The role of watershed storage on exported riverine organic carbon signatures

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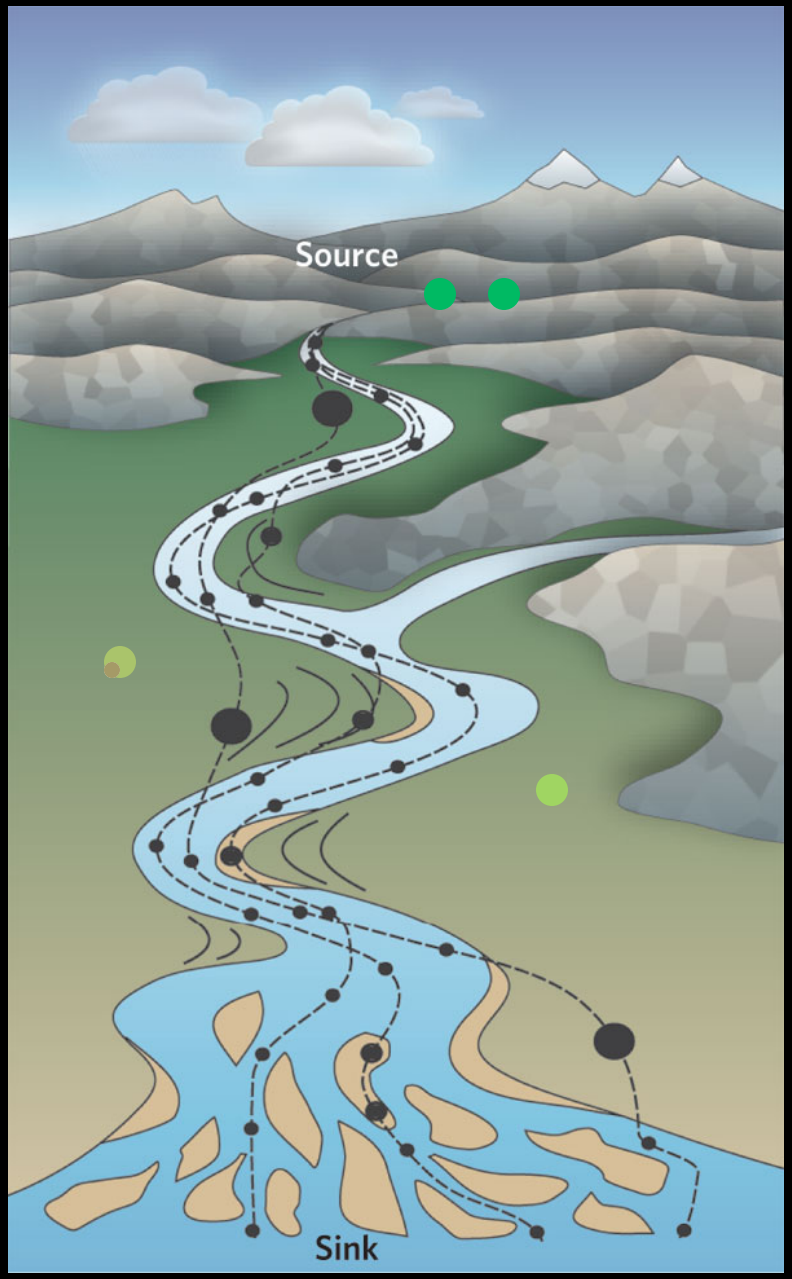


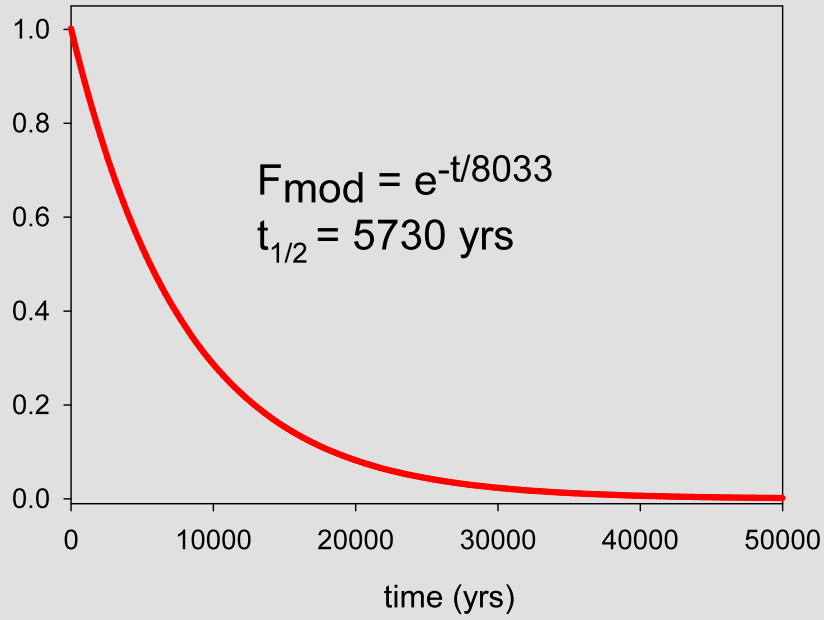
Note:

- Modification of original biogenic signature
- Loss of mass (C)
- Ratio original/modified will vary with degree of storage

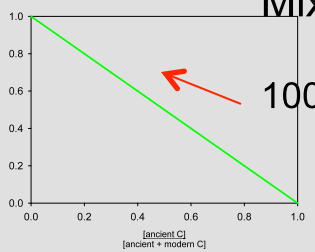
Modified from P. Allen, Nature (2008)

Storage and ^{14}C

Radioactive decay



Mixing-Demixing

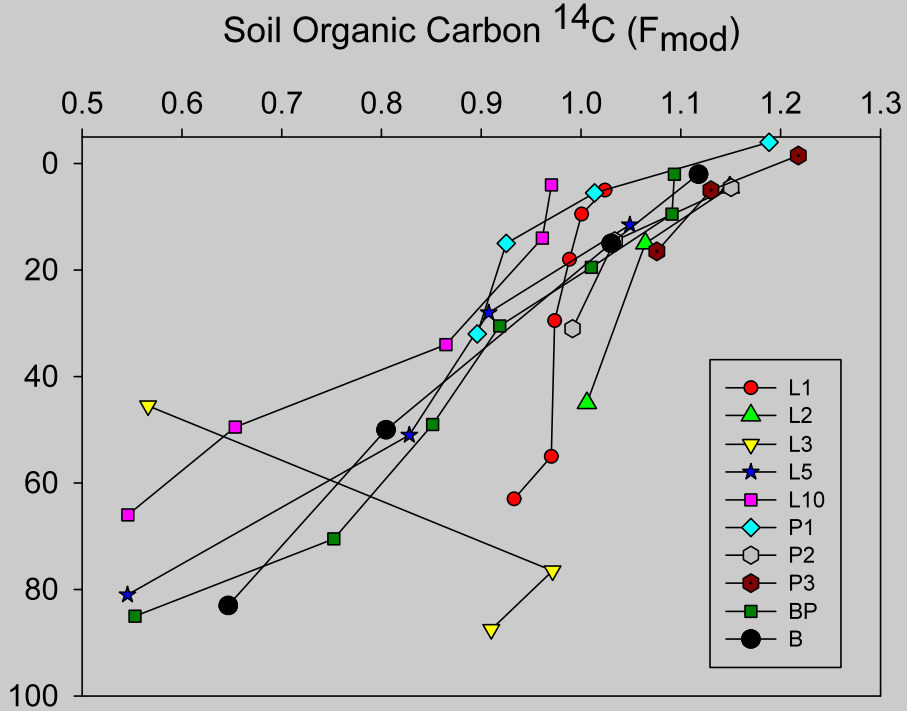


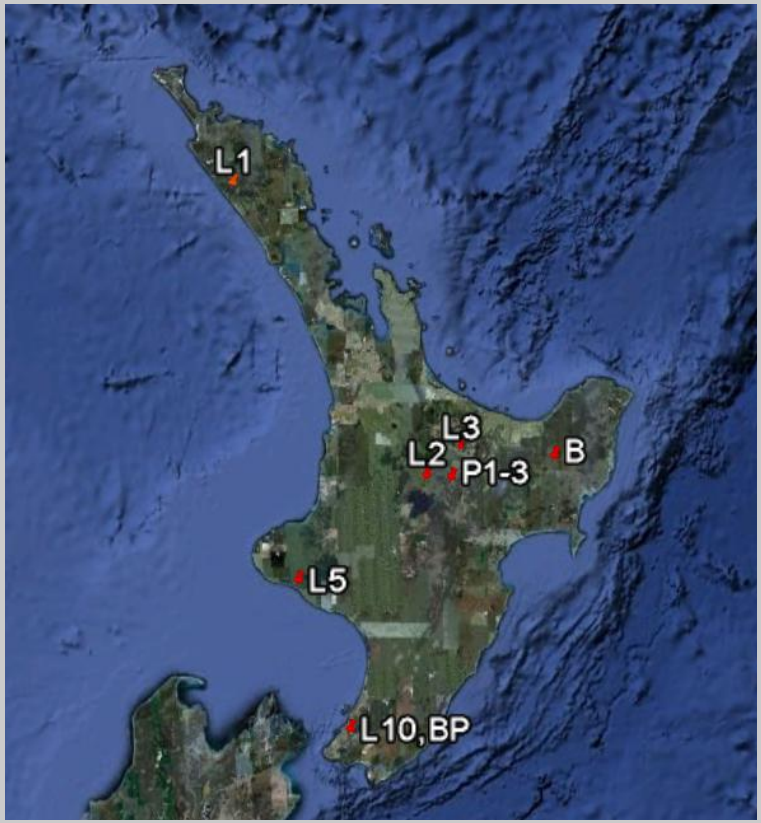
100% modern

50-50 ancient-modern

100% ancient

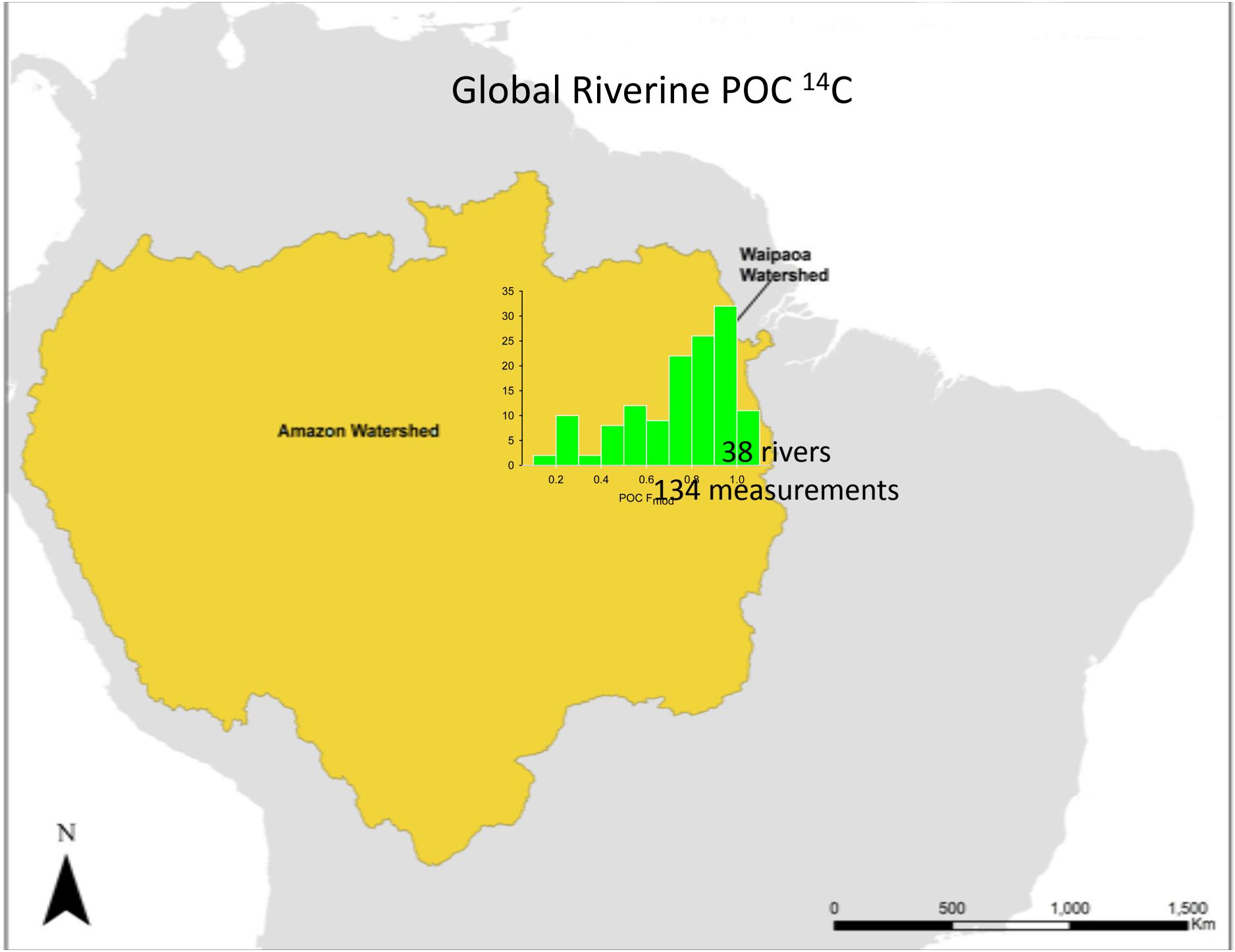
New Zealand North Island soils



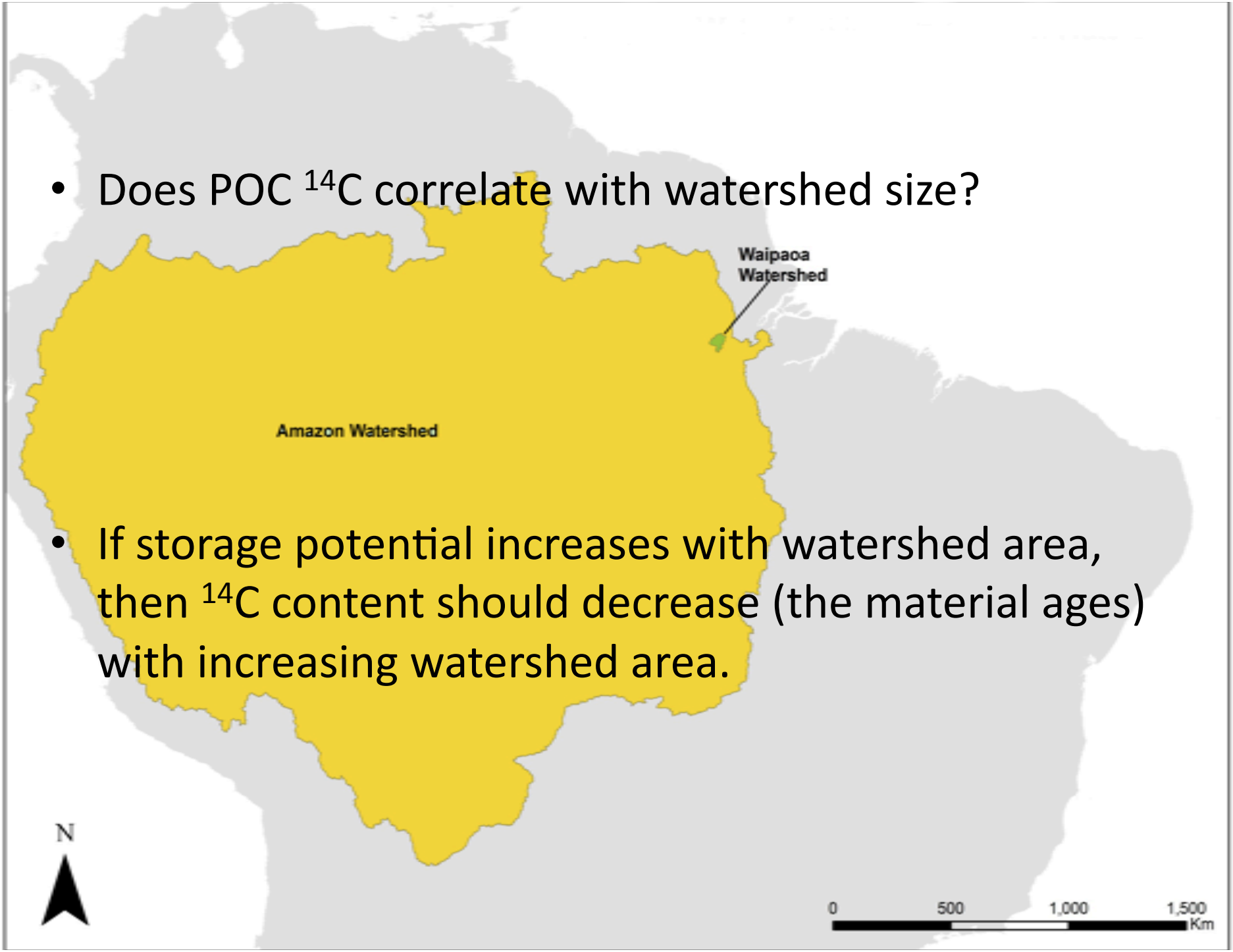


(L) Lassey et al (1996), (P) Parfitt et al (2003), (BP) Baisden and Parfitt (2007), (B) Blair et al (2010)

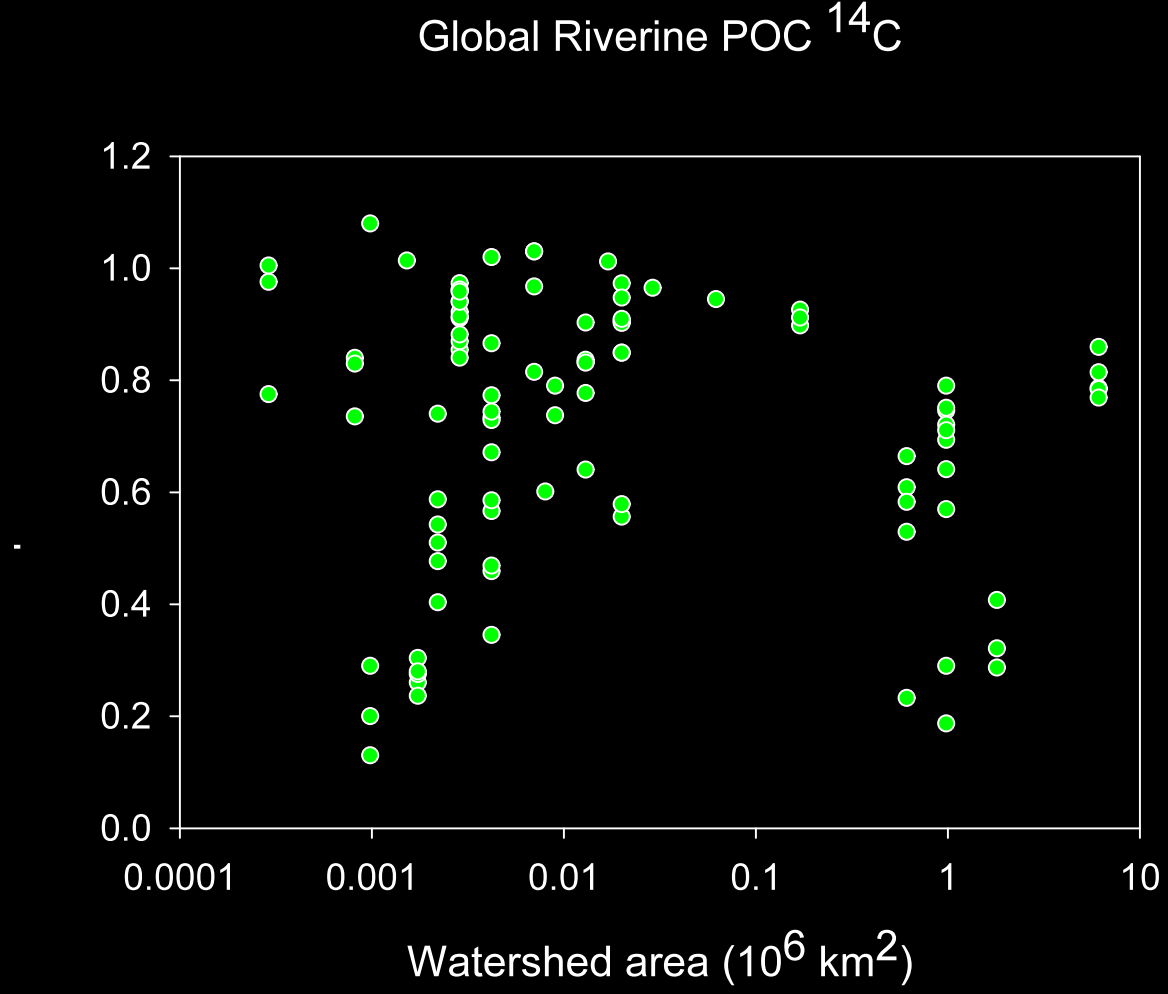
Global Riverine POC ^{14}C

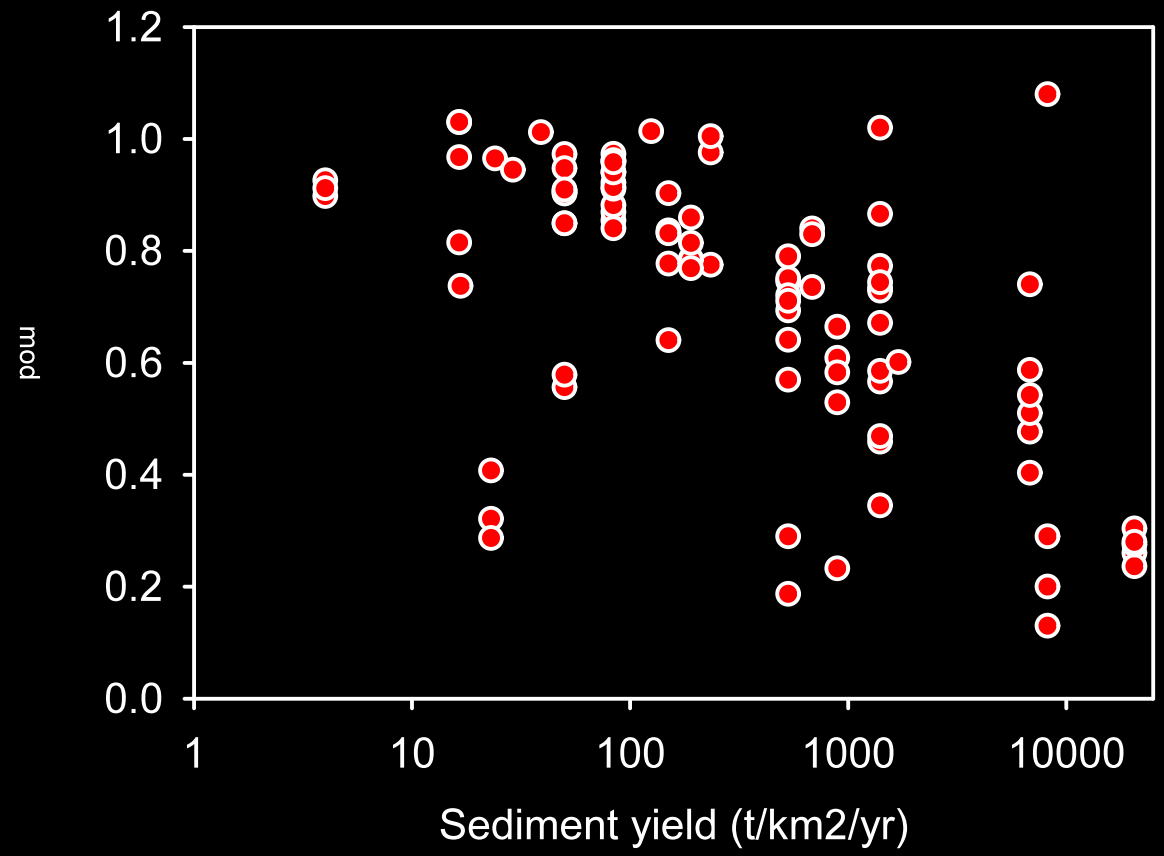


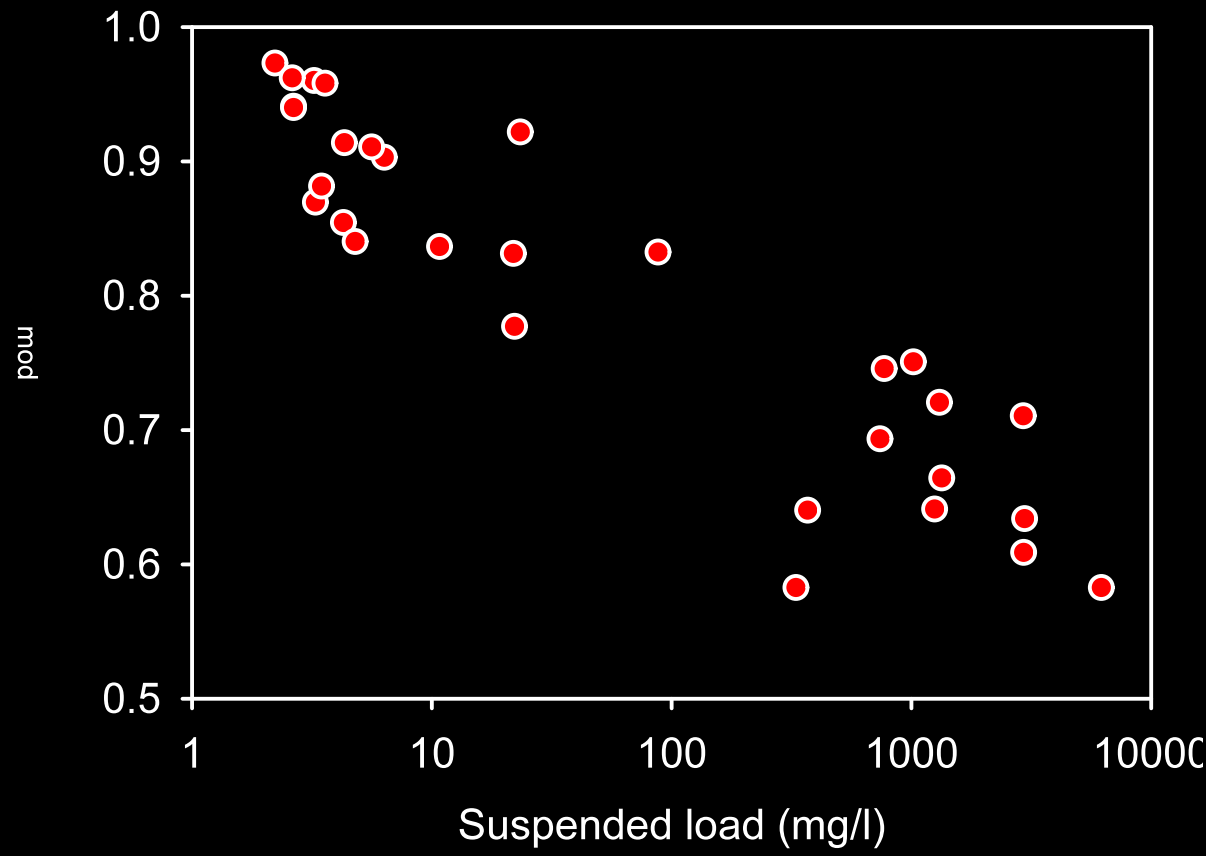
- Does POC ^{14}C correlate with watershed size?

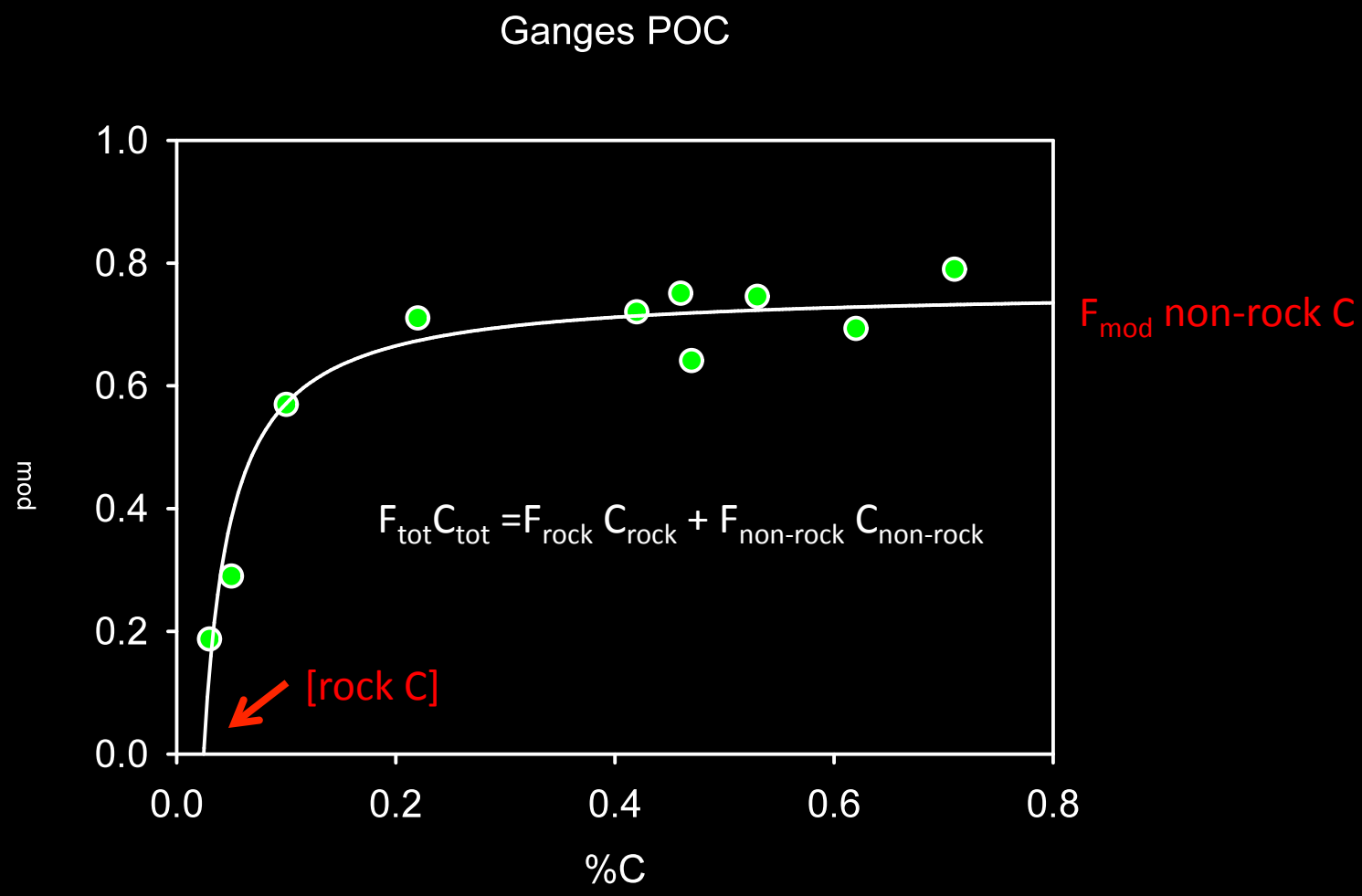


- If storage potential increases with watershed area, then ^{14}C content should decrease (the material ages) with increasing watershed area.


Global Riverine POC ^{14}C
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0001
0.001
0.01
0.1
1
10
Watershed area (10^6 km^2)

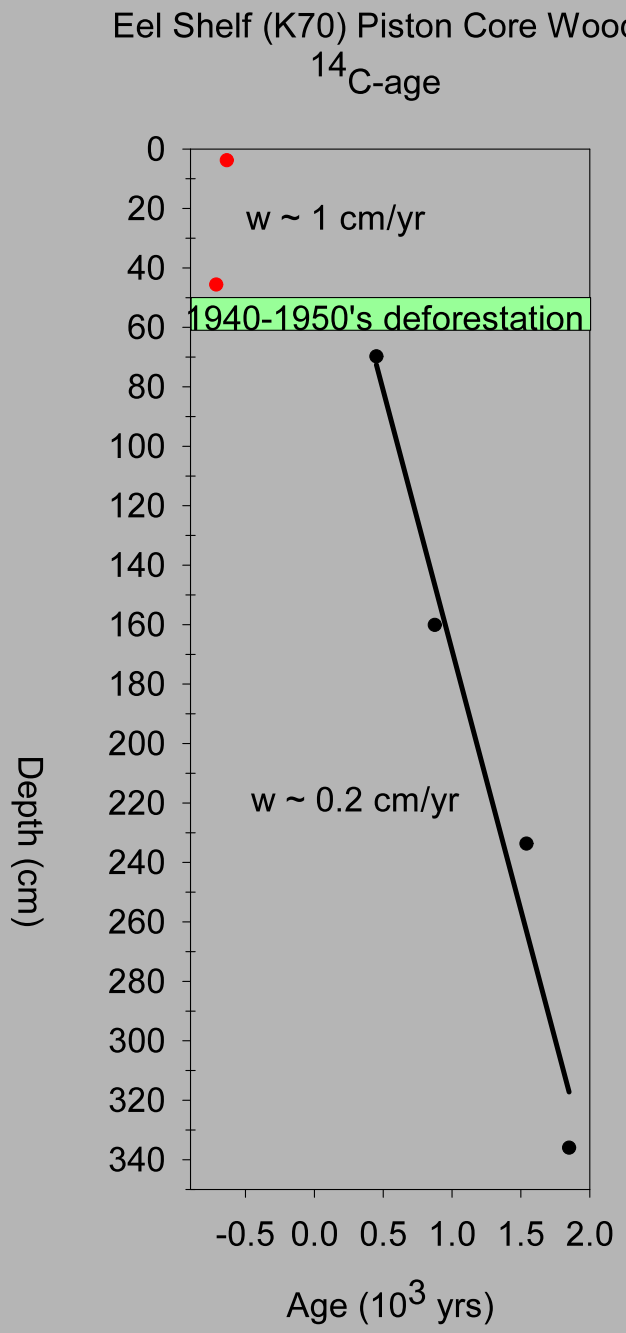

1.2
1.0
0.8
0.6
0.4
0.2
0.0
rmod
1
10
100
1000
10000
Sediment yield (t/km2/yr)


1.0
0.9
0.8
0.7
0.6
0.5
mod
1
10
100
1000
10000
Suspended load (mg/l)



From Galy et al. 2007

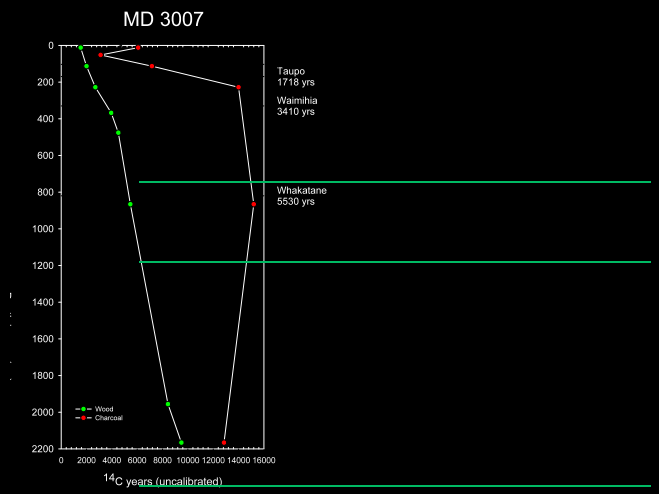
- Rock C concentrations tend to decrease with watershed size, reflecting its slow oxidation
- Non-rock (soil)C tends to age with watershed size due to repeated storage



Accumulation rates on mid-shelf increased ~3-7x after 1940-50's.

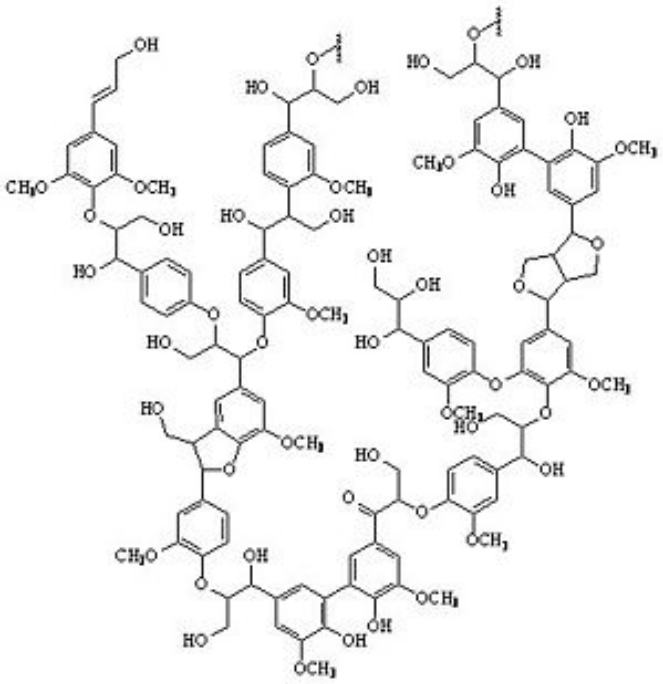
Residence time of POC in watershed was longer prior to 1940's (~500 yrs for wood).

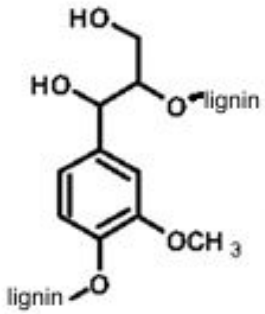
Sommerfield et al., 2002; Leithold et al., 2005



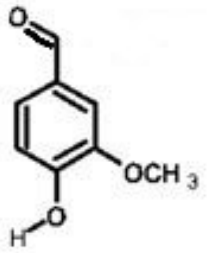
Wood charcoal

Lignin ‘storage’ indicators



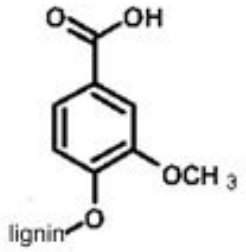


CuO

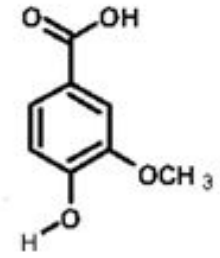


Vanillin
(aldehyde)

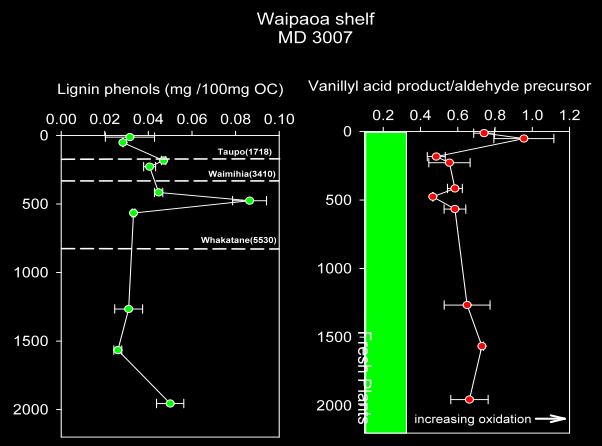
Fungal oxidation
In soils



CuO



Vanillic acid


Waipaoa shelf
MD 3007
Lignin phenols (mg /100mg OC)
0.00 0.02 0.04 0.06 0.08 0.10
0
500
1000
1500
2000
Taupo(1718)
Waimihia(3410)
Whakatane(5530)
Vanillyl acid product/aldehyde precursor
0.2 0.4 0.6 0.8 1.0 1.2
Fresh Plants
increasing oxidation