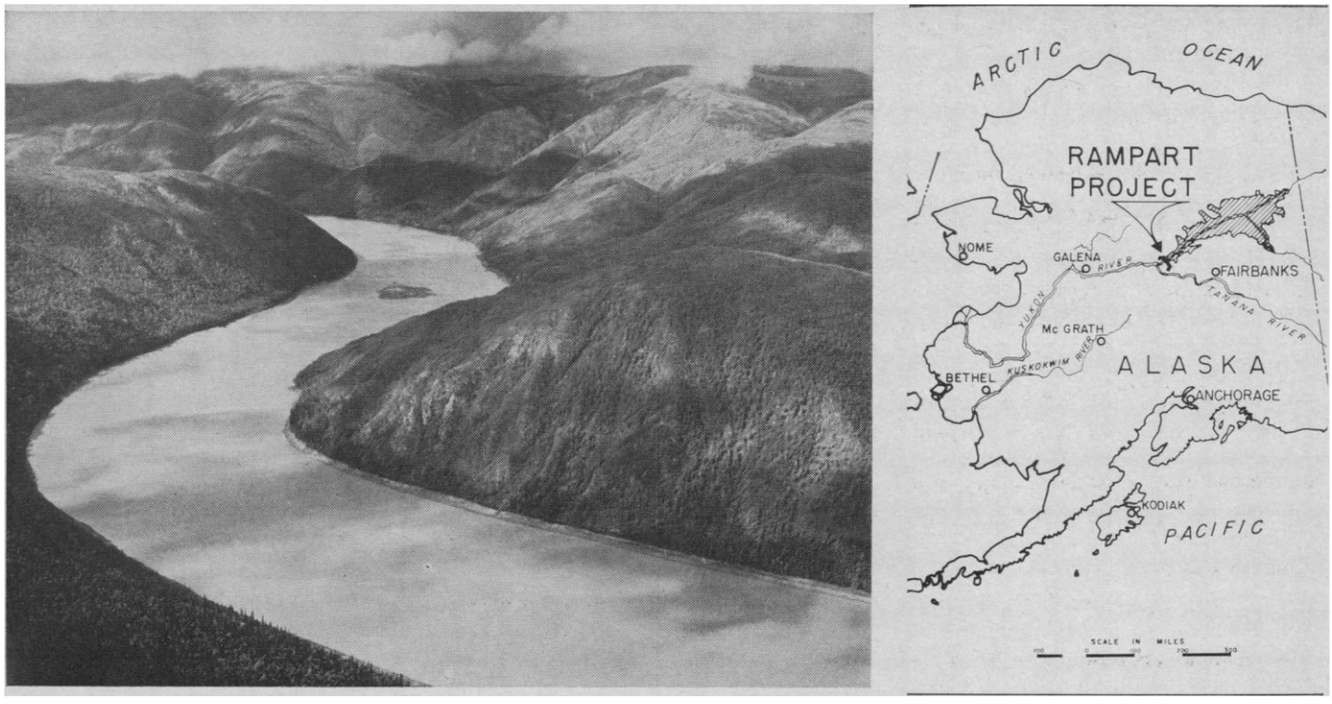


Rampart Canyon, site of the proposed dam on Alaska's Yukon River. The 300-mile-long reservoir which would be formed would stretch over the Yukon flats, hidden in the distance. [Army Corps of Engineers]

ANNUAL MEETING, 26-31 DECEMBER, BERKELEY

The Natural Environment

The 1965 annual meeting of the AAAS will be held in Berkeley, on the University of California campus, from 26 to 31 December. This is the first of a series of articles describing some events planned.

Among the most promising sessions set for Berkeley are four dealing with the natural environment.

Rampart Canyon Dam Proposal

The Rampart Canyon Dam would be the world's biggest dam-hydropower project. At the same time, its construction might result in fish and wildlife losses more "overwhelming" than those caused by any other water development project in history. These losses could be the outcome if the Rampart Canyon Dam is built on Alaska's Yukon River.

The dam would have the potential for generating 5 million kilowatts of power, twice that of the huge Grand Coulee Dam. At the same time it would flood the vast Yukon flats area, in time creating a reservoir larger in area than New Jersey or Lake Erie (but still occupying only a few percent of the total area of Alaska).

From these swampy, potholed flats, each fall some 1½ million ducks, 12,500 geese, and 10,000 cranes begin their migration south. The flats are one of the greatest nesting grounds for waterfowl in North America. University of California zoologist A. Starker Leopold predicts: "If Rampart Dam is built, this sustained production of waterfowl will be completely lost. . . . Even if funds were appropriated to mitigate the loss, there is little ground in Alaska for development to replace the flooded nesting ponds."

Dam proponents and conservationists differ, however, as to the availability of other suitable nesting grounds for the waterfowl.

The U.S. Fish and Wildlife Service, which made a detailed study of the ecological impact of the proposed dam, predicts a loss of 5000 moose. Leopold suggests that moose foraging downstream from the dam would be hard hit. "Winter forage in the form of young willow stands is constantly being renovated by the process of cut and fill that characterizes the unstable Yukon channel today. With [floods eliminated by a dam] normal plant successions would proceed rapidly toward old growth, with little winter forage production for moose."

But in Alaska, moose "are now too numerous. So the hunting season has been lengthened, and cows as well as bulls may be taken," says Ernest Gruening, U.S. Senator from Alaska and perhaps the number one Rampart Dam advocate.

Much of the above information is taken from a remarkable debate on the proposed dam, which took place earlier this year in the *Atlantic Monthly*. Paul Brooks, chief editor of Houghton Mifflin Company and a

writer on conservation, led off in the May issue, and Senator Gruening requested, and was given, space to reply (in the July issue). Some of their other arguments and rebuttals follow.

Brooks writes that "at least 270,000 salmon pass the dam site annually on the way to spawn in the upper water of the main river and tributaries. If Rampart is built [the fish yield] of the entire system [will be] drastically reduced. Fish ladders for such dams have been proved impractical. . . ."

Gruening suggests that, to offset the loss of native fish, a resourceful wildlife agency "could implant in the great [reservoir] a great freshwater fishery—commercial and sport, of lake trout, whitefish and . . . other species. . . ."

"Ecological Considerations of the Rampart Dam" will be the topic of a panel discussion at Berkeley, to be held Monday evening, 27 December. Panel arranger is Stephen H. Spurr, forester and dean of the graduate school, University of Michigan. Panelists will be Leopold; William Benninghoff, University of Michigan plant ecologist; and Gordon Watson, Fish and Wildlife Service and University of Michigan. All five know Alaska.

The major argument favoring building the dam—that it will jack up Alaska's sagging economy—will not be discussed at Berkeley. Spurr suggests that the question of whether the dam should be built cannot properly be decided on the basis of the conservation arguments alone.

(The economic arguments, in brief, are these. Alaska's economy is depressed, particularly since defense spending there has dropped. But Alaska has abundant unused water power potential. Rampart Dam could, at a cost of well over a billion dollars, provide 5 million kilowatts of electric power. This is far more than Alaska can use. The hope is that industries which are heavy users of power, such as the aluminum industry, would flock in to gobble up the low-cost power Rampart would provide. Their payrolls and taxes, plus the injections of cash from the accompanying construction, would, hopefully, go far toward making Alaska prosper.

(Brooks has studied the economic side. He quotes three studies which suggest, he says, that Alaska can't use all the power Rampart would provide; that it wouldn't attract the needed industry; and that, without a quick, major influx of power-using industry, Rampart's power would not in fact be low-cost. Brooks suggests that costs of nuclear and coal-generated power have been dropping, and that any cost advantage of Rampart power is thus open to question. And he mentions three alternative hydropower projects which would provide enough power, he says, for Alaska's needs and would not have the serious ecological side effects of Rampart.

(Gruening casts doubt on the validity of the three economic studies that Brooks cites. The Senator points out the pro-dam recommendation of a recent study by Development and Resources Corporation, headed by David Lilienthal and the late Gordon Clapp, who are, writes Gruening, "the outstanding authorities in the world.")

Pacific Coast Bays

Because they have arid sections, many western states are pondering or planning major water projects. The ecological side effects of any such project should be taken into account during planning.

• This thought prompted planning for the symposium "Bays and Estuaries of the Pacific Coast," to be held the afternoon of 27 December.

Speaker Harold Gilliam of the San Francisco *Chronicle* will report that San Francisco Bay provides "not only harbor facilities but much-demanded recreational opportunities and the advantages of an expanse of open space in an increasingly crowded urban area. Like many bays it is abundant in wildlife . . . an outdoor museum. However, the bay is in jeopardy. It is being filled in to dispose of city wastes. It is in the path of the developers, who regard it as potential real estate and are replacing open water and marshes with subdivisions and industrial sites."

One result has been a "Save the Bay" movement, which has been initially successful in getting established a state commission to regulate filling.

• Since the early 1950's, biologist Donald J. Reish has been studying fauna in Southern California's salt-water bays and marshes. He compared bay-bottom fauna near the Terminal Island sewage-treatment-plant discharge in the Los Angeles harbor with fauna found at the bottom of unpolluted waters nearby. He notes that the presence of the annelid worm *Capitella capitata* is an indicator of polluted water. Another indicator is the presence of few if any varieties of fauna. Near the discharge he found only three species of worms, most of them of the genus *Capitella*. "The farther the sampling stations were located from the outfall, the more varied the fauna become," he wrote.

• A major California water project now in the works will involve taking water from the Sacramento River in northern California, channeling the water across the Sacramento-San Joaquin delta, and sending it south.

George H. Warner of California's department of fish and game will report on a study of the ecological impact of four proposed alternative ways of diverting the water across the delta.

His group set up these criteria. To be acceptable, a plan should maintain a salinity gradient (needed by migratory fish); maintain a downstream flow (for migratory fish); prevent loss of striped-bass eggs and larvae to water pumps; maintain populations of zooplankton and channel-bottom animals (major food for fish); and retain tidal currents.

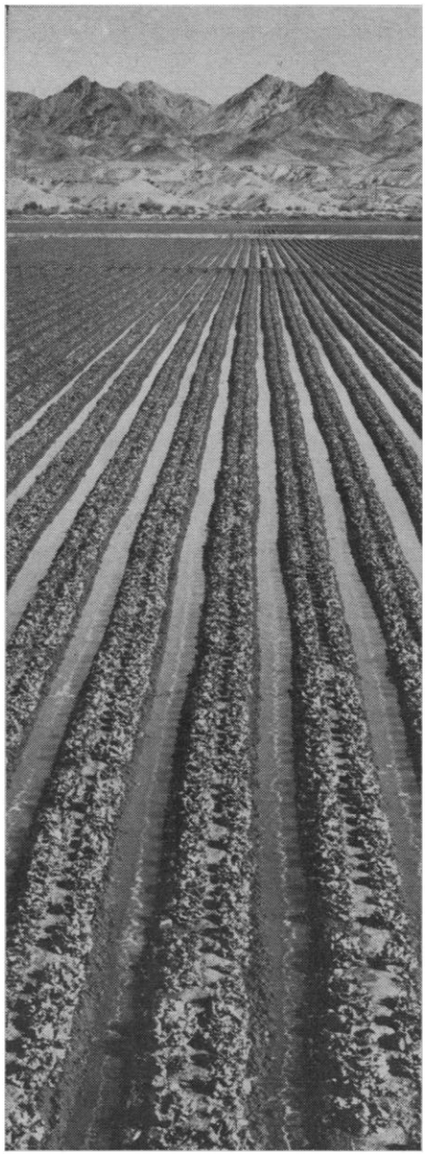
Only one of the four plans met all criteria—the "periphery canal plan." It envisions keeping the diverted water entirely separate from delta water by funneling it through a diversion canal.

Symposium arranger is Joel W. Hedgpeth of the Marine Science Center, Oregon State University, Newport. Other speakers will be Francis P. Filice, University of San Francisco; Herbert F. Frolander, Oregon State University; and Clifford A. Barnes, University of Washington.

Water Law: Federal-State Conflict

Southern California's population continues to spiral, and within 10 years more water sources will be needed. Arizona has so many wells sucking up groundwater that the water table, formerly just 50 feet below ground, is now 400 feet down in some places. For both states, the source of cheapest water is the Colorado River.

As one of the biggest sources of fresh water in the arid Southwest, the Colorado has long been a controversial river. A high point in its legal history came in 1928, when Congress passed the Boulder Canyon Project Act, providing for construction of Boulder (now Hoover) Dam. Alternating floods and droughts, bickering among the states, and the dam's high cost led the federal government to undertake the job.



Irrigated by Colorado River water, this California field yields two lettuce crops a year. Before irrigation, few Americans had winter lettuce. [Bureau of Reclamation]

Under historic Western water law, he who first put a given amount of water to constructive, continuing use had the best legal right to continue using that amount. Because California was growing so much faster and using more Colorado water, Arizona feared that California might preempt the river's water. How were both States to be satisfied?

The 1928 law had the effect of giving California a maximum of 4.4 million acre-feet of water per year, and Arizona, 2.8 million acre-feet. But, since Arizona and other Colorado-basin states couldn't then use all their allocations, fast-growing California was temporarily given the right to use more; she now uses about 5.1 million acre-feet per year.

Then Arizona asked Congress for more water—she wanted to stop drawing down her water table, which may not be self-regenerating. Her proposal was for a Central Arizona Project, which would take more water from the Colorado. This would mean taking water from California. Congress replied "No," until the tangled question of water rights was clarified.

Arizona then turned to the courts. The battle reached the U.S. Supreme Court, which appointed a Special Master to hear testimony and recommend action. The testimony filled 25,000 pages, a record for the Court. The opinion was handed down 3 June 1963.

Central to California's case was that she was entitled to continue using all the water she was then using. (She feared being forced eventually, in case of drought or increased water demand, back to the 4.4 million level.)

But the Court upheld the Congress-specified procedure of allocating water through Interior and of requiring a contract with each user. "Only under unitary management," the Court said, could all the "vast, interlocking machinery" of the Colorado River water system be administered rationally.

States-righters naturally fight the threat of reduction of the water supply to which they have become accustomed.

San Francisco water consultant Harvey Banks argues that more than "75% of the natural runoff in California originates on or flows across federally reserved and withdrawn lands." If the federal government has control of all this water, its present private users have little more than squatters rights. Banks predicts that, for this reason, there will be little private water development unless the law is changed.

Edward Weinberg, deputy solicitor of the Department of the Interior, suggests that private development of water in the West is slowing because of the immense cost of water development projects. No one seriously suggests, he says, that projects the size of Boulder Canyon or the California water plan can be undertaken by private enterprise alone.

He stresses the progress made this year in Congress: passage of both the Water Resources Planning Act and the Federal Water Pollution Control Act. The former requires coordination of federal-agency water policies, and all-basin planning (with both federal and state people cooperating) of river resources. A symposium on these water-law subjects and others will be held 29 December. The arranger is Joel Fletcher of Utah State University. In addition to Banks and Weinberg, speakers will be George Clyde, former governor of Utah; W. D. Criddle, former State Engineer of Utah; H. T. Nelson, Bureau of Reclamation; and Frank E. Moss, U.S. Senator from Utah.

Remote Sensing of Environment

To supplement photography, scientists are investigating the use of sensors of other portions of the electromagnetic spectrum.

William A. Fischer of the U.S. Geological Survey and Peter Badgley of the space agency are hoping to use infrared, radar, passive-microwave, and other sensors to explore the surfaces of the moon and Mars before man lands on them. Fischer reports that infrared pictures indicate something about surface roughness, about possible volcanic activity, and whether the surface is solid or unconsolidated. A combination of pictures taken at different wavelengths might tell geologists something about the chemistry and mineralogy of distant surfaces.

Jack Van Lopik of Texas Instruments, notes that thermal properties (which infrared sensors detect) of soils are closely related to soil moisture content and influence the development of microorganisms and higher plants. So, even qualitative data obtained with infrared sensors can give information useful in studies of drainage, vegetation, and land use.

Forester Robert Colwell of the University of California has been able to pick out diseased trees in an orchard and sick potato plants in a field by comparing infrared and photographic pictures and seeking anomalies.

C. E. Olson, Jr., of the University of Michigan took infrared and ordinary photographs of fields and crops which appeared the same to the eye but appeared different in the two photographic views. He found the likely reason: one field had been planted in alfalfa for 3 years.

A symposium on "Remote Sensing of Environment" will be held 28 December.