SCIENCE EDUCATION

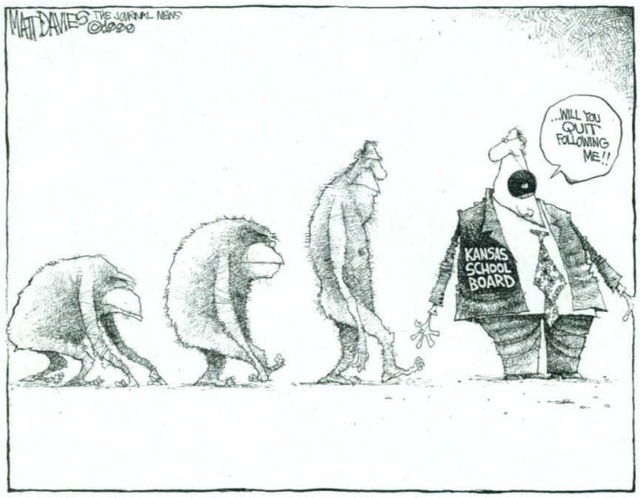
Kansas Dumps Darwin, Raises Alarm Across the United States

Kansas Governor Bill Graves, a Republican, called it "a terrible, tragic, embarrassing solution to a problem that did not exist." Six Kansas college and university presidents and chancellors warned that it "will set Kansas back a century and give hard-to-find science teachers no choice but to pursue other career fields." Science educator Steven Case of the University of Kansas, Lawrence, says: "There's statewide outrage over what they did." And the outrage was not confined to Kansas. National organizations last week joined the chorus of protests over the Kansas Board of Education's vote to eliminate not only evolution but anything hinting at the great age of Earth, and even some cosmological theories, from statewide standards for science teaching.

In the first evolution-related uproar to go nationwide in the 4 years since Alabama required biology textbooks to carry disclaimers labeling evolution an unproven theory, the board voted on 11 August to remove evolution from a draft of the state standards. By 6 to 4, the board adopted standards* in which the word "macroevolution" has been deleted. (Microevolution, which refers to genetic changes within a species, is still allowed.) The "big bang" is gone, along with other hints of geologic time scales such as radioisotope dating. Mount St. Helens is supplied as an example of how some radical geologic changes can occur rapidly. The changes "are more extensive than what we've seen before" in states where evolution battles have raged, says Molleen Matsumura of the National Center for Science Education (NCSE) in El Cerrito, California, which monitors evolution debates around the country. "I think this is the first time that the big bang has bothered anybody," observes retired physicist Jack Davidson, a member of the Lawrence school board.

The standards promote what Case labels "bizarro" hints for how to think scientifically. For example, the 27-member committee of scientists and educators assigned to write the document submitted a standard for 8th graders on the "history and nature of science" that reads: "Display open-mindedness to new ideas. Example: Share interpretations that differ from currently held explanations on topics such as global warming and dietary claims. ..." But the board substituted the following: "Learn about falsification. Example: How many times would we have to prove the theory [that all cars are black] is wrong to know that it is wrong? Answer: One car of any color but black and only one time. ..." Says Matsumura: "There's tremendous emphasis on direct observation in the present. ... All it takes is one pair of 'contemporaneous' human and dinosaur footprints to falsify current conclusions that dinosaurs preexisted humans by millions of years." As Case notes, "Creationists like to limit the nature of science to falsifiability. ... Disproving one thing proves the other."

The standards are supposed to be guidelines, based on national ones put out by the National Academy of Sciences, for teachers in Kansas public schools. They are not mandatory, but once they are tidied up by the board, a process that was still going on early this week, they will form the basis for statewide achievement tests starting in 2001. Observers expect that they will have their largest impact in small communities where, according to Case, 80% of Kansas's science teachers teach. And Case and others are predicting that Kansas students will show "significant declines in college entrance test scores" as a result. What's more, says Matsumura, there are "some expectations that science teachers will be taught in a manner to prepare them to be in accordance with state standards."



The national uproar came swiftly. Groups such as the American Civil Liberties Union and People for the American Way are making noises about suing. NCSE has received a "blizzard of phone calls," says Matsumura. And several scientific societies have registered alarm. The American Geophysical Union's president, Fred Spilhaus, sent out a call for scientists to get more involved in local politics. And the American Physical Society is plotting ways of letting the state know that dumping Darwin is bad for its economy. It can point to one concrete example already: Broadcast Software International in Eugene, Oregon, has already let it be known that it's crossing Kansas off its short list for a new service center.

Education board members who voted in the majority have suggested that public response is overblown. "I have no problem with the teaching of evolution," board chair Linda Holloway told the Associated Press. The main moving force behind the action is said to be Steve Abrams, a veterinarian from Arkansas City and former Republican state chair, who got a fundamentalist group to draft an alternate set of standards which he then presented to the board. The version that is being finalized now is represented by the board as a "compromise," says Case. Abrams, who did not return several phone calls from *Science*, said in a statement on Monday that the board's vote "shows a respect for diversity of opinion and ... expands the learning opportunity of the children of Kansas rather than narrowing it."

But the board could find that its vote will come back to haunt it. The governor and

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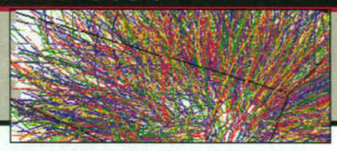
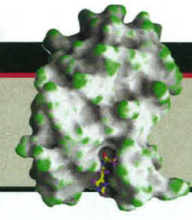
* See the Kansas biology teachers' Web site at www.kabt.org





legislators are talking about a constitutional amendment to bring the education board—which ironically was set up as an elected body to insulate it from politics—back under the control of the legislature. What's more, Case says educators have formed a group called Citizens for Science, which plans to supply local school districts with good standards. And, says Matsumura, "Each event like this makes more scientists become actively concerned. … There are more concerned scientists now than there were before Wednesday."

–CONSTANCE HOLDEN

ENVIRONMENT

Sharp Drop Seen in Soil Erosion Rates

CHICAGO—As any fan of detective thrillers knows, if there is a murder, there must be a body. For soil environmentalists, the "crime" is the use of farming practices that lead to massive amounts of erosion. According to some studies, the bodies—countless tons of precious topsoil—have been washing into rivers and streams at a rate that has changed little in the United States since the Dust Bowl days of the 1930s. But when Stanley W. Trimble went looking for those bodies, like a Lieutenant Columbo in coveralls, the plot took a surprising twist: Most of the expected corpses simply weren't there. Trimble's findings suggest that erosion rates are running much lower than generally estimated. Indeed, over the past few decades they appear to have been a tiny fraction of their historical peaks.

Trimble, a professor in the department of geography and the Institute of the Environment at the University of California, Los Angeles—who also happens to be a Tennessee farmer—based his conclusions on 140 years of data on sedimentation in the heavily farmed Coon Creek Basin, which drains into the Mississippi River 25 kilometers south of La Crosse, Wisconsin. The study, reported on page 1244 of this issue, is being hailed for its scope, but it is also generating controversy. "Trimble's work suggests that rates of erosion in that region are much less than a lot of people seem to have thought," says Pierre Crosson, an agricultural economist at Resources for the Future in Washington, D.C. But some critics question the study's methods, and others argue that the Coon Creek rates may not be typical even of the humid Midwest and eastern United States, let alone other areas. Trimble responds that "the burden of proof is on those who have been making these pronouncements about big erosion numbers. … They owe us physical evidence. For one big basin, I've measured the sediment and I'm saying, I don't see it."

The detail with which Trimble looked at the basin, which sprawls over 360 square kilometers around Coon Creek and its tributaries, is virtually unheard of in large erosion studies. The research benefited from a combination of lucky historical factors and what Trimble describes as scholarly "perspiration"—years of fieldwork. During the erosion crisis of the 1930s, the basin was chosen for intensive study by the Soil Conservation Service (now the Natural Resources Conservation Service) of the U.S. Department of Agriculture (USDA). Trimble tracked down the old monuments and markers—ranging from steel pipes set in concrete to nails pounded in trees—and used them, just as USDA did, as benchmarks for measuring how much sediment has accumulated in the basin from erosion of the rolling fields around it.

Digging the dirt on erosion. Sediments cover old mill dam *(top)*. Strip cropping slows soil loss.

CREDITS: (LEFT TO RIGHT) BOB LLEWELLYN/UNIPHOTO; S. W. TRIMBLE

Records from many such studies were scattered and lost during the confusion of World War II, but Trimble ran across the Coon Creek data in the National Archives in the 1970s. He also enlisted the help of geologist Stafford Happ, who had led some of the original USDA work. "He had a memory like an elephant," says Trimble. "He'd say, 'Yeah, I remember this elm over here. I'm sure we drove a nail in the west side.' " Trimble then resurveyed the soil profiles in dozens of sections across the basin's valley in the 1970s and again in the 1990s to see changes.

To trace erosion rates further back in time, he dug down to find other markers—old roads, railroad beds, concrete dams, and house foundations—that marked soil levels all the way back to the turn of the century. At greater depths, he found the dark, richly organic soil of the original prairie, a benchmark for the soil level when European farmers arrived in the 1850s and eroded sediment first started to accumulate in the basin.

The measured rates jumped in the late 19th century, skyrocketed in the 1920s and 1930s, and then dropped again as USDA pressed farmers there to stop using the traditional moldboard plow and adopt conservation practices like strip-cropping and leaving plant residue and stubble in the fields year-round to inhibit runoff. From the 1970s to the 1990s, sedimentation rates dropped to just 6% of their peak.

Official USDA national averages for the last 2 decades have suggested a slight decline in soil loss, but the decline that Trimble reports is so precipitous that some experts find it hard to believe. Among them is David Pimentel, a Cornell University entomologist who claimed huge, continuing erosion losses in a paper in *Science* (24 February 1995, pp. 1088 and 1117) that has been criticized for including what he now concedes were outdated and erroneous data. Pimentel says he distrusts routine soil-science methods such as locating and dating the original prairie surface. Trimble has "got a good imagination," he says, adding, in reference to the 19th century soil levels: