

California Agriculture AN ACT

Passed at the city of Washington, on Monday, the *Second* day of December, one thousand eight hundred and sixty-one
Granting public lands to the several States and Territories which may provide colleges for benefit of agriculture and the mechanic arts.



the quantities to which said State shall be entitled shall be selected from such lands of such State, and the Secretary of the Interior is hereby directed to states in which there are not the minimum number of acres subject to sale at one dollar and twenty-five cents per acre to which said State may be entitled under the provisions of this act, said scrip to the amount of acres for the distributive share; said scrip to be sold by said States and the proceeds to the use and purposes prescribed in this act and for no other use.

The Morrill Act at 150: How a land-grant law launched the University of California



For 150 years, UC science and agriculture transform California

Mark G. Yudof
President, University of California

Growing up in West Philadelphia, the son of an electrician, I never had much occasion to encounter farm life. Our meat and potatoes came from the grocery store and our vegetables from the frozen food aisle. So one of the great privileges I have enjoyed as president of the University of California is learning about my adopted state's diverse agriculture industry and the amazing bounty it produces.

Having previously served as president of another land-grant college system, the University of Minnesota, I was no stranger to agriculture when I moved here in 2008. But I quickly found that nothing compares to California's agricultural legacy and the forward-thinking leadership of its farmers and ranchers. As UC president I meet regularly with the Advisory Commission on Agriculture and Natural Resources. I have had the opportunity to visit Central Valley farming communities, taste-test a new UC Davis olive oil blend, learn more about almond-growing than any of my city friends could imagine and even get a lesson in lettuce harvesting in the Salinas Valley.

As I have traveled through the state on these eye-opening excursions, I have been reminded many times of the critical contribution agriculture makes to the California economy and the prominent role our university plays in that industry. Whether you're a backyard gardener, a 4-H student, a small family farmer or a major national food producer, chances are what you raise has in some way benefitted from UC innovation and collaboration.

To name just a few examples, about 40% of the strawberries grown in the world come from UC-developed varieties.

UC Davis certifies 95% of the grapevines sold in California, providing our wine industry with a reliable supply of vines. I have even learned that canned fruit cocktail originated at UC when in the 1930s food science pioneer William Vere Cruess came up with a way to keep fruit from going to waste.

Long-standing partnership

From the hundreds of varieties of crops developed to methods of cultivation, irrigation, animal husbandry, pest control, processing and packaging — it is evident that the agriculture industry's long partnership with the university has been a profitable and mutually beneficial one.

Indeed, I would go as far as to say that UC might not have evolved into the world's greatest public university system nor would California agriculture have grown into the \$37.5 billion industry it is today if we hadn't teamed up nearly 150 years ago.

The catalyst for that partnership was, of course, the Morrill Land-Grant College Act, signed into law by Abraham Lincoln on July 2, 1862. This issue of *California Agriculture* celebrates the 150th anniversary of that landmark legislation in recognition of the impact it had on the future of California, our university and our nation (see pages 42–49).

It was the early days of the Civil War when Lincoln signed the law introduced by Vermont Congressman Justin Smith Morrill. The law granted federal land for states to fund colleges teaching agriculture and "the mechanic arts." At the time, our country was being split apart, yet Lincoln had the foresight to envision a future of peace and prosperity in a nation united and populated by an educated citizenry.

Farmers' legislation

The Morrill Act was part of a slate of so-called "farmers' legislation" Lincoln signed that year. Included were the laws that created the U.S. Department of Agriculture and the Homestead Act, which granted plots of land in the West for settlers to farm. He also signed the Pacific Railway Act, which cleared the way to build the transcontinental railroad. You can debate the politics that influenced the creation of these laws and some of the unintended consequences, but there is no question they collectively transformed our country.

With trains connecting East and West, settlers could travel with relative ease to the Western frontier. They could also



In 2010, UC President Mark Yudof (right) viewed harvesting practices designed to ensure freshness and food safety in a Salinas Valley lettuce field, with Jim Lugg (center) of Fresh Express and Tanos Viviani (left) of Chiquita Brands.

transport the products of their farming endeavors to markets across the continent.

The railroad opened access to California's fertile valleys, teeming rivers and rich natural resources for a new crop of pioneer families. The Morrill Act opened access to learning for their children and for future generations who might otherwise never have had the opportunity to earn an education.

The nationwide university access the Morrill Act provided was certainly a game-changer in social mobility and economic prosperity. Just as important was the Act's intention to apply scientific research to farming methods and resource stewardship.

Science and agriculture

UC embraced those intentions with a deep and passionate commitment. From humble beginnings at the campus in Berkeley, the University Farm at Davis and the Citrus Experiment Station at Riverside, UC dedicated its resources and knowledge to improving the quality of life and health of all Californians. Nowhere is that dedication so evident as in the mission of the university's Division of Agriculture and Natural Resources. Working side-by-side with California farmers, thousands of UC researchers and educators toil every day to solve the problems of modern agriculture and resource preservation.

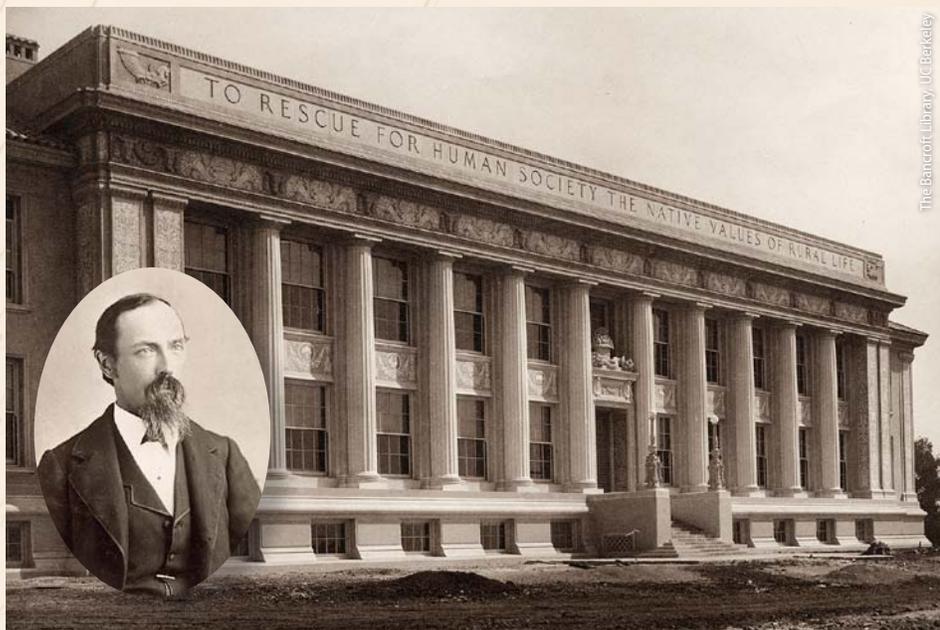
The challenges we face together today are far more complex than those California farmers faced in the 19th century. Today we deal with issues like climate change, exotic invasive pests, food security, nutrition and childhood obesity, to name a few. But no matter how daunting the challenges might seem, UC is on the ground in every county — advising, educating and searching for solutions. True to the Morrill Act's philosophy of melding science and agriculture,

UC might not have evolved into the world's greatest public university system nor would California agriculture have grown into the \$37.5 billion industry it is today if we hadn't teamed up nearly 150 years ago.

UC brings to the table the most visionary, industry-transformative research methods.

In just this one issue of *California Agriculture*, you will find several examples of how UC research works for our state's producers.

One article details the impressive yield increases for corn and tomatoes achieved during an 11-year field study of conservation tillage (see page 55). This cultivation method, which forgoes tilling and leaves residue from the previous crop on the ground, has the



Eugene W. Hilgard, a German-American soil scientist, became professor and director of the Agricultural Experiment Station in 1875. During his 30-year tenure, Hilgard established UC as a respected center of agricultural research and guided the college to transfer knowledge statewide via field stations and farmer institutes. Hilgard Hall, dedicated in 1917, currently houses the College of Natural Resources at UC Berkeley.

potential to reduce soil water evaporation losses in summer by about 4 inches, or 13%.

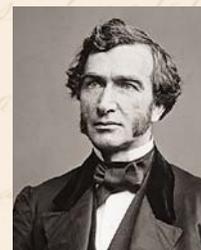
You can read about why dry matter and fruit acidity should be considered as a quality index for kiwifruit (see page 70), while another article analyzes recent trends in genetic engineering of fruit and nut trees, and suggests that grafting may be a promising approach for utilizing biotechnology to address both grower and consumer needs (see page 62).

This is the type of research that ultimately benefits every consumer by increasing the variety and quality of food, keeping supermarket prices down, meeting environmental challenges, promoting nutrition and food safety and contributing to the productivity of

one of the state's most important economic engines. Of course, California agriculture has impacts far beyond the borders of our state: The whole world depends on the bounty of California's fields and orchards. UC is proud to contribute the scientific and technological expertise that helped the

state's producers become world leaders in the global marketplace.

Despite the budget challenges the university has faced in recent years, our commitment to a healthy and sustainable California agriculture industry is as strong as ever. That partnership we forged nearly a century and a half ago is truly a fundamental cornerstone of California society. We at the university, through the leadership of ANR, look forward to building upon it for many years to come.



Library of Congress

Rep. Justin Smith Morrill of Vermont (circa 1860) proposed the federal land-grant system.



Anthony Berger/Library of Congress

President Lincoln (shown in 1864) signed the Morrill Land-Grant College Act on July 2, 1862.

UC's land-grant mission fuels nation's growth, prosperity

Rose Hayden-Smith
 4-H Youth, Family and Community Development Advisor
 UC Cooperative Extension, Ventura County
 ANR Sustainable Food Systems Strategic Initiative Leader

This year marks the sesquicentennial, or 150th anniversary, of four events key to American agriculture. In 1862, the United States Department of Agriculture (USDA) was created. Three pieces of legislation were also passed that would forever change the face of the nation: the Pacific Railroad Act, the Homestead Act and the Morrill Land-Grant College Act, which created America's land-grant institutions, including the University of California.

In 1862, America was in its second year of the Civil War, which threatened the nation's very survival. It was an unsettled time. Battles such as Shiloh — which would haunt American memory for decades — and Lincoln's preliminary Emancipation Proclamation left Americans feeling uncertain, but also in the case of the North, bravely charting a new direction that expressed optimism despite the war. At that time, farmers made up more than 50% of America's labor force; legislation such as the Morrill Act reflected their

importance, and reinforced the economic and social importance of agriculture to the nation's future. The Morrill Act also demonstrated the increasing importance of taking a more scientific approach to agricultural production and education.

The creation of the USDA (President Lincoln called it "the People's Department") institutionalized agriculture in the federal government; the agency was called "to diffuse among the people of the United States useful information on subjects connected with agriculture." While creation

of the USDA was vital to American agriculture, it was the Morrill Act that was truly visionary. It enabled state governments to provide higher education in agriculture, science and mechanical arts. With its passage, all states were given blocks of land by the federal

government that could be sold off by legislatures to fund public universities.

Agricultural societies

Farmers have always sought and shared agricultural knowledge. Agricultural organizations, often called societies, were designed to share agricultural knowledge, and they were prevalent in early America. Leaders in Philadelphia formed a society to promote agriculture in 1785; others quickly followed suit. Many of the letters written by General George Washington during the Revolutionary War focused on agricultural practices and production at his plantation. Like fellow founding father Thomas Jefferson, Washington was an agricultural innovator.

Agricultural experimentation was particularly strong among wealthy Southern growers in the period prior to the Civil War, due in part to a decline in soil fertility combined with decreasing cotton prices in the 1840s and 1850s. By the 1860s, there were more than 1,300 agricultural and horticultural societies in the United States; some states were also creating state boards and departments of agriculture. Agricultural fairs (and later, expositions) were popular, and served not only as places to market goods but also as sites for education and demonstration; George Washington encouraged the movement as early as 1796. The United States Agricultural Society was formed in 1851 and enjoyed significant success until the Civil War, when sectional differences made its operation impossible.

Farmers were hungry for knowledge. Publications such as the *American Farmer* (which came to press in 1819) filled some of the gaps. By the end of the 19th century, more than 3,000 agricultural publications had appeared at various times in the United States and Canada; most quickly failed. But through these efforts an increasing amount of information about agriculture was produced and shared, and more farmers were accessing agricultural information. This created a political culture that supported the idea of land-grant legislation.

Land-grant legislation

Justin Smith Morrill introduced the land-grant bill in the U.S. House of Representatives in December 1857; it was accepted by a narrow margin in April 1858. The Senate passed its own version, which was vetoed by President Buchanan, who acceded to Southern interests opposed to the perceived growth of federal power that the Act represented. Later, however, President Lincoln proved favorable to the idea of industrial education (in fact, agricultural education was a repeating campaign theme when he stumped for president). With the Southern congressional

Morrill



Agricultural societies were important early supporters of the land-grant system. Above, more than 10,000 people attended the Fifth Western Sonoma-Marín Dairy Cattle Show in Valley Ford, in 1927. Stock judges were from the University Farm at Davis, with over \$1,800 in cash prizes.

territories which may provide colleges for the Morrill ACT

members who had opposed the Morrill Act now seceded from the Union, the legislation was reintroduced and signed into law on July 2, 1862.

In September 1862, Iowa became the first state to accept the gift offered by the Morrill Act. By 1870, 37 states had signed on. A second Morrill Act in 1890 gave an additional boost to the land-grant system by fostering institutions serving African Americans in the Southern states.

In California, the Morrill Act enabled the state to combine federal, state and private funds and efforts (the private College of California was part of the genesis of UC). This led to the creation of the University of California in 1868.

Shortly after, a new campus was built on a tract of land near Oakland, called Berkeley. From humble beginnings, UC grew to become one of the world's pre-eminent educational institutions, providing the knowledge and technical education that helped California become one of the world's primary agricultural producers.

The Morrill Act was visionary, but it did not prove an immediate success. It took years for the states to take full advantage of the legislation, and even then, the connection between the production of knowledge at the land-grant institutions and its practical application by farmers was lacking. Some of the problems experienced, including low enrollments and a failure to teach practical agriculture, led to further legislation in the form of the Hatch Act in 1877, which funded linked experiment stations to provide a practical place to help solve the problems of ordinary farmers. The 1905 State Farm Bill would fund establishment of the University Farm at Davisville in 1906, a teaching farm for UC Berkeley students. The Citrus Experiment Station in Riverside was founded in 1907; it proved vital to Southern California's developing citrus industry. In 1919, the California Legislature designated an existing teacher's college in Los Angeles as UC's southern branch; it became the UCLA campus in 1927 and offered some agricultural programs for decades. As a result of increased enrollment at UC due to the GI bill passed during World War II, the University Farm eventually evolved into the UC Davis campus. Likewise, the Citrus Experiment Station eventually gave rise to the UC Riverside campus. The original campus at UC Berkeley remained the flagship agricultural campus.

Responding to wartime needs

The period around World War I is one of the most interesting in the development of institutions such as UC, in part because of the passage of the Smith-Lever Act in 1914, which provided for "Cooperative Agricultural Extension Work," a federal, state and county funding partnership that gave rise to the Cooperative Extension Service. The importance of scientific agriculture and



During World Wars I and II, UC Cooperative Extension supported the federal Victory Garden (shown) program in California. Nearly a million home vegetable gardens were planted and thousands of animals were raised for food.

the role of land-grant institutions in promoting agricultural productivity were highlighted during World War I, when agricultural production and food security were viewed as vital to national security and victory "over there." When the United States entered World War I, national leaders feared an agricultural crisis. Many farmers and laborers were mobilized to war. Foreign labor, used in California, was deemed risky. International allies relied on shipments of U.S. food to avoid mass deprivation and starvation, as most of Europe became a battlefield and agricultural production there plummeted.

Victory gardens. Across the United States and in California, land-grant institutions helped the

nation respond to wartime needs. In the quickly urbanizing nation, home food production again became a national priority, even an imperative. UC was involved in providing research, educational resources and training for the army of Victory Gardeners who arose from the civilian population to help raise food on the U.S. home front, encouraging local production and consumption in a national mobilization. It was thought that increased home food production and food conservation efforts would feed civilians, enabling America to increase its agricultural exports to foreign allies; this proved to be true.

School gardens. UC's groundbreaking efforts in school garden work and agricultural education, much done in the decade prior to World War I — including a program called the California Junior Gardeners offered in conjunction with the Berkeley School District — enabled a national program called



Cooperative Extension supports youth via 4-H, as well as nutrition and community development programs. Early in the 20th century, 4-H was an innovative way to introduce new agricultural technologies to farming communities. Above, the Tomales Joint Union High School Club, with leader Charles Hampton (left), raised and sold pigs in Marin County in 1924.

the U.S. School Garden Army (USSGA) to gain traction and engage tens of thousands of urban and suburban youth in school, home and community gardening efforts across the state. At Ann Street Elementary School in Ventura, where teachers had previously received school gardening instruction from UC, students raised 2 tons of potatoes.

Nearly a century later, UC remains a national leader in school, home and community gardening work. UC advances research about the importance of agricultural and nutrition education and helps homeowners, schools and communities launch gardening efforts. Nearly 5,000 UC Master Gardener volunteers in 44 California counties provided 258,000 hours of service to California communities in 2010. Urban agriculture thrived in the form of national Victory Gardens during World War I and World War II. Today UC supports urban gardening through programs such as the UC Cooperative Extension Los Angeles Common Ground Program and its Grow LA Victory Garden Initiative. Farm advisors and campus-based specialists work with small producers to find new markets closer to home, through Community Supported Agriculture (CSA) and Farm-to-School programs.

Food conservation. During World War I, UC Extension agents also served as local food administrators, helping California communities conserve food by suggesting alternative foods on wheatless and meatless days, and in rationing scarce products such as sugar. During this period, UC hired new Cooperative Extension agents to work with youth and to help women learn best practices in food preservation. UC-trained Master Food Preservers do the same today. In counties 100 years ago, farm advisors worked with agricultural producers, in partnership with local farm bureaus and county government, to boost California's agricultural productivity. They do the same today, helping producers conduct field trials of new varieties, develop markets for new products, reduce pesticide use, improve water use efficiency, reduce impacts on water quality, and remain viable and competitive despite ever-changing conditions.

Women's Land Army. UC played an instrumental role in one of World War I's more controversial efforts, the Women's Land



Special Collections, General Library, UC Davis

UC nutrition programs have long encouraged healthy lifestyles while promoting California agriculture. Above, a Picnic Day float on the University Farm at Davis, circa 1939, featured the nutrient "fairies" in milk.

Army (WLA), which sought to address labor shortages by deploying young women, mostly urban and suburban and many college-educated, to work as agricultural laborers on the nation's farms. UC employed young women first to help conduct an assessment of agricultural labor in the state, and then trained them for agricultural work at the University Farm at Davisville. These young women proved critical to California growers during World War I, and some women used their work in the WLA to press for national suffrage.

Land settlements. During this period, UC professor Elwood Mead worked closely with the State of California to organize a novel land settlement project at Durham, in Butte County, to create a utopian agricultural community. Its first year proved successful, and a second settlement, specifically for returning war veterans, was organized at Delhi, a few miles from Turlock. Today, UC farm advisors once again work with returning veterans as part the USDA's Beginning Farmers and Ranchers effort. As the nation faces a potential crisis inherent in the aging of the American farmer, UC farm advisors train beginning and new farmers, many of them veterans, women and immigrants, to become producers, assuring California's agricultural future and enhancing the security of the world's food supply.

Post-World War II growth

In June 1944, President Roosevelt signed the Servicemen's Readjustment Act, also known as the GI Bill of Rights. This legislation matched the Morrill Act in its vision and national impact. Returning veterans boosted enrollment at UC, creating conditions for the state's phenomenal economic and social growth. Land-grant institutions such as UC proved to be the economic engine of the nation in the 20th century, creating a robust middle class, providing upward mobility for millions of Americans, and assuring America's pre-eminence in agriculture and science. They also provided a place where the nation's promise of equality could be achieved, in part, through accessible public education.

It is impossible to overstate the importance of the GI bill nationally and to the California economy. Nearly 8 million returning veterans participated nationally in the program in the first decade. During this period, UC trained farmers, engineers,



Under the leadership of UC professor Elwood Mead, the state purchased the Durham Tract in 1918, near Chico. The utopian agricultural community of Durham, above, was so successful that a second, called Delhi, was organized near Turlock for returning veterans.

teachers, doctors, scientists and others who helped boost California's economy and college enrollment. (U.S. college enrollment grew to nearly 30% by the late 1960s, up from less than 10% in the pre-war years).

In California, UC's research and agricultural education programs provided the basis for durable economic growth that has made our state one of the world's largest economies. The story of UC is writ large on California's cultural, economic and physical landscape, but it is also a personal story to many of us.

My connection to UC dates back to the mid-1960s, when my father — who received two degrees in the "mechanic arts" at a land-grant institution under the GI Bill — moved our family to California, in large part because of the vision of higher education presented by the state. Like earlier pioneers, we made our way West, not in a covered wagon but in a Ford station wagon. Like pioneers of the past, we were drawn by dreams of prosperity and the brighter future that the Golden State promised.

I grew up knowing from my father that I would attend UC, where I would receive the world's best public education. He was right on both counts. Each day, I reap the benefit of that education. I also reap the benefits of UC research and extension work in myriad ways, whether through the selection of California-grown fruit at the local grocery store (the variety patented by a UC scientist), or when taking my daughter to the local family practice clinic that is part of the UCLA Medical School's teaching program in my community.

UC has evolved from a single campus to 10 campuses spanning the state, which make significant economic contributions statewide. According to an independent 2011 economic impact analysis, UC generates \$46.3 billion in economic activity annually and contributes \$32.8 billion toward California's gross state product. For every \$1 of taxpayer investment, UC leverages and produces nearly \$14 in economic output, while supporting one in every 46 jobs in the state.

UC research has fueled national and international prosperity, but it also remains a local institution

in a very real sense. Through UC's Cooperative Extension program, it supports agricultural producers, youth through 4-H and nutrition programs, natural resource managers and landowners and communities.

UC Master Gardener volunteers enable urban and suburban populations to engage in home food production and community beautification through gardening. UC advisors and volunteers instruct youth, teachers and parents in nutrition and the health benefits of consuming fruits and vegetables. Some lemons grown with advice from a UC farm advisor in an orchard several miles from my home are shipped around the globe; others stay locally, and are used by a small business to produce a coveted limoncello liqueur that is featured in local restaurants. UC connections are global and local, and every place in between.

Service to land and citizens

With agricultural research investment declining, agricultural productivity threatened by a number of factors (including limited water and climate change), and the world's population expected to increase at a dramatic pace, what California can produce is desperately needed.

We tend to take for granted a safe, plentiful and inexpensive food supply, which helps to assure our nation's social and political security. But continued investment is required to sustain the vision of the Morrill Act, to help all Americans reap the promise of abundance our physical geography offers. How will we choose to support the land-grant mission in the next 150 years?

The mission of UC and the land-grant institutions, both at home and abroad, remains larger than our collective imagination. We were a nation of farmers at origin: we are still a nation of farmers at heart. The frontier as once envisioned may be gone, but the real frontier — the pursuit of knowledge — awaits our further exploration.



In 1943, UC began administering the federal Emergency Farm Labor Project in California, which deployed youth, immigrants and other volunteers to areas where harvest assistance was needed. UC and USDA also provided training, transportation and housing assistance.

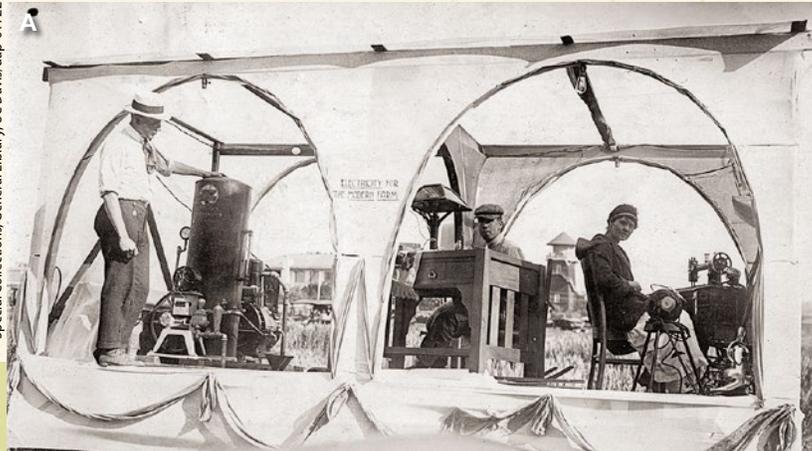


During both World Wars, UC played an important role in the Women's Land Army, which addressed the nation's agricultural labor shortage.



Nutrition paper dolls, circa 1930, were part of a national Extension campaign.

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Special Collections, General Library, UC Davis/uap-01396

Research takes root: 1919–1945

A. A Picnic Day parade float at the University Farm in Davis featured a farm electrification demonstration, circa 1920.

B. From 1922 to 1934, Thomas Tavernetti, in a field of millet, was assistant dean of agriculture at the University Farm, which was designated as UC Davis in 1959.

C. At UC Berkeley, Ansel F. Hall constructed a relief model of Yosemite Valley in 1921. Hall went on to become the first park naturalist of Yosemite National Park.

D. In the 1930s, a researcher in the Citrus Experiment Station's Division of Plant Pathology studied citrus fruit quality. The station became UC Riverside in 1954.*

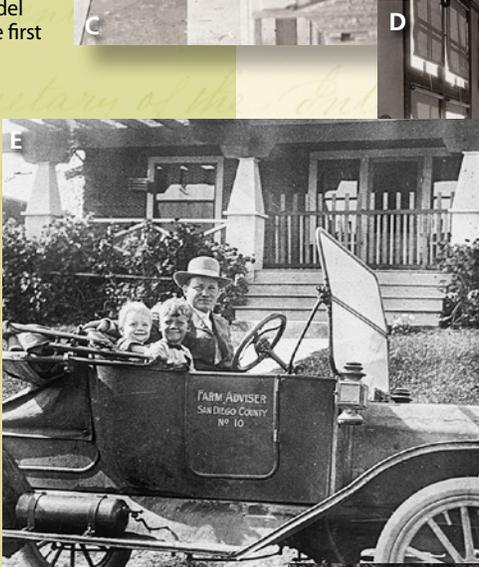
E. The 1920s are often considered the "golden age" for extension, with outreach helping many families achieve better livelihoods. In San Diego County, a farm advisor posed in his Model T.

F. UC Berkeley's Division of Forestry was established in 1913, with field camps in the Sierra Nevada. In 1926, advisors visited Whitaker's Forest; the image was taken by Woodbridge Metcalf, UC Berkeley forestry faculty from 1914–1956.

G. During the 1930s, chemical methods to control citrus pests were tested in a large fumigator at the Citrus Experiment Station in Riverside.



Fritz-Metcalf Collection/UC Berkeley/lib.berkeley.edu/BIOS/fmpc



Special Collections & Archives, UC Riverside Libraries

* Corrected by California Agriculture April 13, 2012, after press run: "in 1954" not "in 1959."

Golden Book of California: 1860–1936



Fritz-Metcalf Collection/UC Berkeley/lib.berkeley.edu/BIOS/fmpc

1946-2000



Ansel Adams Flat Lux Collection, UCR/CMP

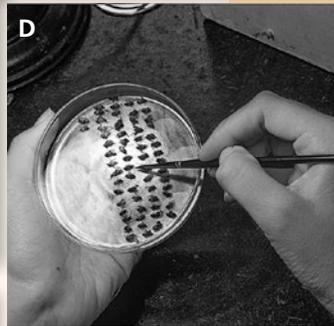


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Postwar years:
1946-2000



Ansel Adams Flat Lux Collection, UCR/CMP



Ansel Adams Flat Lux Collection, UCR/CMP

- A.** The School of Veterinary Medicine was the first professional school at UC Davis; the first classes were in September 1948.
- B.** Extension biologist George Cooke is seen in the distance (in 1966)* in the cellars of the enology building at UC Davis, where research and outreach has been instrumental in building the state's \$18.5 billion wine industry.
- C.** In 1966†, watershed experiments were conducted at Hopland Research and Extension Center, one of 10 RECs operated by UC ANR. The centers represent the state's diverse growing conditions and natural ecosystems.



Ansel Adams Special Collections, General Library, UC Davis



Jack Kelly Clark/UC Statewide IPM Program

- D.** UC Riverside entomology professor Vern Stern made critical contributions to IPM science; in 1966, lygus bugs, an important cotton pest, were segregated in his lab.
- E.** UC Berkeley and UC Davis biologist and geneticist G. Ledyard Stebbins (center) led an agricultural field trip, circa 1967.
- F.** UC Davis entomology professor Frank Zalom directed the UC Statewide IPM Program for 16 years; circa 1990, he placed a trap to monitor for oriental fruit moth.
- G.** The IMPACT (Integrated Management of Production in Agriculture using Computer Technology) system was established at UC Davis in 1979 (shown in 1981).



Jack Kelly Clark

- H.** In 1987, UC Berkeley plant pathologist Steven Lindow received permission to field-test genetically altered *Pseudomonas syringae* (known as "ice minus" bacteria) as a frost-preventive on potatoes in the Tulelake area.
- I.** UC has published peer-reviewed research and news in *California Agriculture* journal continuously since 1946.

* Corrected by California Agriculture April 13, 2012, after press run: "(in 1966)" not "(in 1960)."
† Corrected by California Agriculture April 13, 2012, after press run: "In 1966" not "In 1960."



Gary Andersen





James Block



Matteo Garbelotto, Lab, UC Berkeley



Dan Polhemus



Carlos Puma/UCR Strategic Communications

Recent research highlights

A. Peggy Lemaux (second from right) examines sorghum in a UC Berkeley greenhouse; Lemaux was named the nation's first biotechnology advisor in 1990.

B. Botanists led by Jean-Yves Meyer (center) look out from Mt. Tohiewa on the Polynesian island of Moorea, during a plant-collecting expedition. UC Berkeley researchers are barcoding an entire tropical ecosystem on Moorea.

C. Matteo Garbelotto, forest pathology specialist at UC Berkeley, co-discovered the agent responsible for sudden oak death and is working to stem its spread.

D. UC Riverside entomology professor Thomas Perring investigates carob moth, a key pest of ripening date fruit.

E. UC Riverside entomologist Beth Grafton-Cardwell's work targets IPM and biocontrol solutions for citrus pests.

F. Carole Meredith, professor emerita of viticulture and enology at UC Davis, uses DNA analysis to determine the heritage of wine grape varieties.

G. Medical ecologist Rob Atwill, who leads the Western Institute for Food Safety at UC Davis, tests water samples for disease-causing microbes that could be transferred between livestock, wildlife and humans.

H. UC Davis plant scientist Abhaya Dandekar and colleagues have fused two genes to engineer resistance to Pierce's disease of grapevines.

I. UC school garden studies, curricula and projects have introduced thousands of students across the state to important science and health concepts. The California Master Gardener Handbook, published by ANR Communication Services, is a top seller.



Carlos Puma/UCR Strategic Communications



UC Davis



Karin Higgins



Suzanne Parsley



Gregory Urquiaga

Research highlights

AN ACT

Granting public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the Mechanic arts.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

That there be granted to the several States for the purposes hereinafter mentioned an amount of public land to be apportioned to each State a quantity equal to thirty thousand acres for each Senator and representative in Congress to which the States are respectively entitled by the apportionment under the census of eighteen hundred and sixty: Provided, That no mineral lands shall be selected or purchased under the provisions of this act: Sec. 2. That the land aforesaid, after being surveyed, shall be divided into sections or subdivisions of sections, not less than one quarter of a section, and there are public lands in a State, subject to sale at private entry at the rate of twenty-five cents per acre, the quantity to which said State is entitled under the provisions of this act, shall be selected from such lands within the limits of such State, and the Secretary of the Interior is hereby directed to issue to each of the States in which there is not the quantity of public lands subject to sale at private entry at one dollar and twenty-five cents per acre, to which said State may be entitled under the provisions of this act, an amount in acres for the deficiency of its distribution: And provided further, That the proceeds of the sale of such lands shall be applied to the use and purpose of the college to which said State may be entitled under the provisions of this act and for no other use or purpose whatsoever: Provided, That no State to which land scrip may thus be issued, be allowed to locate the same within the limits of any other State, or any Territory of the United States, and the assignees may thus locate said land scrip upon any of the unappropriated lands of the United States subject to sale at private entry at one dollar and twenty-five cents or less per acre. And provided further, that not more than one million acres shall be located by such assignees in any one of the States, And provided further that no such location shall be made before

California Agriculture

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