A Dendrochronology Study of Select Framing Timbers from the Wolfrum House, North Hoosick, NY

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Introduction

On December 4th , 2021, a selection of timbers were cored in the Wolfrum house located at [redacted] North Hoosick, New York by William Flynt for the purposes of conducting a dendrochronology study. All samples were mounted, sanded, measured, and analyzed back in Vermont by William Flynt.

Background

Dendrochronology, or the study of tree ring growth patterns to date the age of archeological timbers, was initially developed in the 1920's by Andrew E. Douglass using long-lived Ponderosa pines in the Southwest United States. An astronomer by training, Douglass was interested in historical sun spot activity and its relationship to earth's climate. He surmised that by looking at yearly growth ring sequences in long-lived trees growing in an arid environment where moisture is key, he might be able to ascertain yearly variations in climate attributable to sunspot activity. (Baillie, 1982). To push the tree ring database back past the age of living trees, samples were taken from roof poles in Pueblo ruins that turned out to eventually overlap the living tree data. Besides fulfilling his research needs, this work revealed the feasibility of dating archeological structures.

In the 1980's the advent of computer programs to collate data, run comparative analyses, and compile master chronologies enabled unknown samples to be compared to known masters with a high degree of accuracy. Pioneering work in Eastern Massachusetts focusing on Oak (Krusic and Cook 2001, Miles, Worthington and Grady 2002, 2003, 2005) and in the Connecticut River valley initially concentrating on Pitch pine (Krusic 2001,Flynt 2004) and expanding into oak, chestnut, hemlock, spruce, and white pine, has revealed the suitability of using dendrochronology as a mainstream research tool for analyzing and establishing construction timber felling dates in the Northeast, a region heretofore considered too variable climatically to provide reliable results.

Over the past 20 years conducting such studies of historic structures throughout New England and eastern New York state, the author has been able to develop numerous site and regional dated masters for all of the species noted above. These are constantly being updated as additional material is dated and added to the appropriate masters to further enhance the chances of successfully dating future projects.

It should be remembered that trees were usually felled in the winter months with frame preparation occurring shortly thereafter, so the earliest a frame could be raised would be in the year following the felling date delineated in a dendrochronology study such as this.

Procedures

In procuring samples suitable for dendrochronology research, the analyst must be on the lookout for timbers, framing, and boards that exhibit several parameters. First, a bark, or waney, edge must be present if one wishes to establish with certainty the last year of

growth. Second, there needs to be a sufficient number of rings in a sample to span several distinctive climactic variations that register as patterns of wide and narrow rings. Ideally, having 100 or more years of growth is best, but more often than not, samples will range from 50 to 100+ years. While it is feasible to get dates on young samples (50-60 rings), spurious results are possible and thus must be reviewed carefully both with longer-lived samples from the same structure as well as with what documentary and stylistic research uncovers. Third, enough samples need to be obtained (10-15 per building episode is usually reasonable) to allow for comparison and the fact that often some will not align for one reason or another. It is also critical that an assessment be made of the building frame to ascertain that the members from which samples are extracted were not reused or inserted at a later date, or, if so, are duly noted. Fourth, all samples must be labeled and entered into a log book that notes the position of each sampled timber within the structure, its species, whether or not it has wane, and any other information pertinent to the sample. In labeling the samples the following code was employed; NHW (North Hoosick, Wolfrum). The numbers that follow simply refer to the sequence in which the samples were taken.

Samples were extracted using a custom coring bit, chucked into a 20 volt, ½" DeWalt battery-powered drill that creates a 9/16" hole out of which is obtained a 3/8" core. Core samples were glued into custom wood mounts and sanded using successively finer grit paper (150-600 grit) both on a bench top belt sander and by hand sanding to create a mirror-smooth finish. All samples were then viewed under an Amscope 7.5-45X binocular microscope fitted with cross hairs in one eyepiece to count and mark the number of rings per sample. This was followed with a careful visual review, again under magnification, in an attempt to determine if site-specific growth patterns could be ascertained in order to help cross date the samples. Each sample was then placed under the microscope on a Velmex Acu-Rite Encoder sliding stage calibrated to read to the nearest micron (.001mm). Measuring begins at the outer, or last year of growth ring (LYOG), established as 1000, and proceeds to the center of the sample or first year of growth, as measured (FYOG). At the junction of each growth ring, the analyst registers the interface electronically, which sends the measurement to the computer via a VMO Digital Readout.

In all of the work in this study, the measuring program MEASURE J2X was used to compile each sample's raw data files. The program transforms the ring widths into a series of indices that relate each ring's growth to its neighbors, thus standardizing the climate-related influences on a year-to-year basis (Krusic 2001). Thus trees from a similar location but growing at different rates should exhibit similar indices. With the raw data in hand, using the program COFECHA (Holmes, 1983) the samples from this site can be compared with each other to determine if all were cut at the same time or within the span of several years or more. The hope is that a floating chronology can be developed revealing the felling relationship between some, if not all of the samples within each species. The samples are also compared against one or more dated regional master chronologies or site masters of the same species to determine the exact year or years when the samples in question were felled. As strong samples are uncovered, these

are added to a fledgling site master and the raw data is again run against this site master to see if additional samples align.

With COFECHA samples are broken down into ring groups of 50 years that are then compared to either the other undated samples (to create a floating site master) or with various dated masters (to determine a calendar year match). The 50-year ring groups in an individual sample are lagged a certain number of years (in this study a lag of 25 years was used) to provide an overlap of data within the groupings. The results are displayed in a series of ways, with Part 8 "Date Adjustment for Best Fit Matches for Counted or Unknown Series" composed of columns with the "best fit" being in column #1, the next "best fit" in column #2 and so on out 11 columns. The "add" number is the number to be added to the last year of growth (1000) to provide the year date of felling, while the "corr" number relates to how well the "add" meshes with the master. A correlation coefficient of .3281 is considered the threshold of significance for 50-year ring groups. Higher correlation values (preferably over .40) accompanying consistent "add" numbers in the first column usually reveal reliable results. In the example below, consistent "add" numbers with strong correlations appearing in the first column for samples DLBH-07 and 08 reveal each samples true date of felling (1784 and 1782 respectively). Sample DLBH-09 does not show consistently strong correlation with any particular date. Note that the lag used in this example is 10 years.

SERIES	COUNTED SEGMENT	CORR ADD # 1	CORR ADD # 2	CORR ADD # 3	CORR ADD # 4	CORR ADD # 5	CORR ADD # 6	CORR ADD # 7	CORR ADD # 8	CORR ADD # 9	CORR ADD #10
DLBH-07	937- 986	784 .51	712 .47	729 .37	713 .37	847 .33	846 .31	728 .30	813 .29	800 .29	763 .28
DLBH-07	947- 996	784 .54	712 .45	760 .33	816 .31	729 .31	800 .29	713 .29	671 .29	847 .26	808 .25
DLBH-07	951-1000	784 .41	760 .35	712 .35	661 .31	787 .30	800 .29	774 .29	729 .27	808 .26	832 .25
DLBH-08	929- 978	782 .44	746 .42	793 .33	760 .32	705 .32	840 .31	858 .30	689 .30	824 .28	685 .26
DLBH-08	939- 988	782 .61	746 .37	689 .34	840 .30	725 .29	708 .27	723 .27	806 .27	684 .25	724 .25
DLBH-08	949- 998	782 .69	669 .47	840 .41	722 .32	806 .28	708 .27	700 .26	683 .25	723 .25	720 .24
DLBH-08	951-1000	782 .69	669 .38	840 .38	722 .34	757 .29	700 .28	730 .25	659 .24	838 .23	723 .23
DLBH-09	932- 981	713 .52	785 .35	848 .35	744 .35	729 .32	863 .31	846 .28	849 .26	693 .26	714 .25
DLBH-09	942- 991	846 .38	713 .36	785 .33	848 .33	729 .29	727 .29	790 .29	693 .28	761 .28	705 .27
DLBH-09	951-1000	799 .43	783 .39	731 .30	689 .30	808 .29	767 .27	756 .26	790 .25	814 .24	846 .24

Once samples from a site are firmly dated and grouped into a site master, Part 2 "Correlations with Master Series of all Segments as Dated and Measured" and Part 3 "Segments Correlating Low, or Higher, at other than Dated Position" of COFECHA can be viewed to see how well each sample correlates with the others in the group and where weak areas within the ring counts are located for further scrutiny.

Results- See Figure 1

Of the twelve samples extracted from the attic and basement framing, all were pitch pine with excellent ring counts. The first series of tests compared individual samples from the house with the group as a whole in an attempt to create an undated floating master that would indicate the relationship of each sample's felling with the others in the group. Chart 1A reveals that all samples could be related to each other as having been felled in the same year (delineated by the "0" repeatedly showing up in the first column). Sample NHW-08 clearly has a missing ring buried somewhere in its growth pattern as illustrated by the two "-1" notations for the first two 50-year ring groups which change over to "0" for the last two 50-year ring groups. In spite of a detailed microscopic inspection of this sample with a number of the others, the exact location of the missing ring could not be

determined. With eleven samples aligning strongly as having come down the same year, the discrepancy noted in NHW-08 is not cause for much concern. Chart 1B reveals how well each of the aligned samples' 50-year ring groups relate to the other samples where they overlap. Overall the correlation coefficients are strong, indicating the alignments are accurate.

The next series of tests compared the raw pitch pine data to several regional dated pitch pine masters developed by the Lamont-Doherty Tree-Ring Laboratory (LDTRL) and the author. While not all provided meaningful results, two revealed significant alignments with specific dates, and one clearly hinted at the same dates. A run against an Albany pitch pine master (LDTRL), as depicted on Chart 2, reveals that many of the samples align in portions of their growth with the year 1772. Sample NHW-05 aligns well with this date throughout its growth whereas with the other samples, the date is sprinkled throughout the columns signaling a generally weaker affinity to the dated master. Interestingly, NHW-08 indicates wanting to align with 1771 for the first half of its growth and 1772 for the second half, In agreement with the one –year difference noted on Chart 1A. A second test against a more regional eastern New York pitch pine master (LDTRL & the author), illustrated on Chart 3, once again indicates a strong affinity for the 1772 date in all samples with the exception of NHW-03. Samples NHW-02, 04, and 05 show a stronger alignment with 1772 than they did against the Albany master while the other samples tend to align better, as well, but still with areas of weakness. A third test working with a larger, but more geographically distant, pitch pine master from the Connecticut River Valley of Massachusetts (Chart 4) reveals weaker, but still consistent appearances of the 1772 date in a majority of the samples. While not strong enough on its own to conclusively date the Wolfrum house samples, the fact that the recurring date in this test agrees with the geographically closer New York master comparisons helps confirm the validity of the date. With the results of the various tests in agreement, the Wolfrum house samples were assigned calendar dates to create a pitch pine site master as delineated on Charts 5A and 5B.

Discussion

As William Krattinger points out in his field notes on the house, while the detailing of the building might appear to indicate a construction period in the second quarter of the 19th century, a close inspection of the framing in the attic and basement reveals scribe rule construction, a method typical of the 18th century and earlier (but not later). The results of this study confirm this scenario. Other evidence of 18th century detailing was noted on entering the attic space where the original north vertical board wall sheathing of the closet below extends up into the attic where it is secured with large wrought nails to the original collar tie that serves as the second floor ceiling joists. How many other original board walls remain behind later plaster in the house is unclear, but worthy of study. However, one perplexing aspect of the attic framing (below the added 19th century rafter extensions) relates to the fact that the Roman numerals noted at most joinery connections indicate that the original roof framing bents were not erected in numerical sequence from one end to the other. Might this be due to reuse? Were they erected out of order initially? This too, warrants further scrutiny. Being able to access framing members within the main body of the house (posts, plates, first floor ceiling framing, etc) for inspection/testing would certainly help resolve this question.

While the data from the house did not align as strongly as one would hope when compared to various regional pitch pine masters, this could well be due to the fact that the buildings included in the New York pitch pine master chronologies are a bit distant from North Hoosick. Most are located in the Hudson River Valley in the Albany area and points south and west of the city. In fact it was a bit surprising to find all framing sampled to be pitch pine in light of the North Hoosick location. Be that as it may, the samples did align with enough strength to confirm that the trees felled for this small dwelling's frame were all cut during the winter of 1772/3 with frame erection no earlier than the spring of 1773. Knowing the date of felling, a focus on documentary records for the period 1772-4 might reveal additional information related to the construction of the house.

Acknowledgements
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FIGURE 1

WOLFRUM HOUSE, [redacted] NORTH HOOSICK, NEW YORK

SAMPLE	AGE	FYOG	LYOG	WANE	SPECIES	LOCATION
ATTIC						
NHW-01	113	1660	1772	Y	PIRI	E.SIDE RAFTER,RN*III,1STS.OF ATTIC STAIRWAY
NHW-02	127	1646	1772	Y	PIRI	CEILING TIE BEAM(RAFTER COLLAR)ASSOCIATED WITH NHW-01
NHW-03	84	1689	1772	Y	PIRI	E.SIDE RAFTER POST RN*II
NHW-04	101	1672	1772	Y	PIRI	E.SIDE RAFTER,RN*VII(4THFROM S.GABLE)
NHW-05	118	1655	1772	Y	PIRI	E.SIDE RAFTER POST,RN*VIII
NHW-06	138	1635	1772	Y	PIRI	W.SIDE RAFTER,RN*VI (4THFROM N.GABLE)
NHW-07	99	1674	1772	Y	PIRI	W.SIDE RAFTER POST,RN*II(5TH FROM N.GABLE)
NHW-08	116	885	1000	Y	PIRI	W.SIDE RAFTER POST,RN*VI
BASEMENT						
NHW-09	147	1626	1772	Y	PIRI	4TH MAJOR E-W GIRT FROM N.SILL
NHW-10	120	1653	1772	Y	PIRI	2ND MAJOR E-W GIRT FROM N.SILL
NHW-11	108	1665	1772	Y	PIRI	1ST MAJOR E-W GIRT FROM N.SILL
NHW-12	135	1638	1772	Y	PIRI	3RD MAJOR E-W GIRT FROM N.SILL

FYOG = FIRST YEAR OF GROWTH, AS MEASURED
LYOG = LAST YEAR OF GROWTH
PIRI = PITCH PINE
RN* = ROMAN NUMERAL

NOTE: RAFTER ROMAN NUMERAL NUMBERING SYSTEM NOT IN SEQUENCE FROM ONE END TO THE OTHER

CHART 1A

PART 8: DATE ADJUSTMENT FOR BEST MATCHES FOR COUNTED OR UNKNOWN SERIES — Tucson-Mendoza-Hamburg-Lamont ProgLib

NHW PITCH PINE VS NHW PITCH PINE ALIGNED
50-YEAR SEGMENTS LAGGED 25 YEARS

SERIES	COUNTED SEGMENT	CORR ADD # 1	CORR ADD # 2	CORR ADD # 3	CORR ADD # 4	CORR ADD # 5	CORR ADD # 6	CORR ADD # 7	CORR ADD # 8	CORR ADD # 9	CORR ADD #10	CORR ADD #11
NHW-01	888- 937	0 .68	-23 .32	5 .30	12 .30	-12 .26	58 .24	36 .24	14 .23	-31 .22	-25 .21	-7 .20
NHW-01	913- 962	0 .64	25 .41	26 .40	-43 .34	-42 .26	-12 .24	35 .21	-59 .21	15 .17	-11 .16	-34 .15
NHW-01	938- 987	0 .74	-26 .43	-81 .38	-69 .29	-58 .23	-34 .23	-10 .23	-57 .22	-46 .22	-48 .19	1 .19
NHW-01	951-1000	0 .72	-26 .50	-69 .34	-42 .26	-48 .22	-35 .21	-27 .20	-34 .18	-15 .18	-13 .17	-85 .16
NHW-02	874- 923	0 .74	48 .36	57 .36	31 .33	-12 .32	42 .27	58 .25	23 .24	12 .19	-16 .16	64 .16
NHW-02	899- 948	0 .73	42 .36	11 .32	-12 .32	-25 .30	23 .22	22 .19	-43 .18	12 .17	35 .16	-37 .15
NHW-02	924- 973	0 .59	-54 .27	27 .23	-42 .23	-36 .21	-59 .21	-10 .20	6 .20	24 .19	-58 .19	-50 .19
NHW-02	949- 998	0 .50	-58 .33	-73 .24	-35 .22	-9 .21	-82 .20	-37 .19	-70 .19	-24 .19	-59 .18	-66 .17
NHW-02	951-1000	0 .49	-58 .34	-35 .25	-9 .23	-73 .22	-37 .21	-24 .20	-82 .20	-70 .20	-59 .19	-89 .18
NHW-03	917- 966	0 .57	33 .39	-47 .35	-59 .25	11 .24	-49 .23	-35 .23	-51 .22	-1 .22	-58 .21	26 .21
NHW-03	942- 991	0 .56	-76 .34	-33 .28	-67 .27	-1 .26	-17 .25	-59 .25	-9 .24	-58 .23	-24 .21	-51 .21
NHW-03	951-1000	0 .55	-58 .34	-33 .28	-1 .27	-67 .26	-83 .26	-76 .24	-25 .23	-46 .23	-53 .22	-43 .20
NHW-04	900- 949	0 .64	-25 .32	22 .32	48 .29	-21 .26	11 .23	-12 .23	-4 .22	34 .20	-39 .20	-9 .18
NHW-04	925- 974	0 .75	-16 .29	10 .27	-1 .26	-13 .26	-58 .25	-50 .24	-25 .22	-35 .22	-15 .21	-38 .17
NHW-04	950- 999	0 .71	-50 .30	-61 .29	-15 .27	-24 .26	-73 .26	-27 .25	-35 .24	-59 .24	-3 .22	-84 .21
NHW-04	951-1000	0 .72	-50 .30	-61 .29	-73 .26	-15 .26	-24 .25	-59 .25	-27 .25	-35 .24	-3 .21	-84 .21
NHW-05	883- 932	0 .69	-12 .34	-23 .33	31 .27	5 .26	34 .26	-25 .25	58 .21	24 .20	59 .20	35 .19
NHW-05	908- 957	0 .59	15 .34	35 .33	-42 .28	-11 .27	-48 .25	-6 .20	31 .20	-54 .17	-31 .17	-19 .17
NHW-05	933- 982	0 .74	-48 .31	-66 .26	15 .25	-42 .22	-61 .22	-23 .21	-58 .20	-35 .19	-25 .18	-15 .17
NHW-05	951-1000	0 .75	-66 .27	-15 .26	-16 .25	-73 .24	-58 .23	-42 .21	-35 .20	-92 .19	-31 .15	-50 .15
NHW-06	863- 912	0 .65	12 .48	60 .34	59 .30	85 .28	-4 .24	58 .21	5 .20	3 .18	39 .17	38 .17
NHW-06	888- 937	0 .69	12 .43	-23 .32	58 .31	46 .26	23 .24	-20 .23	38 .22	-18 .22	-31 .20	-11 .19
NHW-06	913- 962	0 .62	-59 .34	25 .34	-48 .32	15 .27	-36 .27	-43 .25	13 .24	-56 .23	-11 .23	-23 .22
NHW-06	938- 987	0 .66	-59 .37	-10 .32	-11 .32	-58 .27	-75 .27	-83 .26	-25 .23	-36 .22	-79 .20	-48 .19
NHW-06	951-1000	0 .67	-11 .32	-32 .29	-58 .28	-59 .23	-46 .22	-44 .22	-75 .19	-63 .19	-92 .18	-42 .17
NHW-07	902- 951	0 .53	46 .32	33 .28	45 .27	-47 .25	11 .25	-15 .22	26 .21	-12 .19	35 .19	31 .19
NHW-07	927- 976	0 .56	-1 .32	-58 .26	-51 .26	-16 .23	-46 .17	18 .16	-8 .16	-15 .16	-13 .15	-71 .15
NHW-07	951-1000	0 .66	-58 .39	-46 .26	-33 .24	-51 .24	-83 .24	-84 .22	-27 .22	-53 .22	-35 .21	-1 .20
NHW-08	885- 934	-1 .72	4 .29	30 .26	-13 .25	-8 .22	63 .22	-26 .21	-31 .21	22 .21	17 .20	-12 .19
NHW-08	910- 959	-1 .52	-12 .37	-43 .30	-55 .25	-24 .23	-31 .23	14 .22	-7 .22	-49 .21	-32 .20	26 .20
NHW-08	935- 984	0 .44	-35 .32	-24 .27	-80 .21	-66 .21	-50 .19	-15 .17	-13 .16	-62 .16	-2 .16	-37 .16
NHW-08	951-1000	0 .54	-15 .43	-50 .33	-89 .26	-58 .25	-62 .22	-16 .22	-32 .17	-80 .17	-33 .15	-37 .15
NHW-09	854- 903	0 .86	25 .43	83 .27	82 .26	56 .26	9 .25	57 .25	81 .24	55 .21	61 .21	43 .19
NHW-09	879- 928	0 .76	31 .35	-12 .29	25 .28	36 .23	-23 .23	18 .22	-7 .21	-25 .20	-22 .18	12 .18
NHW-09	904- 953	0 .62	-43 .37	-48 .29	11 .28	-23 .28	37 .27	35 .24	26 .23	-47 .23	12 .22	-12 .19
NHW-09	929- 978	0 .76	-48 .35	-57 .29	-22 .26	-69 .25	-34 .25	1 .24	-1 .23	-59 .22	-43 .22	2 .21
NHW-09	951-1000	0 .75	-34 .41	-82 .33	-84 .22	-42 .22	-93 .21	-64 .19	-53 .19	-91 .19	-46 .18	-21 .17
NHW-10	881- 930	0 .65	25 .36	-12 .32	-5 .25	18 .24	-18 .23	43 .23	16 .21	60 .20	59 .19	31 .17
NHW-10	906- 955	0 .64	35 .39	-18 .26	-13 .25	-36 .24	22 .24	44 .23	1 .23	-38 .21	25 .19	33 .19
NHW-10	931- 980	0 .60	-26 .36	-69 .32	-57 .27	-61 .23	-60 .23	12 .21	-24 .20	-48 .19	-34 .19	-45 .18
NHW-10	951-1000	0 .56	-34 .32	-69 .32	-85 .28	-81 .25	-46 .24	-88 .24	-53 .22	-26 .21	-24 .19	-21 .18
NHW-11	893- 942	0 .50	-38 .42	58 .31	-25 .29	51 .26	43 .25	42 .24	11 .23	-1 .22	25 .20	23 .19
NHW-11	918- 967	0 .48	-38 .30	26 .27	-20 .26	-63 .25	16 .21	1 .21	-42 .19	4 .19	-7 .18	22 .17
NHW-11	943- 992	0 .54	-20 .45	-42 .34	-26 .24	-44 .22	-89 .21	6 .16	-31 .16	-78 .16	-21 .16	-55 .16
NHW-11	951-1000	0 .59	-20 .30	-42 .24	-21 .22	-58 .21	-33 .20	-44 .20	-78 .17	-66 .16	-92 .16	-89 .15
NHW-12	866- 915	0 .64	60 .31	38 .28	48 .27	17 .26	12 .26	73 .24	76 .24	51 .23	25 .22	36 .19
NHW-12	891- 940	0 .66	-30 .33	38 .31	12 .28	25 .27	50 .26	-21 .23	-31 .20	-18 .18	58 .18	36 .18
NHW-12	916- 965	0 .56	21 .34	-35 .29	-26 .26	-37 .24	11 .24	13 .24	-12 .24	-39 .22	-55 .21	26 .21
NHW-12	941- 990	0 .56	-15 .32	-82 .32	9 .30	-60 .30	-26 .28	1 .24	-37 .24	-76 .19	-57 .18	-16 .16
NHW-12	951-1000	0 .63	-15 .44	-16 .24	-82 .23	-73 .22	-53 .21	-37 .21	-76 .19	-85 .18	-12 .17	-60 .16

CHART 1B

PART 2: CORRELATIONS WITH NHW FLOATING PITCH PINE MASTER SERIES OF ALL SEGMENTS AS DATED AND MEASURED

32-YEAR CUBIC SPLINE FILTER; CORRELATIONS OF 50-YEAR SEGMENTS LAGGED 25 YEARS

FLAGS: __A = CORRELATION UNDER 0.3281; __B = CORRELATION HIGHER AT OTHER POSITION

0SEQ	SERIES	INTERVAL	850 899	875 924	900 949	925 974	950 999	975 1024	1000 1049	1025 1074	1050 1099	1075 1124	1100 1149	1125 1174	1150 1199	1175 1224	1200 1249	1225 1274	1250 1299	1275 1324	1300 1349	1325 1374	FLAGS/ TOTAL
1	NHW-01	888-1000	=	.57	.56	.69	.66	.64															
+																							0/ 5
2	NHW-02	874-1000	.65	.65	.62	.51	.39	.37															
+																							0/ 6
3	NHW-03	917-1000	=	=	.47	.46	.47	.47															
+																							0/ 4
4	NHW-04	900-1000	=	=	.55	.69	.62	.63															
+																							0/ 4
5	NHW-05	883-1000	=	.55	.50	.62	.66	.66															
+																							0/ 5
6	NHW-06	863-1000	.48	.52	.54	.59	.58	.58															
+																							0/ 6
7	NHW-07	902-1000	=	=	.41	.49	.58	.58															
+																							0/ 4
8	NHW-09	863-1000	.61	.65	.49	.69	.68	.67															
+																							0/ 6
9	NHW-10	881-1000	=	.51	.49	.48	.46	.46															
+																							0/ 5
10	NHW-11	893-1000	=	.40	.32	.54	.51	.52															
+					___A																		1/ 5
11	NHW-12	866-1000	.47	.53	.44	.43	.52	.52															
+																							0/ 6

PART 3: SEGMENTS CORRELATING LOW, OR HIGHER AT OTHER THAN DATED POSITION Tucson-Mendoza-Hamburg-Lamont ProgLib

CORRELATIONS OF 50-YEAR SEGMENTS
FROM TEN YEARS EARLIER (-10) TO TEN YEARS LATER (+10) THAN DATED

SERIES	SEGMENT	HIGH	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
NHW-11	900- 949		-.16	.07	.09	.14	.01	.10	-.04	-.14	-.02	.19	.32	-.07	-.18	-.20	-.05	.02	.02	-.10	.00	-.03	.23
+		0											<___>										

CHART 2

PART 8: DATE ADJUSTMENT FOR BEST MATCHES FOR COUNTED OR UNKNOWN SERIES — Tucson-Mendoza-Hamburg-Lamont ProgLib

NHW VS ALBANY AREA PITCH PINE MASTER
50-YEAR SEGMENTS LAGGED 25 YEARS

SERIES	COUNTED SEGMENT	CORR ADD # 1	CORR ADD # 2	CORR ADD # 3	CORR ADD # 4	CORR ADD # 5	CORR ADD # 6	CORR ADD # 7	CORR ADD # 8	CORR ADD # 9	CORR ADD #10	CORR ADD #11
NHW-01	888- 937	686 .42	710 .42	848 .34	772 .32	830 .30	797 .28	616 .27	648 .25	697 .25	602 .24	869 .22
NHW-01	913- 962	654 .45	734 .38	791 .36	664 .35	601 .32	797 .31	600 .30	674 .29	749 .28	751 .26	724 .26
NHW-01	938- 987	675 .44	638 .39	724 .36	601 .35	674 .33	772 .31	566 .28	756 .27	783 .26	628 .26	725 .25
NHW-01	951-1000	675 .52	772 .42	638 .36	566 .34	751 .32	601 .31	625 .28	567 .28	575 .27	745 .27	698 .26
NHW-02	874- 923	697 .37	632 .33	803 .30	772 .29	754 .28	793 .28	825 .27	814 .27	799 .26	710 .24	844 .24
NHW-02	899- 948	772 .45	782 .33	799 .32	634 .30	814 .30	830 .29	697 .28	813 .28	632 .28	587 .25	768 .25
NHW-02	924- 973	674 .44	634 .41	681 .35	564 .30	751 .30	573 .29	772 .27	601 .27	664 .26	582 .25	830 .25
NHW-02	949- 998	772 .42	582 .38	809 .36	553 .33	625 .32	796 .32	628 .31	714 .31	536 .30	564 .29	745 .29
NHW-02	951-1000	772 .43	582 .36	625 .34	796 .34	553 .33	714 .30	628 .29	564 .29	536 .27	743 .26	745 .26
NHW-03	917- 966	639 .46	673 .35	783 .35	608 .35	801 .35	593 .34	743 .33	721 .32	630 .32	708 .32	741 .30
NHW-03	942- 991	565 .40	725 .39	708 .37	576 .31	666 .30	603 .30	675 .25	766 .24	783 .24	673 .24	664 .24
NHW-03	951-1000	565 .40	725 .35	603 .33	744 .32	708 .32	576 .32	640 .27	536 .24	766 .24	650 .23	666 .23
NHW-04	900- 949	772 .50	756 .34	622 .33	693 .29	623 .28	793 .27	855 .27	836 .27	584 .26	751 .26	585 .26
NHW-04	925- 974	833 .36	809 .34	709 .34	696 .31	576 .30	649 .30	772 .30	659 .30	674 .29	832 .29	831 .29
NHW-04	950- 999	772 .46	796 .44	539 .42	573 .32	647 .31	709 .30	675 .30	769 .28	659 .27	757 .27	649 .26
NHW-04	951-1000	772 .47	796 .46	539 .41	573 .32	675 .31	709 .30	647 .30	601 .28	769 .28	672 .28	649 .27
NHW-05	883- 932	772 .44	632 .38	740 .33	710 .30	868 .29	670 .28	830 .28	697 .28	825 .26	665 .25	755 .25
NHW-05	908- 957	772 .42	643 .32	634 .31	681 .30	710 .28	777 .27	697 .26	662 .24	723 .23	834 .23	760 .23
NHW-05	933- 982	772 .46	649 .38	564 .33	686 .30	675 .30	745 .30	575 .30	709 .28	796 .27	582 .27	674 .27
NHW-05	951-1000	772 .50	606 .40	708 .34	574 .30	564 .30	531 .29	757 .28	575 .28	675 .26	709 .25	745 .25
NHW-06	863- 912	811 .39	623 .39	722 .34	660 .33	869 .33	784 .32	670 .32	734 .32	793 .32	772 .31	864 .30
NHW-06	888- 937	772 .45	686 .36	784 .34	848 .33	677 .32	807 .31	623 .31	697 .31	833 .29	869 .29	830 .28
NHW-06	913- 962	654 .47	674 .46	833 .45	771 .40	576 .31	634 .30	749 .30	622 .30	686 .29	601 .26	813 .26
NHW-06	938- 987	675 .36	809 .36	724 .36	564 .34	755 .33	714 .32	612 .28	761 .27	775 .27	565 .26	649 .26
NHW-06	951-1000	564 .36	772 .35	755 .33	675 .30	777 .29	739 .29	664 .29	639 .28	628 .27	724 .27	618 .26
NHW-07	902- 951	803 .47	817 .43	624 .41	742 .35	608 .33	717 .31	595 .29	782 .29	634 .27	772 .27	833 .26
NHW-07	927- 976	619 .38	673 .35	593 .35	639 .34	708 .33	638 .33	701 .32	566 .31	817 .29	608 .28	723 .27
NHW-07	951-1000	565 .34	688 .31	664 .30	566 .30	772 .30	659 .29	714 .28	619 .27	614 .27	725 .26	536 .26
NHW-08	885- 934	771 .48	631 .33	810 .32	872 .30	829 .29	709 .28	669 .28	716 .27	615 .27	863 .26	824 .26
NHW-08	910- 959	771 .36	748 .32	833 .32	798 .31	673 .30	801 .29	709 .29	642 .27	680 .24	667 .24	806 .24
NHW-08	935- 984	772 .43	710 .38	673 .38	708 .34	606 .31	675 .30	775 .30	818 .28	563 .28	686 .26	660 .24
NHW-08	951-1000	772 .41	708 .39	658 .36	710 .32	775 .31	805 .29	740 .29	606 .29	597 .28	599 .27	577 .27
NHW-09	854- 903	797 .42	710 .36	872 .30	642 .27	648 .27	722 .27	691 .26	850 .26	793 .25	873 .25	742 .25
NHW-09	879- 928	658 .40	710 .39	740 .34	618 .31	767 .31	612 .30	807 .29	818 .28	850 .28	792 .27	834 .26
NHW-09	904- 953	825 .48	601 .46	710 .39	846 .31	674 .31	600 .29	617 .28	772 .27	750 .27	724 .26	809 .25
NHW-09	929- 978	674 .42	686 .41	601 .39	791 .36	809 .34	576 .34	825 .34	724 .32	710 .30	675 .30	761 .30
NHW-09	951-1000	772 .42	640 .36	558 .33	566 .32	724 .31	675 .31	791 .29	751 .29	606 .29	759 .28	539 .28
NHW-10	881- 930	767 .40	717 .39	618 .35	864 .31	710 .29	820 .29	671 .28	834 .28	733 .27	623 .25	697 .24
NHW-10	906- 955	710 .39	734 .36	673 .32	672 .32	831 .31	625 .31	719 .29	626 .28	654 .26	771 .26	759 .23
NHW-10	931- 980	686 .36	799 .35	641 .33	708 .33	598 .33	575 .32	812 .32	599 .31	710 .31	601 .31	634 .30
NHW-10	951-1000	772 .49	575 .38	675 .36	542 .35	799 .35	746 .30	687 .30	641 .29	788 .29	751 .28	783 .27
NHW-11	893- 942	697 .44	717 .43	767 .40	602 .36	716 .34	672 .32	834 .31	776 .28	643 .26	802 .23	632 .23
NHW-11	918- 967	712 .36	580 .36	602 .30	673 .30	690 .29	716 .29	647 .28	601 .28	834 .28	565 .27	772 .26
NHW-11	943- 992	688 .41	751 .34	772 .33	580 .30	599 .29	813 .29	666 .28	690 .27	655 .27	639 .26	765 .24
NHW-11	951-1000	772 .45	751 .42	688 .40	675 .36	601 .31	639 .30	662 .29	690 .29	799 .26	580 .25	654 .24
NHW-12	866- 915	789 .44	722 .41	772 .37	640 .36	832 .32	884 .32	679 .31	639 .31	623 .29	670 .29	869 .28
NHW-12	891- 940	772 .63	640 .43	639 .33	623 .32	733 .32	602 .28	685 .26	710 .26	822 .26	722 .25	834 .25
NHW-12	916- 965	576 .41	660 .38	834 .36	822 .36	833 .34	772 .33	589 .30	717 .30	600 .28	675 .26	758 .26
NHW-12	941- 990	660 .40	560 .34	707 .33	638 .31	756 .30	675 .30	576 .29	724 .27	619 .26	697 .25	696 .24
NHW-12	951-1000	675 .33	772 .32	756 .32	725 .32	784 .29	657 .29	724 .28	588 .28	591 .27	619 .27	613 .26

CHART 3

PART 8: DATE ADJUSTMENT FOR BEST MATCHES FOR COUNTED OR UNKNOWN SERIES — Tucson-Mendoza-Hamburg-Lamont ProgLib

NHW VS EASTERN NEW YORK STATE PITCH PINE MASTER
50-YEAR SEGMENTS LAGGED 25 YEARS

SERIES	COUNTED SEGMENT	CORR ADD # 1	CORR ADD # 2	CORR ADD # 3	CORR ADD # 4	CORR ADD # 5	CORR ADD # 6	CORR ADD # 7	CORR ADD # 8	CORR ADD # 9	CORR ADD #10	CORR ADD #11
NHW-01	888- 937	686 .42	710 .39	848 .35	755 .31	760 .30	830 .30	797 .28	772 .28	616 .27	648 .25	738 .25
NHW-01	913- 962	654 .45	664 .35	772 .34	734 .33	601 .32	686 .30	600 .30	674 .29	724 .27	797 .26	602 .26
NHW-01	938- 987	772 .40	638 .39	601 .35	675 .34	746 .32	566 .28	708 .27	683 .27	628 .26	759 .24	651 .24
NHW-01	951-1000	675 .44	772 .44	638 .36	566 .34	601 .31	688 .30	751 .29	698 .29	625 .28	567 .28	575 .27
NHW-02	874- 923	697 .37	772 .37	632 .33	814 .29	793 .29	799 .26	841 .24	754 .24	844 .24	873 .24	803 .24
NHW-02	899- 948	772 .58	799 .32	634 .30	830 .29	632 .28	814 .27	587 .25	714 .24	674 .24	697 .24	793 .24
NHW-02	924- 973	674 .45	634 .41	714 .36	772 .35	743 .35	564 .30	741 .29	573 .29	601 .27	664 .26	708 .26
NHW-02	949- 998	772 .42	809 .39	582 .38	553 .33	625 .32	628 .31	714 .31	536 .30	564 .29	644 .29	796 .29
NHW-02	951-1000	772 .43	582 .36	625 .34	553 .33	714 .30	796 .30	628 .29	564 .29	722 .27	784 .27	536 .27
NHW-03	917- 966	639 .46	783 .37	608 .35	593 .34	673 .33	743 .32	630 .32	693 .28	801 .28	833 .27	708 .26
NHW-03	942- 991	565 .40	708 .35	673 .32	576 .31	603 .30	666 .29	664 .29	714 .23	650 .23	746 .23	783 .23
NHW-03	951-1000	565 .40	603 .33	714 .32	576 .32	664 .30	640 .28	708 .27	666 .27	744 .26	650 .25	536 .24
NHW-04	900- 949	772 .55	622 .33	693 .31	793 .29	623 .28	836 .27	584 .26	855 .26	585 .26	654 .25	745 .24
NHW-04	925- 974	772 .42	833 .35	809 .35	576 .30	649 .30	659 .30	832 .28	831 .28	757 .27	573 .27	796 .26
NHW-04	950- 999	772 .52	796 .43	539 .42	573 .32	649 .32	769 .30	757 .30	659 .29	601 .26	647 .26	604 .25
NHW-04	951-1000	772 .52	796 .44	539 .41	649 .33	573 .32	757 .29	769 .29	601 .28	659 .28	647 .25	563 .24
NHW-05	883- 932	772 .51	632 .38	740 .31	830 .30	868 .30	710 .29	670 .28	697 .28	755 .27	717 .27	665 .25
NHW-05	908- 957	772 .48	743 .32	738 .32	723 .32	643 .32	634 .31	681 .30	697 .25	749 .25	799 .25	662 .24
NHW-05	933- 982	772 .47	649 .38	564 .33	747 .31	575 .30	713 .29	745 .28	686 .28	757 .27	582 .27	574 .27
NHW-05	951-1000	772 .52	606 .40	708 .35	574 .30	564 .30	718 .30	531 .29	757 .29	688 .29	575 .28	747 .27
NHW-06	863- 912	623 .39	734 .36	784 .35	722 .35	832 .34	660 .33	869 .33	670 .32	811 .30	830 .29	793 .28
NHW-06	888- 937	784 .39	848 .36	686 .36	833 .34	772 .33	677 .32	734 .31	623 .31	807 .31	697 .31	830 .28
NHW-06	913- 962	654 .47	674 .46	833 .45	771 .37	686 .37	576 .31	634 .30	622 .30	713 .29	772 .29	813 .27
NHW-06	938- 987	809 .36	564 .34	772 .32	761 .31	714 .31	697 .30	673 .28	612 .28	775 .27	675 .27	565 .26
NHW-06	951-1000	772 .37	688 .37	564 .36	777 .29	639 .27	664 .27	628 .27	618 .26	718 .26	739 .25	662 .25
NHW-07	902- 951	624 .41	803 .39	817 .39	608 .33	717 .33	595 .29	634 .27	833 .26	742 .26	609 .26	587 .25
NHW-07	927- 976	619 .38	593 .35	639 .34	638 .33	708 .32	673 .31	566 .31	817 .29	608 .28	701 .27	664 .26
NHW-07	951-1000	664 .42	714 .35	688 .35	565 .34	772 .32	659 .30	666 .30	566 .30	708 .27	735 .27	619 .27
NHW-08	885- 934	771 .63	631 .33	810 .31	829 .30	872 .29	798 .28	669 .28	709 .27	716 .27	615 .27	702 .25
NHW-08	910- 959	771 .44	798 .39	737 .32	833 .31	673 .29	742 .29	767 .29	642 .27	748 .26	801 .25	680 .25
NHW-08	935- 984	673 .41	708 .38	772 .34	699 .32	818 .31	775 .31	606 .31	563 .28	770 .28	675 .26	731 .25
NHW-08	951-1000	772 .40	708 .39	673 .36	658 .32	775 .31	606 .29	699 .28	597 .28	599 .27	577 .27	805 .26
NHW-09	854- 903	797 .54	710 .36	850 .31	765 .30	642 .27	873 .27	648 .27	722 .27	742 .27	691 .26	791 .24
NHW-09	879- 928	710 .41	658 .40	797 .38	740 .33	618 .31	722 .30	612 .30	772 .29	767 .28	779 .26	749 .26
NHW-09	904- 953	825 .47	601 .46	772 .44	710 .36	750 .34	784 .32	674 .31	846 .30	600 .29	617 .28	724 .27
NHW-09	929- 978	601 .39	674 .38	686 .37	772 .35	825 .34	576 .34	791 .34	809 .31	771 .30	563 .28	708 .26
NHW-09	951-1000	772 .44	640 .35	649 .34	558 .33	751 .33	566 .32	791 .31	759 .30	757 .29	606 .29	539 .28
NHW-10	881- 930	767 .45	717 .36	618 .35	710 .32	864 .32	820 .32	797 .30	671 .28	873 .27	623 .25	733 .24
NHW-10	906- 955	719 .38	710 .37	673 .33	672 .32	736 .31	831 .31	625 .31	717 .30	741 .28	626 .28	654 .26
NHW-10	931- 980	799 .34	641 .33	598 .33	710 .33	708 .32	673 .32	575 .32	812 .32	672 .32	686 .31	599 .31
NHW-10	951-1000	772 .50	575 .38	542 .35	799 .32	641 .30	788 .29	746 .29	762 .27	783 .24	751 .23	613 .21
NHW-11	893- 942	697 .43	717 .41	716 .37	602 .36	672 .32	814 .28	772 .28	767 .27	643 .26	734 .25	834 .24
NHW-11	918- 967	580 .36	772 .36	690 .36	712 .35	716 .34	602 .30	673 .29	710 .29	647 .28	601 .28	565 .27
NHW-11	943- 992	688 .45	772 .33	813 .32	751 .31	737 .31	580 .30	599 .29	710 .29	741 .28	765 .26	639 .25
NHW-11	951-1000	772 .45	688 .42	751 .40	675 .34	601 .31	639 .28	710 .25	580 .25	662 .24	539 .24	566 .23
NHW-12	866- 915	722 .39	640 .36	797 .35	679 .31	639 .31	884 .31	863 .29	869 .29	623 .29	670 .29	710 .28
NHW-12	891- 940	772 .44	640 .43	639 .33	797 .33	623 .32	822 .30	710 .29	602 .28	722 .27	685 .26	626 .25
NHW-12	916- 965	717 .45	772 .41	576 .41	660 .38	822 .37	834 .36	833 .32	793 .31	589 .30	825 .29	600 .28
NHW-12	941- 990	660 .40	746 .35	697 .35	560 .34	638 .31	772 .30	576 .29	756 .29	619 .26	719 .26	671 .24
NHW-12	951-1000	772 .39	784 .31	746 .29	756 .28	588 .28	760 .28	757 .28	591 .27	657 .27	619 .27	613 .26

CHART 4

PART 8: DATE ADJUSTMENT FOR BEST MATCHES FOR COUNTED OR UNKNOWN SERIES Tucson-Mendoza-Hamburg-Lamont ProgLib

NHW VS CRVM PITCH PINE MASTER 1511-1848
50-YEAR SEGMENTS LAGGED 25 YEARS

SERIES	COUNTED SEGMENT	CORR ADD # 1	CORR ADD # 2	CORR ADD # 3	CORR ADD # 4	CORR ADD # 5	CORR ADD # 6	CORR ADD # 7	CORR ADD # 8	CORR ADD # 9	CORR ADD #10	CORR ADD #11
NHW-01	888- 937	790 .40	647 .39	788 .34	759 .33	812 .33	760 .32	861 .32	772 .30	626 .29	859 .29	696 .29
NHW-01	913- 962	764 .37	760 .34	765 .33	684 .33	849 .32	666 .30	734 .29	724 .28	645 .28	884 .27	813 .26
NHW-01	938- 987	858 .49	750 .48	646 .37	788 .34	787 .33	772 .32	813 .32	696 .29	714 .29	724 .29	825 .29
NHW-01	951-1000	605 .39	686 .36	787 .36	788 .35	750 .34	566 .32	772 .30	627 .29	698 .28	592 .28	724 .27
NHW-02	874- 923	867 .34	857 .33	807 .29	844 .29	738 .27	747 .27	722 .27	751 .27	760 .26	772 .26	922 .24
NHW-02	899- 948	867 .51	772 .43	631 .39	760 .37	747 .33	836 .29	824 .29	684 .28	648 .25	807 .25	776 .24
NHW-02	924- 973	772 .41	631 .40	654 .37	684 .34	682 .33	821 .27	730 .26	611 .26	613 .25	589 .25	777 .24
NHW-02	949- 998	809 .38	701 .37	772 .37	714 .36	724 .32	788 .31	821 .30	631 .30	684 .29	835 .28	831 .28
NHW-02	951-1000	701 .39	809 .38	772 .36	714 .36	788 .32	724 .31	821 .30	684 .30	631 .29	835 .28	777 .28
NHW-03	917- 966	673 .45	639 .43	680 .42	611 .42	796 .39	600 .38	660 .32	859 .30	797 .30	772 .29	640 .29
NHW-03	942- 991	575 .40	603 .33	696 .32	801 .31	684 .31	671 .29	763 .27	620 .26	638 .25	660 .25	631 .25
NHW-03	951-1000	575 .35	638 .33	671 .30	631 .29	801 .29	646 .29	603 .28	832 .24	846 .24	763 .23	813 .23
NHW-04	900- 949	836 .49	772 .37	760 .32	798 .32	718 .31	868 .30	704 .27	807 .27	834 .25	730 .25	651 .25
NHW-04	925- 974	696 .39	646 .38	809 .38	739 .38	668 .38	774 .37	749 .36	854 .34	823 .32	772 .31	761 .31
NHW-04	950- 999	772 .33	748 .32	796 .32	800 .31	638 .30	747 .29	809 .29	576 .27	738 .25	787 .25	763 .25
NHW-04	951-1000	796 .33	772 .33	748 .31	800 .31	809 .29	763 .29	638 .28	747 .28	787 .27	738 .26	576 .26
NHW-05	883- 932	891 .37	807 .33	830 .32	635 .31	776 .29	696 .29	913 .27	747 .26	808 .24	905 .24	772 .24
NHW-05	908- 957	749 .32	802 .29	777 .28	745 .27	860 .27	834 .25	836 .25	771 .25	693 .25	654 .25	655 .24
NHW-05	933- 982	749 .40	724 .38	772 .37	604 .31	739 .31	684 .31	606 .29	825 .29	823 .28	669 .28	844 .27
NHW-05	951-1000	772 .45	710 .30	825 .29	739 .29	638 .29	631 .27	606 .27	640 .26	735 .25	813 .23	842 .23
NHW-06	863- 912	670 .40	918 .39	927 .38	743 .36	649 .36	772 .36	824 .34	811 .33	691 .31	734 .31	727 .31
NHW-06	888- 937	772 .49	704 .45	734 .40	836 .36	684 .34	873 .33	904 .32	727 .31	848 .30	859 .29	810 .26
NHW-06	913- 962	724 .49	684 .43	772 .37	849 .35	858 .31	754 .31	836 .31	825 .29	776 .28	868 .28	734 .27
NHW-06	938- 987	629 .41	579 .36	772 .35	858 .34	714 .33	684 .32	749 .31	739 .31	595 .30	724 .30	638 .30
NHW-06	951-1000	567 .45	659 .40	739 .40	593 .35	638 .35	814 .34	629 .31	847 .30	813 .30	772 .29	692 .29
NHW-07	902- 951	869 .39	704 .35	891 .33	635 .33	889 .32	610 .29	859 .29	808 .29	879 .29	845 .26	820 .26
NHW-07	927- 976	801 .42	638 .41	639 .32	646 .31	814 .30	619 .30	640 .29	675 .26	591 .25	723 .25	739 .25
NHW-07	951-1000	638 .45	801 .43	739 .31	646 .31	714 .29	813 .27	814 .26	833 .25	575 .25	671 .24	659 .24
NHW-08	885- 934	771 .44	829 .39	775 .36	759 .30	695 .29	876 .28	710 .27	717 .27	746 .26	806 .26	835 .25
NHW-08	910- 959	748 .36	692 .33	771 .32	776 .32	801 .30	833 .29	723 .27	753 .26	625 .26	759 .25	653 .24
NHW-08	935- 984	748 .41	576 .39	710 .39	649 .35	606 .34	772 .33	708 .32	858 .29	669 .29	647 .28	801 .27
NHW-08	951-1000	710 .40	669 .35	739 .35	708 .34	697 .33	578 .32	735 .30	638 .29	772 .28	786 .28	748 .28
NHW-09	854- 903	747 .46	797 .42	772 .38	709 .37	831 .34	687 .32	853 .31	660 .30	722 .29	802 .29	828 .27
NHW-09	879- 928	722 .35	807 .33	790 .33	760 .33	747 .32	697 .30	896 .30	658 .27	802 .27	801 .26	767 .25
NHW-09	904- 953	879 .42	776 .41	867 .39	684 .38	825 .36	836 .35	724 .31	712 .30	641 .29	772 .27	704 .26
NHW-09	929- 978	858 .47	825 .42	724 .36	870 .34	640 .32	800 .32	749 .31	788 .30	712 .30	813 .30	738 .29
NHW-09	951-1000	606 .36	605 .36	823 .32	825 .31	569 .30	620 .30	670 .29	567 .28	813 .28	750 .28	766 .28
NHW-10	881- 930	917 .38	691 .31	797 .31	656 .30	767 .30	873 .30	771 .28	861 .28	638 .26	772 .26	885 .26
NHW-10	906- 955	673 .42	772 .35	771 .34	847 .33	794 .33	691 .32	706 .31	736 .29	836 .27	628 .27	823 .26
NHW-10	931- 980	589 .37	666 .35	799 .35	772 .34	788 .32	736 .32	836 .30	867 .28	694 .27	783 .27	628 .26
NHW-10	951-1000	662 .38	762 .36	788 .35	750 .35	820 .33	566 .33	799 .30	686 .30	833 .27	606 .25	775 .25
NHW-11	893- 942	806 .41	859 .36	867 .35	713 .33	642 .33	722 .31	900 .29	633 .29	734 .27	691 .26	684 .26
NHW-11	918- 967	880 .35	684 .34	692 .33	629 .31	608 .30	765 .30	712 .29	764 .27	627 .26	646 .26	752 .25
NHW-11	943- 992	781 .36	768 .35	608 .30	803 .30	628 .30	605 .30	627 .29	606 .28	571 .28	813 .27	649 .26
NHW-11	951-1000	569 .34	781 .33	838 .32	662 .31	608 .31	571 .29	714 .28	692 .27	768 .27	728 .26	710 .25
NHW-12	866- 915	772 .54	722 .40	918 .40	884 .34	917 .33	742 .33	863 .32	759 .32	896 .32	789 .32	670 .31
NHW-12	891- 940	772 .65	742 .40	859 .38	905 .37	861 .36	666 .34	640 .34	797 .31	908 .31	649 .30	692 .29
NHW-12	916- 965	822 .44	867 .44	880 .38	834 .37	846 .36	692 .33	600 .32	879 .31	695 .31	797 .31	772 .30
NHW-12	941- 990	750 .34	669 .33	605 .29	858 .26	788 .26	775 .26	613 .26	787 .26	590 .26	654 .25	781 .25
NHW-12	951-1000	669 .34	750 .32	723 .29	797 .28	788 .28	587 .27	654 .27	734 .26	647 .25	748 .25	763 .24

CHART 5A

PART 8: DATE ADJUSTMENT FOR BEST MATCHES FOR COUNTED OR UNKNOWN SERIES Tucson-Mendoza-Hamburg-Lamont ProgLib

NHW PITCH PINE VS NHW PITCH PINE DATED SITE MASTER
50-YEAR SEGMENTS LAGGED 25 YEARS

SERIES	COUNTED SEGMENT	CORR ADD # 1	CORR ADD # 2	CORR ADD # 3	CORR ADD # 4	CORR ADD # 5	CORR ADD # 6	CORR ADD # 7	CORR ADD # 8	CORR ADD # 9	CORR ADD #10	CORR ADD #11
NHW-01	888- 937	772 .68	749 .32	777 .30	784 .30	760 .26	830 .24	808 .24	786 .23	741 .22	747 .21	765 .20
NHW-01	913- 962	772 .64	797 .41	798 .40	729 .34	730 .26	760 .24	807 .21	713 .21	787 .17	761 .16	738 .15
NHW-01	938- 987	772 .74	746 .43	691 .38	703 .29	714 .23	738 .23	762 .23	715 .22	726 .22	724 .19	773 .19
NHW-01	951-1000	772 .72	746 .50	703 .34	730 .26	724 .22	737 .21	745 .20	738 .18	757 .18	759 .17	687 .16
NHW-02	874- 923	772 .75	820 .37	829 .36	803 .33	760 .32	814 .27	830 .25	795 .24	784 .19	756 .16	836 .16
NHW-02	899- 948	772 .73	814 .36	783 .32	760 .32	747 .30	795 .22	794 .19	729 .18	784 .16	807 .16	735 .15
NHW-02	924- 973	772 .59	718 .27	799 .23	730 .23	736 .21	713 .21	762 .20	778 .20	796 .19	714 .19	722 .19
NHW-02	949- 998	772 .50	714 .34	699 .24	737 .22	763 .21	690 .20	735 .19	702 .19	748 .19	713 .18	706 .17
NHW-02	951-1000	772 .49	714 .34	737 .25	763 .23	699 .22	735 .21	748 .20	690 .20	702 .20	713 .19	683 .18
NHW-03	917- 966	772 .57	805 .39	725 .35	713 .25	783 .24	723 .23	737 .23	721 .22	771 .22	714 .21	798 .21
NHW-03	942- 991	772 .56	696 .34	739 .28	705 .27	771 .26	755 .25	713 .25	763 .24	714 .23	748 .21	721 .21
NHW-03	951-1000	772 .55	714 .34	739 .28	771 .27	705 .26	689 .26	696 .24	747 .23	726 .23	719 .22	729 .20
NHW-04	900- 949	772 .64	747 .32	794 .32	820 .29	751 .27	783 .23	760 .23	768 .22	806 .20	733 .20	763 .18
NHW-04	925- 974	772 .75	756 .29	782 .27	771 .26	759 .26	714 .25	722 .24	747 .22	737 .22	757 .21	734 .17
NHW-04	950- 999	772 .71	722 .30	711 .29	757 .27	748 .26	699 .26	745 .25	737 .24	713 .24	769 .22	688 .21
NHW-04	951-1000	772 .72	722 .30	711 .29	699 .26	757 .26	748 .25	713 .25	745 .25	737 .24	769 .21	688 .21
NHW-05	883- 932	772 .69	760 .34	749 .33	803 .27	777 .26	806 .26	747 .25	830 .21	796 .20	831 .20	807 .19
NHW-05	908- 957	772 .59	787 .34	807 .33	730 .28	761 .27	724 .25	766 .20	803 .20	718 .17	741 .17	753 .17
NHW-05	933- 982	772 .74	724 .31	706 .26	787 .25	730 .22	711 .22	749 .20	714 .20	737 .19	747 .18	757 .17
NHW-05	951-1000	772 .75	706 .27	757 .26	756 .25	699 .24	714 .23	730 .21	737 .20	680 .19	741 .15	722 .15
NHW-06	863- 912	772 .65	784 .48	832 .34	831 .30	857 .29	768 .24	830 .21	777 .20	775 .18	811 .17	810 .17
NHW-06	888- 937	772 .69	784 .43	749 .32	830 .31	818 .26	795 .24	752 .23	810 .22	754 .22	741 .20	761 .19
NHW-06	913- 962	772 .62	713 .34	797 .34	724 .32	787 .27	736 .27	729 .25	785 .24	716 .23	761 .23	749 .22
NHW-06	938- 987	772 .66	713 .37	762 .32	761 .32	714 .27	697 .27	689 .26	747 .23	736 .22	693 .20	724 .19
NHW-06	951-1000	772 .67	761 .32	740 .29	714 .28	713 .23	726 .22	728 .22	697 .19	709 .19	680 .18	730 .17
NHW-07	902- 951	772 .54	818 .32	805 .28	817 .27	725 .25	783 .25	757 .22	798 .21	760 .19	807 .19	803 .19
NHW-07	927- 976	772 .56	771 .32	714 .26	721 .26	756 .23	726 .17	790 .16	764 .15	757 .15	759 .15	701 .15
NHW-07	951-1000	772 .66	714 .39	726 .26	739 .24	721 .24	689 .24	688 .22	745 .22	719 .22	737 .21	771 .20
NHW-08	885- 934	771 .72	776 .29	802 .26	759 .25	764 .22	835 .22	746 .21	741 .21	794 .21	789 .20	760 .18
NHW-08	910- 959	771 .52	760 .37	729 .30	717 .25	748 .23	741 .23	786 .22	765 .22	723 .21	740 .20	798 .20
NHW-08	935- 984	772 .44	737 .32	748 .27	692 .21	706 .21	722 .19	757 .17	759 .16	710 .16	770 .16	735 .16
NHW-08	951-1000	772 .54	757 .43	722 .33	683 .26	714 .25	710 .22	756 .22	740 .17	692 .17	739 .15	735 .15
NHW-09	854- 903	772 .86	797 .43	855 .28	854 .26	828 .26	781 .25	829 .25	853 .24	827 .21	833 .21	815 .19
NHW-09	879- 928	772 .76	803 .35	760 .29	797 .28	808 .23	749 .23	790 .22	765 .21	747 .20	750 .18	784 .18
NHW-09	904- 953	772 .62	729 .37	724 .29	783 .28	749 .28	809 .27	807 .24	798 .23	725 .23	784 .22	760 .19
NHW-09	929- 978	772 .76	724 .35	715 .29	750 .26	703 .25	738 .25	773 .24	771 .23	713 .22	729 .22	774 .21
NHW-09	951-1000	772 .75	738 .41	690 .33	688 .22	730 .22	679 .21	708 .19	719 .19	681 .19	726 .18	751 .16
NHW-10	881- 930	772 .65	797 .36	760 .32	767 .25	790 .24	754 .23	815 .23	788 .21	832 .20	831 .19	803 .17
NHW-10	906- 955	772 .64	807 .39	754 .26	759 .25	736 .24	794 .24	816 .23	773 .23	734 .21	797 .19	805 .19
NHW-10	931- 980	772 .60	746 .36	703 .32	715 .27	711 .23	712 .23	784 .21	748 .20	724 .19	738 .19	727 .18
NHW-10	951-1000	772 .56	738 .32	703 .32	687 .28	691 .25	726 .24	684 .24	719 .22	746 .21	748 .19	751 .18
NHW-11	893- 942	772 .50	734 .42	830 .31	747 .29	823 .26	815 .25	814 .24	783 .23	771 .22	797 .20	795 .19
NHW-11	918- 967	772 .48	734 .30	798 .27	752 .26	709 .25	788 .21	773 .21	730 .19	776 .19	765 .18	794 .17
NHW-11	943- 992	772 .54	752 .45	730 .34	746 .24	728 .22	683 .21	778 .17	741 .17	694 .16	751 .16	717 .16
NHW-11	951-1000	772 .59	752 .30	730 .24	751 .22	714 .21	739 .20	728 .20	694 .17	706 .16	680 .16	683 .15
NHW-12	866- 915	772 .64	832 .31	810 .28	820 .27	789 .26	784 .26	845 .24	848 .23	823 .23	797 .22	808 .19
NHW-12	891- 940	772 .66	742 .33	810 .31	784 .28	797 .27	822 .26	751 .23	741 .20	754 .18	830 .18	808 .18
NHW-12	916- 965	772 .56	793 .34	737 .29	746 .26	735 .24	785 .24	783 .24	760 .24	733 .22	717 .21	798 .21
NHW-12	941- 990	772 .56	757 .32	690 .32	781 .30	712 .30	746 .28	773 .24	735 .23	696 .19	715 .18	756 .16
NHW-12	951-1000	772 .63	757 .44	756 .24	690 .23	699 .22	719 .21	735 .21	696 .19	687 .18	760 .17	712 .16

CHART 5B

PART 2: CORRELATIONS WITH NHW PITCH PINE DATED SITE MASTER SERIES OF ALL SEGMENTS AS DATED AND MEASURED

32-YEAR CUBIC SPLINE FILTER; CORRELATIONS OF 50-YEAR SEGMENTS LAGGED 25 YEARS

FLAGS: __A = CORRELATION UNDER 0.3281; __B = CORRELATION HIGHER AT OTHER POSITION

0SEQ	SERIES	INTERVAL	1625 1650 1675 1700 1725 1750 1775 1800 1825 1850 1875 1900 1925 1950 1975 2000 2025 2050 2075 2100	FLAGS/ TOTAL
			1674 1699 1724 1749 1774 1799 1824 1849 1874 1899 1924 1949 1974 1999 2024 2049 2074 2099 2124 2149	
1	NHW-01	1660-1772	= .57 .58 .73 .64 =	0/ 4
2	NHW-02	1646-1772	.65 .67 .62 .53 .37 =	0/ 5
3	NHW-03	1689-1772	= = .48 .43 .47 =	0/ 3
4	NHW-04	1672-1772	= .55 .51 .66 .63 =	0/ 4
5	NHW-05	1655-1772	= .55 .51 .66 .66 =	0/ 4
6	NHW-06	1635-1772	.48 .52 .55 .59 .58 =	0/ 5
7	NHW-07	1674-1772	= .41 .46 .45 .58 =	0/ 4
8	NHW-09	1635-1772	.61 .67 .53 .68 .67 =	0/ 5
9	NHW-10	1653-1772	= .51 .52 .49 .46 =	0/ 4
10	NHW-11	1665-1772	= .40 .37 .53 .52 =	0/ 4
11	NHW-12	1638-1772	.47 .55 .50 .41 .52 =	0/ 5