Random Forests to classify salt-affected soils from soluble salt ions

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INTRODUCTION

- Salt-affected soils are characterized by an excess of soluble salts and/or Na^+ in the soil exchange complex.

- Breiman and Cutler's random forests (RF) algorithm chooses the most voted class over all the trees at training time.

Objective: To model and predict soil salt-term categories from soluble salt ions, by using the RF model classification.

METHODS

- Topsoil samples (110) from the High Valley of Cochabamba (Bolivia)

- Soluble cations (Na^+, K^+, Ca^{2+}, Mg^{2+}) and soluble anions (HCO_3^-, Cl^-, CO_3^{2-}, SO_4^{2-})

- Salinity parameters: ESP, EC_e and pH

- Threshold values: USSL classification

- Validation dataset (26 soil samples)

- RF classification algorithm
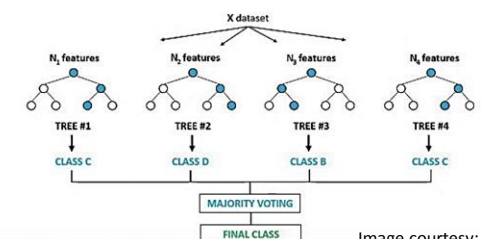

Cochabamba
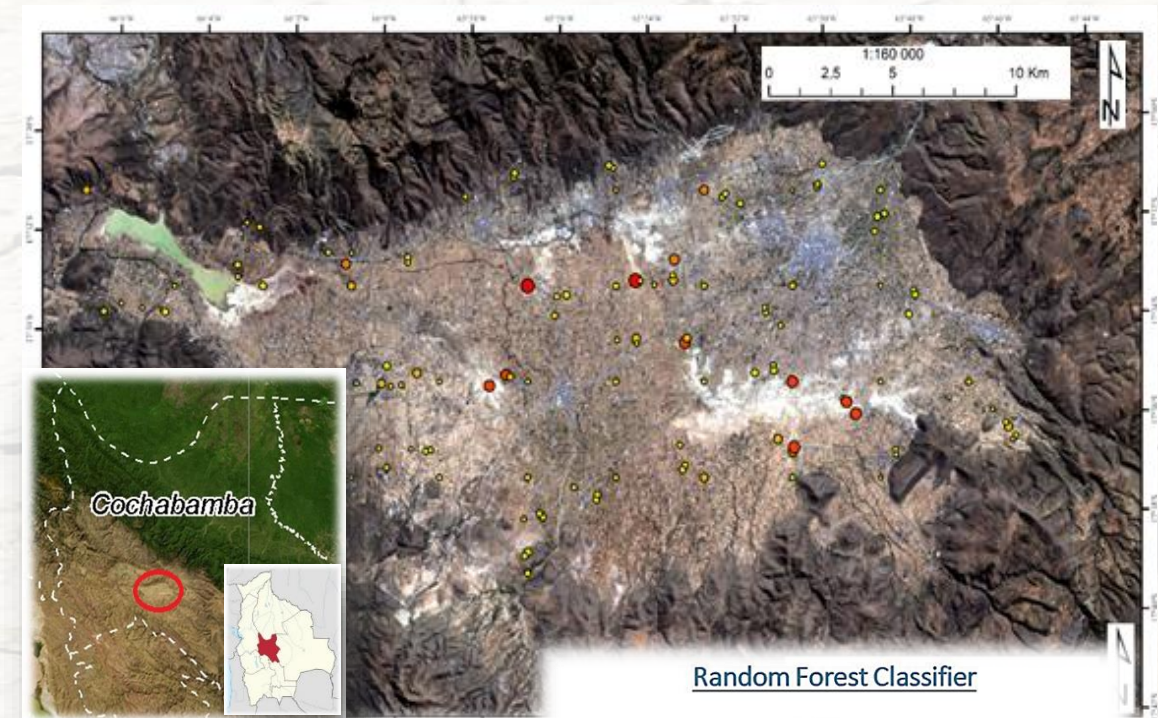
Random Forest Classifier

Image courtesy: Google

RESULTS

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Confusion matrix:
    1   2   3 class.error
1  51   0   7   0.1206897
2   0  18   0   0.0000000
3  11   1  21   0.3636364
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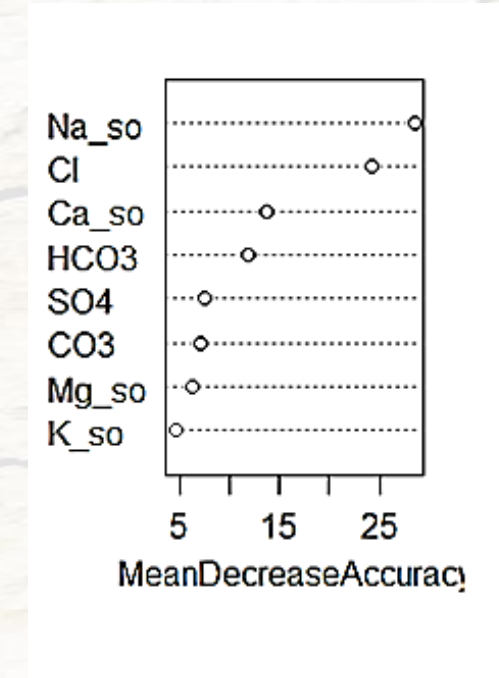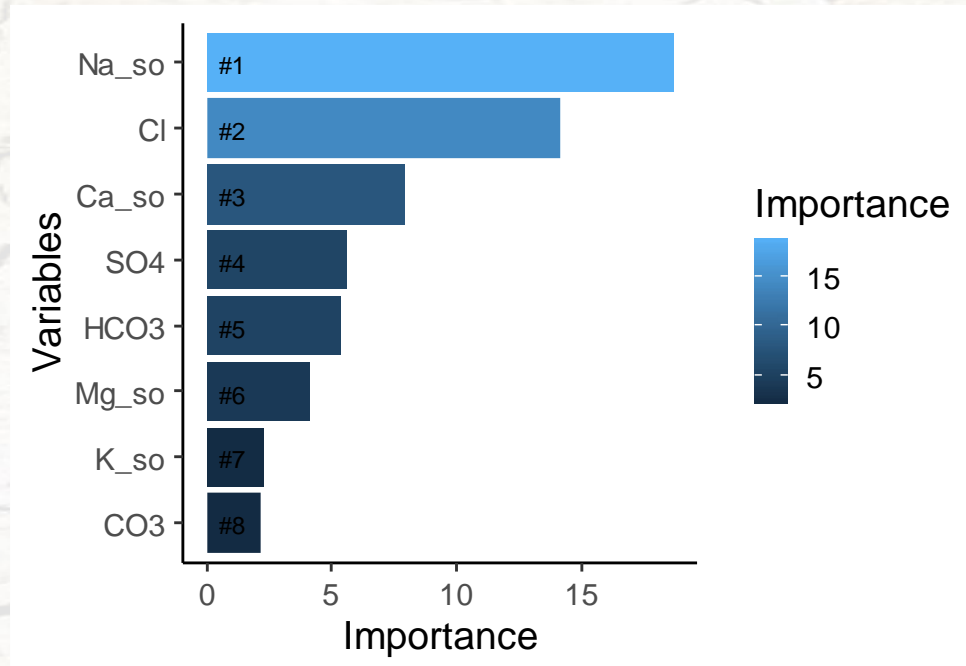
Reference

Prediction		1	2	3
	1	6	0	2
	2	0	12	1
	3	1	1	3

The overall OOB error was 17.4%, and the class errors for normal, saline-sodic and sodic soil were 0.12, 0.00 and 0.36, respectively. The performance of the classifier showed an accuracy of 81%.

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RESULTS

The variables with the higher importance were: Na⁺ and Cl⁻, followed by Ca^{2+}, HCO_3^- and SO_4^{2-}.

CONCLUSIONS

- ✓ The model might be useful in predicting salt-term classes from soluble salt ions, as a cost-effective alternative for lab analysis.
- ✓ Additional samples can reduce errors and misclassifications, and improve the selection of variables.

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