

Coupling high resolution data and national baseline estimates for farm scale soil carbon auditing

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New Zealand sheep & beef farm

- Why audit soil C?
- Land management practices that sequester soil C mitigate climate change with co-benefits of improved soil productivity.

New Zealand national soil carbon model



How to audit soil C?

- Use a national or regional model to guide downscaling, for stratification.
- Optimised soil sampling of strata through time.

Soil carbon stocks (t/ha)



National model: baseline soil C (t/ha)



The national model provides a baseline soil C stock value of 93.77 tC/ha to 0.3 m (90% confidence interval 54.4 - 133.15 tC/ha to 0.3 m)



High resolution datalayers

- LiDAR-DEM & terrain attributes used to disaggregate the national model.
- Dissever R package downscales using a common grid, on a block by block basis, with mass preservation.
- Added value to the national model, and provides framework for farm-scale soil sampling.

Disaggregating the national model



- Inputs: national model (1-km pixels) + high resolution covariates (< 10-m pixels)
- dissever R package
- Outputs: downscaled soil C map (25-m pixels) for 218 ha sub-catchment area

Strata and sampling locations



- Stratify the downscaled soil C raster
- Use the Ospats method which is guided by predicted values and associated error variances (de Gruijter et al., 2016)
- Value of Information guides the no. of strata and sampling positions
- Stratified Simple Random Sampling

90% CI of predicted SOCs (Ospats v random)



subsample (n) of 42 soil cores; 500 simulations

No. cores	random		Ospats	
	SOCS (tC/ha)	CI	SOCS (tC/ha)	CI
11	100.65	22.70	96.21	16.01
42	100.64	10.72	96.28	7.90

Reported SOC stocks (Ospats v random)



Conclusions

- A method has been developed that uses high resolution covariate data to downscale a national soil C model (*dissever R package*).
- The *dissevered* map enables optimal stratified soil sampling to determine unbiased baseline estimates of SOC stocks for the farm at Time 1 (*Ospats,* de Gruijter et al., 2016).
- Resampling at Time 2 provides a statistically robust and transparent method for farm-scale soil C auditing.
- Farm management strategies that sequester soil C effectively mitigate climate change.

