NAME: _____ **GROUP:**_____

I-4 WORKSHEET -- Fall '06
The Bristlecone Pine (BCP) Research Project

(NOTE: Take careful notes during the class activity on this worksheet. You will turn this worksheet in as part of your BCP Project Report. ***Your notes will be graded and worth 10 pts*** *out of the 50 pts for the report)*

Objectives:
- to learn more about bristlecone pine sites and how to collect and analyze tree-ring data from cores
- to understand the concept of pattern-matching & crossdating between trees and between sites
- to become aware of the influences of climate and elevation on trees
- to understand the methods of making a master chronology
- to discover evidence of how climate varies through time

Logistics for the class project:

Five tree-ring sites are being studied (see attached site map). There are 4 groups working on each site; two groups working on the early period of the record at a site (1750-1900) and two groups working on the later period of the record at a site (1850- present -- *note overlap in record*).

At each site, there are records from for 4 different trees (for groups with more than 4 members, some students will have duplicate cores) (2 cores per tree -- early part and later part of record is represented in different groups)

1 master chronology for the site *(to be provided by instructor)*

What you should have completed in advance:
- A skeleton plot on graph paper for your own core, marked with frost rings if applicable, & starting & ending dates
- A "site composite" with all the plots for your site properly pattern-matched, dated, & taped together

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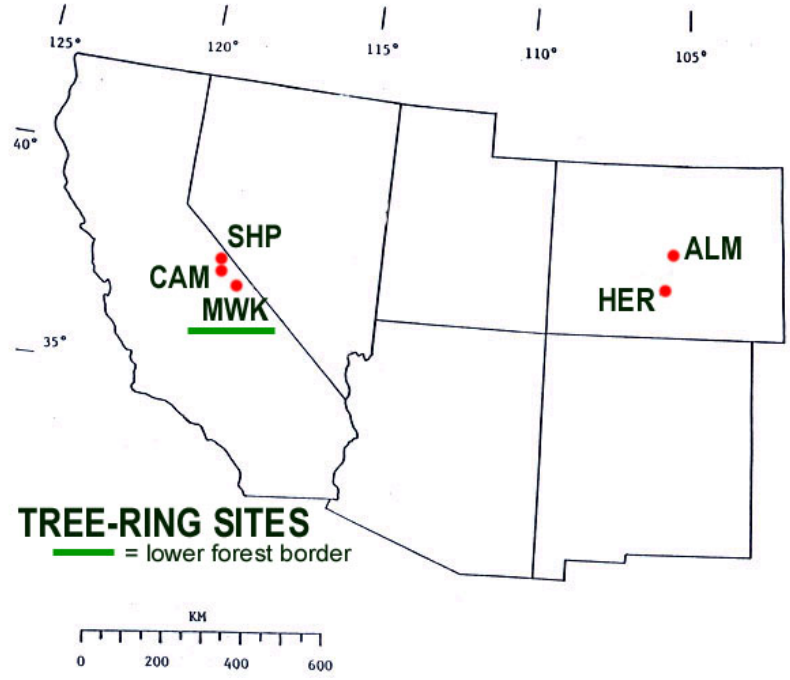
PART A -- DESCRIPTIONS OF THE FIVE BRISTLECONE PINE SITES (class presentation)

❑ 1. As you listen to the presentation on the 5 bristlecone pine sites, **fill in the TABLE on the last page of this handout** with information and comments about the 5 sites being analyzed by the class. You will need this information to answer questions later and for your BCP Research Reports.

BRISTLECONE PINE SITES

	Core ID
Sheep Mt (SHP)	**C**
Campito Mt (CAM)	**D**
Methuselah Walk (MWK)	**B**
Almagre Mt (ALM)	**E**
Hermit Lake (HER)	**A**



PART B -- ANALYZING <u>YOUR</u> SITE

- ❑ Your Preceptor will gather together the 2 teams that analyzed the same site (the early part of the record & the later part of the record) into a **SITE GROUP**. Your Preceptor will present and explain the full chronology of the measured **ring-width indices** for your site and point out key things to notice. **Discuss** what you discovered about your site (e.g., variations, frost rings, and trends -- Are there differences between pre-1900 ring widths and post-1900 ring widths and frost ring frequency?)

✍ Enter the name of your site:

<u>Data collection & Observations from your site's **SKELETON PLOT MASTER:**</u>

✍ Enter the **years** during which **frost rings** formed at your site:

✍ Describe the relationship between **frost ring years** and **narrow ring years** (if any):

✍ Describe differences (if any) between pre-1900 & post-1900 frequency of frost rings:

<u>Data collection & Observations from your site's **RING WIDTH INDICES PLOT :**</u>

✍ Describe the variation in the time series of the **ring width indices** at your site (e.g., *increasing trend, no trend ,step change beginning at 1900, etc. etc.)*

✍ Describe any other interesting things about your site that you observed:

PART C: ANALYZING SITE-TO-SITE COMPARISONS

❑ Your Preceptor will then provide you with **the skeleton plot masters** and **ring-width indices for the 4 other sites** so you can compare the data from site to site. Spend some time looking at all the site chronologies and reviewing the notes you took during Dr H's presentation. Which sites appear to be similar in terms of tree growth? Which are different? What explanations can you come up with for the similarities and differences?

✎ Now continue to fill in the observation **table on the last page s**o that you can make site-to-site comparisons

PART D: DEVELOPING & TESTING HYPOTHESES

As a SITE GROUP, **discuss and develop various hypotheses** about site-to-site comparisons in tree-ring variability and what evidence of global change the trees at the study sites might contain.

(NOTE: to review what a hypothesis is, see p 13 in Class Notes)

IMPORTANT: A hypothesis must be stated in a way that can be tested by the available data.

Hypotheses #1 & # 2 are stated for you to get you started:

❑ **Hypothesis #1: Trees in sites that are closer together will pattern-match and crossdate better than sites that are far apart.**
(Discuss and figure out how to test this hypothesis. HINT: use the master skeleton plots!)

❑ Determine which sites are **near each other** and which are far apart (e.g. CA sites vs. CO sites), TEST Hypothesis #1 and RECORD YOUR FINDINGS HERE:

	Results of comparison between the California sites:	Results of comparison between the Colorado sites:	Results of comparison between the California & Colorado sites:
Describe whether sites pattern match and/or crossdate			
Is Hypothesis #1 supported?			

❑ SPECULATE on what factors (similar local climate, similar species, similar elevation, etc.) might influence whether sites **pattern-match & crossdate** or not.

❑ **Hypothesis #2**: **Trees in sites that are closer together -- and which crossdate -- will exhibit similar <u>variation</u> and <u>trends</u> in their ring-widths over time (i.e., throughout the entire length of their records).**
(Hint: ,for this hypothesis, use the <u>master plot of ring width indices</u> in addition to the master skeleton plots, which have frost rings marked on them.)

❑ TEST Hypothesis #2 and RECORD YOUR FINDINGS HERE:

	Results of comparison of indices between the California sites:	Results of comparison of indices between the Colorado sites:	Results of comparison of indices between the California & Colorado sites:
Describe whether sites have similar ring width variation and trends			
Is Hypothesis #2 supported?			

❑ SPECULATE on which factors (temperature vs. precipitation sensitivity; elevation; soil type, and/or geographic location.) might influence trees to grow at different sites in similar ways -- or in different ways -- over a long period of time.

❑ Scientists have proposed different hypotheses for why the tree growth at some of the study sites exhibits a prominent increasing trend in the 1900s. One of them is:

Hypothesis #3: The increasing growth trend in the 1900s is evidence of a <u>local</u> or <u>regional</u> temperature response to the <u>Northern Hemisphere / Global warming trend</u>. *(see the graphs on pp 99 -102 & 119 in CLASS NOTES for plots of the Northern Hemisphere / Global warming trend)*

This hypothesis can **NOT** be tested with the data you have collected alone -- additional data would have to be collected to test it.

❑ DISCUSS & DESCRIBE WHAT ADDITIONAL DATA would be useful to test hypothesis #3 to determine if it is correct:

❑ **CONSTRUCT A TESTABLE HYPOTHESIS about Frost Rings in the trees at the study sites.**

(Hints: Might the frost ring frequency be expected to change under warmer conditions? Might frost rings be expected to occur more often in some locations rather than others? Do frost rings always occur in otherwise stressful years, or stress the tree's growth in a future year? etc. etc.)

Your Hypothesis #4:

❑ Now examine the frequency and characteristics of frost rings over time at the various sites, TEST your Hypothesis #4, and DESCRIBE YOUR FINDINGS.

❑ STATE SEVERAL EXPLANATIONS for why this hypothesis might be true or not true:

VARIABLES *(NOTE: A variable is something that varies from site to site or from time to time at one or more sites* **)**	**OBSERVATION TABLE: SITE-to-SITE COMPARISONS**				
	Sheep Mt Core ID = C	**Campito Mt Core ID = D**	**Methuselah Walk Core ID = B**	**Almagre Mt Core ID = E**	**Hermit Lake Core ID = A**
Geographic Location					
Elevation					
Upper or Lower Forest Border?					
Moisture- or Temperature- sensitive?					
Rock / soil type					
# of frost rings in entire record **Any differences in # of frost rings over time?**					
Trends in the time series of the ring width indices?					
Pre- & post 1900 differences?					
Other observations or things you noticed at each site?					