



**CALIFORNIA STATE SCIENCE FAIR  
2003 PROJECT SUMMARY**

<b>Name(s)</b> <b>Erin E. Herman-Kerwin</b>	<b>Project Number</b> <b>J0811</b>
<b>Project Title</b> <b>Bond... Paper Bond: Investigating a Sustainable Paper Source</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> We are using up all our trees to make paper and soon we will start to run out of trees. I want to know if I can find a sustainable paper source that can be used to make writing paper. I am going to test three different kinds of plants to find a new fiber source.</p> <p><b>Methods/Materials</b> I tested three types of plants: sage, a woody plant with small pith center; reeds, a hollow dead plant stalk with long fibers; mallow, an annual weedy stem with a thin outer fibrous layer and thick pithy center. Equal volumes of plant stalks were chopped into small pieces, soaked in saturated soda ash solution, pounded with wood beater, cooked in crock-pot in soda ash solution, rinsed and neutralized to pH 7, mechanically processed in blender until all of the plant fibers were small and separated. I then pulled paper from the resulting pulp, dried the new paper on the sliding glass door, and then tested the paper for smooth surface for writing and fiber strength. The overall scores of the resulting papers were compared.</p> <p><b>Results</b> I rated the plants as a fiber source on a scale of 1 to 10 for the new paper's fiber strength and smoothness. The reed stalks made the paper with the smoothest surface and best fiber strength, the sage was too grainy for writing, but fibers were stronger than the mallow, which was an unacceptable source for making paper.</p> <p><b>Conclusions/Discussion</b> The reeds worked best because it did not have a pith to interfere with the fibers binding, had no woody layers with lignin, that were difficult to break down, and the stalk had long cell-wall fibers made of cellulose. The sage did not work very well because the lignin, a plant protein in woody layers, did not break down so it interfered with the binding of the fibers. The pulp fibers need to separate in the vat for making paper. The surface of the sage paper had large pieces of wood that proved that the lignin did not allow the fibers to separate. The mallow plant did not work at all. This plant was an annual that did not have long cell walls or long fibers to make a strong paper. The plant also had a lot of pith that interfered with the fibers binding. If I expanded on this project I would try adding binding agents, such as methylcellulose, to the pulp vat.</p>	
<b>Summary Statement</b> Three types of plants were tested to find a sustainable paper fiber source.	
<b>Help Received</b> Mom supplied paper making equipment, explained pH and chemistry terms	