Monitoring of ^{14}C and ^{13}C in air

EBIS Project Meeting

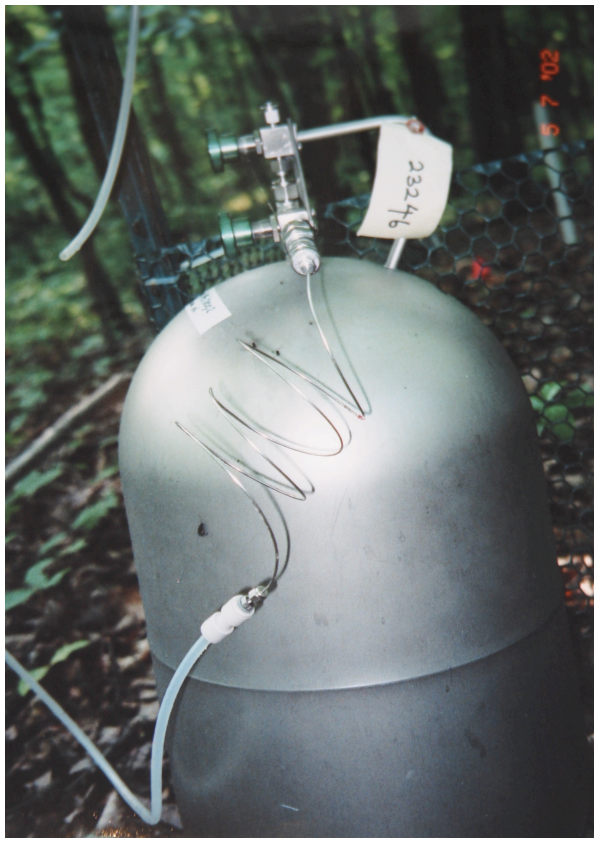
January 27 and 28, 2003

University of California, Irvine

Outline

- Sampling method
- Results of ^{14}C and ^{13}C to date
- Interpretation
- Conclusions

Sampling method



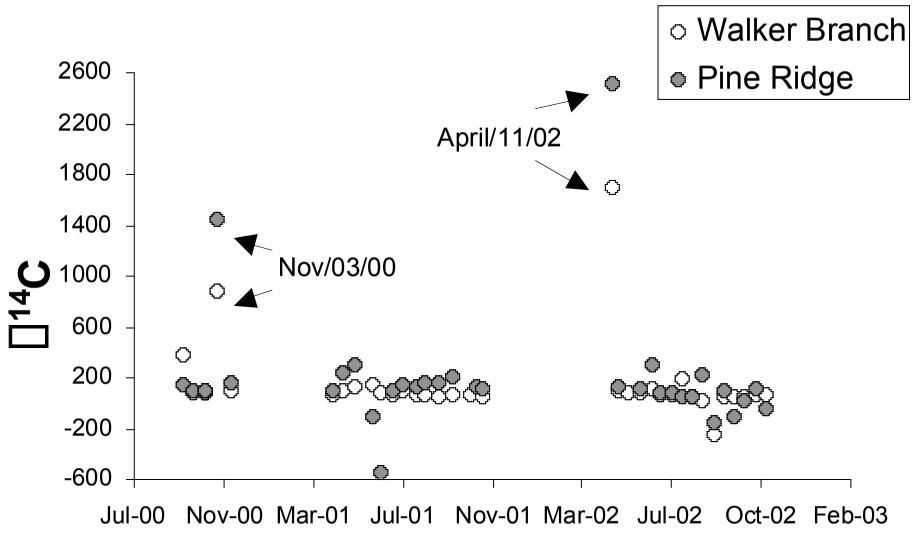
- An evacuated canister is filled with ambient air through a capillary restrictor over a period of two weeks, 24-hr a day

- Air inlet is located at approximately 1.5 m above the ground

- Air samples have been taken continuously during the growing season (March to November) since September 2000

- Monitoring takes place at both, western and eastern sides of ORR (Pine Ridge and Walker Branch respectively)

$\Delta^{14}C$ data

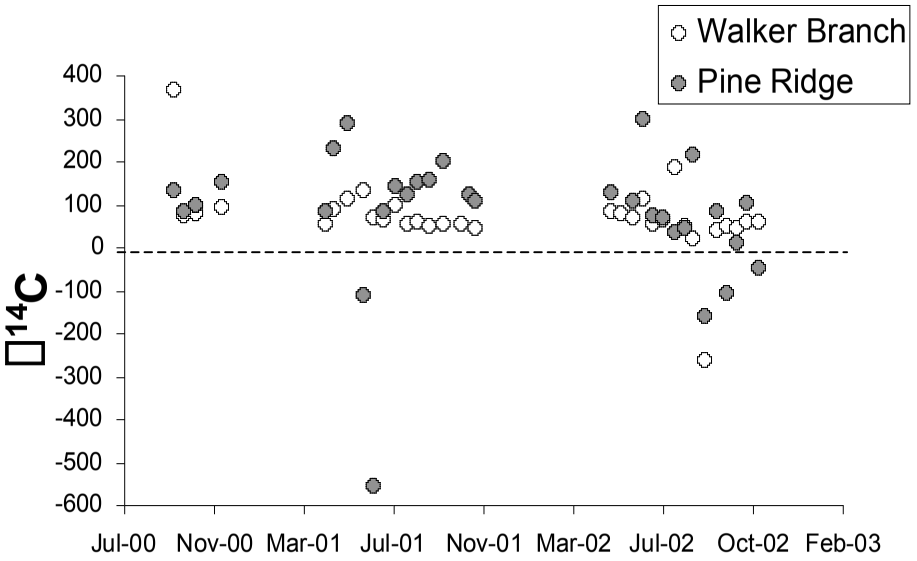


- A couple of dates with high values (close to +1000‰ and higher) in November 2000 and in April 2002

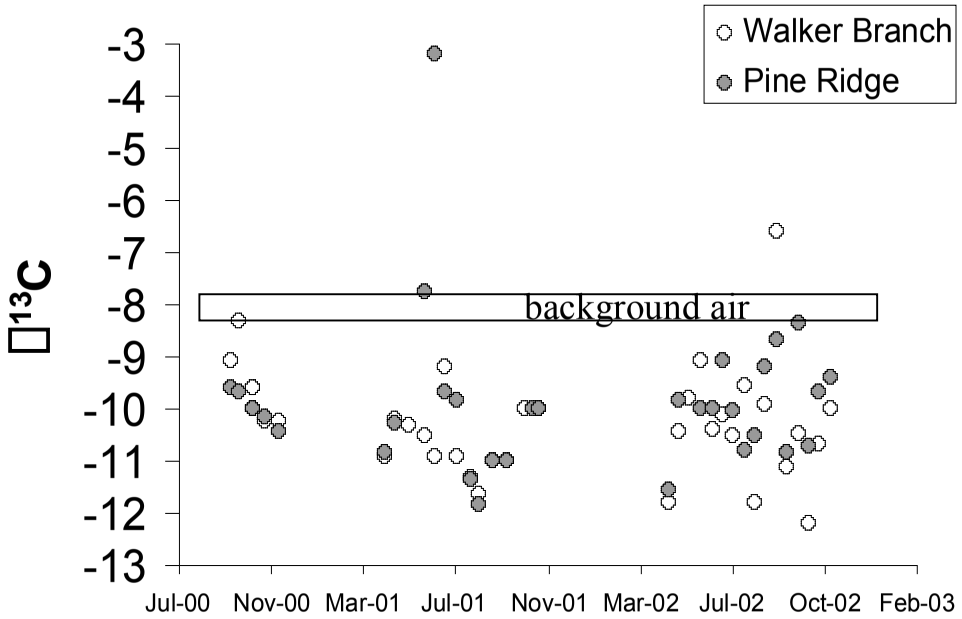
- Most of the time values in Pine Ridge were higher than in Walker Branch

- Negative values (up to -550‰ in Pine Ridge in 2001) were observed in 2001 and 2002

- They were mostly from Pine Ridge at different dates each year



$\delta^{13}C$ values

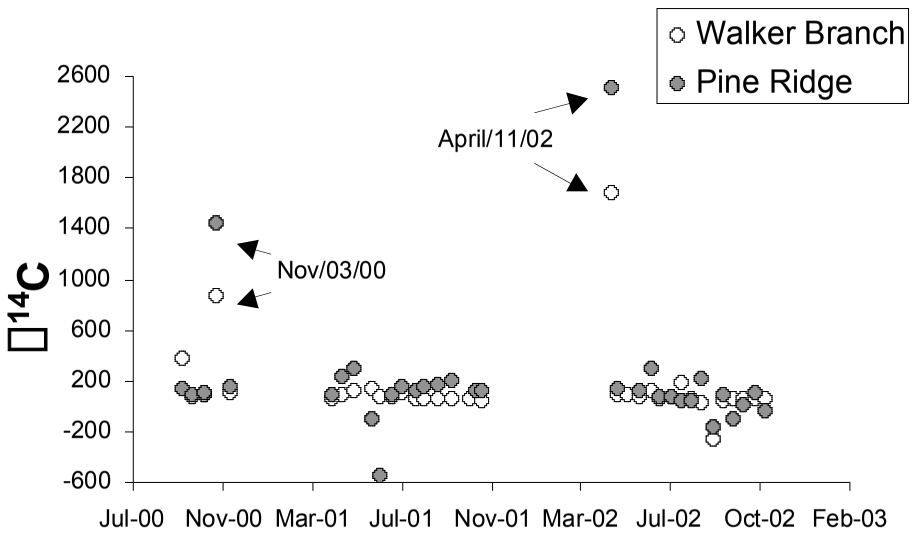


- $\delta^{13}C$ values were usually more negative than the value reported by NOAA for ambient air at this latitude (as of 1999)

- This is observed at both sites

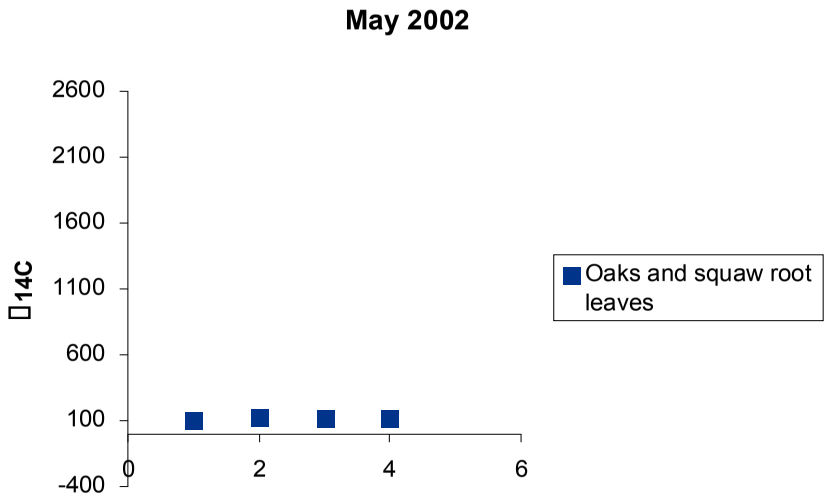
- An unusual enriched value in June 2001 from Pine Ridge ($\delta^{13}C$ =-3.19‰)

Interpretation of $\Delta^{14}C$ values



- High levels of $\Delta^{14}C$, new local releases..!!
- In 2000, likely no effect on plants
- In 2002, leave samples collected in May did not reflect the high values observed in ambient air in April

- This is a good sign to believe that the high level of ^{14}C did not enter the ecosystem through photosynthesis



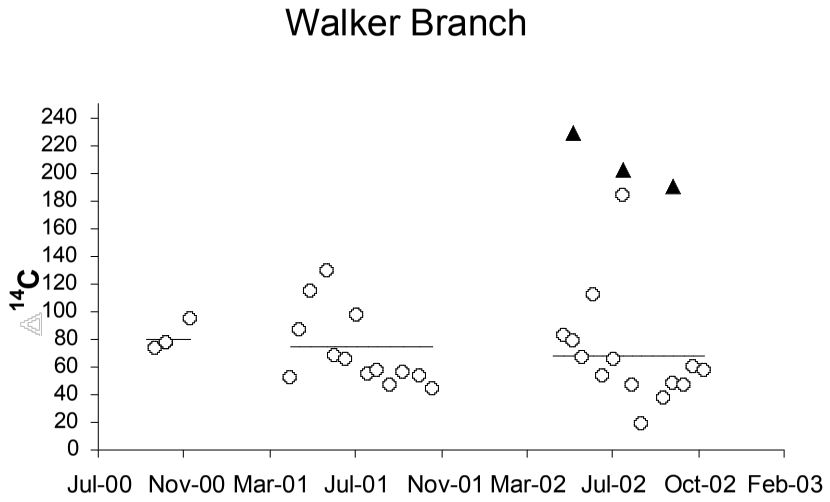
Interpretation -continued

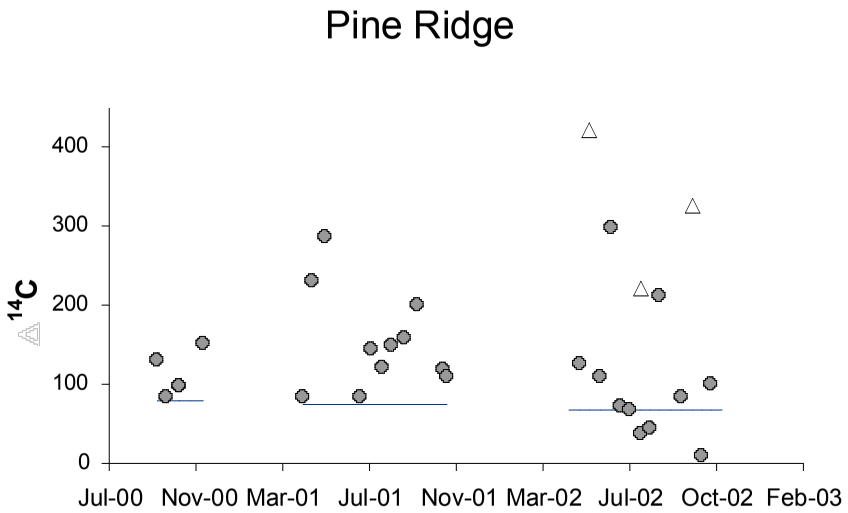
- In Walker Branch, values of $\Delta^{14}C$ were more depleted than atmospheric values (black line) most of the time, and the opposite was true for Pine Ridge

- That may be the combined effect of two things:

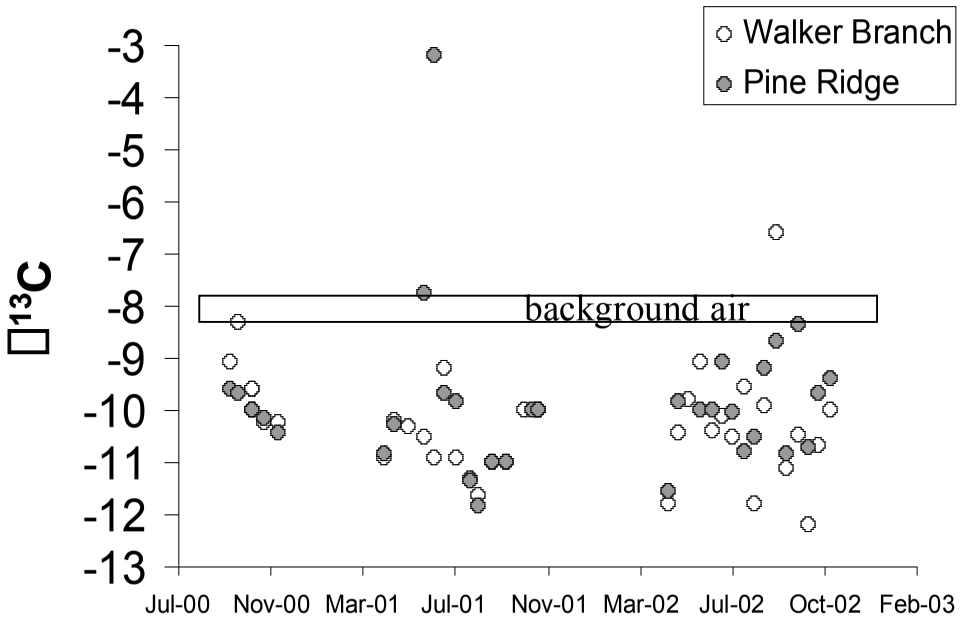
1) Soil respiration (shown in triangles for 2002) and
2) Burning of fossil fuels in the area

- Higher values in Pine Ridge may reflect the higher signature of soil respiration there (the site is closer to the suspected source)





Interpretation of ^{13}C values



- Some CO_2 from soil respiration may be present in the sample collected in the canister

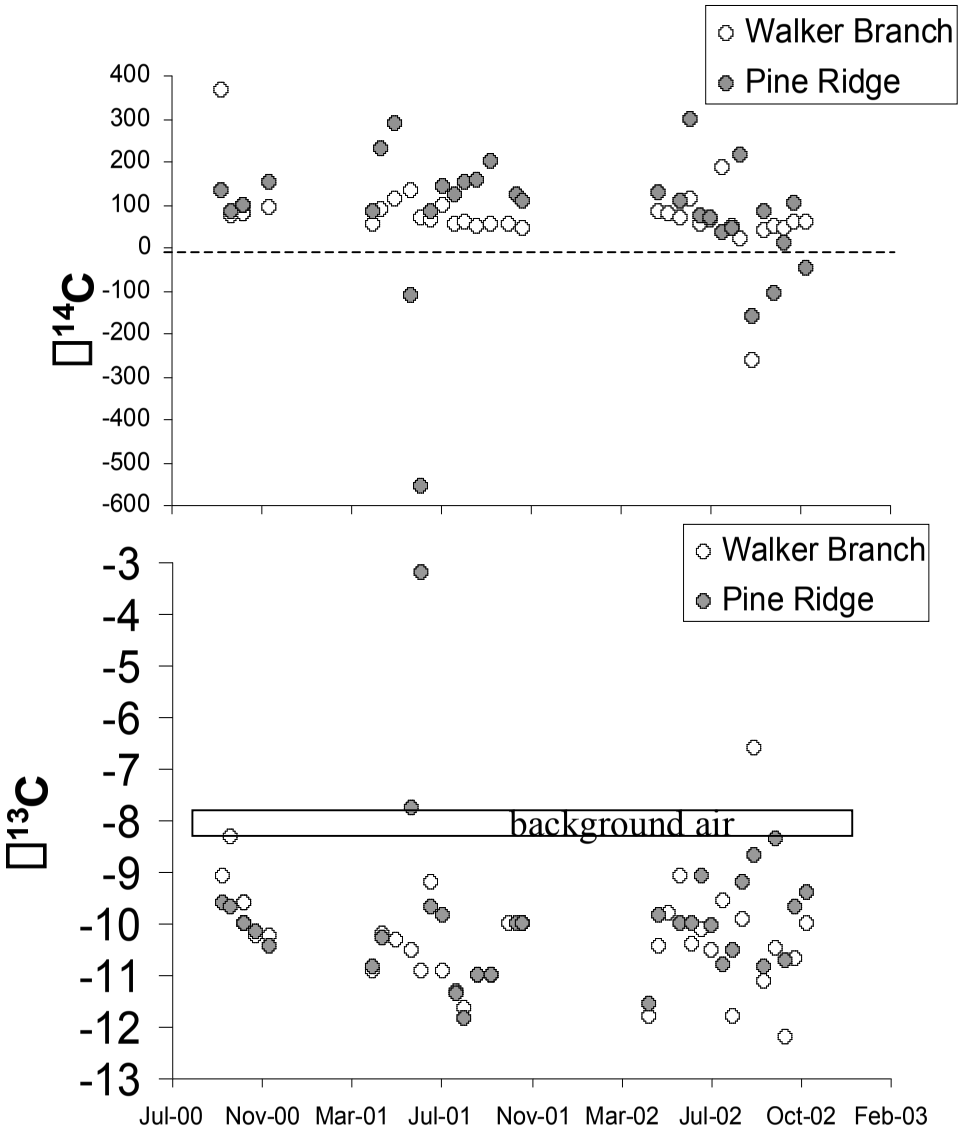
- The $\delta^{13}C$ of soil respiration is always around -26‰

- Two factors could favour this:

1) Stable conditions at night

2) Air inlet close to the ground

Interpretation - continued



- The most depleted values of $\Delta^{14}C$ coincide with the most enriched values of $\Delta^{13}C$

- There is not clear explanation for these and the other negative $\Delta^{14}C$ values, unless the sample was impure

Conclusions

- The monitoring of ^{14}C and ^{13}C in air (at 1.5 m from the ground) has been carried out since September 2000
- High values of ^{14}C (above +1000‰) have been observed in two occasions (November 2000 and April 2002), but we believe that neither of them was incorporated through photosynthesis
- The isotopic signature from soil respiration may be present in the sample (inferred more easily from the ^{13}C data)
- Both $\Delta^{14}C$ and $\Delta^{13}C$ may include signatures from other sources, such as soil respiration and fossil fuel burning (and others?)