

Supplemental Material - Carbone et al. Atmospheric radiocarbon for the period 1910 to 2021 recorded by annual plants

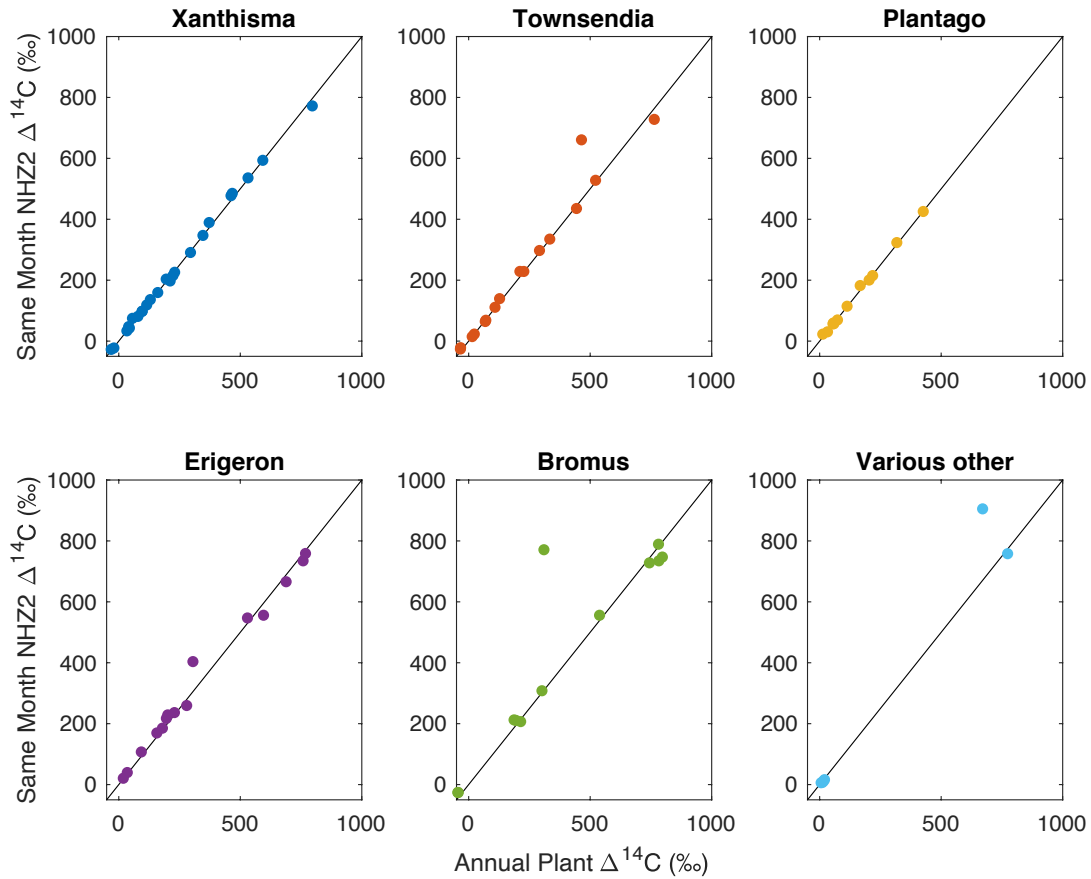


Figure S1 – Annual plant radiocarbon data (‰) versus Hua et al. (2022) NH zone 2 monthly radiocarbon record for different genera: *Xanthisma*, *Townsendia*, *Plantago*, *Erigeron*, *Bromus* and Various other species. Black solid line is one-to-one line. We used a generalized linear model to investigate differences among genera in $\Delta\Delta^{14}\text{C}$. For the four genera with more than 5 samples each (*Erigeron*, *Plantago*, *Townsendia*, and *Xanthisma*), this analysis ($n = 43$, $r^2 = 0.10$) found that neither genus ($p = 0.29$) nor year of collection ($p = 0.78$) were significant factors. From this analysis, we conclude that there were no systematic differences among genera in deviations from the NHZ2 record.

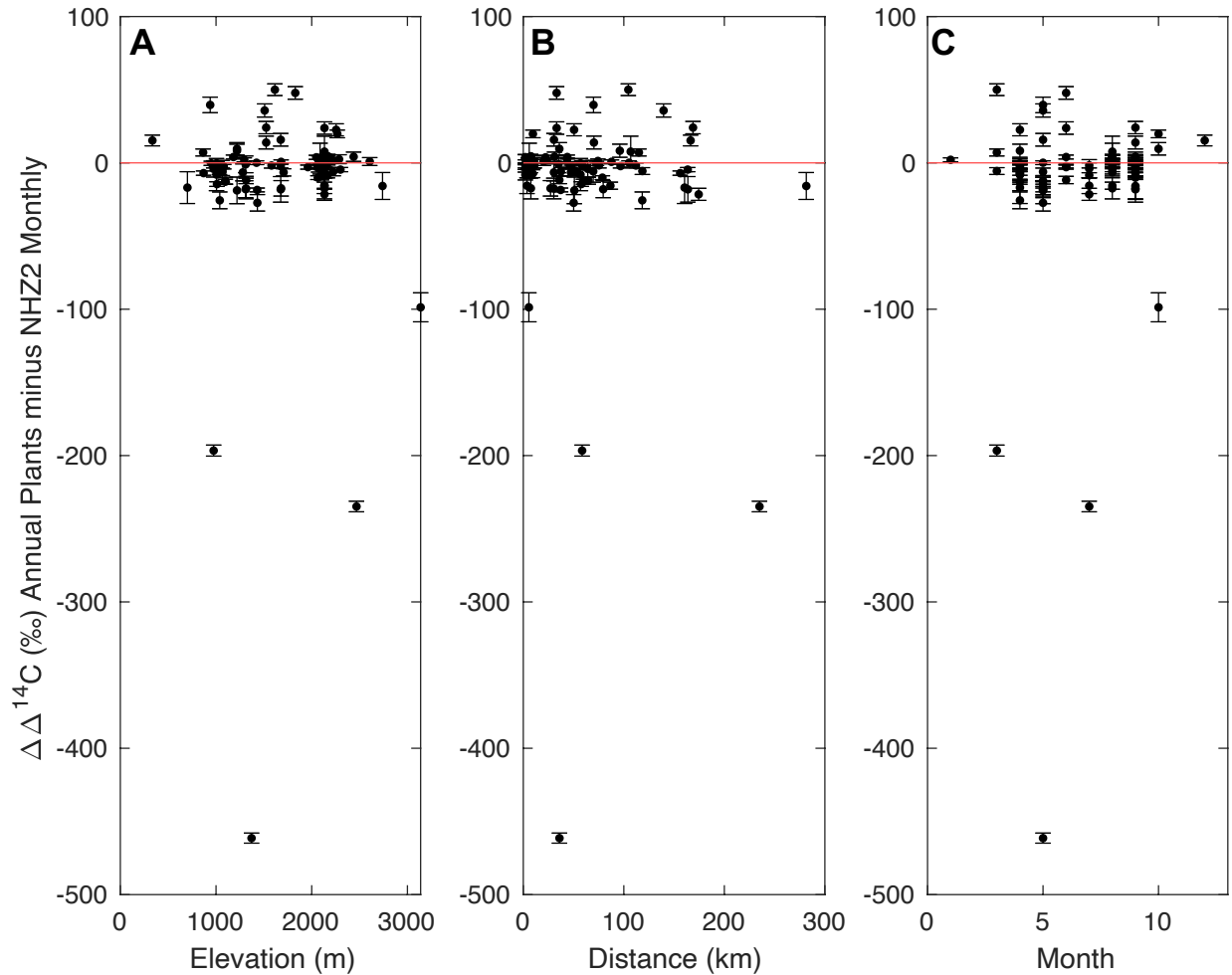


Figure S2 Difference ($\Delta\Delta^{14}\text{C} \text{‰}$) between the annual plant radiocarbon data and NH zone 2 monthly radiocarbon record from Hua et al., (2022) versus elevation (a) distance (b) from Flagstaff and month of sampling (c). Error bars represent \pm combined reported error of both datasets. Solid red horizontal line is 0‰. Using data since 1973 (to avoid the confounding effect of the delayed arrival of the peak of the bomb spike in Northern Arizona), there was a modest, but not statistically significant, relationship ($n = 48$, $r^2 = 0.06$, slope = $-0.036 \pm 0.020 \text{‰ km}^{-1}$, $p = 0.09$) between distance from Flagstaff and $\Delta\Delta^{14}\text{C}$. Similarly, the relationship between elevation and $\Delta\Delta^{14}\text{C}$ was negligible and not statistically significant ($n = 48$, $r^2 = 0.06$, slope = $0.0030 \pm 0.0018 \text{‰ m}^{-2}$, $p = 0.10$). However, based on one-way generalized linear model (GLM), some differences in $\Delta\Delta^{14}\text{C}$ among months were significant ($n = 48$, $F = 2.39$, $p = 0.03$), with a minimum $\Delta\Delta^{14}\text{C}$ in June and maximum in November.

Table S1. The RITA (Radiocarbon In Terrestrial Annuals) synthetic $\Delta^{14}\text{C}$ curve, fit to data from annual plants collected in the vicinity of Flagstaff, Arizona. This local record, developed using LOESS smoothing (see Methods), is intended to be representative of the southern Colorado Plateau. For year, the “.5” suffix denotes summertime values, in 1962-64 during rapid change, subannual values were also included (“.0”). The “Annuals” column indicates the number of locally-collected plants that were analyzed for $\Delta^{14}\text{C}$ and used for fitting the “RITA $\Delta^{14}\text{C}$ ” record. “1 σ uncert.” is our estimate of uncertainty on the annual value, calculated from smoothed loess residuals, and is an indication of the region ($\pm 1 \sigma$) in which a new measurement might be expected to fall. “Yearly change” is the first-difference slope of the RITA record, and provides a measure of the potential dating accuracy in relation to other uncertainties. “Hua” and “Graven” columns repeat the smoothed curves (annual, summertime values) presented by Hua et al. (NH zone 2) and Graven et al. (NH) respectively, the ΔHua and ΔGraven columns are the arithmetic difference between those smoothed curves and the RITA record. We encourage users of RITA to consider the uncertainties we report when dating samples, and to account for how uncertainty in the RITA curve translates to uncertainty in the estimated age of a sample.

Year	Annuals	RITA $\Delta^{14}\text{C}$	1 σ uncert.	Yearly change	Hua	ΔHua	Graven	ΔGraven
1910.5	1	-13	4				-8	-6
1911.5		-14	4	0			-8	-6
1912.5		-14	4	0			-8	-6
1913.5		-14	4	0			-8	-6
1914.5	1	-15	4	0			-9	-6
1915.5		-15	4	0			-9	-6
1916.5		-16	4	-1			-10	-6
1917.5		-16	4	-1			-11	-6
1918.5		-17	4	-1			-11	-5
1919.5		-17	4	-1			-12	-5
1920.5		-18	4	-1			-13	-5
1921.5		-18	4	-1			-13	-5
1922.5		-19	5	-1			-13	-6
1923.5	1	-19	5	-1			-13	-6
1924.5		-20	5	-1			-13	-6
1925.5		-20	5	-1			-14	-7
1926.5		-21	5	-1			-14	-6
1927.5		-21	5	-1			-15	-6
1928.5	1	-22	5	-1			-16	-6
1929.5		-22	5	-1			-16	-6
1930.5		-23	5	-1			-17	-6
1931.5		-24	5	-1			-17	-7
1932.5		-24	5	-1			-17	-7
1933.5	1	-25	5	-1			-17	-8
1934.5		-25	5	-1			-17	-8
1935.5		-26	5	-1			-18	-9
1936.5	1	-27	5	-1			-18	-9
1937.5		-27	5	0			-19	-8
1938.5		-26	5	0			-19	-7

Year	Annuals	RITA $\Delta^{14}\text{C}$	1 σ uncert.	Yearly change	Hua	ΔHua	Graven	ΔGraven
1939.5		-26	5	0			-20	-6
1940.5		-26	5	0			-20	-6
1941.5		-26	5	0			-21	-5
1942.5		-25	5	0			-21	-4
1943.5		-25	5	0			-22	-3
1944.5		-25	5	0			-22	-3
1945.5	1	-25	5	0			-23	-2
1946.5		-27	5	-3			-23	-4
1947.5	1	-31	5	-4			-24	-8
1948.5		-35	5	-4			-24	-11
1949.5		-39	5	-4			-24	-15
1950.5	1	-43	6	-4	-27	-16	-25	-18
1951.5	1	-42	6	1	-26	-16	-25	-17
1952.5	2	-39	7	3	-26	-13	-25	-14
1953.5		-31	8	8	-20	-11	-24	-7
1954.5		-13	9	18	-16	3	-21	8
1955.5		5	10	18	5	0	-8	13
1956.5		41	10	36	29	12	27	14
1957.5		77	11	36	64	13	73	4
1958.5		157	12	81	120	37	140	17
1959.5	2	203	13	46	213	-10	228	-25
1960.5	2	202	7	-1	215	-13	212	-11
1961.5	3	202	19	0	220	-18	222	-20
1962.0	1	231	43	39				
1962.5	1	286	67	85	309	-23	359	-72
1963.0	1	387	83	156				
1963.5	3	534	85	247	722	-188	718	-185
1964.0	2	740	54	353				
1964.5	3	800	27	267	784	16	836	-36
1965.5	4	759	9	-41	734	25	756	3
1966.5	1	694	16	-65	678	16	692	2
1967.5	1	634	18	-60	632	2	624	10
1968.5	1	574	20	-60	583	-9	565	9
1969.5	3	541	20	-32	553	-12	545	-4
1970.5	1	515	15	-27	509	6	529	-15
1971.5	1	488	11	-26	489	-1	499	-11
1972.5	1	460	7	-29	474	-14	466	-6
1973.5	2	431	5	-28	442	-11	419	12
1974.5		406	5	-25	415	-9	401	5
1975.5	1	380	5	-25	386	-6	370	10
1976.5	1	355	5	-25	356	-1	353	2
1977.5	1	335	5	-20	336	-1	334	1
1978.5	1	316	6	-19	328	-12	326	-10
1979.5	2	297	6	-19	291	6	296	1
1980.5	1	278	7	-19	274	4	265	14
1981.5		261	7	-18	263	-2	257	4
1982.5	1	243	6	-17	243	0	238	5
1983.5	2	227	6	-17	230	-3	224	3
1984.5	1	211	5	-16	212	-1	209	2

Year	Annuals	RITA $\Delta^{14}\text{C}$	1 σ uncert.	Yearly change	Hua	ΔHua	Graven	ΔGraven
1985.5	2	196	5	-15	205	-9	201	-5
1986.5	1	182	5	-14	192	-10	191	-9
1987.5	1	170	5	-12	184	-14	184	-14
1988.5	1	158	6	-12	172	-14	175	-16
1989.5	1	151	6	-8	163	-12	164	-13
1990.5		143	7	-8	151	-8	152	-10
1991.5	1	135	7	-8	142	-7	142	-7
1992.5	1	128	6	-7	137	-9	136	-9
1993.5		120	6	-7	128	-8	129	-8
1994.5	1	113	5	-7	119	-6	122	-9
1995.5	2	108	5	-6	114	-6	116	-8
1996.5	1	103	5	-5	106	-3	110	-7
1997.5	1	97	5	-5	102	-5	103	-6
1998.5	1	92	5	-5	100	-8	99	-7
1999.5		87	6	-5	93	-6	94	-8
2000.5		81	6	-5	86	-5	88	-7
2001.5	1	76	7	-5	81	-5	82	-6
2002.5	1	71	7	-5	75	-4	76	-5
2003.5	2	67	6	-4	69	-2	71	-3
2004.5	1	64	5	-4	65	-1	65	-2
2005.5	2	60	4	-4	59	1	61	-1
2006.5	1	54	3	-5	57	-3	57	-2
2007.5		49	3	-5	51	-2	53	-4
2008.5	1	44	3	-5	48	-4	49	-5
2009.5	1	41	3	-3	45	-4	46	-5
2010.5	1	37	4	-5	40	-3	42	-5
2011.5	1	32	4	-5	36	-4	37	-6
2012.5	1	27	4	-5	31	-4	30	-4
2013.5	2	22	4	-5	23	-1	24	-3
2014.5	1	18	4	-3	20	-2	20	-1
2015.5	2	16	3	-2	15	1	14	2
2016.5	1	15	2	-1	12	3		
2017.5	1	12	2	-4	8	4		
2018.5	1	8	2	-4	4	4		
2019.5	4	5	1	-3	0	5		
2020.5	3	2	1	-2				
2021.5	2	0	1	-2				