Guns of the Golden State: Economics and Courage

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Introduction

The American state of California currently is divided into fifty-eight counties. Twenty-three of these can be grouped as compact meaning relatively small in area and not very heavily populated. Among other complications, this usually causes challenges in K-12 education and often causes teenagers wanting to attend college to move away. For almost all public schools and for most charter schools state-wide there are three sources of revenues: local (typically property taxes collected by the county), state and Federal funds. Federal funds generally come in two waves: one for the regular school year and one for summer sessions. The relative percentage of federal funds for a school district and its schools varies a fair amount. In the recent past the State of California has had total K-12 education revenues of $15,326,982,000 Federal (about 13%), $40,487,245,300 local (about 35%) and $59,558,562,000 state (about 52%). The table below gives Federal amounts and percentages of total education for the twenty-three compact counties.

	A	B	C	D	E	F	G	H	I
1	**County**	**Federal**	**Total**	**Percent**		**County**	**Federal**	**Total**	**Percent**
2	Alpine	$694,000	$3,479,000	19.95%		Modoc	$4,092,000	$22,918,000	17.85%
3	Amador	$3,818,000	$56,158,000	6.80%		Mono	$2,517,000	$44,214,000	5.69%
4	Calaveras	$5,250,000	$90,790,000	5.78%		Nevada	$27,435,000	$303,082,000	9.05%
5	Colusa	$7,220,000	$72,365,000	9.94%		Plumas	$4,805,000	$44,520,000	10.79%
6	Del Norte	$8,431,000	$67,721,000	12.45%		San Benito	$11,717,000	$183,124,000	6.40%
7	Glenn	$11,922,000	$105,209,000	11.33%		Sierra	$546,000	$7,155,000	7.63%
8	Inyo	$6,968,000	$58,945,000	11.82%		Siskiyou	$13,322,000	$119,028,000	11.19%
9	Lake	$15,995,000	$160,691,000	9.95%		Sutter	$12,656,000	$152,195,000	8.32%
10	Lassen	$5,678,000	$62,803,000	9.04%		Tehama	$15,582,000	$167,456,000	9.31%
11	Mariposa	$2,871,000	$33,188,000	8.65%		Trinity	$5,437,000	$44,801,000	12.14%
12	Mendocino	$24,749,000	$250,561,000	9.88%		Tuolumne	$6,606,000	$100,861,000	6.55%
13						Yuba	$24,325,000	$242,804,000	10.02%

The financial challenge is what are schools and school districts in compact counties to do if Federal funds are greatly reduced AND there are no notable increases or even slight decreases in local and state funds. There is a delicate balance between not being dependent on Federal funds and not obtaining an extra million dollars – or two or three. While Amador and Calaveras counties are often used as examples throughout the following text, the comments about them almost always apply equally to the other twenty-one compact counties.

The Problem Fairly Stated

Like much of the rest of the United States, California has legal entities known as school districts which are typically limited to one county within one state. School districts obtain revenues from Federal, state and local sources and distribute these funds to schools. For the last several years increasing local revenues has been challenging as counties and cities often have had financial difficulties of their own, and raising property taxes has not been popular. At the same time, the State of California's population growth has stalled, revenues from taxes have decreased and the state has struggled to achieve a balanced budget as required by state law. At this writing the State of California's budget has just been finalized and will almost certainly be subject to revisions over the next year. Presently, it appears that slightly less money will be available to primary and secondary (K-12) education than last year and that there was no increase to offset inflation. Prospects for any financial relief for next year's (2026 – 2027) state funding are bleak. Like local and state funding, Federal funding as a percentage of district revenues varies considerably from school district to school district – 13% would be a reasonable estimate: the California state totals are $15 billion Federal; $60 billion state and $40 billion local so the total loss or severe reduction of Federal funds will have a powerful negative impact for many school districts. There also may well be ongoing direct impacts for school districts if Federal funding for transportation, meals and other programs gets delayed, reduced or eliminated. In addition, there may well be indirect impacts for school districts if Federal funding for grants to colleges, loans to students and health care, notably SNAP (formerly food-stamps) and Medicare, are delayed, reduced or eliminated because the State of California would likely have to find a way to offset these losses.

Generally, California's dozens of small rural counties are poor and are probably going to get poorer. California currently has over 1,100 public school districts which manage over 10,000 schools which teach over 5,800,000 students (almost 800,000 of which are disabled, so about one in seven) and employ over 275,000 teachers. It is very unclear how the bulk of those schools could survive significant revenue reductions. For example, for better or for worse, California public school have a bewildering variety of grade groupings. There are over 2,400 K-5 schools and over 1,700 K-6 schools. For a rural school district these will usually have 150 to 180 students with one teacher per grade and several specialist teachers for art, music and physical education. The State of California requires an annual document known as a SARC (School Accountability

Report Card) – it is a fair bet the SARC for such a school will contain pages of needed repairs. Firing one teacher to make up for revenue reductions leaves the school with the very unpleasant choice of which three grades to make into two. That might mean grades 2, 3 and 4 with 26 students each get combined into two classes of 39 each. This is absurd, probably passes irresponsible and approaches criminal.

What is needed then are stable, predictable revenue streams for the state, its counties and their school districts. While necessary, this is hardly sufficient. Calaveras County has five districts and 21 schools since Railroad Flat Elementary closed. Since 1986 the State of California has recognized distinguished schools. There have been 7800 such awards: five (5) went to the following schools in Calaveras County

District	School	Year
Vallecito Union	Avery Middle School	2013
Calaveras Unified	West Point Elementary	1995
Vallecito Union	Albert Michelson Elementary School	1993
Calaveras Unified	Calaveras High	1990
Vallecito Union	Hazel Fischer Elementary School	1986

During the period 2015 to 2017 the State of California did not have distinguished schools but instead awarded 1403 gold ribbons. Three (3) went to the following schools in Calaveras County

District	School	Year
Vallecito Union	Avery Middle School	2015
Vallecito Union	Hazel Fischer Elementary School	2016
Vallecito Union	Albert Michelson Elementary School	2016

In contrast, Miramonte High School in Contra Costa County has won the award ten (10) times out of 19 possible. Competition there is intense: other high schools in its district have done just about as well.

Calaveras County schools, among many others, need more money and need to produce much better results. The next page has a table of total awards for some counties over 40 years (Appendix B shows Los Angeles County with 2383 awards)

Alpine	4
Lassen	5
Del Norte	6
Inyo	6
Plumas	6
Mono	7
Calaveras	**8**
Modoc	8
Sierra	8
Colusa	9
Glenn	11
San Benito	11
Lake	12
Tuolumne	14
Trinity	17
Amador	**18**
Mariposa	19
Siskiyou	20
Mendocino	24
Yuba	30
Merced	32
Yolo	33
Madera	34
Nevada	34

Tehama	34
Sutter	36
Kings	37

Since 1986 the State of California has recognized individual schools for what is alleged to be academic achievement. There were two years - 1991 and 2022 - where no awards were announced. In 2015, 2016 and 2017 instead of Distinguished Schools there were Gold Ribbon schools. During the Gold Ribbon period there were also some awards given for Exemplary Physical Education and Nutrition; Exemplary Arts; and Exemplary Career Technical Education. In addition there are awards for Title I Academic Achievement and for National Blue Ribbon schools. It is also important to bear in mind that the award is for two years so a school being recognized as distinguished in 2019 would not be eligible again until 2021. How meaningful the awards were during the COVID years of 2019, 2020 and 2021 is hard to say. Appendix A has the number of awards of all types by year.

In total, 10,159 awards over 40 years. There is considerable dispute about the fairness of comparing the achievements of a county such as Calaveras with a small population (about 46,500 people) and a small number of schools (21) to a county such as Orange with a large population (almost 3.2 million so almost 70 times more people than Calaveras County) and a large number of schools (633). As a parent or a student who desires to compete academically some notion of consistency across time can be gained by comparing the overall totals of awards per school. The data could improved by standardizing the spelling of districts and schools (schools open, and close and change their names – to a lesser extent so do districts) but some of the more distinguished schools statewide are

County	**District**	**School**	**Awards**
San Francisco	San Francisco Unified	Lowell High	13
Contra Costa	Acalanes Union High	Miramonte High	10
San Mateo	Menlo Park City Elementary	Hillview Middle	10
Los Angeles	Glendale Unified	Anderson W. Clark Magnet High	9
Alameda	Fremont Unified	Joshua Chadbourne Elementary	8
Contra Costa	San Ramon Valley Unified	Charlotte Wood Middle	8

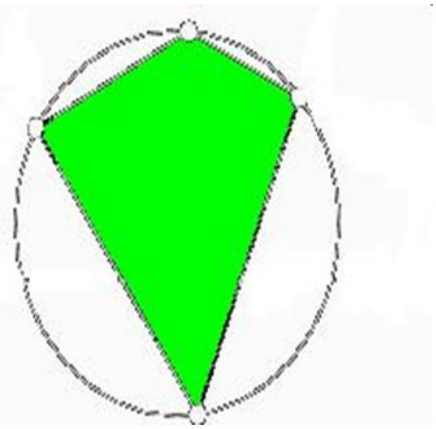
Contra Costa	San Ramon Valley Unified	Stone Valley Middle	8
Los Angeles	Glendale Unified	Rosemont Middle	8
Los Angeles	Los Angeles Unified	Francisco Bravo Medical Magnet High	8
Los Angeles	Los Angeles Unified	Renaissance Arts Academy	8
Orange	Los Alamitos Unified	Rossmoor Elementary	8
San Bernardino	San Bernardino City Unified	Richardson PREP HI Middle	8
San Mateo	Las Lomitas Elementary	La Entrada Middle	8
Santa Clara	Fremont Union High	Lynbrook High	8
Santa Clara	Fremont Union High	Monta Vista High	8
Ventura	Oak Park Unified	Medea Creek Middle	8

There are another 20 schools statewide with seven achievements and 56 schools statewide with six achievements. Of course, as a parent or student or teacher or administrator, one would want to give more weight to recent achievements, although, as noted previously, the COVID years introduce complications in interpretation.

What should be clear is that in addition to a reliable revenue stream, a great many schools need immediate help to overcome past under-funding and other mishaps.

In the summer of 2008 after the very deadly (officially 87,587 dead, 374,643 injured, 18,392 missing; $130 BILLION in damage; an estimated 10,000,000 – yes, ten million - homeless) Great Sichuan earthquake that May, I gave presentations at several local high schools and to their school board based on reports from several colleagues from China. They had been invited to give a lecture on the mathematics used to analyze the seismic events: the aftershocks included one Richter 6; 19 Richter 5s; 209 Richter 4s in the first month and 48 Richters 3s. Note that those are United States Geological Survey figures – Chinese figures differ somewhat. The critical problem was to decide if there was one or two series of earthquakes and where to deploy rescuers. The lecture audience was at a school for gifted high schoolers near Chengdu (population 20,937,577 in the 2020 census) which is the provincial capital of Sichuan Province (population 83,674,866 in 2020). Prior to their lecture there was time to sit in on a geometry class. There were two teachers, both with PhD s and each with what we here would call an MAT (Master of Arts in Teaching) plus two aides for 20 (twenty) students. They were working on what was eventually identified as problem A6 of the 2005 William Lowell Putnam contest. This contest has run since 1938 and is often

considered the most difficult. Out of about 4,000 contestants from the US and Canada five (5) answered the problem correctly. Below is a portion of the slide deck I used.



The question posed was for a convex shape like the green one depicted to the left with four or more sides inscribed in a circle what are the odds one angle is acute (less than 90 degrees – like the one at the bottom)?

The teachers presented **two** different solution methods and went to some lengths to make certain everyone understood not only the specific problem but some general considerations about taking tests.

For those fascinated by the problem the answer I myself would teach is that one should prove

/1/ no convex polygon of four or more sides can have three acute angles

/2/ if there are two acute angles they are adjacent

/3/ the answer is n * (n – 2) * ½ ** (n – 1) where n is the number of sides

Sides	**Probability**	**Sides**	**Probability**
4	100.00%	11	9.67%
5	93.75%	12	5.86%
6	75.00%	13	3.49%
7	54.69%	14	2.05%
8	37.50%	15	1.19%
9	24.61%	16	0.68%
10	15.63%	17	0.39%

The points being made back then were that the Acalanes schools including Miramonte High School needed more teachers, better teachers, ways to inspire students without Red Bull and much more timely reporting.

Geography

As with many other aspects, California is large and complicated. California is roughly 250 miles wide (east to west) and roughly 750 miles long (north to south). Unlike more easily described rectangular states like Colorado and Wyoming, California's outline is dominated by its Pacific Ocean coastline on the west and the Sierra mountains on the east. In terms of raw square miles California is the third largest United States state:

State	**Square miles**
Alaska	665,384
Texas	268,596
California	**163,695**
Montana	147,040
New Mexico	121,590
Arizona	113,990
Nevada	110,572
Colorado	104,094
Oregon	98,379
Wyoming	97,813

For readers who prefer the metric system, California's overall area is 423,970 square kilometers. Note that the land-only area of California is 155,959 square miles or 403,932 square kilometers. Among countries of the world California ranks 55th – slightly smaller than Yemen, Sweden, Uzbekistan, Morocco and Iraq and slightly larger than Paraguay, Zimbabwe, Norway, Japan and Germany. The fifty states of the United States and the District of Columbia have 3135 counties (or equivalent) with an average of about 105,500 inhabitants and an average area of 1,150 square miles.

It is unlikely that a map of California's counties, as shown above, would ever be mistaken for the work of a world class artist or for a geometric tessellation. California has 58 counties with an average population of 656,326 (distorted by nearly ten million people in Los Angeles County) and an average area of 2686 square miles. By either California or national standards Amador and Calaveras counties are small.

Counties range from compact (leftmost)

County	Area in square miles
San Francisco	46.87
Santa Cruz	445.17
San Mateo	448.41

to sprawling (rightmost)

County	Area in square miles
Siskiyou	5,278
Riverside	7,206
Kern	8,132
Inyo	10,181
San Bernardino	20,057

San Bernardino County is the largest county in the contiguous U.S. and is larger than each of the nine smallest states; it is larger than the four smallest states combined (New Jersey, Connecticut, Delaware, Rhode Island).

But not all square miles are equal. The US Census publishes land ownership by state

State	% Publicly owned	State	% Publicly owned
Alaska	95.8%	North Carolina	14.6%
Nevada	87.8%	Tennessee	14.1%
Utah	75.2%	Kentucky	11.8%
Idaho	70.4%	South Carolina	11.8%
Oregon	60.4%	Missouri	11.2%
Arizona	56.8%	Mississippi	10.9%
Wyoming	55.9%	Louisiana	10.7%
California	**52.1%**	Georgia	9.7%
New Mexico	47.4%	North Dakota	9.1%
Colorado	43.3%	South Dakota	8.9%
Washington	41.9%	Maryland	7.6%
Montana	37.5%	Delaware	7.4%
New York	37.1%	Alabama	7.1%
Florida	29.2%	Massachusetts	6.3%
Michigan	28.1%	Connecticut	6.2%
Minnesota	23.5%	Maine	5.7%
Hawaii	19.0%	Oklahoma	4.6%
New Jersey	18.3%	Indiana	4.5%
New Hampshire	18.0%	Ohio	4.2%
Wisconsin	17.8%	Texas	4.2%
Arkansas	17.3%	Illinois	4.1%
Virginia	17.1%	Iowa	2.8%
West Virginia	16.5%	Nebraska	2.8%
Pennsylvania	16.1%	Kansas	1.9%
Vermont	15.8%	Rhode Island	1.5%

Overall, 39.8%, although it is not clear what detailed measures the Census uses.

https://www.blm.gov/about/what-we-manage/california notes that the Bureau of Land Management administers about 10% of the land in the United States and about 15 million acres in California. Dividing through by 640 acres per square mile results in 23,437.5 square miles or 15.028% of California's land. However, the State of California publishes land ownership data at https://data.ca.gov/dataset/california-land-ownership1/resource/

The major public landowners are

Owner	**Square miles**	**Parcels**	**% California**	**% Public**
Federal government	120,058	25,885	76.98%	86.05%
State of California	11,237	7,279	7.21%	8.05%
Local entities	4,539	21,159	2.91%	3.25%
Non-profit conservancies	2,142	3,028	1.37%	1.54%
Indian tribes	1,547	910	0.99%	1.11%
TOTAL	139,524	91,425	89.46%	

The overall figure above (89.46%) and the Federal ownership above (76.98%) are difficult to reconcile with the census figure of 52%.

Similarly, rather tediously summing the total for 18,408 parcels purported to be owned by the Bureau of Land Management provides a result of 37,823.75 square miles which is similarly difficult to reconcile with the twenty-three thousand square miles from above. Details for parcels and square miles by state and Federal agencies can be found in Appendix C.

Regardless of which of the figures (if any) one might believe is more or less accurate, it should be obvious that there is plenty of now publicly owned land that could be sold. One strategy for the education problem is to auction off some of the land where possible. This would provide immediate cash from the sales, would decrease state and Federal responsibilities for clearing and fire prevention, would increase county revenues (passed to schools) due to future taxes and would increase the land available for building in order to alleviate the unending affordable housing crisis in California.

Immigration and Recent Demographics

According to the United States Census Bureau the State of California has been having a mildly alarming decline in population. Annual population changes are generally calculated using a base (the count every ten years) plus births minus deaths and some sort of difference between those arriving in the state and those departing.

	U S Census	Wikipedia	CA Dept of Finance P6	CA Dept of Finance E4
Year	39,538,212	39,538,223		
2020	39,503,200		39,542,000	39,538,223
2021	39,145,060		39,247,000	39,369,530
2022	39,040,616		39,146,000	39,179,680
2023	38,965,193		39,109,000	39,228,444
2024		39,431,263	39,431,000	39,420,663
2025				39,529,101
Net	-573,809	-106960	-111,000	-9,122

For Calaveras County there is only one city

Year	Angels Camp	Unincorporated	County Total
2020	3,652	41,640	45,292
2021	3,642	41,608	45,250
2022	3,620	41,392	45,012
2023	3,603	41,287	44,890
2024	3,585	41,239	44,824
2025	3,570	41,152	44,722
Net	-82	-488	-570

Probably a change for schools in terms of enrolled students of about -210.

For Amador County there are five incorporated cities

Year	Amador	Ione	Jackson	Plymouth	Sutter Creek
2020	200	8,849	5,031	1,067	2,644
2021	200	8,691	4,963	1,083	2,627
2022	199	8,950	4,972	1,063	2,616
2023	197	8,924	4,929	1,083	2,592
2024	197	9,000	4,905	1,109	2,580
2025	196	9,037	4,822	1,122	2,538
Net	-4	188	-209	55	-106

Year	Unincorporated	County Total
2020	22,683	40,474
2021	22,548	40,112
2022	22,348	40,148
2023	22,192	39,917
2024	22,181	39,972
2025	21,848	39,563
Net	-835	-911

3

Probably a change for schools in terms of enrolled students of about -360.

If it will still be available going forward, the daily attendance incentive is at least $55 per day per student so for a school year of 180 days $9900 per student. Losing 360 students is a loss of $3,564,000 per year. That is easily 20 or more teachers including their benefits – it is unlikely building and transport costs would change. Amador County now employs just over 200 teachers. Most of the smaller schools cannot cut a teacher and stay open so Amador High School and Argonaut High School as well as, to a lesser extent, five schools in Ione, Jackson and Sutter Creek would bear the brunt of these cuts. One need not be Nostradamus to foresee the same process looming for next year.

Largest changes by county (source: same US Census Service figures)

County	Change (plus)	County	Change (negative)
Riverside County	74,260	Los Angeles County	-350,631
San Joaquin County	21,735	San Francisco County	-64,962
Placer County	18,816	Alameda County	-60,161
San Bernardino County	13,951	Santa Clara County	-58,687
Merced County	10,715	Orange County	-51,242
Fresno County	8,516	San Mateo County	-38,079
Madera County	6,600	San Diego County	-28,675
Tulare County	6,352	Ventura County	-14,250
Kern County	4,591	Contra Costa County	-10,905
Yuba County	4,144	Santa Cruz County	-9,323
Yolo County	4,135	Monterey County	-8,312
San Benito County	3,965	Marin County	-7,914
Amador County	1,340	Sonoma County	-7,038
Calaveras County	1,281	Santa Barbara County	-6,963
El Dorado County	1,026	Napa County	-4,797
Colusa County	201	Butte County	-4,458
Kings County	196	Solano County	-4,273
		Lassen County	-3,872
		Mendocino County	-2,482
		Humboldt County	-2,477
		Shasta County	-1,792
		Sutter County	-1,688
		Stanislaus County	-1,452
		Tuolumne County	-1,420
		Siskiyou County	-1,172

		Del Norte County	-1,156
		Tehama County	-936
		San Luis Obispo County	-804
		Glenn County	-792
		Sacramento County	-757
		Plumas County	-663
		Imperial County	-656
		Inyo County	-491
		Trinity County	-444
		Lake County	-282
		Mariposa County	-207
		Modoc County	-203
		Nevada County	-200
		Mono County	-135
		Alpine County	-61
		Sierra County	-31

Note the considerable difference for Amador and Calaveras county level figures between the US Census figures (in yellow on the left for the previous page) and the California Department of Finance E4 figures (pages 15 and 16).

For schools, births are not of immediate interest, although one should expect to provide 13 or 14 years of education in four or five years. The number of deaths of children aged 4 to 18, while tragic, is typically very low so unless there is a disaster or a pandemic deaths are not of immediate interest either.

There are three figures that might be of interest to a school district: school age children moving out of the district; school age children moving into the district and undocumented immigrant children moving into the district and expected to register. So far, I have been unable to obtain any of these numbers.

However, the Department of Homeland Security does make available some estimates. The Southwest Border northbound crossing estimates of undocumented are

Fiscal year	Persons	US Population
2015	444,860	**320,738,994**
2016	558,990	
2017	415,200	
2018	519,940	
2019	977,230	
2020	458,080	
2021	1,734,680	
2022	2,378,940	
2023	2,475,670	
2024	2,135,000	**340,110,988**
TOTAL	12,098,590	**19,371,994**

Apparently, for the ten year period of fiscal year 2015 to fiscal year 2024 when the United States population was estimated by the United States Census to have grown by over 19 million people, there were just over 12 million border crossers in the Southwest. Typically, about one fifth of all such immigrants nation-wide go to California, so the Department of Homeland Security estimates that about 2.6 million undocumented immigrants are or at least were in California.

By California law, if a student shows up and registers he or she is entitled to a free public education. This is probably not much of an issue in Amador or Calaveras counties. For schools in Los Angeles County there are probably about 78,000 undocumented immigrant children of school age out of about 1,300,000 students. That would be out of an estimated 951,000 undocumented immigrants of all ages in the county.

To summarize, it is very challenging for a school or a school district even in July to estimate how many students will be getting educated in the fall.

Immigrating to California

For decades the prevailing theory of the peopling of the Americas was that groups of hardy adventurers from northeast Asia crossed the now-submerged Bering land bridge; moved eastward 1100 miles or so across the daunting Arctic terrain of Ice Age Alaska; located a miraculous ice-free south-bound corridor between two massive glaciers; invented the distinctive Clovis lithic technology; slaughtered the North American megafauna from the Yukon to Venezuela and then, after a reign of a few short centuries, disappeared.

The bright orange coloring is not a reference to the ocher found on some weapons, artifacts and buried remains, but rather represents lands now submerged. Classically, the first immigrants would have journeyed from the top left to the bottom right – probably 5,000 miles across very tough terrain.

A minority hypothesis was the so-called Kelp Highway which conjectured that a marine culture used small boats (none found yet) to paddle along thousands of miles of now-submerged Arctic shorelines (probably not via the western Aleutian islands

but rather from present-day Kamchatka) along the Bering Sea, the Gulf of Alaska and south, presumably hunting and consuming seals, fish and shellfish. Upon reaching warmer areas, possibly near modern-day Seattle or Portland, the intrepid sailors transformed into relentless big game hunters who swept across the three thousand miles of mountains, plains and forests to the east coast.

Clovis points and an edge view. Depending on the maker's likely target the points range in overall length from two to seven inches. The flute area (upside U-shape at the bottom half of the leftmost image) is nearly universally believed to have been used to haft a wooden spear shaft. Depending on circumstances and tactics, the weapon could have been used as a lance or thrown using an atlatl. It would be a great event were someone to discover a Clovis spear shaft or atlatl handle. Despite having a city named Clovis (in Fresno County; population 120,124), so far there is little evidence California was popular with Clovis people: there are three possible Clovis points from San Diego

and some from Tulare lake. Dating has been a challenge. However, Coso obsidian from Inyo County has been shown to have been very desirable. It was traded and used from, at a minimum, the Channel Islands to Arizona.

So far, there is no (zero) evidence of Clovis technology in Siberia – in fact, what has been found is microblade technology (below) which is quite different. There is good evidence of microblade technology dated to around 12,000 BCE across Alaska in the Tenana River valley at Swan Point, at Broken Mammoth and at the Mead site.

Over the centuries, different hunting and fighting technologies came and went in California.

It is very unclear if changes to spear points and other objects happened in response to changes in targets, easier manufacturing, trade or invasions. One implication of the

disputed El Fin del Mundo discoveries in Sonora in Mexico would be that Clovis technology entered California from the south as opposed to the later waves of immigrants who arrived from the north. Inordinate amounts of computer resources have been consumed trying to understand human population increases and megafauna decreases.

Eventually, Russian migrants followed similar paths and maintained the Russian-American Company from 1812 to 1841 at what is today Fort Ross in northwestern Sonoma County. Of considerable more impact were Spanish migrants starting with Juan Rodríguez Cabrillo's voyage northward along to coast to present-day Oregon in 1542. The expeditions of 1769-1770 led by Gaspar de Portolá, governor of *Las Californias*, the Spanish colonial province that included California, Baja California, and other parts of present-day Mexico and the United States, went northward by land and by sea and reached San Francisco. Unfortunately, there were few attempts to accurately count native Americans as the Spanish missions were being developed.

In 1821, the First Mexican Empire became independent of Spain. Stable governance for the Mexican Republic, which had Alta California as a territory rather than a full state, was elusive. For decades migrants arrived mostly by ship with little or no restrictions as California was considered a backwater without many prospects of ever generating any revenue. The United States Congress issued a declaration of war against Mexico on May 13, 1846. Word did not reach California for about a month, but a reasonably non-violent revolt was triggered. Once the skirmishes around Los Angeles were resolved, there was considerable confusion about who was planning to live where as California became an independent republic and then a state. When gold was discovered in 1848 even the US Army and US Navy had difficulty preventing desertions, and even less attention was paid to civilian arrivals. The census of 1850 was a catastrophe. No matter – there were mines to be dug; miners to be supplied, a civil war to be fought, railroads to be built …

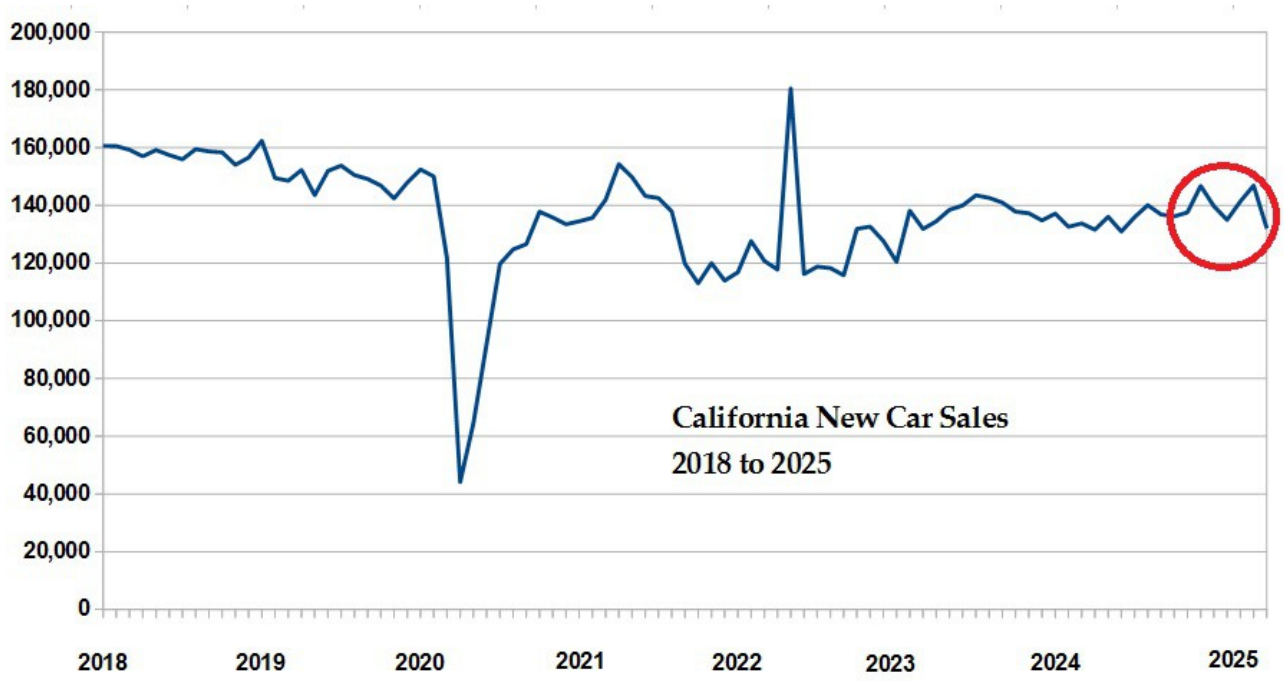
One claim of the scientists working on the Cerutti Mastodon site is that about 130,000 years ago an unknown species of *Homo* was using tools to break up mastodon bones to access marrow and obtain other resources. If this or the Hartley Mammoth site (37,500 years BP) or the footprints at White Sands (between 20,700 and 22,400 years BP) turns out to be true it would radically extend the time horizon for how long California has not done a good job of managing or even tallying immigrants. Despite that, and a few

mishaps along the way, here we are with forty or more million people and, as will be seen below, a significant economy.

Economic Measures

One of the measures used by the State of California's Legislative Analyst's Office is new car sales. Historically, there have been disagreements about whether model-year end clearance sales (selling 2024 models to make space for arriving 2025 models) should count. There have been further objections that the sale of a $115,010 GMC Hummer EV Pickup

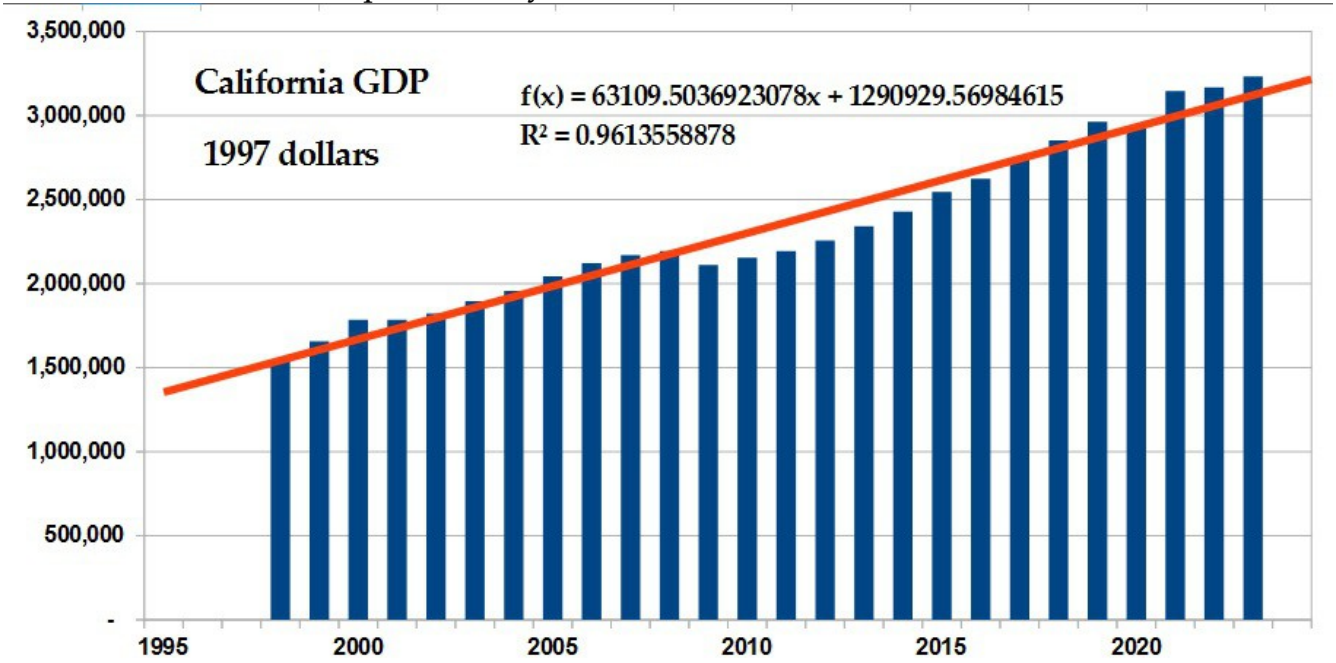
should not be weighted the same as a $17,190 Nissan Versa



The rather jagged changing between 131,000 new cars sold and 147,000 new cars sold over the last several months (red circle) are thought to be strongly influenced by consumers fearing that tariffs would force prices upward by 10% or more. The eventual fate of gasoline-powered cars in California is still being litigated. Unfortunately, just as this data masks the cost of a new car, this data also masks whether the new cards are electric, hybrid or gasoline.

In the spirit of full disclosure, the author is not much of a fan of Gross Domestic Product, either at the national, state or county level. How GDPs are built up tends to resemble witchcraft: often bitter controversy rages when a large corporation moves its headquarters, for example. Imagine the impact on the State of Washington GDP or the Kings County if Microsoft and Amazon followed Boeing out of Seattle.

In order to compare GDPs (and a lot of other measures) one needs to divide through by population to obtain per capita ratios. As already been seen, population is rarely counted so there are estimates based on births and deaths with guesses about movements into or out of a geographical unit. A complication is that earlier years of GDP are "corrected" to current dollars so the current GDPs going back say 50 years are all adjusted by inflation to reflect 2024 dollars. Among other things that means one must refresh GDP data periodically.

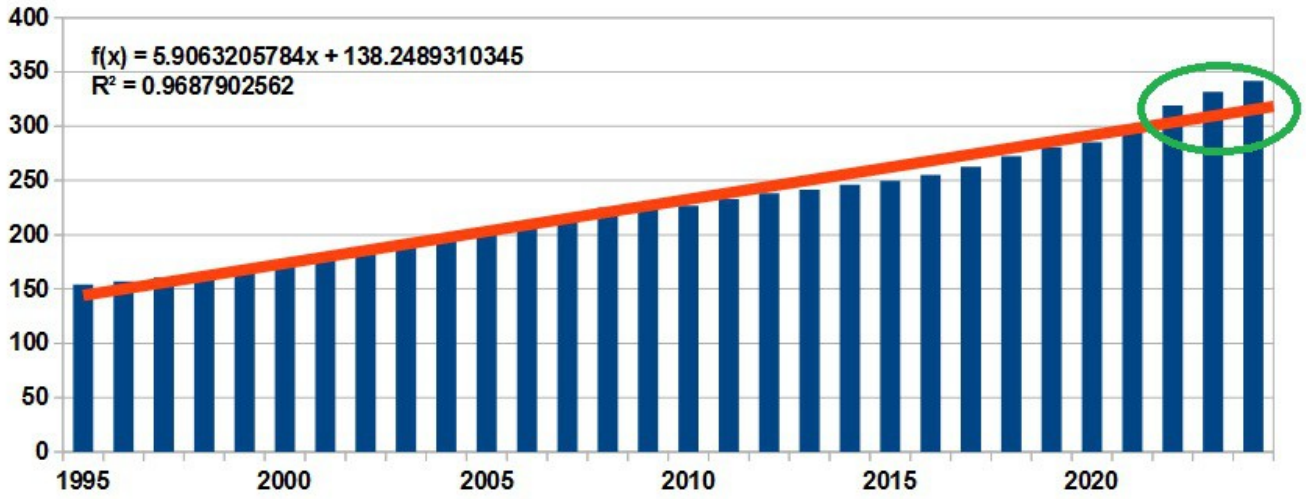


California's Gross Domestic Product for 1998 to 2023 corrected as 1997 dollars to remove the influence of inflation. The two dips (2009 and 2020) should make one wary of asserting that the GDP will continue to grow in a linear fashion, although using the regression equation is tempting. The regression line (red) has a very good fit as is seen in the comparatively high R-squared. Ignoring the slumps and jumps this shows 3.05% average annual growth. However, another problem is GDP is reported annually in arrears so economic downturns in January, February, March … might not get diagnosed in time.

The survey of economic forecasters known as the Blue Chip Economic Indicators overwhelmingly expects declines in gross domestic product growth for the next few quarters. This is largely based on diminishing production capacity, decreasing efficiency and lessening competitiveness, as well as the unpredictability of tariffs inbound and outbound.

CALIFORNIA

URBAN CONSUMERS PRICE INDEX



Again, a fairly impressive fit for the regression equation (red line) as shown by the very high R squared. However, one concern is that the index has been rising faster than usual as shown by the green circle to the right: six of the last seven years have been above the average annual growth of 2.81%. A second concern, especially for mostly rural counties such as Calaveras, is that the California Department of Industrial Relations calculates a monthly consumer price for urban consumers as seen in the title.

There is some justification for this: in the 2020 Census California had both the highest urbanization and the highest population density among US states. As defined by the Census, 94.2% of California residents live in urban areas, just ahead of Nevada with 94.1%. The Census reports that in 2020 the urban population of the United States was 265.2 million, 80.0% of the total population.

As may be known to some readers, school budgets for K-12 and public tertiaries (universities, colleges, specialties like law schools and medical schools as well as community colleges) are made up of very variable amounts of local taxes, state

contributions and federal contributions. To an extent, local taxes are driven by real estate with some special (but minor) additions. Examples of the latter are Beverly Hills gets oil royalties and Geyserville (Sonoma County) gets money from PG&E's steam generation. For most counties a prolonged real estate slump would be close to lethal. As can easily be imagined and even witnessed, high interest rates, fires and fire insurance all combine to make a bad housing situation worse.

State contributions were being addressed with portions of the **preliminary** budget being published at random intervals over the last week or so. For K-12 it looks like a slight decrease amounting to a loss due to inflation. California is probably headed for tough times there – in https://lao.ca.gov/LAOEconTax/Article/Detail/777 the Legislative Analyst's Office is predicting declines in corporate and personal taxes as well as sales tax due to

/1/ The gold rushes predicted for education based on casinos, marijuana, alcohol and tobacco have largely failed to materialize
/2/ The state's economy has been in an extended slowdown for over two years.
/3/ unemployment is up
/4/ The state has added no jobs so far in 2025
/5/ consumer spending has consistently declined
/6/ the stock market is viewed as overheated
/7/ the impact of tariffs on imports and exports is difficult to assess, which is in itself a problem

And the wildest of wild cards would be Federal funding. For California in particular it would be foolish not to expect direct Federal cuts for K-12 (including transportation and meals) as well as direct Federal cuts to student loans and research grants for colleges. Likewise, it would be equally foolish not to expect indirect cuts to education so the State of California can make up for changes to SNAP, healthcare and disasters. Money to fight fires or recover from an earthquake has to come from somewhere. A huge problem for small (less than 150 students) K-5 types of schools is they generally already have pages of plant repairs listed, don't have a nurse or librarian and have only one teacher per grade. If the school loses or fires the third grade teacher those 25 or so students would have to be split among the already crowded second and fourth grade classes. A ridiculous notion. Salaries and benefits are by far the largest expenses for almost every school. It is unclear without additional funds what districts

composed of small schools can do except try to close a school and transport students. Since 1850 or maybe even 1550 the questions have remained the same: /1/ How many teachers are needed for how many students and what will it cost. /2/ How to conveniently and accurately predict changes in near-real time to population and gross domestic product?

FIREARMS

Guns are not quite an isolated commodity. There really are not any substitutes such as almonds for peanuts. There are related costs for ammunition, licenses, optics, carrying, cleaning and so on. One could make the case that shotguns sometimes substitute for handguns when it comes to self-defense - it seems to be more common that someone purchases both a handgun and a shotgun.

As readers may be aware, California's scheme for hunting licenses is quite Byzantine. There are all sorts of rules for weapons (typically, rifles, shotguns and archery) with distinct seasons and locations for everything from elk to quail. For the most part, no one hunts with handguns so we may conclude that handguns contribute economically either as collectibles (probably not going to be used very much) or self-defense. Further, there is no easy way to distinguish cheap Saturday night specials from handguns bought by law enforcement or from high-end handguns bought for competition. I had thought that handgun sales (no distinction about new or used) might be some sort of indicator for how fearful people were. Sadly, California does not report sales by caliber, county or month. It is also difficult to determine how many handgun-owning households there are as distinct from how many handgun owners. As far as I can determine, about 90% of handguns statewide are purchased for self-defense.

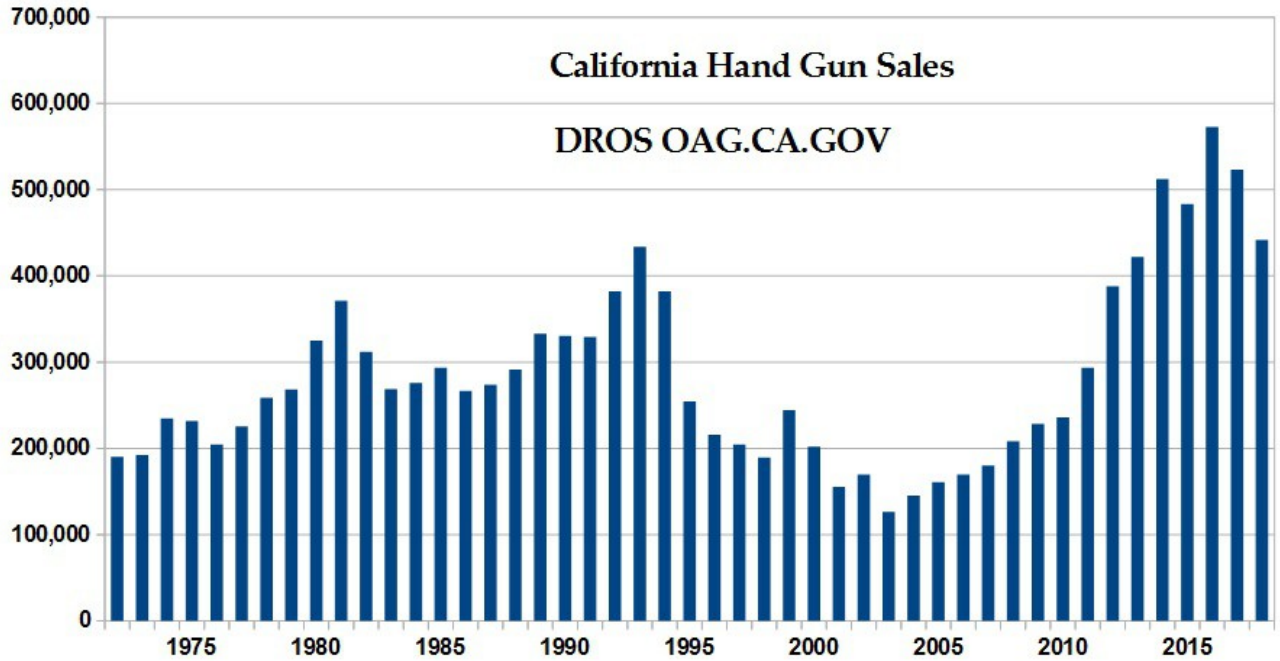
The situation is further muddled as long guns can also be purchased by law enforcement, competition, hunting and for self-defense. As far as I can determine, about 80% of long guns statewide are purchased for self-defense.

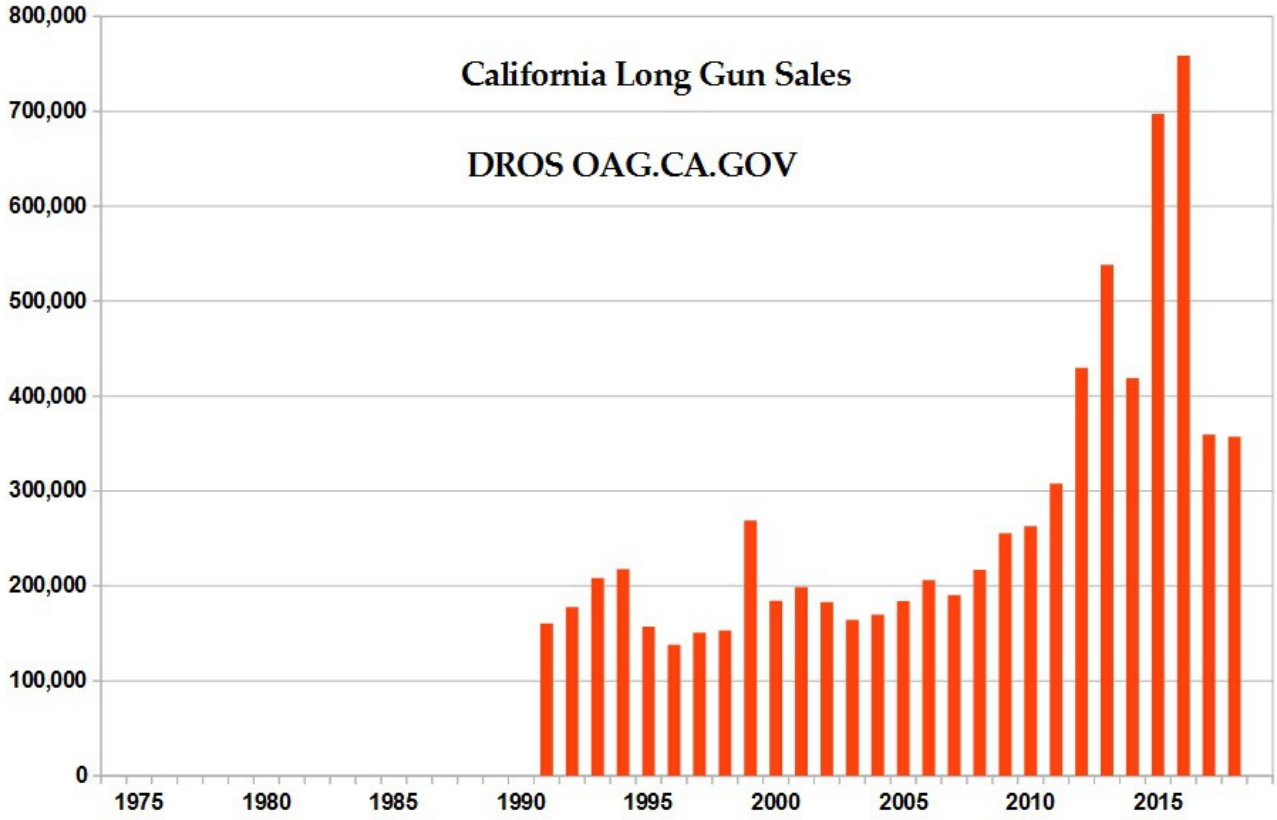
What California currently makes available is Dealer Record of Sales tabulations by year. Yes, that misses homemade guns, ghost guns, guns without serial numbers, guns bought out of state, black powder and so on. There are no (zero) details by caliber, month or county, although there are separate figures for handguns and long guns. But

things are worse than that: shockingly, there is no starting estimate of how many guns there were in California in say 1970. Estimates of the number of firearms in California range from 16 million to 20 million (thought to be about equally divided between long guns and hand guns) with between 4 million and 5 million distinct owners. From 1972 (earliest records) to 1981 California only recorded handguns and no (zero) long guns. Then from 1982 to 1990 still only handguns, but denials were added. These were usually 1% or so - in many cases the denial was too slow and the waiting period was too short so the customer got the handgun anyway. In 1991 long guns and their denials were added. There was an only one gun purchased every 30 days limit as well - that was recently vaporized. But we are not quite done. There are no records after 2018 available yet. Yes, that's correct - no way to analyze the effect of COVID, among other issues.

Virtually all statisticians have a tattoo to the effect that "correlation does not imply causality". With that in mind

/1/ if we correlate handgun sales with itself (known as autocorrelation) there is a high correlation (> .90) BUT this is a common and often spurious result when two sequences of more or less ascending values are used. That's not a big deal - there isn't any compelling evidence that buying a handgun this year will prompt buying a handgun next year.

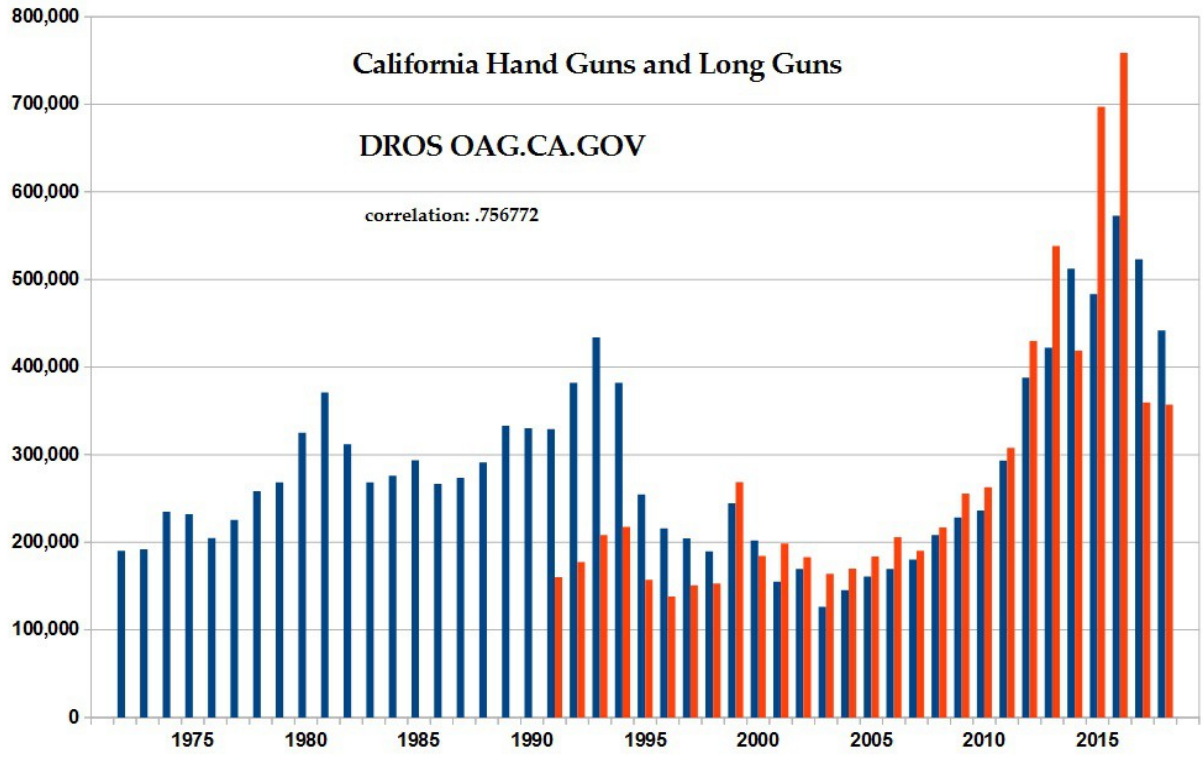




/2/ One can tentatively conclude that gun ownership tends to increase as population does. However, proving this statistically is fraught with difficulties. California's population has increased from nearly 20 million in 1970 to nearly 40 million today. The 1980s were a time of explosive growth and population easily outstripped infrastructure. As a cautionary note, in the last nine years California's official population growth has slowed dramatically - the population was flat in 2019 and 2022 and actually declined almost 1% in 2021.

/3/ It would be foolish to depend on the current fees for concealed carry, silencers and the supplementary 11% taxes on guns and ammunition to be uncontested, let alone be able to significantly help schools.

/4/ Besides no long gun for the first 20 years it is unknown neither how many hand guns there were in California in 1970 nor how many long guns there were in California in 1990. To be fair, it is not clear how accurate population estimates, state gross domestic products or much else from 50 or even 30 years ago were.



/5/ As noted previously, it is difficult to defend the notion that all cars are created equally in an economic sense. Even if somewhat detailed new car sales (model year, month of purchase, price and county of residence for the owner) could be obtained from the California Department of Motor Vehicles there are a number of factors that complicate the interpretation of the data going forward:

/a/ whether California's policy of shifting off gasoline-fueled vehicles will prevail
/b/ the prices and availability of tires, repairs and gas
/c/ the ability or inclination to substitute a used car
/d/ how well car makers respond to tariffs
/e/ it appears that for many consumers in Amador and Calaveras counties (and a fair number of the other small foothill counties) new vehicles would be likely to be purchased from a dealership in the Sacramento area.

The current protocol is to buy a gun (hand or long gun; new or used) that one may either purchase directly from a properly licensed gun dealer or purchase over the internet and have the weapon sent to a properly licensed gun dealer. There is a waiting period and a background check. Among the dealers in Amador County

/1/ Foothill Firearm Supply
845 N State Highway 49 88, Jackson, CA 95642

/2/ Lava Dog Gun Vault
9454 Main St, Plymouth, CA 95669

/3/ Tate Gun Maker
2951 Curran Rd, Ione, CA 95640
Similarly, among the gun dealers in Calaveras County

/4/ Liberty Guns & Ammo
49 California St, Valley Springs, CA 95252

/5/ Rusty Gunsmithing
1039 Highway 49, San Andreas, CA 95249

/6/ The Rusty Knife
2275 Highway 4, Arnold, CA 95223

One might, perhaps for sentimental reasons, wish to do business in another county:

El Dorado County

/7/ Sherman's Gunsmithing
3000 Mosquito Rd, Placerville, CA 95667

/8/ Morrow Firearms
1525 Crooked Mile Ct, Placerville, Ca 95667

/9/ Mosquito Creek Outfitters
3000 Mosquito Rd, Placerville, CA 95667

/10/ Sierra Mountain Firearms
4050 Durock Rd, Shingle Springs, CA 95682

/11/ Big Horn Gun Shop
6271 Pleasant Valley Rd, El Dorado, CA 95623

/12/ Foothill Ammo
3977 Durock Rd, Shingle Springs, CA 95682

Note that like new car sales, gun sales do not distinguish between whether two sales over a reasonable period are to the same or different households.

Tuolumne County

/13/ Confidence Firearms
16675 W Brookside Dr, Sonora, CA 95370

/14/ Tea Party Arms
15270 McKamey Ct, Sonora, CA 95370

As with new car sales one would want to collect type, month of purchase and county of residence for the owner) – much as I would value caliber, price and new versus used it is difficult to determine an immediate need for such data. Today, the state of California can capture local taxes (primarily real estate) but associating sales taxes with a county is challenging: someone in Calaveras County might choose to shop in Jackson in Amador County. Likewise, state income tax – both personal and corporate – has frequent (weekly, biweekly, monthly) withholding for people on payrolls as well as quarterly estimates. There are annual surges in March and April (and, to a lesser extent, February) as annual reconciliations are paid. It may well be the case that multiple variables – perhaps GDP, new auto sales and gun sales will provide better predictions for school district and individual school attendance and achievement. What should be clear is that school districts need

/1/ much more granular data relevant to the district and its cities, towns, and census-defined places as opposed to state or county level data

/2/ much more timely data. This is more easily written than done as property taxes are mostly paid twice per year. However, it is possible to combine reported sales and abandonments to provide frequent revenue estimates. The California State Legislative

Analyst's Office does provide periodic updates on the collection of personal income taxes, corporate income taxes and sales taxes unit. There s usually a closely run race to get these figures after the peaks in March and April and then fashion a state budget. How stable future state budgets will be remains to be seen.

/3/ As the recent Richter 8.8 earthquake in Kamchatka showed, floods, storms, fires, earthquakes and other disasters are very difficult to predict. As a working geologist, I would comment that for the sixth most powerful earthquake recorded (so probably in the last 120 years – a blink in geological time) the damages and injuries due to shaking and tsunamis were miraculously low. However, it should be noted that there have been over 600 associated local earthquakes – mostly Richter 4s and 5s but including fourteen Richter 6s - offshore of Kamchatka this month. That is an exceptionally large swarm, and so many Richter 6s is very unusual. It is unclear if the Russian volcano Klyuchevskoy Sopka (actually on the peninsula and somewhat north) and others will have a major eruption. It is a mid-sized volcano, and is fairly remote, but has been the most active volcano in the Northern hemisphere the last few years. The consideration should be borne in mind that for a school district in Amador County or Calaveras County a disaster in Siskiyou County has to be responded to and paid for. It will be challenging if a school district makes employment decisions in July and has revenue clawed back in December.
/4/ While it might be possible for transferring students to have their family or school district alert a receiving school district in advance, there remains the problem of school-age immigrants. This is probably not a major issue for Calaveras County or Amador County schools but it is likely worth someone's time to determine what, if anything, schools in Imperial County, San Diego County … do.

Note that even if a great deal more money is obtained – either from diverting Federal income tax or from selling land or both – it is not obvious where more teachers can be obtained. Among the possibilities to entice Californians into teaching might be

/1/ subsidized housing

/2/ no income taxes

/3/ student loan forgiveness

	A	B	C	D
1		**Amador**	**Calaveras**	**Total**
2	Students	4,131	5,294	9,425
3	Existing teachers	206	266	472
4	Additional teachers	207	264	471
5	Salaries	$42,947,870	$55,114,700	$98,062,570
6	Benefits	$19,756,020	$25,352,762	$45,108,782
7	Aides	338	440	778
8	Special Aides	75	90	165
9	Salaries	$22,302,000	$28,620,000	$50,922,000
10	Benefits	$8,920,800	$11,448,000	$20,368,800
11	Staff salaries			
12	Staff benefits			
13	Subtotal	$93,926,690	$120,535,462	$214,462,152
14	Local	$32,682,000	$55,823,000	$88,505,000
15	State (existing)	$19,648,000	$29,717,000	$49,365,000
16	State (new)	$41,596,690	$34,995,462	**$76,592,152**
17				
18	Federal (old)	$3,818,000	5,250,000	$9,068,000
19	Attendance subsidy	38,624,850	49,498,900	88,123,750

I was unable to obtain the number of non-teaching staff and their average salaries. I did NOT include daily attendance subsidies. These can be estimated as $9350 per student assuming that the student attends 170 days in a school year as shown in line 19 above. In the apparently unlikely event that most or all Federal funding (previous amounts shown on line 18) is restored it could be used to reduce line 16.

For those who consider 76.6 million dollars (plus some other costs) a huge cost to rescue two small counties here are equivalent figures for two very populous counties - Riverside and Los Angeles – as well as for the entire state (to clarify, the column of figures labeled California – far right – is for all 58 counties rather than the remaining 54 counties).

	Riverside	Los Angeles	California
Students	423,548	1,307,845	5,815,592
Existing teachers	18,481	60,802	266,902
Additional teachers	23,874	69,983	314,657
Salaries	$4,404,496,450	$13,600,332,150	$60,476,320,410
Benefits	$2,026,068,367	$6,256,152,789	$27,819,107,389
Aides	36,304	112,101	498,479
Special Aides	6,051	18,684	83,080
Salaries	$2,287,170,000	$7,062,390,000	$31,404,186,000
Benefits	$914,868,000	$2,824,956,000	$12,561,674,400
Staff salaries			
Staff benefits			
Subtotal	$9,632,602,817	$29,743,830,939	$132,261,288,199
Local	$1,940,803,000	$8,379,189,000	$40,487,245,300
State (existing)	$4,680,260,000	$15,835,623,000	$59,558,562,000
State (new)	$3,011,539,817	$5,529,018,939	$32,215,480,899
Federal (old)	$1,028,032,000	$4,631,645,000	$15,326,982,000
Attendance subsidy	$3,960,173,800	$12,228,350,750	$54,375,785,200

The advantage of starting with two or more small counties is that the pool of possible supplementary teachers and aides is quite limited. How or where the various school districts in Amador and Calaveras counties could hire (and retain) 500 teachers and possibly 900 aides is very unclear. The Governor and the California legislature might want to choose counties with particular demographic or geographic properties. It might also be attractive to select counties or even school districts that in the past depended on either especially low or especially high percentages of Federal funds. Whether the ratio of local and state funds is or should be important is difficult to say. It is likely to be the case that counties or school districts will need to demonstrate that they and their school boards have had and still have the administrative abilities and systemic integrity to handle more money and more personnel.

Canada and the United Mexican States

Canada currently has a population of almost forty million (40,000,000) people, of whom about six million are enrolled as students. Canada is thought to have 420,000 teachers and 100,000 doctors nationwide. While Canadian professionals are attractive because they speak English, Canada would not appear to be a target-rich environment for recruiting: Canada needs more teachers and doctors and the working and social environments there are usually considered quite superior to those here.

At one time, the bulk of immigrants to the United States were of Mexican origin. Whether that trend will persist is hard to foresee, in part due to the low quality of Customs and Border Patrol statistics. The United Mexican States likely has over 130,000,000 inhabitants, making it the tenth most populous country in the world. It is also the thirteenth largest country by land area. Current estimates are that about 13 million former or current Mexican citizens live outside of Mexico, primarily as legal residents or American citizens in large cities in the southwestern United States. As mentioned previously, it is asserted, depending on the source, that somewhere between 13 million and 26 million current Mexican citizens live as illegal immigrants in the United States. According to the US Census, over 37 million U.S. Residents (11% of the US population), identified as being of full or partial Mexican ancestry. Currently, there is considerable debate about whether a child born in the United States with one or two illegal immigrant parents should be counted as an American citizen. For a school in California the issue of citizenship is largely irrelevant – the child will have to be educated.

The United Mexican States likely has over 330,000 doctors – that is not really enough for a country of that size. By comparison, California, with about 30% of the population of the United Mexican States, has an estimated 123,000 doctors. Note that it is unlikely that the United States has 1,100,000 doctors nationwide. Doctors are slow and expensive to produce, so I am very doubtful that President **Claudia Sheinbaum Pardo** would appreciate or allow doctors to be poached.
However, current estimates are that the United Mexican States has 30 million K-12 students; 156,000 preschool teachers; 560,000 primary school teachers; 310,000 secondary school teachers and 225,000 college and university teachers. Could the United Mexican States be a useful resource for recruiting teachers? If so, what sorts of enticements might be attractive?

Some History from 1940

Recent publications by the State of California's Legislative Analyst's Office paint a gloomy economic picture: unemployment is high and there are few jobs being created. In addition, affordable housing has become less affordable and maintaining fire insurance is challenging. The housing problem bodes poorly when recruiting teachers.

On June 18, 1940 Prime Minister Winston Churchill, who had only been in office five weeks, addressed the House of Commons and predicted that the Battle of Britain would soon begin. Over 338,000 Allied soldiers had just been evacuated from Dunkirk and other coastal areas two weeks earlier. However, the British Expeditionary Force had lost over 68,000 soldiers – German treatment of prisoners of war was not exemplary. In addition, thousands of tons of equipment, fuel, munitions and supplies were left behind. The Royal Navy lost six destroyers and the French Navy lost three. There were at least 234 other ships, mostly British, lost. The Royal Air Force lost 145 planes including 42 Spitfires.

It was not known at the time that the Luftwaffe had lost 156 planes. France surrendered four days after the speech.

The exact numbers are still hazy, but the Allies (chiefly England with some help from exiles and Commonwealth countries) started with about 1960 aircraft versus about 2550 for Germany. However, not all aircraft were equal – for example, some like the German Junkers JU-87, the so-called "Stuka", had been very successful in the fighting in Poland, the Low Countries, France and Norway, but was easy prey for Allied fighters over England. The Luftwaffe had developed hundreds of different airplanes but the most relevant types for the Battle of Britain were fighters and bombers, with some varying needs for night specialists and reconnaissance/patrol. The Luftwaffe lost about 2585 pilots killed, 735 wounded and 525 captured. This can be compared to Allied losses of 1542 killed, 422 wounded and zero captured. The figures of planes destroyed are still disputed almost a century later. One pair of figures is 1744 Allied fighters and bombers versus 1977 German fighters and bombers. In the interests of full disclosure, over 23,000 English civilians were killed and over 32,000 wounded. The problems were

/1/ German armed forces were preparing to invade Russia

/2/ Allied forces did not need to win (and really did not) – they had to avoid losing
/3/ The Luftwaffe had to establish air superiority over the English Channel and the southern coasts of England in order to make possible a combined parachute and seaborne invasion.
/4/ Logistical support for the Luftwaffe was not done in the expectation of campaign last months with relatively high losses. A fair percentage of American observers were convinced Germany would win very quickly.
/5/ **Hermann Wilhelm Göring (**12 January 1893 – 15 October 1946) was much more skilled as a politician than he was as a commander

On the other hand,

/1/ Britain was struggling to limit U-boat successes in the Battle of the Atlantic
/2/ It was challenging for Britain to import and produce war materials and food
/3/ There was a general shortage of trained pilots - untrained pilots did not tend to survive very long
/4/ The Fighter Command network, including radar towers, implemented by **Hugh Caswall Tremenheere Dowding, 1st Baron Dowding** (April 24, 1882 - February 15, 1970) allowed considerable tactical flexibility and optimization of scarce resources.
/5/ **Winston Leonard Spencer Churchill** (30 November 1874 – 24 January 1965) was correct – it was the British Empire's finest hour (from his June 18th speech) and that "Never in the field of human conflict was so much owed by so many to so few" (from his August 20 1940 speech). In my opinion, the statements still stand.

Depending on who is writing the history, Luftwaffe strategy shifted from attacking airfields and aircraft production to bombing cities from September 7 1940 until May 11 1941. This second campaign was known as The Blitz. The skies over London and other cities remained deadly to both sides by day and night. The United States of America still had not officially entered the war. As is well-known, that situation changed on December 4, 1941. Japanese forces swept across eastern Asia and the West Pacific. But, on April 18, 1942, then **Lieutenant Colonel James Doolittle** (December 14, 1896 – September 27, 1993) led a group of 16 specially modified B-25B bombers that launched from the aircraft carrier USS Hornet then 750 miles east of Japan. The task group was composed of two aircraft carriers, three heavy cruisers, one light cruiser, eight destroyers and two fleet oilers. Detected by a Japanese picket boat, the bombers were launched 10 hours early and 200 miles further east than had been planned for. This

turned a very difficult mission into a near-suicidal one. One bomber had to divert to Vladivostok in Russia where the plane was sequestered and the five crew were interned for about a year. The remaining fifteen bombers of the Doolittle Raid did not do much physical damage to Japan – 50 killed, 400 injured, five patrol boats sunk, and some damage to a merchant ship being converted to become the aircraft carrier ***Ryūhō***. All fifteen of the remaining bombers crashed or were ditched. Of the seventy-five crew, one was killed bailing out, two drowned, eight were captured and sixty-four escaped. Of the eight captured, three were executed and one died in captivity. There were two very important consequences: Japanese troops killed about 250,000 Chinese and devastated about 20,000 square miles along the eastern coast of China AND Japan's military leadership decided to attack the US-occupied Midway Island.

On May 6, the Philippines surrendered, but from May 4 to May 8 1942 there was a long-running naval air battle in the Coral Sea southeast of New Guinea and northeast of Australia. Despite being out-numbered 139 planes to 128, and probably out-skilled, the United States Navy chose to give battle. The United States Navy lost a fleet aircraft carrier (USS Lexington), a destroyer and an oiler. A second US Navy aircraft carrier, USS Yorktown, was severely damaged. The aircraft carriers USS Hornet and USS Enterprise were still returning from the Doolittle Raid and were unable to reach the Coral Sea in time. In addition, the US Navy lost 69 aircraft and 715 personnel killed. In contrast, the Imperial Japanese Navy lost a light carrier, a destroyer and three minesweepers, and had one fleet carrier damaged, one destroyer damaged, one transport damaged and one smaller warship damaged, Tallies conflict – somewhere between 69 and 97 Japanese aircraft were destroyed. It is usually agreed that 966 Japanese personnel were killed. By most measures the Battle of the Coral Sea was a tactical defeat for the Americans, but the Japanese task force that had intended to attack and occupy Port Moresby on the southeastern coast of New Guinea turned back. To make Japan's strategic shortcomings worse, the two Japanese carriers, *Shōkaku* and *Zuikaku,* could not participate in the imminent and crucial Battle of Midway.

During the Battle of Coral Sea the USS Yorktown dodged eight torpedoes and several bombs. There were, however, multiple near misses by bombs that caused structural and hull damage. One 550 pound bomb pierced the flight deck and two lower decks before exploding. The Yorktown was able to sail some 4,000 miles back to Pearl Harbor. In his after-action report her commander, Captain Elliott Buckmaster,

wrote: “The conduct in battle of the entire ship's Company of the Yorktown and her Air Group was worthy of the highest traditions of the Naval Service. I can have no higher honor than to have commanded them in battle.” The Yorktown was repaired enough at Pearl Harbor to put back to sea in time to steam westward to participate in the Battle of Midway which was to start June 4, 1942.

There have been many books written about the Battle of Midway – for something of a sample see Appendix E. One can certainly make several comments:

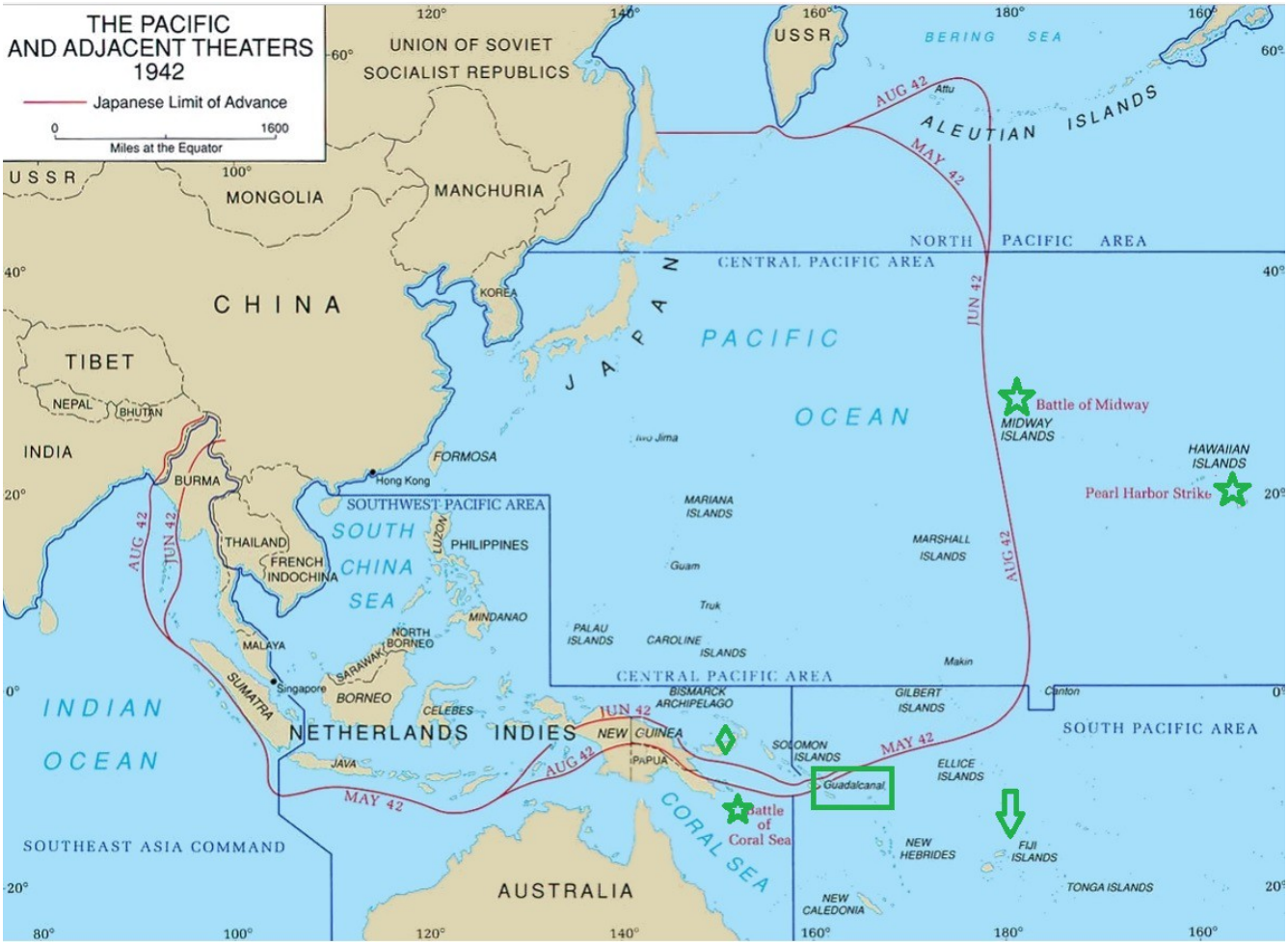
/1/ Japanese submarines, patrol planes, spies and code-breakers did not determine how many active aircraft carriers the US Navy still had. It was suspected that two aircraft carriers were involved in the Doolittle Raid, and it was known that the USS Lexington had been sunk at Coral Sea. There was no consensus as to whether the USS Yorktown had been sunk at Coral Sea, or was undergoing lengthy repairs either at Pearl Harbor, Seattle or San Diego. For some reason, it was very difficult to determine how long repairs and refitting of the USS Saratoga at San Diego might take.

/2/ Although it was against Imperial Japanese Navy doctrine, a hodge-podge of aircraft could have been cobbled together to bring the *Zuikaku* up to full capacity and probably allow her and 50 to 60 more planes to join in the Battle of Midway. Notwithstanding, there is very evidence that the Imperial Japanese Navy was very concerned about whether it might face two, three or four American aircraft carriers

/3/ Either side could have won the battle. An American defeat, perhaps including the loss of one or more of the three engaged aircraft carriers, probably would have meant the loss of Midway itself and prolonging the Pacific War by six to twelve months.

As history has it, after all the blunders, bravery and brilliancies, the United States lost the USS Yorktown, despite her surviving two Japanese aerial attacks featuring three bomb hits and two torpedo hits. While under tow she was struck by two torpedoes from Imperial Japanese Navy submarine I-168 on June 6 and sank the next day. At the same time the destroyer USS Hammond was sunk by a torpedo from the same submarine. American personnel (Navy and land-based) losses were 307 killed (including three executed as prisoners) and 150 aircraft destroyed (out 233 carrier-based and 127 land-based). Japanese losses were significant: all four fleet carriers and one heavy cruiser, Mikuma, were sunk; heavy cruiser Mogami and two destroyers

were damaged; 3,057 killed; 37 captured and **ALL** 248 planes carrier-based planes destroyed. Admittedly, a great deal of luck was involved, but the United States Navy achieved a profound victory despite fighting at inferior odds.



Ominously, on the previously ignored island of Guadalcanal coast-watchers under the direction of Martin Clemens reported that the Japanese had landed 2,000 Korean laborers and some troops and were constructing a major airfield. This was confirmed by a bomber flying a reconnaissance mission. Once fully functional such an airfield could support further Japanese invasions of southward toward Fiji and threaten the supply lines from the western United States to New Zealand and Australia.

Some of the air distances

		miles
Rabaul (green diamond)	Port Moresby, Papua New Guinea	500
Rabaul	Guadalcanal	660
Guadalcanal (green rectangle)	Luganville, Vanuatu	600
Guadalcanal	Port Vila. Vanuatu	780
Guadalcanal	Port Moresby, Papua New Guinea	885
Guadalcanal	Noumea, New Caledonia	970
Guadalcanal (green arrow)	Suva, Fiji	1300
Guadalcanal	Brisbane, Australia	1300
Guadalcanal	Sydney, Australia	1800
Guadalcanal	Canberra, Australia	1900

Japanese naval and aerial attacks from Rabaul and satellite bases against Guadalcanal were an almost daily occurrence known as the Allies as The Tokyo Express. Had Guadalcanal not been contested successfully by the Allies, whether Japan would have stationed long range bombers, scout planes, submarines and even surface ships is difficult to say, but it likely would have been quite a different war.

In contrast to Pearl Harbor, Coral Sea and Midway, the Guadalcanal Campaign was a long series of land and naval battles that started with the landings by the United States First Marine division eighty-three years ago on August 7, 1942 and ended with Guadalcanal being evacuated by Japanese forces by February 9, 1943. Even four score and three years after the campaign there is quite a wide spectrum of opinions on both sides. There is general agreement that

/1/ a commander of Special Naval Landing Forces (Japanese equivalent of US Marines) is alleged to have said: “This is the decisive battle between Japan and the United States: a battle upon which the rise or fall of the Japanese Empire will depend.”
/2/ not all of the commanders on the two sides were equal to the task

/3/ American admirals often failed to exploit the technical advantage of radar, and, as a result, Japanese naval forces dominated night actions. On the other hand, it is an enduring puzzle why Japanese aircraft carriers did not provide air cover for the various Japanese naval convoys and bombardment groups.

/4/ It was not immediately appreciated by either side that the jungle and diseases like malaria, dengue and dysentery were enemies to all human combatants. Virtually none of the American or Japanese units had any experience with jungle warfare and few of the American Marines or Army troops had any combat experience at all.

/5/ The Americans took some advantage of spies in the form of coast-watchers, Solomon Islands inhabitants and signals intelligence. Neither side had decent maps.

/6/ For the first half of the campaign the United States forces were outnumbered on land, in the air and at sea. However, United States commanders on land were usually able to operate inside the decision cycles of their Japanese counterparts – a critical advantage. In addition, the coordination between American and Allied land, sea and air forces, while not always terrific, was considerably better than the coordination between the Japanese Army and the Japanese Navy.

/7/ Neither side had anticipated a protracted battle of attrition at the end of lengthy supply lines so there was a bloody struggle to maintain a stream of food, ships, planes and people.

/8/ At both the United States Naval Academy and United States Navy War College as well as at their Japanese counterparts the Guadalcanal Campaign is still studied today, albeit often as an example of how NOT to conduct warfare. There is particular emphasis today placed on the need for commanders to have accurate tallies and locations of troops, ships, planes, supplies and other resources. There should be an obvious correspondence to teachers, students, buildings, books, meals and buses.

/9/ In view of the relationship between Beijing and Taipei, it is ominous that the Guadalcanal Campaign has been closely studied by the armed forces of both countries.

Estimates of the costs at the end of the campaign

	Allied	Japanese
Aircraft carriers sunk	2	1 (light)
Aircraft carriers damaged	2	2
Battleships sunk		2
Battleships damaged	3	
Heavy cruisers sunk	6	1
Heavy cruisers damaged	7	6
Light cruisers sunk	2	1
Light cruisers damaged	3	4
Destroyers sunk	17	15
Destroyers damaged	9	8
Transports sunk	2	8
Transports damaged	1	6
Submarines sunk	0	6
Naval personnel killed	5,413	4,533
Grounds troops deployed	60,000	36,200
Ground troops killed	7,100	19,200
Ground troops wounded	7,789	8,100
Pilots deployed	1,900	2,100
Pilots killed	254	512
Planes destroyed	615	683

Materially, probably a draw. But Allied troops, ships and planes held Guadalcanal, although at considerable cost. The Japanese evacuated about 11,000 troops by ship.
In the future, the Allied forces would begin by attacking northwest against other islands in the Solomons group. It became increasingly clear that Japanese armed forces could not replace their losses. Some thirty months of often savage fighting was ahead, but it was also clear that American military would use more people, better technology and improving tactics to inevitably defeat a determined enemy.

1st Marine Division patch (above) and one of the Battle of Britain monuments (below)

There have certainly been valiant fighters who were not victorious

The German U-boat memorial at Moltenort which summarizes its contents as

1914–1918: 4,744 dead; 200 U-Boats lost

1939–1945: 30,002 dead; 739 U-Boats lost of 1154 commissioned (64%)

Above is the most recent version of the Thermopylae Memorial in Greece. Designed and executed by Vasos Falireas in the early 1950s, it features a brass statue of Spartan king Leonides with his sword and shield and commemorates him, the 300 Spartans that he led and the 6,000 to 7,000 Greek allies. Modern estimates are they confronted 120,000 to 300,000 Persians probably around July 21-23 480 BC. Estimated casualties were about 4,000 Greeks and 20,000 Persians. Included on the monument is the epigram of the poet Simonides of Ceos: Ὦ ξεῖν', ἀγγέλλειν Λακεδαιμονίοις ὅτι τῇδε κείμεθα, τοῖς κείνων ῥήμασι πειθόμενοι. This has been translated many ways: one is "O Stranger, tell the Lacedaemonians that here we lie, obedient to their wishes". Overall, Thermopylae was an expensive but affordable Persian victory. The invasion of Greece continued for over a year, but the Persians were eventually decisively defeated at Mycale, Plataea and Salamis. The Achaemenid dynasty of Persia controlled the largest empire (2 million square miles) of the time for another 150 years.

Conclusions

It has to be kept in mind that any policy has a price.

Further, in these days of diminished resources, policies will need to have priorities.

If there is a stable source of funding free from extortion, clawbacks and delays for K-12 education besides diverting Federal tax payments or selling public land I am not able to discover it. Likewise, to salvage the K-12 education system the only strategy I could locate that offered any hope is more teachers and more aides and improved salaries. At the same time, data collection and reporting needs to be at least an order of magnitude faster and more accurate.

The opportunities to face daunting odds and very difficult situations like the Greeks at Thermopylae, the Royal Air Force over London in 1940 or the Americans and their allies at Guadalcanal in 1942 do not come along all that often. That is not to imply that the Persians, the German Luftwaffe or the Japanese were any less valiant.

It remains to be seen if some or many or most Californians, and any allies they might attract, decide that it is worthwhile to exert significant effort to determine how best to educate their children and probably their grandchildren. There are no poems and no monuments to Greeks who, instead of replying “μολὼν λαβέ “ ('having come, take them') to Xerxes I, laid down their arms; nor to those who only watched from afar as Britain struggled to survive; nor to those who declined to contest hitherto obscure Pacific islands.

The bell has tolled.

INDEX

Appendix A - Academic Achievements by Year – all types

1986	90	2006	377
1987	245	2007	171
1988	124	2008	343
1989	233	2009	254
1990	175	2010	484
1991	0	2011	100
1992	148	2012	387
1993	206	2013	218
1994	180	2024	424
1995	211	2015	556
1996	182	2016	781
1997	225	2017	361
1998	211	2018	288
1999	158	2019	163
2000	249	2020	324
2001	162	2021	223
2002	247	2022	0
2003	136	2023	356
2004	302	2024	323
2005	204	2025	336

Title I Academic Achievement	227	Gold Ribbon school	1429
Exemplary Physical Education and Nutrition	3	Exemplary Art	28
Exemplary Career Technical Education	11	Distinguished school	8429
National Blue Ribbon school	30		

Appendix B - Academic Achievements by County

Alpine	4	Yuba	30	Stanislaus	98
Lassen	5	Merced	32	San Francisco	110
Del Norte	6	Yolo	33	Santa Barbara	134
Inyo	6	Madera	34	Placer	135
Plumas	6	Nevada	34	Sonoma	141
Mono	7	Tehama	34	Marin	151
Calaveras	**8**	Sutter	36	Kern	178
Modoc	8	Kings	37	Sacramento	259
Sierra	8	Imperial	41	San Mateo	268
Colusa	9	Butte	50	Ventura	286
Glenn	11	Napa	50	Fresno	330
San Benito	11	Monterey	56	Contra Costa	386
Lake	12	Tulare	71	Riverside	395
Tuolumne	14	Santa Cruz	72	San Bernardino	407
Trinity	17	Humboldt	84	Alameda	471
Amador	**18**	Shasta	85	Santa Clara	675
Mariposa	19	San Joaquin	87	San Diego	823
Siskiyou	20	San Luis Obispo	87	Orange	1173
Mendocino	24	El Dorado	93	Los Angeles	2383
		Solano	95		

Appendix C – Ownership of California Land by Public Agencies

Agency	Square miles	Parcels
Department of Defense	9,570.82	319
Army Corps of Engineers	174.16	115
Bureau of Land Management	**37,823.75**	**18,408**
Bureau of Reclamation	653.88	217
United States Coast Guard	0.42	9
Fish and Wildlife Service	935.55	2,498
USDA Forest Service	54,196.52	3,903
National Park Service	16,697.07	376
Other Federal Lands	6.26	40
TOTAL FEDERAL	**120,058.43**	**25,885**
CA Dept. of Fish and Wildlife	1,759.17	1,860
CA Dept. of Forestry and Fire Protection	254.78	57
CA Dept. of General Services	56.07	15
CA Dept. of Parks and Recreation	3,365.00	1,219
CA Dept. of Transportation	3,782.69	198
CA Dept. of Veterans Affairs	4.33	3
CA Dept. of Water Resources	186.19	66
California State Coastal Conservancy	2.98	28
California State Lands Commission	1394.83	1,221
California State University	29.94	19
University of California	139.89	101
California Tahoe Conservancy	16.87	1,978
California Wildlife Conservation Board	4.58	12
Central Valley Flood Protection Board	32.43	22

Coachella Valley Conservation Commission	9.24	86
Coachella Valley Mountains Conservancy	42.59	180
Desert and Mountain Conservation Authority	3.93	18
Santa Clara Valley Habitat Agency	11.68	7
Santa Monica Mountains Conservancy	25.71	120
Sierra Nevada Conservancy	2.28	6
Other State Lands	112.06	63
CALIFORNIA STATE TOTAL	**11,237.25**	**7,279**
LOCAL (Cities, Towns, Counties) TOTAL	**4,538.95**	**21,159**
Non-Profit Conservancies and Trusts	**2,141.82**	**3,028**
Bureau of Indian Affairs	**1,547.38**	**910**
GRAND TOTAL	**139,523.83**	**58,261**

Appendix D – Considerations

A group of us considered the economic consequences of California, perhaps with a few other western states, leaving the United States and either becoming a separate country or joining with other existing nations such as Canada or Mexico. It turned out to be a rather involved process, but in almost all cases the United States was so economically damaged as to no longer be recognizable. Among the issues

/1/ public lands and reservations to visit them. There are also leases.
/2/ seaports
/3/ railroads
/4/ banks and credit unions
/5/ stocks, bonds and exchanges
/6/ timing of cessation of Federal taxes
/7/ transfer of Social Security
/8/ Medicare and Medicaid
/9/ borders
/10/ tariffs
/12/ airports, airlines and private planes, FAA controllers
/13/ military personnel, bases and equipment including the Coast Guard. There are about 175,000 active duty armed services members stationed in California. How many would wish to leave the state, presumably with their families to continue to serve in the United States military is difficult to predict. Like there are military out of state who might prefer to serve in California. The situation becomes more complex with reserves. At the moment, the United States is not at war so that complication need not be dealt with at this time. What is to happen, for example, to the various US Navy ships that currently home port in San Diego is unclear. Perhaps the USS California (SSN-781), a Virginia class attack submarine commissioned in 2011, would have to be renamed.
/14/ law enforcement officials (US Marshalls, FBI, DEA , ATF …)
/15/ pending litigation
/16/ prisons and prisoners and wanted criminals. There are currently 33 state prison holding 114,654 inmates (designed capacity is 91,967). California had stopped exporting prisoners to other states before 2020 and is believed to have repatriated all. There are three United States penitentiaries and seven Federal Correctional Institutes holding 13,315 inmates. There are also various halfway houses and other facilities.

/17/ memberships in national unions such as teachers, grocery clerks, Teamsters …
/18/ mail delivery, United States Postal Service and post offices
/19/ electrical grid including coal and petroleum products shipments
/20/ water – the most vivid example if the Colorado River basin: water from it is shared by seven US states (Arizona, California, Colorado, New Mexico, Nevada, Utah and Wyoming) as well as two Mexican states and ten Native American tribes (with varying amounts of success).
/21/ fishery and marine mammal regulation
/22/ migratory bird and butterfly management
/23/ California residents who wish to remain US citizens: can they be granted the equivalent of a green card? What about those who wish to be Californians but reside outside of California?
/24/ out of state students studying California; Californians studying out of state. In particular there would need to resolution of Pell grants other student loans as far as what a student choosing to become a Californian would owe to the US. Conversely, a US student might want to confirm that his or her financial arrangements to attend school in California still pertain.
/25/ participation in NCAA, AAU, NAIA ... sports and tournaments
/26/ As there are professional sports teams from Canada in Major League Baseball, the National Basketball Association, the National Hockey League and so we assumed no changes would be needed.
/27/ former Federal agencies such as NASA, USGS and NOAA
/28/ insurance – commercial, auto, personal, ear5thquake, flood and property
/29/ The US Merchant Marine Academy is in Kingston, New York. The California State University Maritime Academy (Cal Maritime or CSU Maritime Academy) is a public university in Vallejo California. It is part of the California State University system and the only maritime academy on the contiguous West Coast. Cal Maritime will merge with California Polytechnic and become a subsidiary of Cal Poly on July 1, 2025 and will be known under two names: Cal Poly, Solano Campus and Cal Poly Maritime Academy. Students and faculty might have to be transferred.
/30/ TLD (top level domain codes such as adding .cal in a manner similar to .us) and top level country codes transfers and routing. Currently, TLDs of .mil (military) and .gov (government) would need to be duplicated for California. Country code TLDs are two letters: cb,ce, cj, cq, cp, cs and ct are available
/31/ patents, copyrights and trademarks – it would probably be best to recognize existing United States copyrights, trademarks and patents. This leaves unresolved for

the moment what an inventor in the future in California must do to reserve intellectual property rights for both California and the United States.
/32/ In a similar manner, it would likely be best, at least initially, to co-recognize professional licenses for law, medicine, engineering, construction and so on.
/33/ The simplest solution for currency would be to create a central bank for California and to issue a new currency while preserving dual use for an interim period. To be resolved would be whether ATMs are obliged to provide a choice of currencies.
/34/ In special education a student can petition to obtain an education outside of California – usually the State of California pays for this. It is not clear how this would be handled as there currently are no California students known to be getting a special education in Canada or Mexico.
/35/ Politics: The United States Senate would be somewhat impacted. Since there are two Senators per state the Vice President could still cast a tie-breaking vote, and the filibuster option would probably be reduced to sixty percent of the remaining Senators. It is likely committees and sub-committees would have to undergo considerable reallocation depending on how many other states besides California leave. It seems unlikely that red states would be leaving but stranger things have happened. That probably means control of the Senate and chairpersonships would remain the same.
In the House of Representatives there are two scenarios – maintain the number of representatives at 435 (in effect, decreasing the number of people per representative) or roughly maintain the number of people per representative and decrease the number of representatives. Today, the Huntington-Hill method is used to initially assign one representative per state and then to allocate additional representatives recursively. Currently, there are the following allocations:

California	52	Oregon	6
Washington	9	Alaska	1
Hawaii	2	Arizona	9
Nevada	4	Idaho	2
New Mexico	3	Colorado	8
Utah	3		

For example, suppose California, Hawaii, Oregon and Washington decide to leave.

Huntington-Hill could allocate 46 seats – one for each remaining state. Then it could allocate 389 more seats in order to keep the total at 435. This would have the fortunate effect of keeping the House electoral vote count the same but there would be eight less Senators so the electoral votes needed, were the Electoral College preserved, would be 269 (half of the new total of 537). On the other hand, if the representatives of the four states were simply dropped the new membership of the House would be 366 which means tie votes (183 to 183) could occur. The electoral votes needed would be have to be clarified as the new total is 458, which is an even number. In either House scenario there would likely be dramatic committees and sub-committees reallocations.

How much appeal a new Congress and a new Senate might have for northeastern states is difficult to gauge. The District of Columbia, among others, might well acquire considerable bargaining strength.

APPENDIX E – Books about the Battle of Midway

/1/ Barde, Robert E. (December 1983). "Midway: Tarnished Victory". Military Affairs. 47 (4). ISSN 0899-3718.

/2/ Bicheno, Hugh (2001). Midway. London: Orion Publishing Group. ISBN 978-0-304-35715-4.

/3/Buell, Thomas B. (1987). The Quiet Warrior: A Biography of Admiral Raymond A. Spruance. Annapolis, Maryland: Naval Institute Press. ISBN 0-87021-562-0.

/4/ Cressman, Robert J.; Ewing, Steve; Tillman, Barrett; Horan, Mark; Reynolds, Clark; Cohen, Stan (1990). "A Glorious Page in our History", Adm. Chester Nimitz, 1942: The Battle of Midway, 4–6 June 1942. Missoula, Montana: Pictorial Histories Pub. Co. ISBN 0-929521-40-4.
Davidson, Joel R. (1996). The Unsinkable Fleet: the Politics of U.S. Navy Expansion in World War II. Annapolis, Maryland: Naval Institute Press. ISBN 978-1-55750-156-1.

/5/ Dull, Paul S. (1978). A Battle History of the Imperial Japanese Navy (1941–1945). Annapolis, Maryland: Naval Institute Press. ISBN 1-59114-219-9. Archived from the original on 14 May 2022. Retrieved 4 June 2020.

/6/ Isom, Dallas Woodbury (2007). Midway Inquest: Why the Japanese Lost the Battle of Midway. Bloomington, Indiana: Indiana University Press. ISBN 978-0-253-34904-0.

/7/ Kleiss, Norman (2017). Never Call Me A Hero: The Battle of Midway. New York: Harper Collins. ISBN 978-0-06-269205-4.

/8/ Koenig, William J. (1975). "Midway, 1942". Epic Sea Battles. London: Peerage Books. ISBN 0-907408-43-5. OCLC 70866344. OL 22361603M.

/9/ Lord, Walter (1967). Incredible Victory. New York: Harper and Row. ISBN 1-58080-059-9.

/10/ Lundstrom, John B. (1984). The First Team: Pacific Naval Air Combat from Pearl Harbor to Midway. Annapolis, Maryland: Naval Institute Press. ISBN 1-59114-471-X.

/11/ Lundstrom, John B. (2006). Black Shoe Carrier Admiral: Frank Jack Fletcher at Coral Sea, Midway, and Guadalcanal. Annapolis: Naval Institute Press. ISBN 978-1-59114-475-5. OCLC 62782215.

/12/ Morison, Samuel E. (1988) [1949]. Coral Sea, Midway and Submarine Actions: May 1942 – August 1942. History of United States Naval Operations in World War II. Vol. 4. Boston: Little, Brown. ISBN 978-0-316-58304-6.

/13/ Parshall, Jonathan; Tully, Anthony (2005). Shattered Sword: The Untold Story of the Battle of Midway. Dulles, Virginia: Potomac Books. ISBN 1-57488-923-0.

/14/ Prange, Gordon W.; Goldstein, Donald M.; Dillon, Katherine V. (1982). Miracle at Midway. New York: McGraw-Hill. ISBN 0-07-050672-8.

/15/ Shepherd, Joel (2006). "Battle of Midway: June 4–6, 1942". USS Enterprise (CV6.org). Archived from the original on 23 November 2020. Retrieved 11 December 2020.

/16/ Stille, Mark (2007). USN Carriers vs IJN Carriers: The Pacific 1942. New York: Osprey. ISBN 978-1-84603-248-6.

/17/ Toll, Ian W. (2012). Pacific Crucible: War at Sea in the Pacific, 1941–1942. New York: W.W. Norton. ISBN 978-0-393-06813-9.

/18/ Kernan, Alvin (2005). The Unknown Battle of Midway. New Haven, Connecticut: Yale University Press. ISBN 0-300-10989-X. An account of blunders that destroyed the American torpedo squadrons - the author alleges a cover-up

/19/ Layton, Edwin T. (1985). And I Was There: Pearl Harbor and Midway. New York: W. Morrow. ISBN 978-0-688-04883-9.