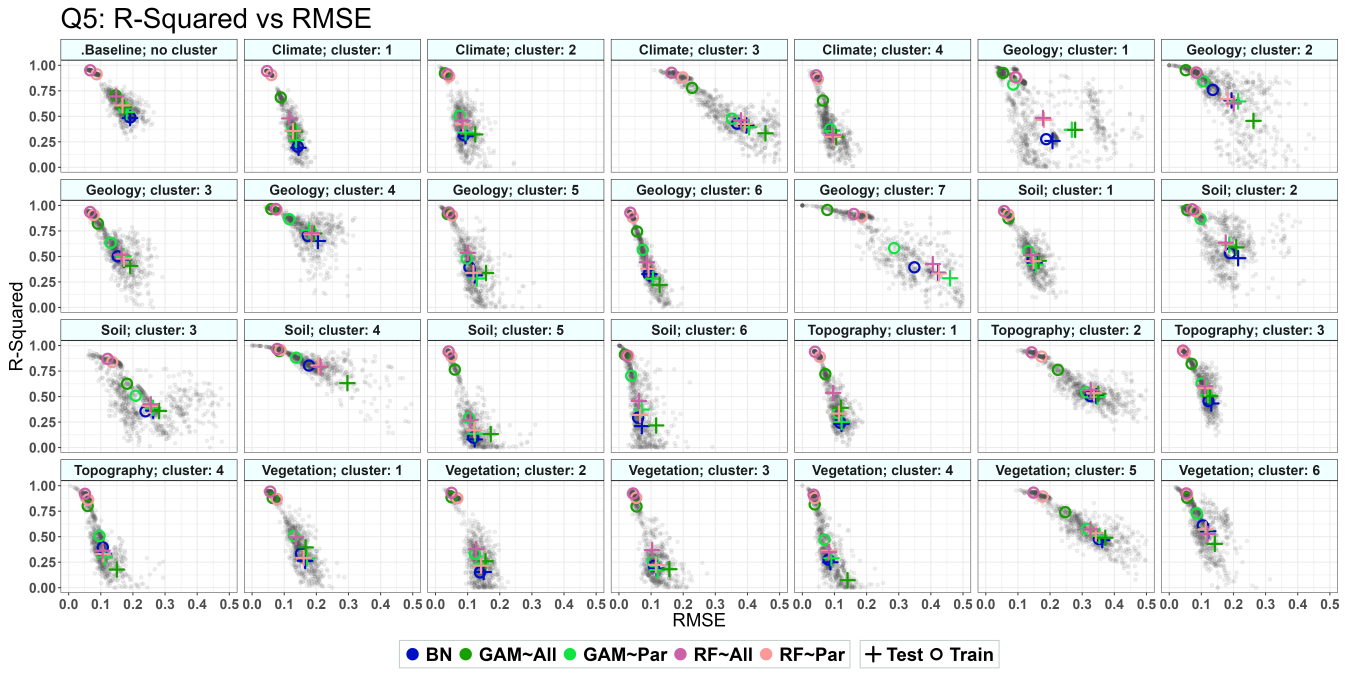

Fig S 28. R squared vs RMSE in each cluster for all models for low flow.

8 High Flow (Q95)

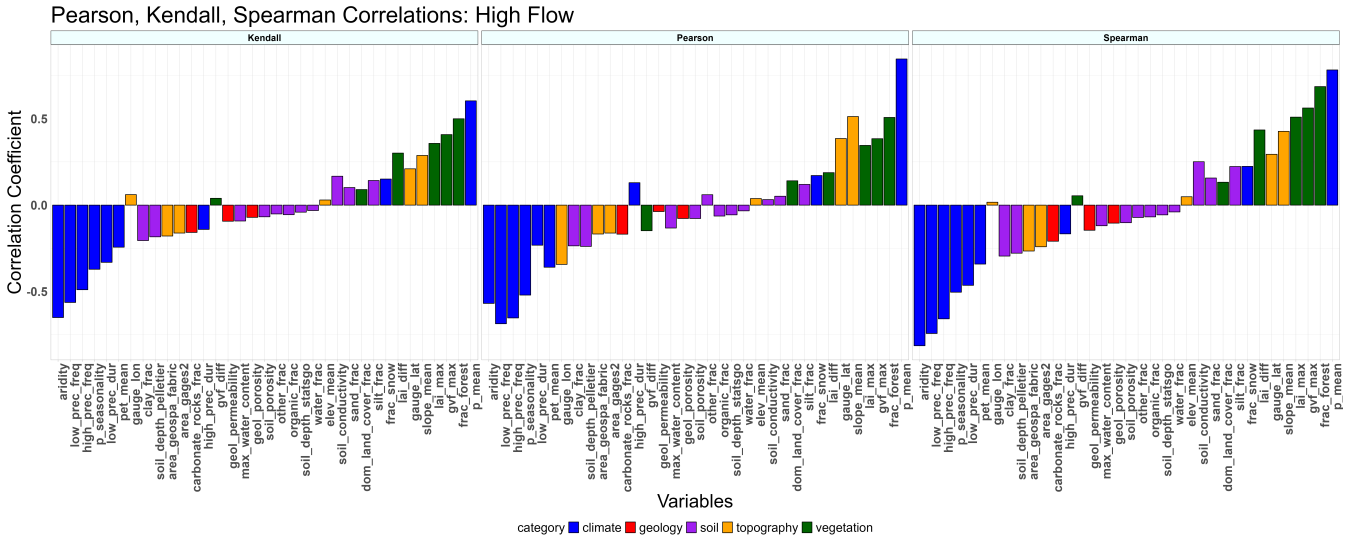

Fig S 29. Correlation analysis between catchment and climate attributes and high flow

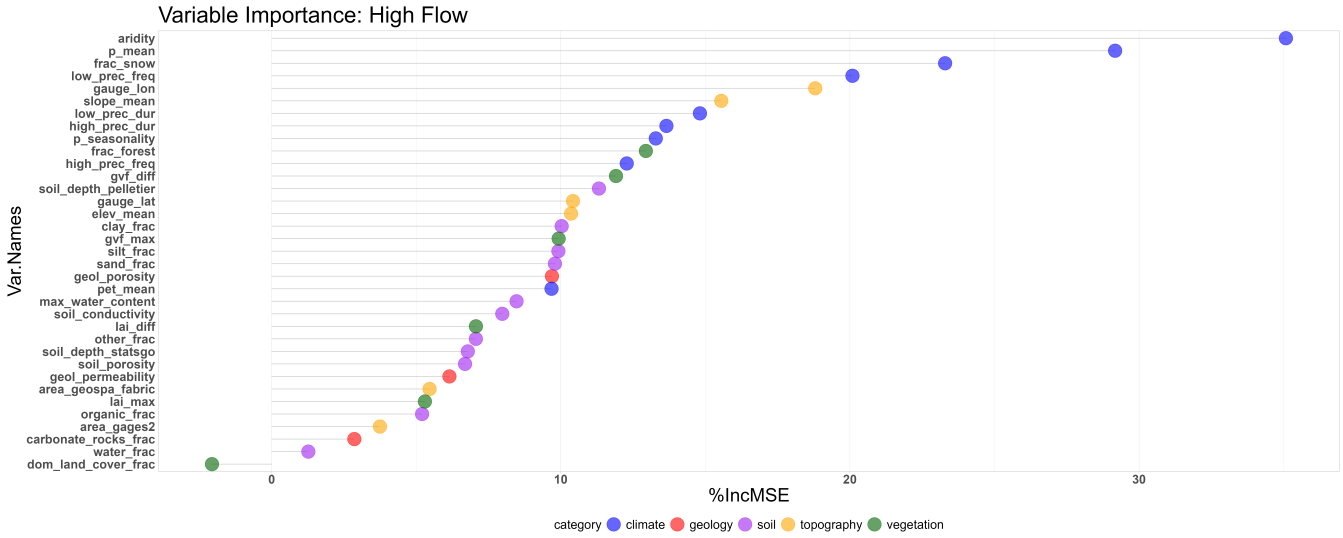

Fig S 30. Random forest variable importance analysis between catchment and climate attributes and high flow

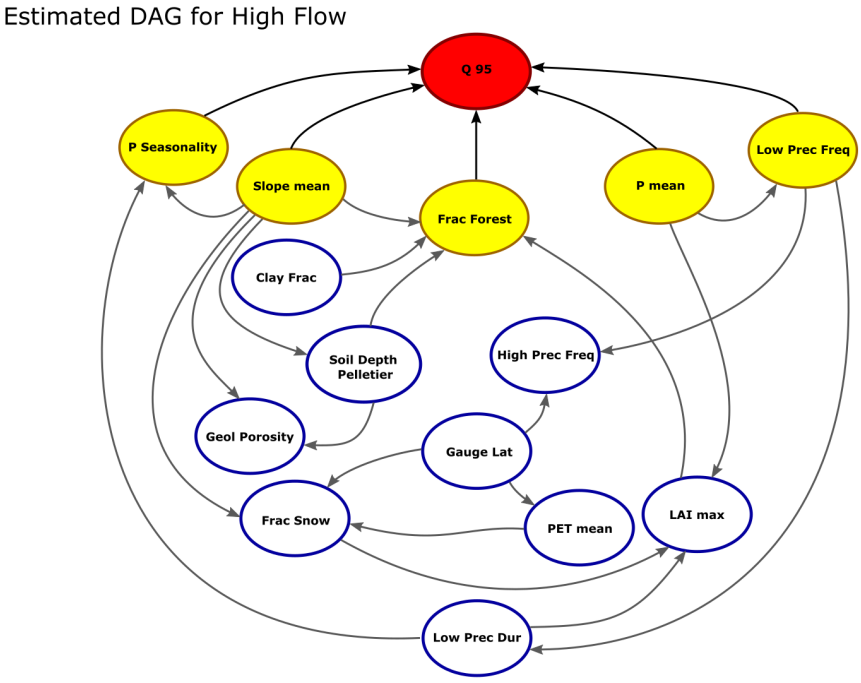

Fig S 31. Directed acyclic graph and selected variables for high flow

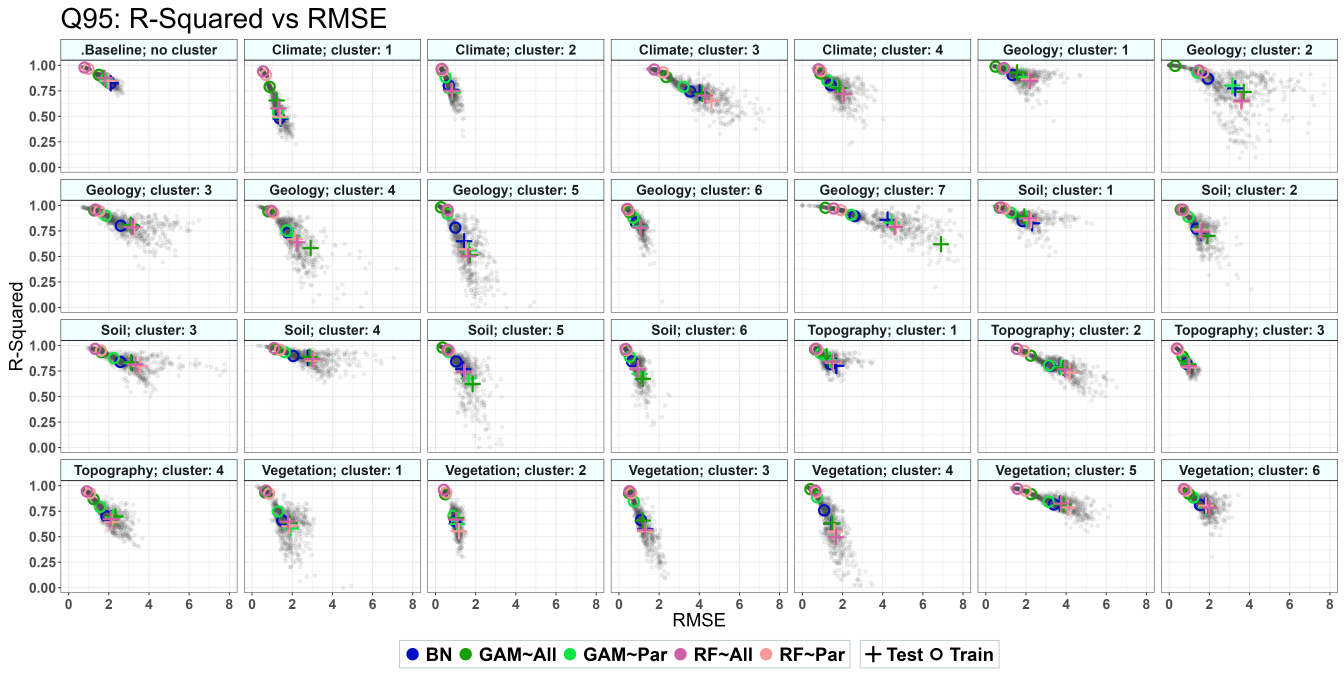

Fig S 32. R squared vs RMSE in each cluster for all models for high flow.

9 Runoff Ratio (runoff_ratio)

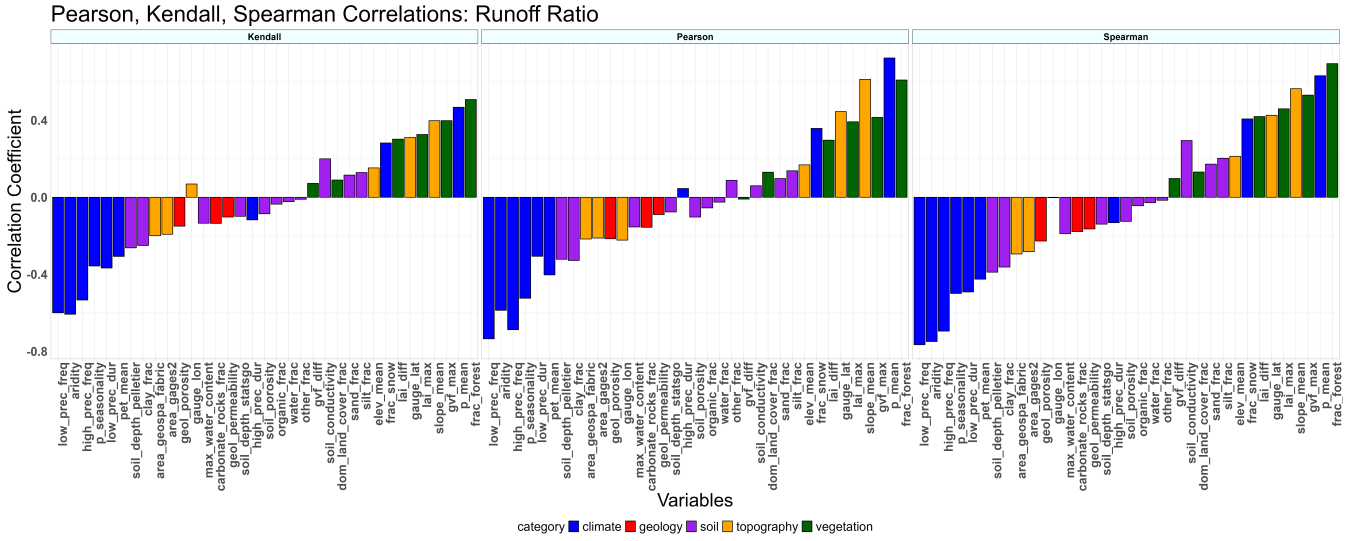

Fig S 33. Correlation analysis between catchment and climate attributes and runoff ratio

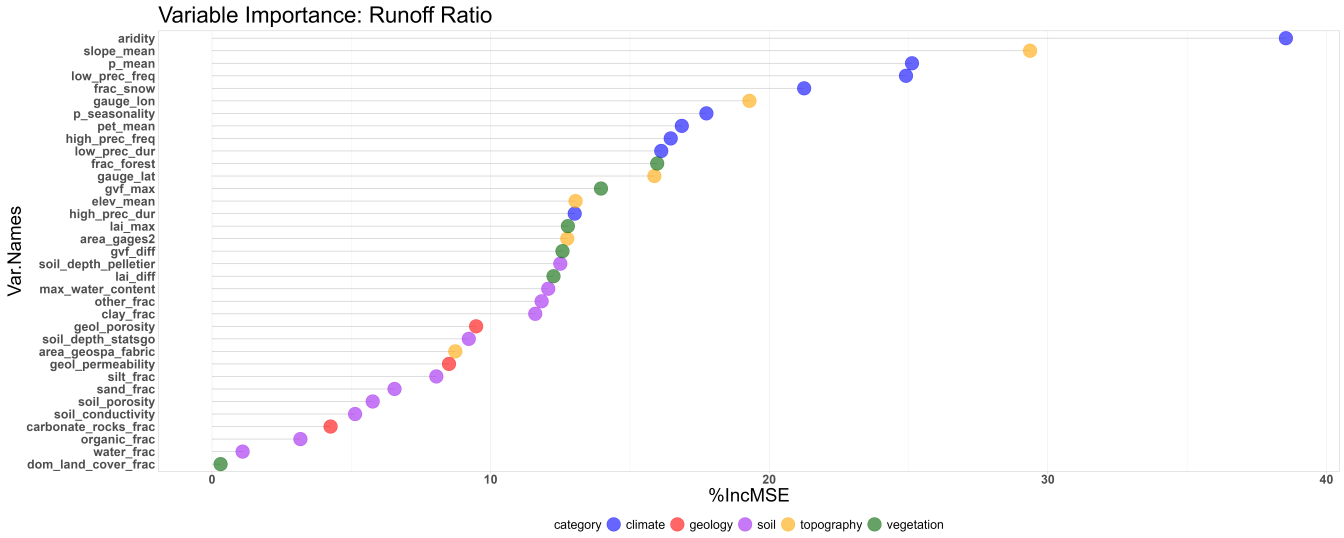

Fig S 34. Random forest variable importance analysis between catchment and climate attributes and runoff ratio

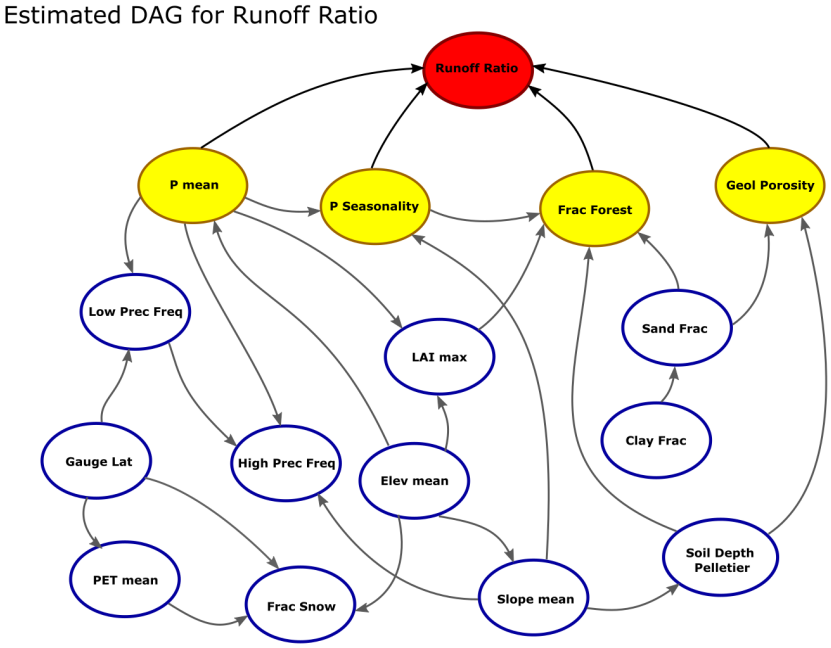

Fig S 35. Directed acyclic graph and selected variables for runoff ratio

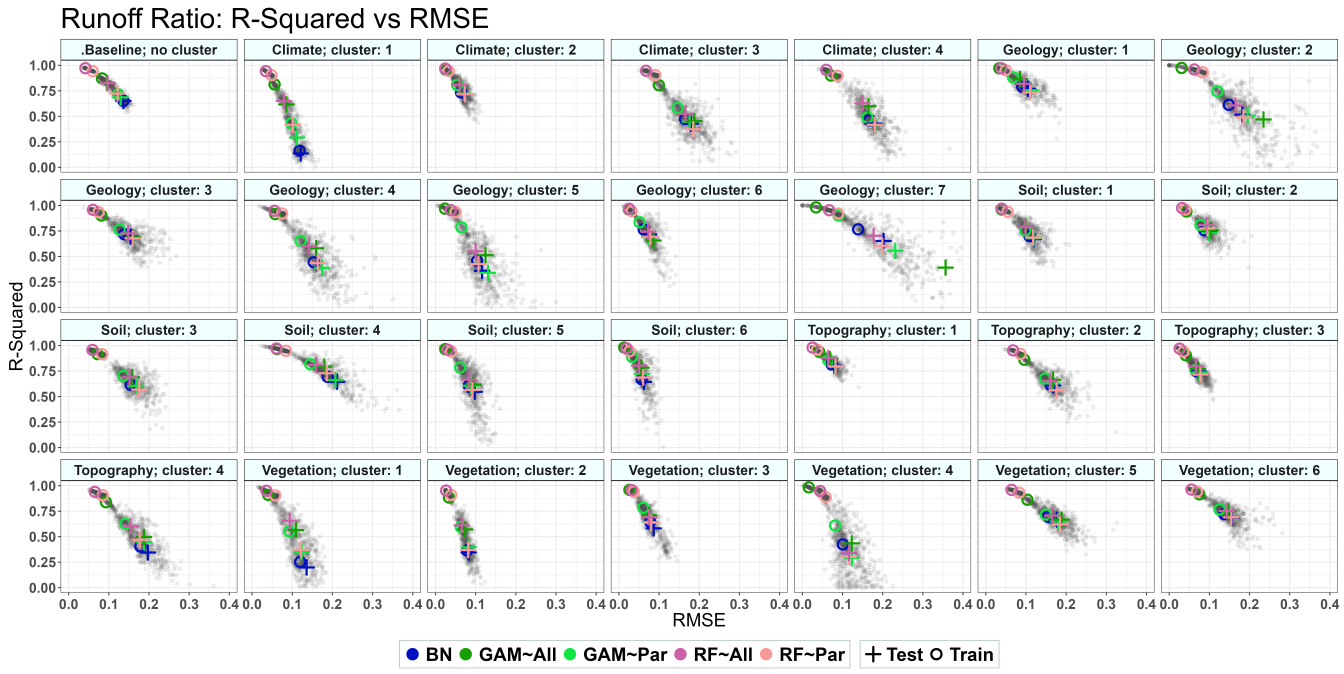

Fig S 36. R squared vs RMSE in each cluster for all models for runoff ratio.

10 Slope of Flow Duration Curve (slope_FDC)

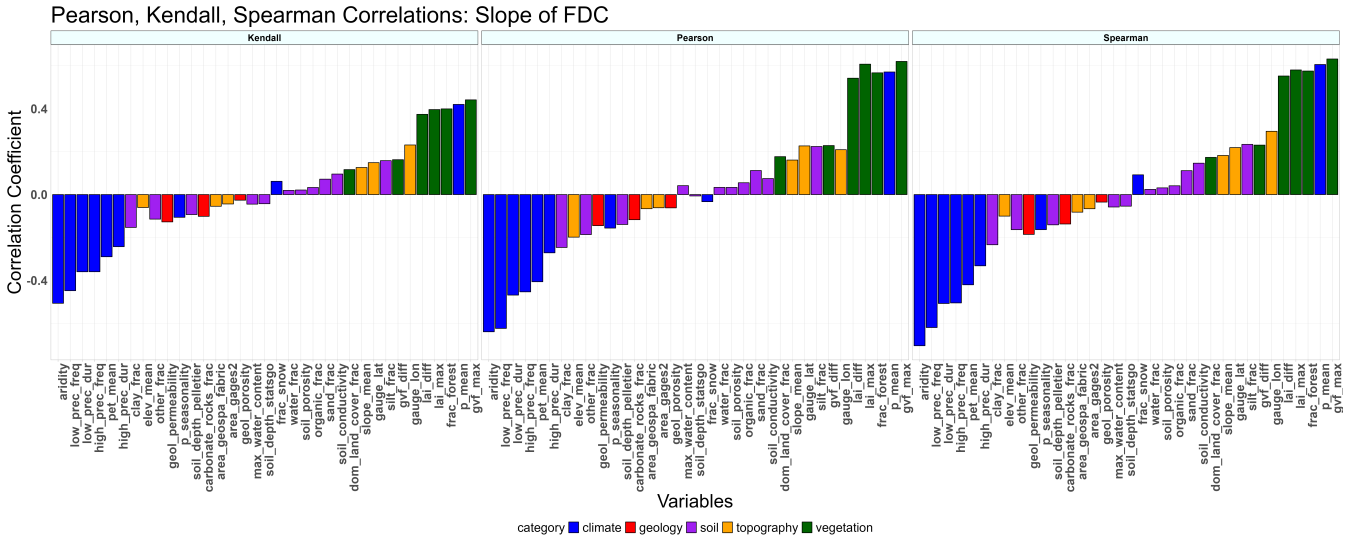

Fig S 37. Correlation analysis between catchment and climate attributes and the slope of flow duration curve

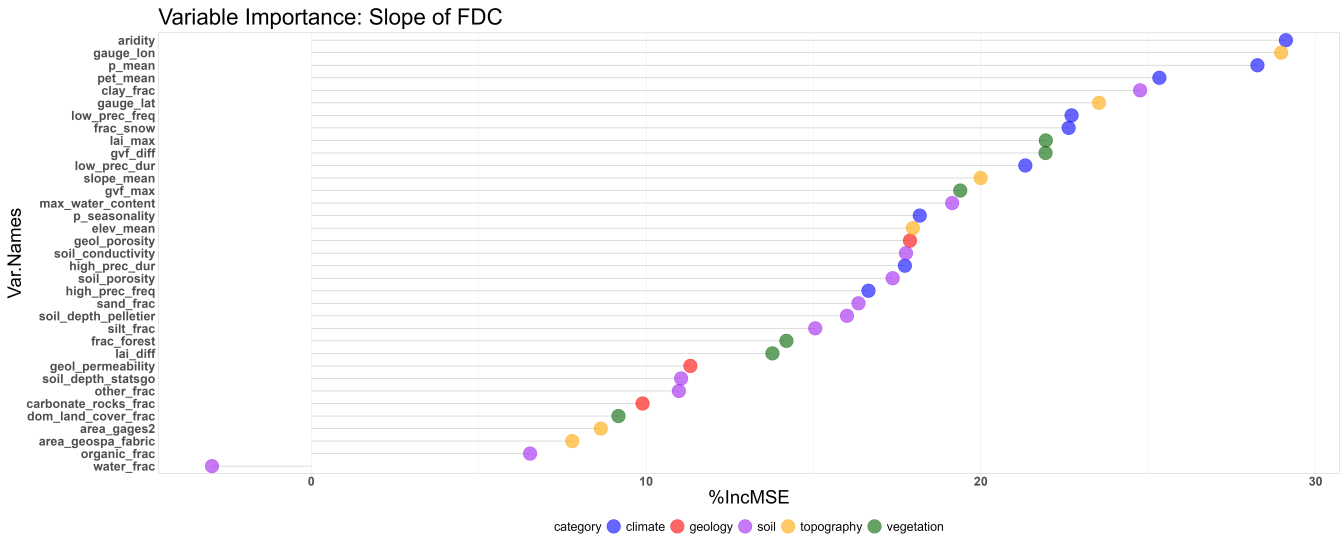

Fig S 38. Random forest variable importance analysis between catchment and climate attributes and the slope of flow duration curve

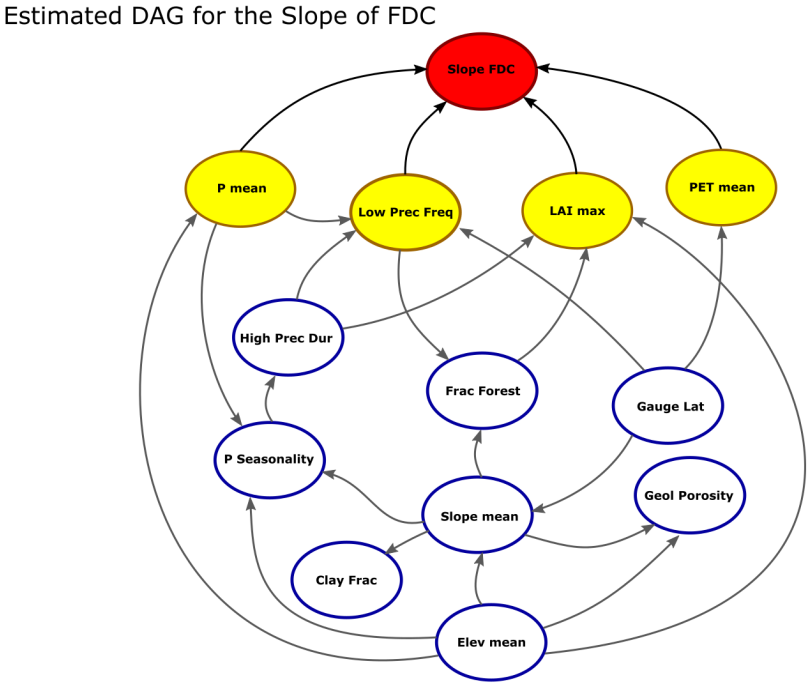

Fig S 39. Directed acyclic graph and selected variables for the slope of flow duration curve

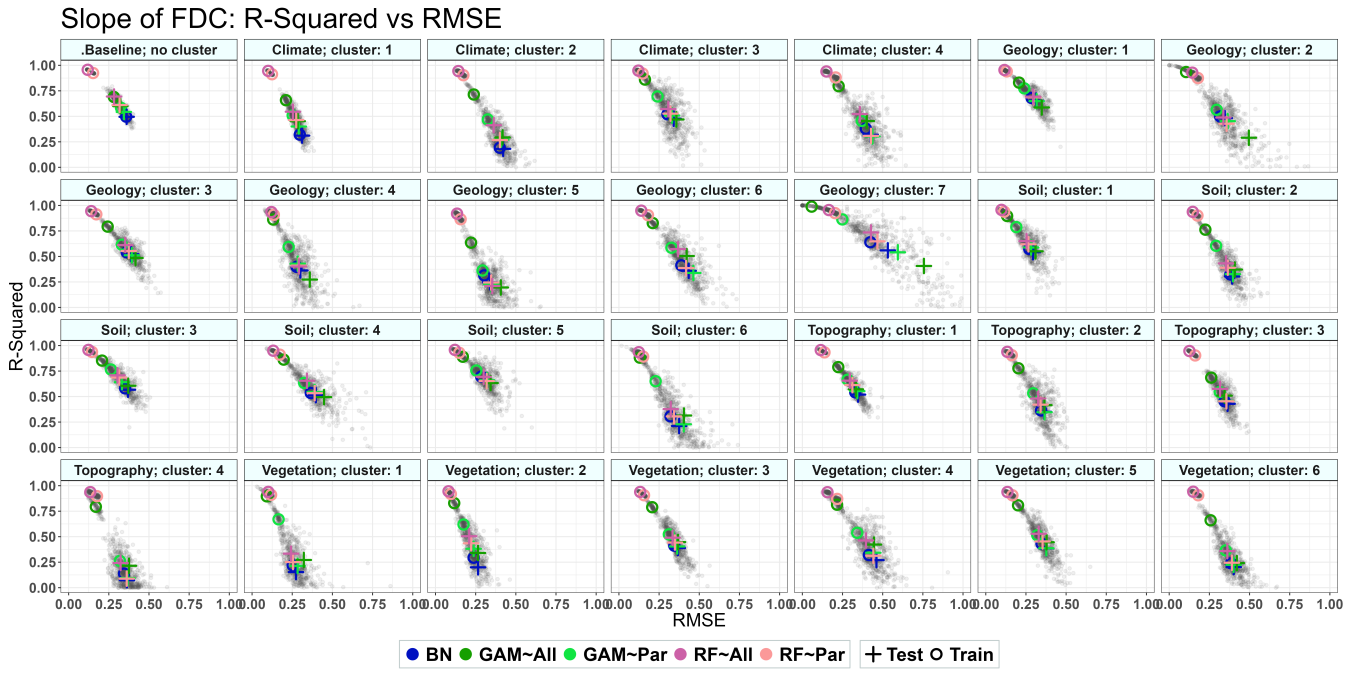

Fig S 40. R squared vs RMSE in each cluster for all models for the slope of flow duration curve.

11 Streamflow Elasticity (stream_elast)

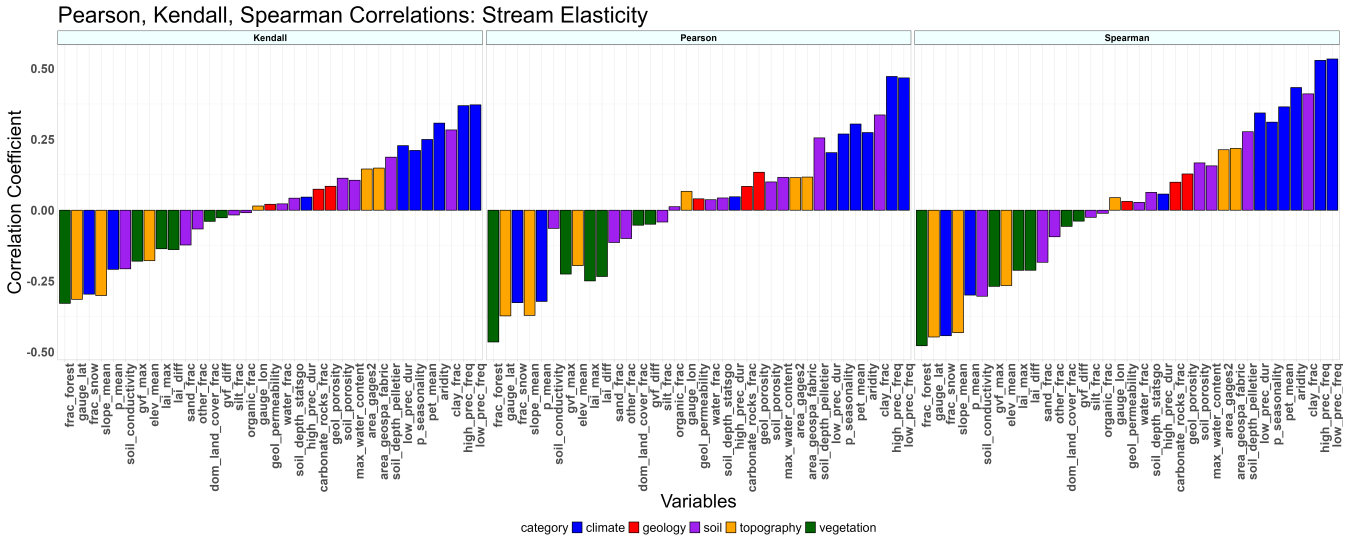

Fig S 41. Correlation analysis between catchment and climate attributes and streamflow elasticity

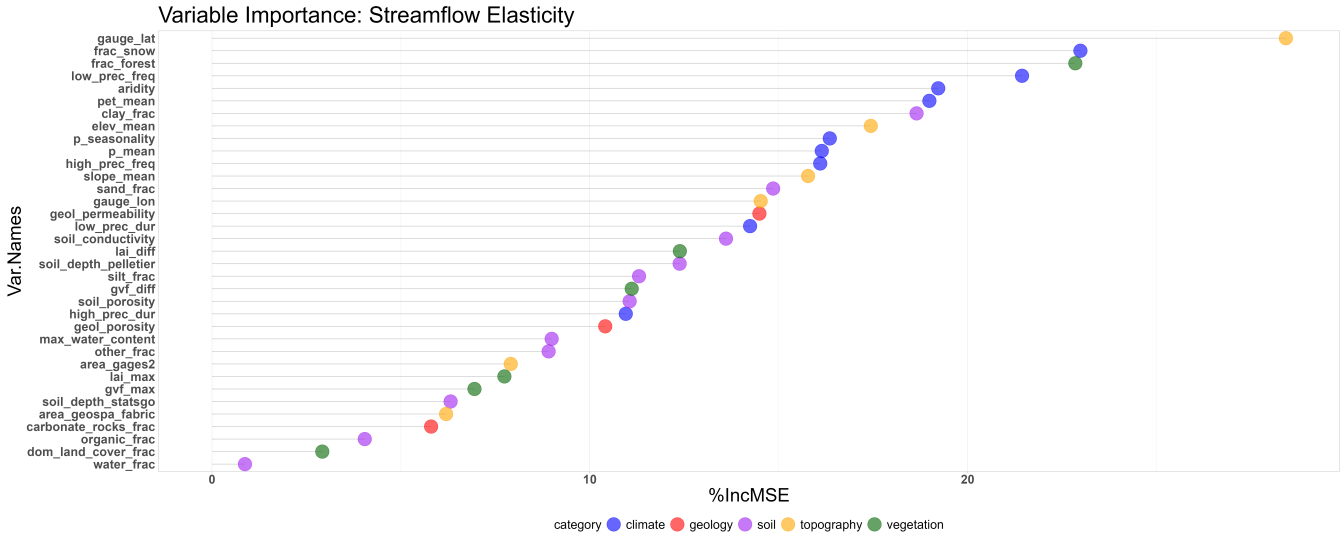

Fig S 42. Random forest variable importance analysis between catchment and climate attributes and streamflow elasticity

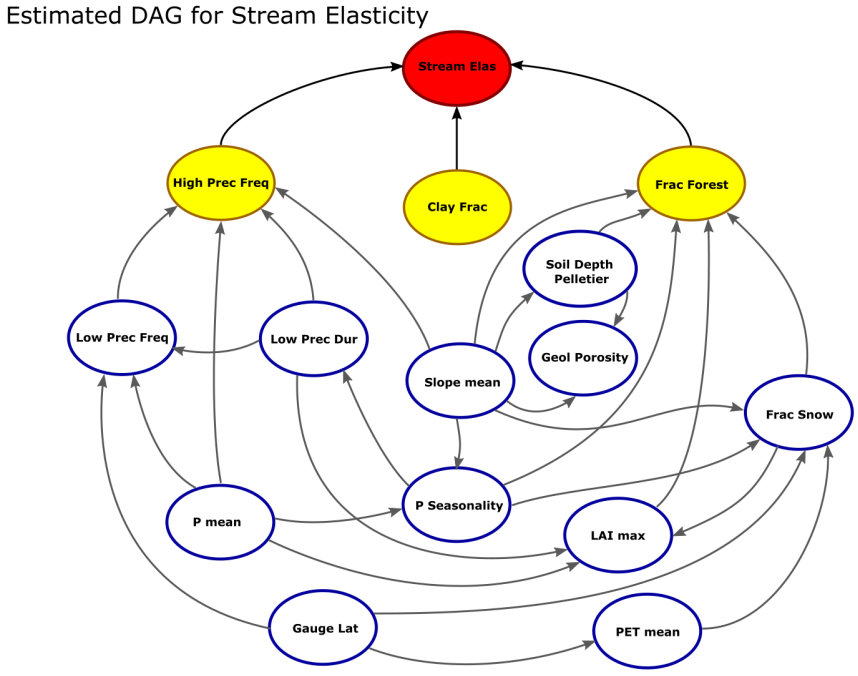

Fig S 43. Directed acyclic graph and selected variables for streamflow elasticity

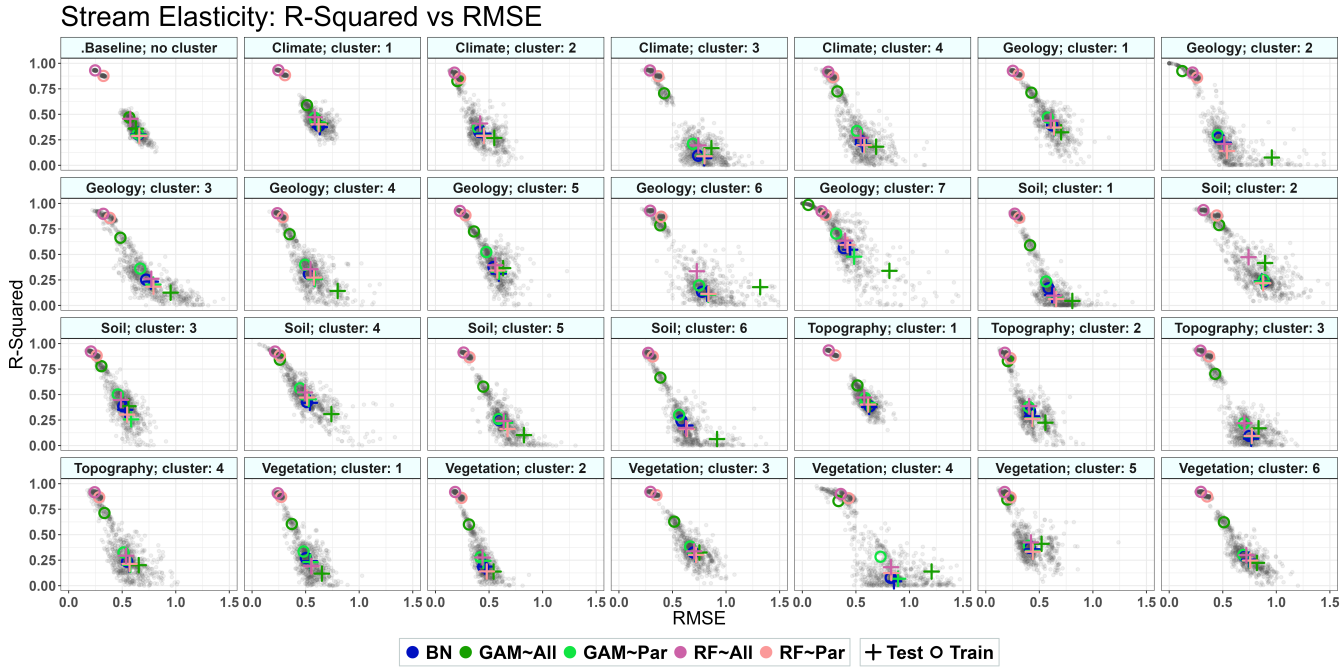

Fig S 44. R squared vs RMSE in each cluster for all models for streamflow elasticity.