

How Sediment Deposition Establishes a Template for Floodplain Ecosystem Development

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Floodplains are ecological hotspots:

high productivity and biodiversity

mediate terrestrial-aquatic exchanges

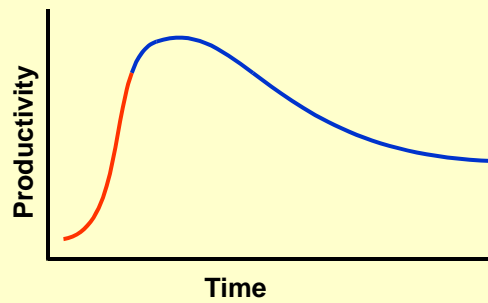


How do floodplain soils change over time?

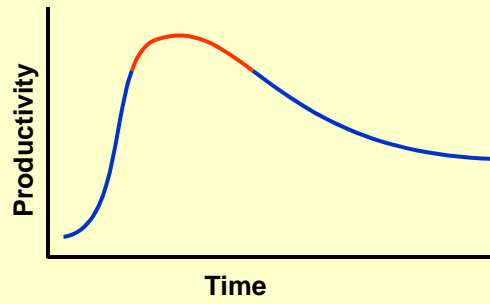
How long to become productive?

How long do they stay productive?

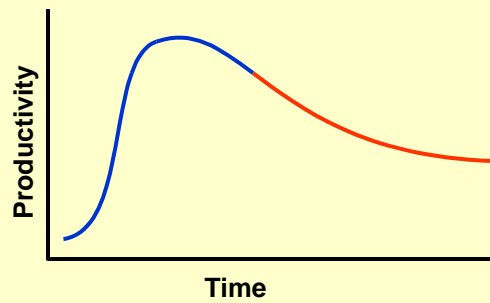
Ecosystem Development



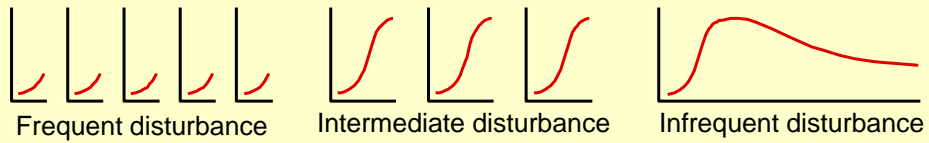
Ecosystem Development



Ecosystem Development



Ecosystem Development Relative to Disturbance Interval



Particle size distribution is a master variable

The size of pore spaces controls the movement of liquids and gases

Reactive surface area affects adsorption of microbes, nutrients and organic matter

Surface area affects weathering of parent material

Fluvial sorting creates temporal and spatial patterns in sediment size distribution.



1962



2002





Hypothesis: Fine particle distribution constrains organic matter dynamics in floodplain soils

Distribution of soil OM relative to particle size

Mineralization of C and N relative to particle size, site age/history and environmental variables



Queets River

1,153 km² watershed

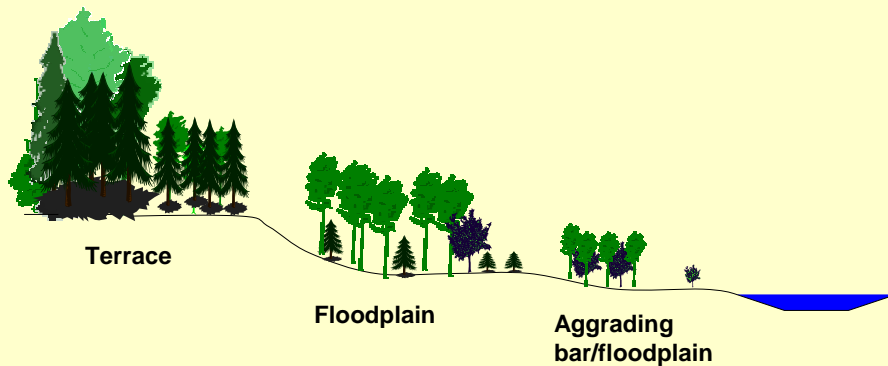
~ 3 m annual precip

Uplifted marine sediments

Recently glaciated

Chronosequence approach

27 "patches" ranging in age from 4 to ~1000 years.



Isolation of ecologically meaningful pools

Size

Particulate OM

Sand

Silt

Clay

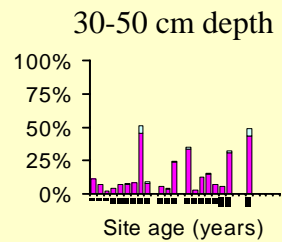
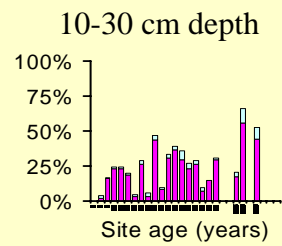
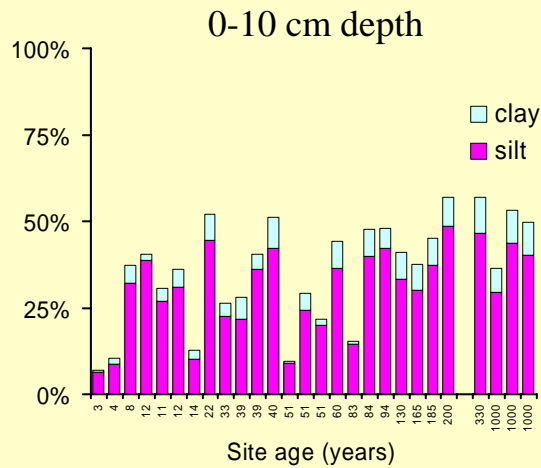
Incubation

Fast-cycling

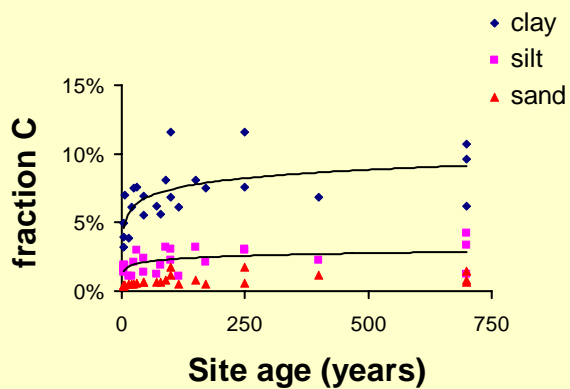
Slow-cycling

Stable

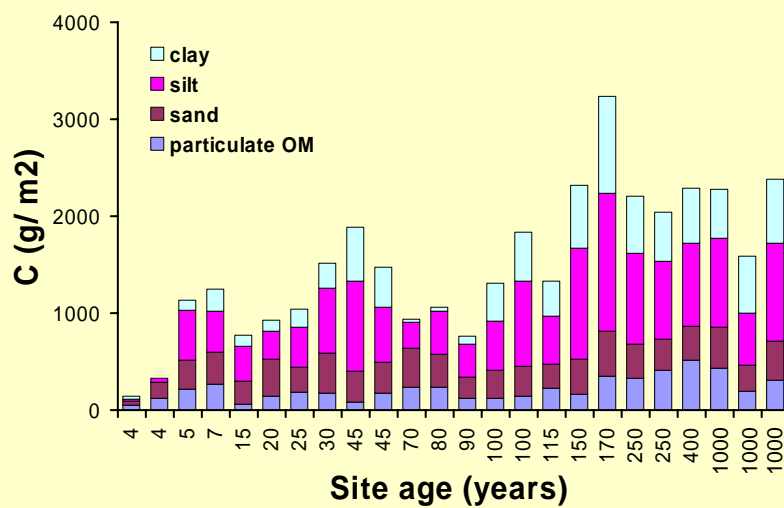
Particle size distribution



Soil C in particle size fractions



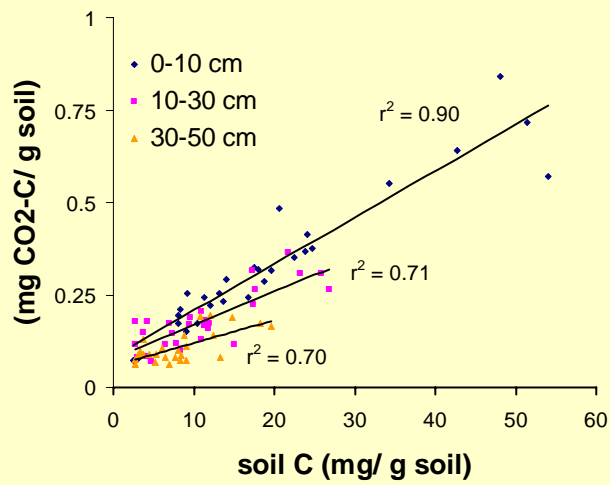
Mineral-associated OM fractions (0-10 cm depth)



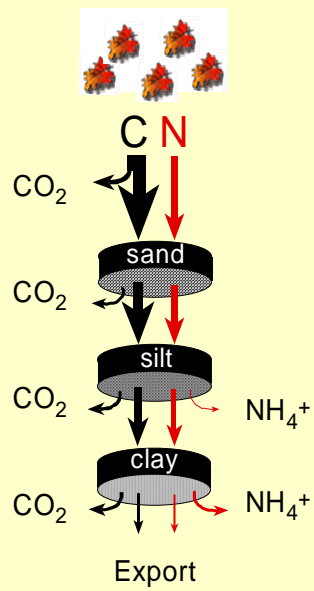
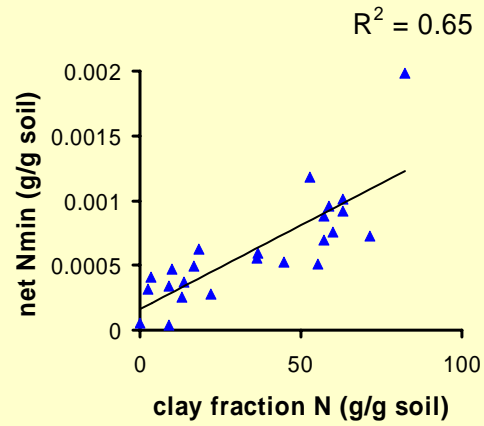
C:N ratios in particle size fractions

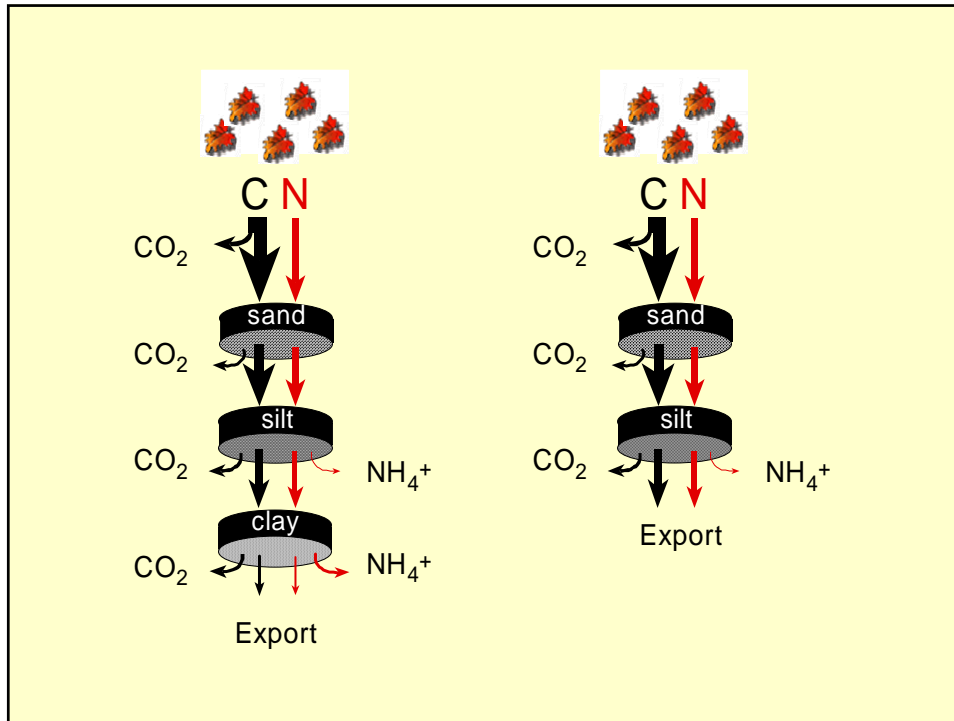
| | C:N ratio | SE |
|------|-----------|-------|
| sand | 30.1 | (6.4) |
| silt | 15.5 | (0.3) |
| clay | 12.4 | (0.4) |

C mineralization relative to soil C



N mineralization relative to clay fraction N





Summary

Organic matter was strongly associated with silt and clay particles in soils and fluvial sediments

Fine-textured soils have more C and N and more efficiently retain N

Implications

Sediment distribution acts as a template constraining organic matter dynamics



Alteration of sedimentation regimes due to human activity may have far reaching implications for soil biogeochemistry



Acknowledgments

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