

K-12 Education Partnership:

Students and Teachers Experiencing LTER

Long Term Ecological Research Network



K-12 Education Partnership: Students and Teachers Experiencing LTER

Recognizing a need for increased understanding of inquiry-based science among our nation's youth, the National Science Foundation has supplemented the 24 sites in the Long Term Ecological Research Network with funding for educational programs that engage kindergarten through 12th grade students and teachers with LTER principal investigators. Three years into the SLTER program, a survey of the sites demonstrates more than 60 LTER principal investigators have interacted directly with more than 200 K-12 teachers and well over 6,000 children. These interactions have yielded numerous products, including LTER plots on schoolyard sites, guidance through inquiry-based science methods for K-12 students and teachers, and new datasets produced by school children.



The following is a glimpse into those activities, encouraging dialogue within the scientific community about ideas, experiences, and future interactions among those committed to including K-12 teachers, students and parents in our future research and education endeavors...

The LTER Network



Coweeta LTER

Coweeta LTER scientists, staff, and teachers provide middle school, high school, and community college students "hands on" field and laboratory research experience. This Schoolyard initiative formally provides instruction, field research, and data summary and analysis experiences to K-16 students and

instructors using Coweeta LTER research projects as an example. In addition, these groups have initiated six new research collections. The overall goal of this Schoolyard LTER initiative is to impress the importance of long-term research and environmental awareness into the curriculum of K-16 science instructors.

The Coweeta Schoolyard LTER Web Site Includes

- Education Overview
- Project Descriptions
- Photo Album
- Schoolyard LTER News
- Student and Teacher Summaries

[Visit the Coweeta SLTER Website](#)

Coweeta SLTER

Student-collected Data

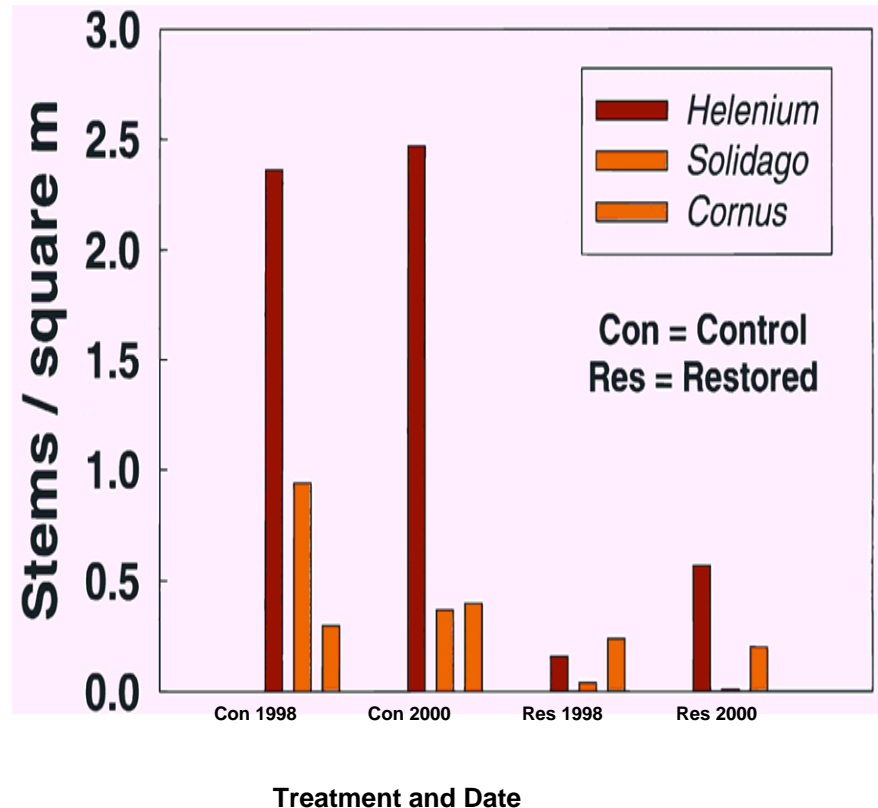
The Coweeta LTER Student Collected Data Includes

- Carbon Cycling
- Fish Populations
- Microclimate
- Riparian Restoration
- Stream Macroinvertebrates

Coweeta Schoolyard LTER—Riparian Restoration Vegetation Summary

This data was collected at Killian's Creek
Little Tennessee River
by
Macon Middle School students, in September
1998
and in September 2000

Killian's Creek Riparian Vegetation
Restoration Comparison 1998–2000



Coweeta SLTER

Teacher Support Includes

- Collaborative Planning Meetings
- Education Web Page
- Full Scale Microclimate Station
- School Year Stipends
- Scientist Classroom Visits

Coweeta LTER Scientist Brian Kloepfel discusses carbon cycling measurement with Schoolyard LTER Students



Schoolyard LTER group manages the stream macroinvertebrate collection



Students, teachers and scientists conduct a stream biotic inventory





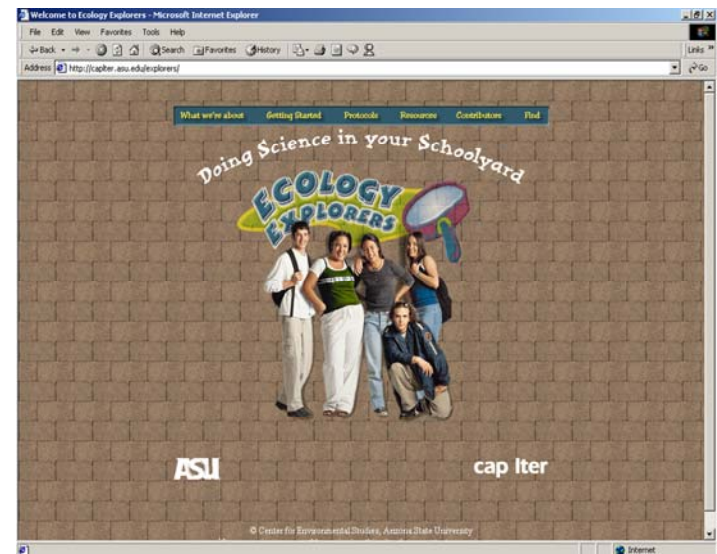
Central Arizona–Phoenix LTER

The CAP LTER education outreach program, called **Ecology Explorers**, links K-12 students and teachers to CAP LTER scientists and research projects. Students and teachers collect data in their schoolyards or backyards to study the effect of urbanization on the Phoenix ecosystem. This contributes to science literacy in the schools and to the long-term monitoring of our desert city. The program is coordinated by CAP LTER education personnel and participation has grown to over 30 schools since it started in 1998.

[Visit the CAP Ecology Explorers Website](http://caplter.asu.edu/explorers/)

Our Web site includes:

- Protocols
- On-line database
(entry & retrieval forms)
- Lesson plans
- Meet the scientist



Central Arizona-Phoenix SLTER

Teacher support includes:

- Summer Internships
- School-year workshops
- Scientist classroom visits
- Curriculum Resources
- Biannual Teacher Meetings

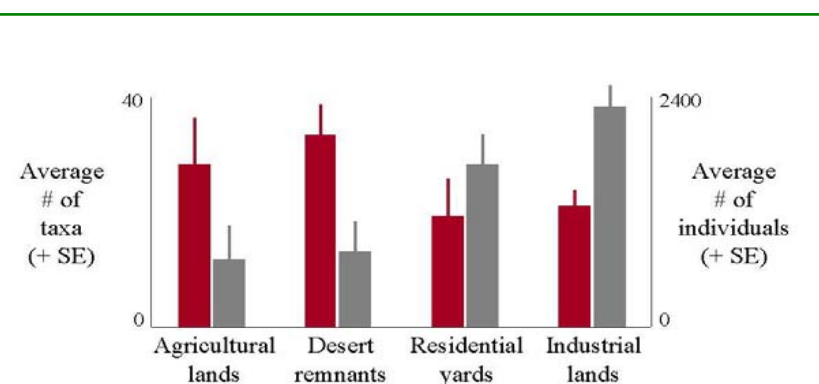
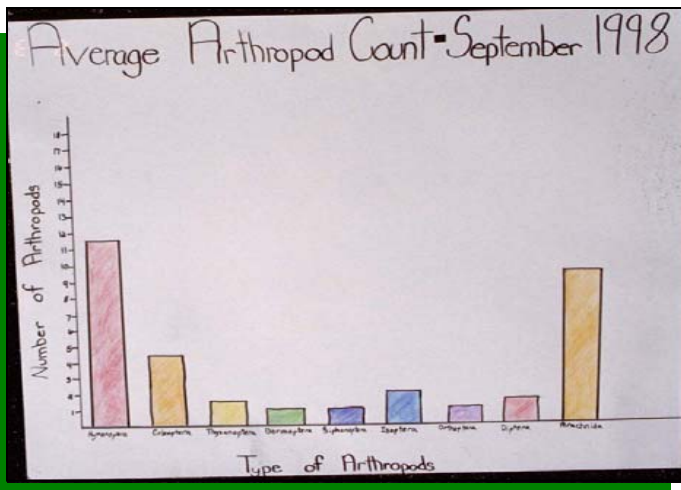


Students collect schoolyard and backyard data about:

- Bird Populations
- Ground Arthropod Populations
- Bruchid Beetles Populations
- Plant Diversity
- Biogeochemical cycles & microclimate (new this year)

Student-collected Data

Arthropod data from Brimhall Jr. High and CAP LTER





Education Outreach program at the **Palmer Station (PAL) LTER** site in Antarctica fosters partnerships among classroom teachers, research scientists, information managers, and educators by establishing ties with ongoing programs. Palmer participants facilitate teachers' field experience with inquiry based science.

The **Teachers Experiencing the Arctic and Antarctica (TEA)** Program is funded by NSF-ESIE/HER and OPP. TEA teacher participants include high school teachers Besse Dawson (1998), Mimi Wallace (1999) and Bill Swanson (2000).



Students use online field data:

- Air and water column temperature
- Biomass and nutrients
- Krill abundances
- Adelie penguin populations



Visit the Palmer SLTER Website

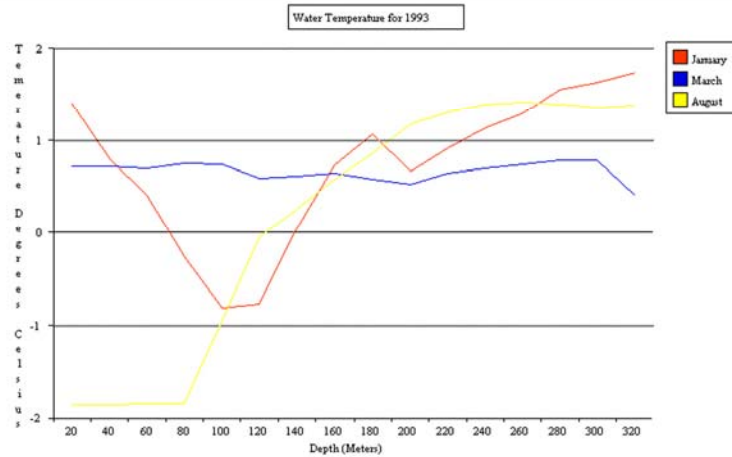
Web site includes:

- Research-Education Overview
- Field Communications
- On-line journals
- <http://tea.rice.edu>



Student-collected Data

Water Temperature Data
January, March and August
1998
Presented by Synergy Team
Students
Montwood High School
El Paso, Texas



Teacher support includes:

- Summer Internships
- Education Outreach Trunk
- Digital archive
- Field Team participation
- On-going collaborations
- Scientist classroom visits

Sevilleta LTER Bosque Ecosystem Monitoring Program



The Bosque Ecosystem Monitoring Program (BEMP) is long-term ecological research that utilizes volunteers (mainly teachers and their students) to monitor key indicators of structural and functional change in the Middle Rio Grande riparian forest, or “bosque”, over time.

Involving students in the collection of data and lab processing helps to increase their understanding and concern about the riparian ecosystem. At the same time, the abiotic (e.g., groundwater level, precipitation, air and soil temperatures) and biotic (e.g.,

cottonwood productivity, surface-active arthropod activity, vegetation cover) data gives us insight into the status or “health” of various sites.

Site representatives, University of New Mexico students, and contracted experts provide quality control on the data. This information is made available to land and resource managers and researchers attempting to restore or manage cottonwood-dominated sites along the Rio Grande.

- Information is available to the public increasing awareness of the ecological state of one of New Mexico’s richest ecosystems.

- Funding from U.S. Fish and Wildlife Service, National Science Foundation, Bosque School, and Sevilleta Long-Term Ecological Research Schoolyard Education Program

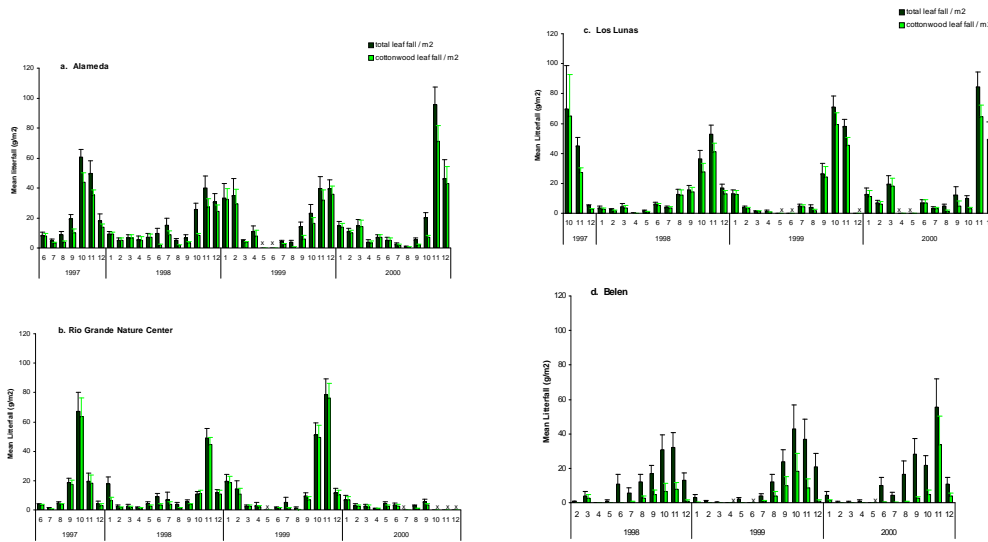
- Currently seven sites (north to south: Santa Ana Pueblo, Alameda, Bosque School/Savannah, Rio Grande Nature Center, Los Lunas, Belen, and Lemitar) span approximately 130 km of the Rio Grande and cover public, private, and tribal lands.

- Sites are monitored by K-12 public, private, and home school students + summer camp groups and Big Brothers/Big Sisters.

[Vist the Website](#)

Sevilleta SLTER

Student-collected Data



Mean monthly total leaf fall and mean cottonwood leaf fall per site. Values are the means for 10 litter tubs at each site with standard error bars. 'x' denotes missing data. All are on a scale of 120 g/m². a. Alameda (6/1997 – 12/2000) b. Rio Grande Nature Center (6/1997 – 12/2000) c. Los Lunas (10/1997 – 12/2000) d. Belen (2/1998 – 12/2000)

BEMP vegetation and litterfall data show that Alameda, the Nature Center and Los Lunas are all senescing cottonwood-dominated sites. Restoring cottonwoods once canopy openings are available will be easiest at Los Lunas where the potential for overbank flooding and connection to the river will naturally promote cottonwood seedling germination and establishment.

Although Alameda is dominated by native cottonwoods and New Mexico olive, and its water table is connected to river flow, the site is perched, and low water table depths are not likely to support cottonwood seedling establishment.

The Nature Center, like Lemitar and Savannah, is hydrologically disconnected from the Rio Grande. Water table depths differ at these three sites, but the lack of spatial and temporal variation in the water table indicates efforts to establish new cottonwoods by seed or pole planting will likely fail without periodic overbank flooding or artificial watering. Savannah and Lemitar, our newest sites, are both dominated by exotic plant species.

Data from Santa Ana suggest that this, too, is a senescing cottonwood-dominated site. However, active efforts at restoring native vegetation and

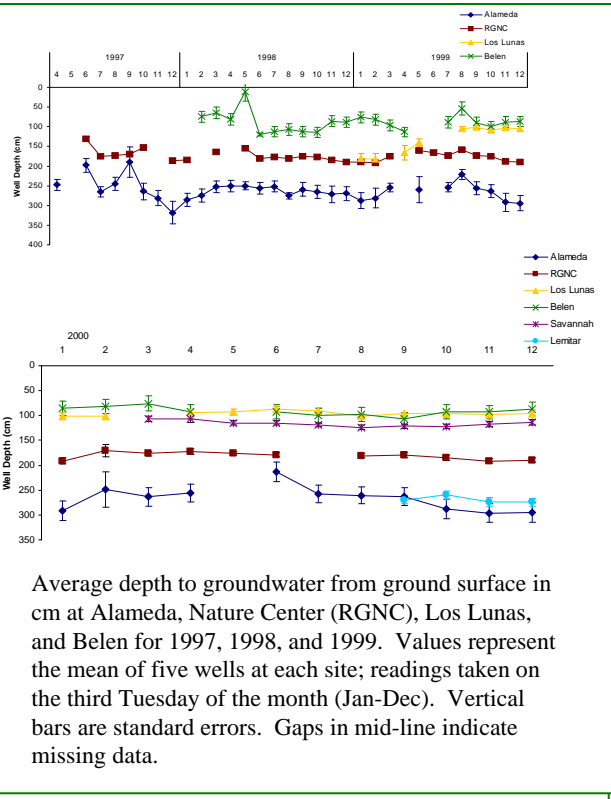
eliminating exotics have been undertaken. Continued monitoring of this site will give managers insight into the effectiveness of different techniques.

Long-term monitoring is especially important for sites like Belen, where the dominant vegetation is undergoing rapid change. Vegetation and litterfall data suggest that Belen is a young, growing cottonwood site, still dominated by willows and Russian olive. Data show strong response to fluvial change and there are large variations in water table depth within the site. This site also floods in years of high river flow, and is an excellent area for aiding naturally occurring cottonwood restoration.

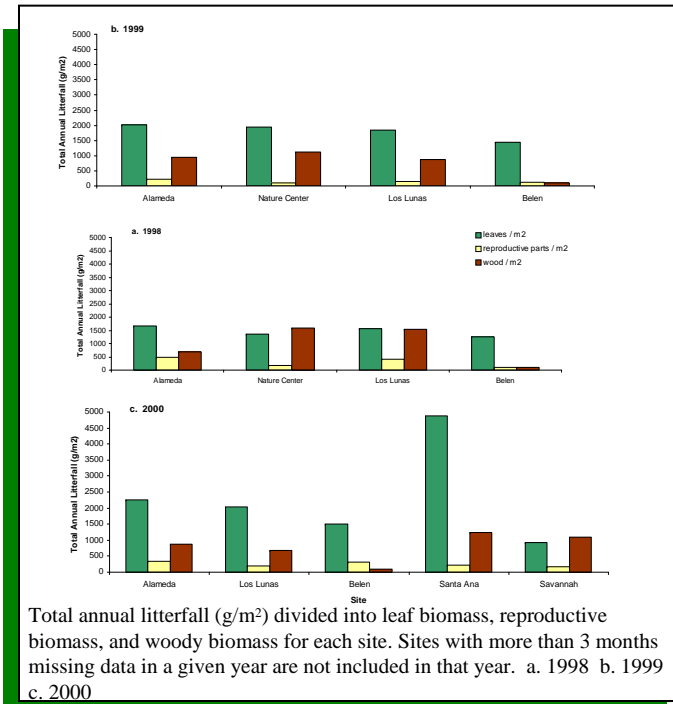
Sevilleta SLTER

Student-collected Data

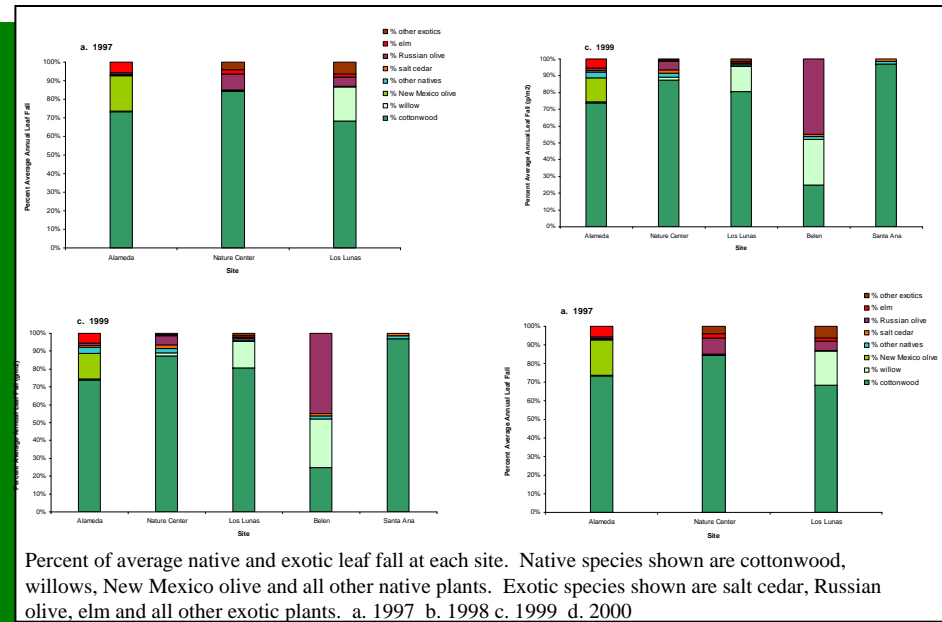
BEMP data indicate the overall age and health of cottonwood-dominated sites, change in the amount of exotic or native vegetation, accessibility of groundwater, ground moisture levels, and the potential for restoration of native cottonwoods and willows, which are under threat by exotics species and fire. Long-term data can indicate where restoration efforts are most likely to be successful, what efforts are needed to make restoration successful, and where naturally occurring restoration can be aided. Where restoration or management efforts are in place, monitoring will indicate the success and effectiveness of these efforts.



Average depth to groundwater from ground surface in cm at Alameda, Nature Center (RGNC), Los Lunas, and Belen for 1997, 1998, and 1999. Values represent the mean of five wells at each site; readings taken on the third Tuesday of the month (Jan-Dec). Vertical bars are standard errors. Gaps in mid-line indicate missing data.



Total annual litterfall (g/m^2) divided into leaf biomass, reproductive biomass, and woody biomass for each site. Sites with more than 3 months missing data in a given year are not included in that year. a. 1998 b. 1999 c. 2000



Percent of average native and exotic leaf fall at each site. Native species shown are cottonwood, willows, New Mexico olive and all other native plants. Exotic species shown are salt cedar, Russian olive, elm and all other exotic plants. a. 1997 b. 1998 c. 1999 d. 2000



Bonanza Schoolyard LTER Program



The Bonanza Creek Experimental Forest LTER education outreach program at the University of Alaska Fairbanks, fosters partnerships among K-12 students, teachers and LTER scientists. Students and teachers are engaged in ecological studies at their schoolyards. This contributes to science literacy in the schools, to data that help verify

remotely sensed data and to other scientists' research. The program, coordinated by Elena Sparrow, has mentored high school students and partnered with other science education programs such as GLOBE (Global Learning and Observations to Benefit the Environment) and Partners in Science.

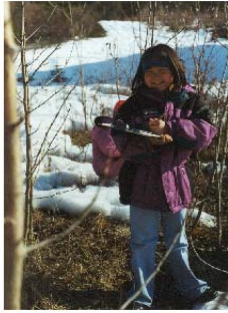
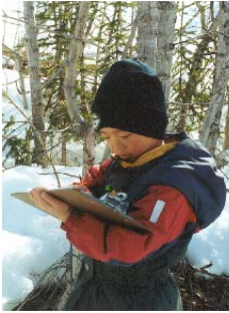
Teacher support includes:

- GLOBE training
- Best science classroom practices instruments & computers
- Scientist classroom visits
- Curriculum Resources
- Biannual Teacher Meetings

Visit the BNZ SLTER Website

Web site includes:

- Protocols and some data
- Link to <http://www.globe.gov> where other protocols and on-line entry and database are located
- Participating teachers, their schools, and scientists
- Taiga biome-West Valley HS



Students collect schoolyard data and about:

- Phenological events
- Current, max, min air temperatures
- Precipitation
- Soil temperatures
- Tree ring width

Does growth relate to temperature or precipitation ?

We selected rings that showed the greatest difference in size from those around them. This means we are not analyzing long term trends, only a few specific years that did not show normal growth compared to those around them.

Narrow Rings:				Wide Rings:			
Year	Ring Size	Temperature	Precipitation	Year	Ring Size	Temperature	Precipitation
1999	343.7	12.34		1986	636.7	10.38	22.12
1958	391.7	10.44	17.86	1938	1108	10.78	24.99
1952	606.9	10.53	19.15	1926	1326.9	8.06	23.39
1914	898.4	11.14	32.79	1923	1401	10.67	26.47
1913	772.4	8.68	29.67	1919	1951.4	10.03	24.71
1912	820.8	9.34	25.2	1918	1842.3	10.93	38.28
1906	820.8			1916	1507	9.56	32.26
1905	784.5			1908	1328		10.14
				1907	1293.4		
				1906	1214		
				1902	1161.8		
		mean:				mean:	mean:
		10.41	24.83			10.07	27.46

According to the data collected, there is no definite correlation between ring size and either temperature or precipitation in the stand of trees that were tested. The larger ring years did have a slightly higher level of precipitation on average, but the difference is not great enough to show a clear connection.

Joy Elementary School Air and Soil Temperatures

