

Evaluating Carbon Budgets in Kentucky Valley Fills

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Introduction

In the Southern Appalachian Region of Kentucky, valley fill sites have been an acceptable technique for the disposal of material removed from surface mining areas. The analysis that follows focuses on the carbon storage capacities of valley fill forests (separate from the surface mine from which the fills were created) in contrast to an established old growth forest.

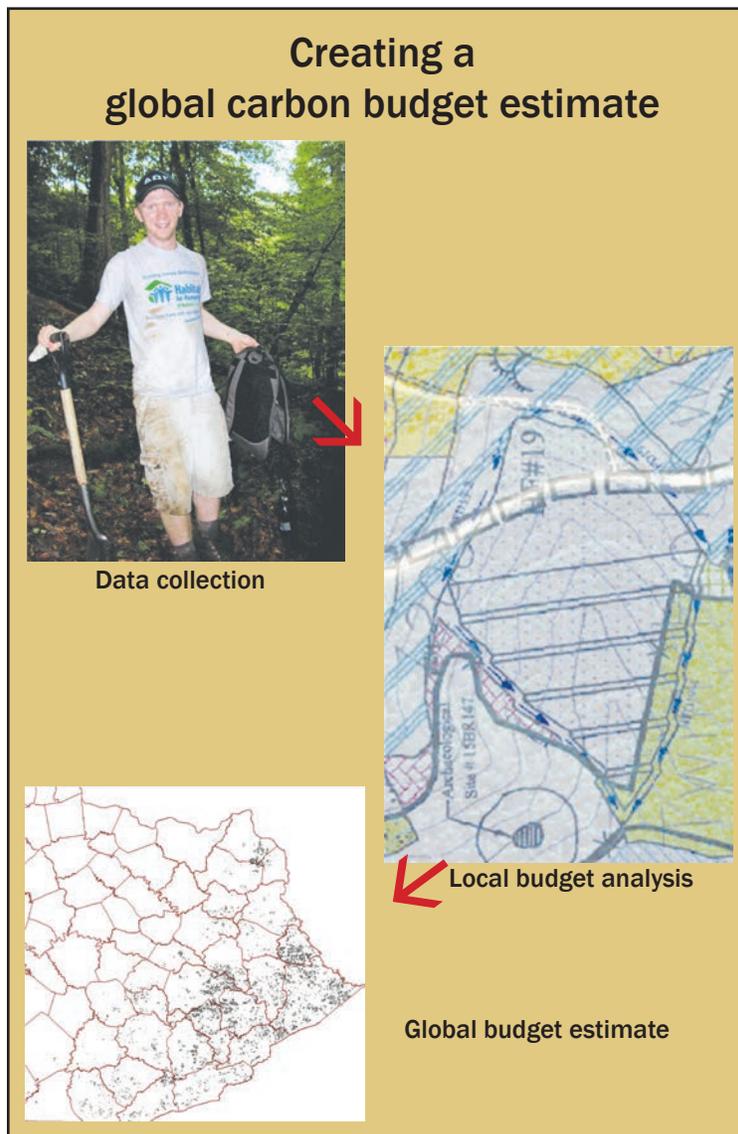
Methods

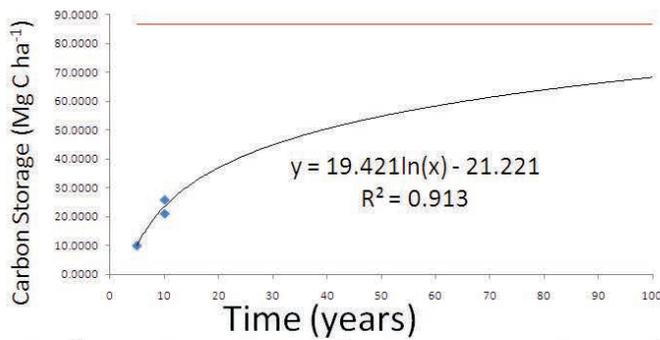
Sites selected for study were three southeastern Kentucky valley fill sites of varying ages as well as one old growth forest, used as a control to model pre-mining conditions. Parameters measured for soil analyses were carbon fractionation, total organic carbon (TOC), and bulk density. Data collected was extrapolated to calculate the impact of valley fills on the global carbon budget.



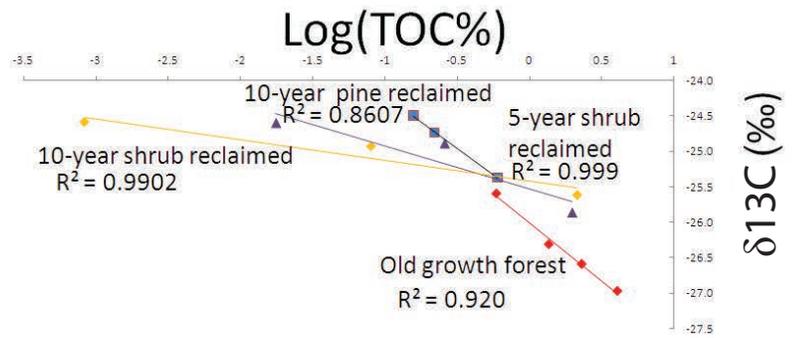
Data

The 10-year-old shrub covered valley fills retained 25.9 Mg C/ha of soil carbon while the pine covered land of similar age sequestered 21.1 Mg C/ha. The 5-year-old shrub-covered valley fill had similar carbon density to that reported by Akala and Lal (2001) for 5-year-old reclaimed mined lands overall. The old growth forest sequestered 5 to 10 times more carbon than the valley fills.





Carbon storage vs. time – comparison of carbon in valley fills and old growth soils



log(TOC%) vs. carbon fractionation – steeper slope indicates higher turnover of organic carbon

Site	Storage (MgC ha ⁻¹)	Δ Storage (MgC ha ⁻¹)	Deficit from completed valley fills(MgC)	Possible deficit from valley fills under construction(MgC)
Old growth	86.6801	-	-	-
10-yr, shrub	25.8963	-61	1.13E+06	5.86E+04
10-yr, pine	21.0971	-66	1.22E+06	6.32E+04
5-yr, shrub	10.0352	-77	1.42E+06	7.39E+04

Carbon budget analysis – carbon deficit determined from data supplied by the Kentucky Office of Surface Mining

Analysis

There was no significant difference in soil carbon between shrub and pine reclaimed land. However, the valley fill deficit ranged from 61 to 77 Mg C/ha when compared to the old growth forest. At this rate, the global impact of Kentucky valley fills upon the carbon budget through 2006 is on the order of 1.13-1.42x106MgC.

Conclusions

In terms of carbon storage, valley fill sites behaved similarly to reclaimed areas. Valley fills younger than 15 years showed little capability to store carbon compared to the old growth forest. Valley fills have a significant impact on global carbon budgets. Over time, carbon storage capability does appear to increase, but young valley fill soils lack the organic carbon distribution across the soil column.

References

Akala , V. A. & R. Lal. 2000. Potential of Mine Land Reclamation for Soil Organic Carbon Sequestration in Ohio. *Land Degradation and Development*. 11: 289±297 (2000)

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