

World avocado production prospects

California

In transition

On the following 22 pages is a report on the California avocado industry. *From the Grove* and the California Avocado Commission have received permission from the authors to reprint this report in the pages of this magazine as an important service to the California avocado grower community.

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The avocado in California

A pioneering and innovative origin in many fields, both technical and marketing, the Californian avocado industry remains to this day the world number four in terms of planted areas, extending over approximately 55 000 acres. Since the early 1990s it has faced growing problems of competitiveness, in a context of rampant urbanization. The production system and structure have remained mainly traditional, while the costs of the main production factors have boomed, to become the highest in the avocado world. Nonetheless, the drastic shrinkage trend of the 2000s has given way to stabilizing planted areas, with the production zone situated to the north of Los Angeles holding up better than the southern zone, under greater stress.



History

The Californian avocado industry is pioneering in more than one respect. First of all, let's take the literal meaning. The avocado tree is not a native plant: reports of the first documented specimen, imported from Nicaragua and planted in a San Gabriel orchard, date from 1856. However, California was one of the first zones in the world where industrial plantations were set up, starting in 1908 in San Marino (east of Los Angeles). The Californian industry was also a pioneer in technical terms, bringing major innovations in key fields such as varietal creation and propagation, with Popenoe's prospecting work supported by the USDA in the early 20th Century, the selection of Fuerte, and then of Hass by Rudolph Hass in the 1920s and the development of clonal plants thanks to the technique of etiolation. Another key field was managing the first pathology to hit the world industry, namely *Phytophthora*, with Zentmyer's work leading to the development of a combination of tolerant plant/chemical treatment. The Californian industry also laid the foundations of modern avocado marketing, by developing a ripened fruit offering in the early 1980s (Henry in San Diego), and then setting up a local and then federal promotion system, based on a mandatory assessment paid by industry stakeholders.

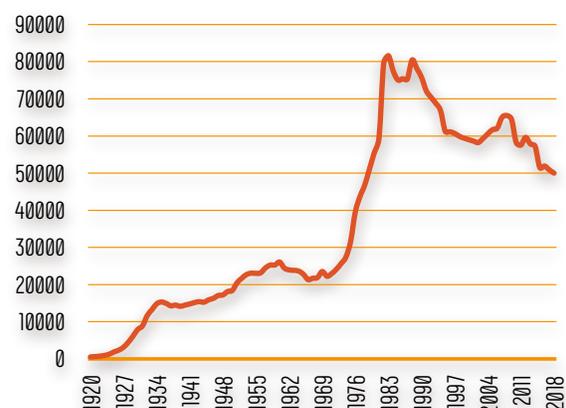
The solid bases on which the industry was able to develop were laid from the beginning of the 20th Century. On the one hand, the ban on imports, for sanitary reasons, of fruit



from neighbouring Mexico, implemented in 1914, indirectly enabled the industry to take off in an uncompetitive context. On the other hand, a variety well suited to Californian winters, sometimes cool, was selected from the beginning of the 20th Century, Fuerte – a natural selection. This cultivar was the only one able to withstand the severe frosts of 1913. Finally, professionals managed to get organised at a very early stage to defend their interests and work together on marketing, promotion and improving production techniques by creating the California Avocado Association in 1915, with the support of Riverside University in terms of the technical aspects. Planted areas started to grow considerably from the mid-1920s. The industry's centre of gravity at the time was in the far south of the State: the area of San Diego and southern Los Angeles still accommodated 90 % of the cultivation area in the early 1950s. The more northern counties of Santa Barbara and Ventura made up just 370 to 500 acres in the aftermath of WW2. The cultivation area gradually expanded thereafter, at an irregular rate. New very hard-hitting pathologies appeared, such as *Phytophthora* in the 1930s, and further severe frosts occurred (1922, 1937, 1949). The dynamic also followed economic cycles, with considerable expansion in planted areas in the mid-1920s, and then the late 1940s. This expansion



California avocado - Evolution of planted areas
(in acres | sources: CCLR, CAS, CAC)



California in a few figures:

With a GDP of nearly 3 trillion USD, California is the world's 5th biggest economy. It is the most populous State in the USA, and the 3rd biggest in the world in terms of planted area.

- **Population:** 39.5 million inhabitants in 2019
(source: United States Census Bureau)
- **GDP/capita:** 75 949 USD/year in 2018
- **Agriculture:** 1.5 % of state GDP (far behind finance, real estate, technology, tourism, trade, etc.) and employs 3 % of the workforce

Value of main agricultural crops

(source: California Department of Food and Agriculture, 2018):

- **Grape:** 6.25 billion USD
- **Almond:** 5.47 billion USD
- **Pistachio:** 2.62 billion USD
- **Strawberry:** 2.34 billion USD
- **Orange:** 1.12 billion USD
- **Avocado:** 383 million USD



was followed in both cases by a period of stagnation due to pressure on prices exerted by the increase in production. The industry rallied to tackle these crises, by streamlining the very wide varietal range around Fuerte (creation of a Variety Committee within the CAA), organising the marketing (creation of the California Avocado Grower Exchange in 1924, which became Calavo in 1927) and launching promotion actions, which in 1961 led to the establishment of a California Hass Avocado Marketing Order, imposing a contribution from all industry players. New markets were also opened up (East Coast from 1926, and export from 1927).

Growth greatly gathered pace from the early 1970s, when the cultivation area comprised approximately 25 000 acres. This new Gold Rush had three main origins, according to analysts: the implementation of a fiscal policy favorable for agricultural investment, higher agricultural water availability thanks to the execution of major infrastructure work, and the arrival in the USA of innovative irrigation techniques from Israel, which meant that cheap sloping terrain (Chaparral zones) could be used. A great many "gentlemen farmers", often alien to the crop and even the world of agriculture (liberal professions, Navy personnel based in San Diego, pensioners, etc.), acquired a few acres, thereby creating a wide base of very small growers with limited technical know-how, especially in the San Diego region. The industry also focused on Hass, a more productive variety with a longer season, and more resistant in the post-harvest phase. Its centre of gravity started to shift gradually northward, with large cultivation areas being set up in the counties of Ventura and Santa Barbara. The sector reached



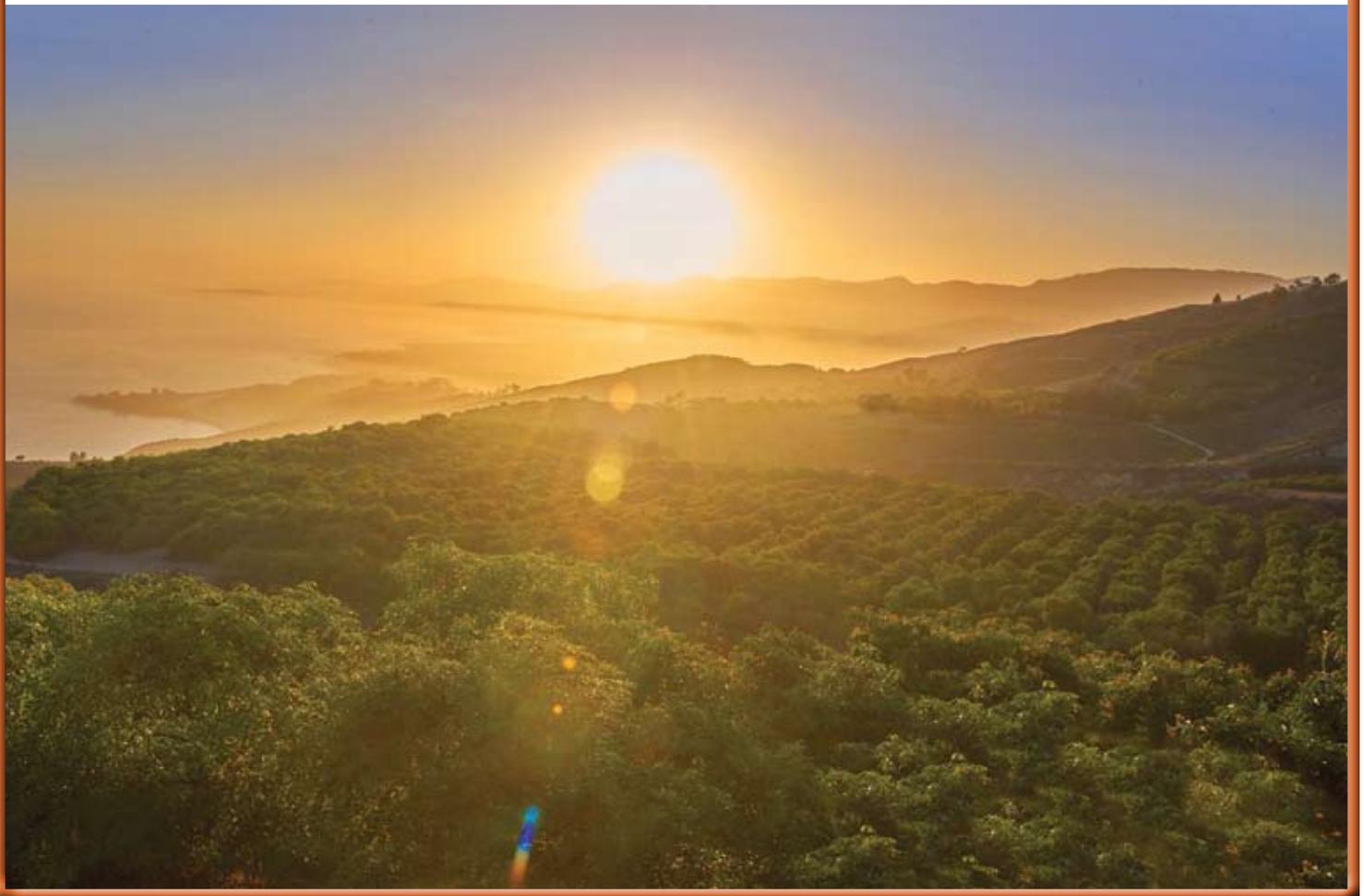
its peak in the early 1990s, encompassing more than 75 000 acres and 8 000 growers. Another overproduction cycle appeared thereafter, intensified by increased international competition, with the arrival of Chilean Hass, which supplanted local varieties, and then the gradual entry of Hass from Michoacán, from 1997. Planted areas shrank, especially with 1990 bringing a hard frost in the north and with the water stress starting to weigh very heavily in the south, as California water quota from the Colorado fell. Furthermore, new stricter rules on food safety and orchard sanitary practices appeared, driving some of the lower-tech growers to abandon the crop. The implementation in 2001 of a larger-scale promotion programme, with creation of the HAB, enabled not only a real consumption boom in the USA, but also helped halt the shrinkage of avocado planted areas in California, by providing growers with better revenue. The Californian avocado planted area has stabilized at approximately 55 000 acres since 2004-2005, and currently has approximately 3 650 growers.

Current extension of the cultivation area, and location

A huge southern cultivation area, stabilizing after a long period of decline

Extending over an estimated 55 000 acres in 2018, the Californian avocado cultivation area is the fourth largest in the world. It is currently the only one of significant proportions in the country. The Floridian industry, which specialises in West Indian varieties and covered approximately 11 500 acres at its height in the late 1980s, was practically decimated after a major spell of frost in 1989 and Hurricane Andrew in 1992. California's place as the national avocado number one illustrates this agricultural State's specialization in fruit: if the Mid-West is the breadbasket of the USA, the "Golden State" is its fruit basket, providing nearly two-thirds of the national fresh fruit and dried fruit supply (avocado, citruses, strawberry and other berries, almond, pistachio, etc.). Californian avocado production is concentrated in the south-west of the State, on the strip of land varying in width between the coastal strip and the sea, mainly between Morro Bay in the north and the Mexican border in the south. This zone has a very suitable climate, due to the predominance of a hot Mediterranean climate, with more

temperate zones in the north and other semi-arid zones in the south, though the frost risk remains present. California is increasingly exposed to extreme climate risks, especially droughts, uncontrollable large-scale fires and hot winds among others. Conversely, rainfall is low, which means that irrigation is required across the board. Planted areas, falling steeply until 2015, are now tending to stabilize, with the cultivation area's centre of gravity gradually shifting northward. Hence the production area located north of Los Angeles (Ventura and Santa Barbara, with additional planted areas in counties further north such as San Luis Obispo) now encompasses approximately 30 500 acres, i.e. just over half of the State's total planted areas. Meanwhile, the historic production zone of San Diego and the other counties situated south of Los Angeles has shrunk, with the cultivation area recently dropping below the 24 000-acres mark. Alternate bearing is highly marked, resulting in production fluctuating between 220 000 and 500 000 pounds since 2010, with an average of approximately 330 000 pounds.



The avocado in California

Avocado production zones

-  Major zones
-  Other zones



Avocado – California – Planted areas by county in 2018

Breakdown by county	in acres	share
San Diego	17 661	32 %
Riverside	5 175	9 %
Other southern counties	1 474	3 %
Total, South	24 311	44 %
Ventura	19 500	36 %
Santa Barbara	6 479	12 %
San Luis Obispo	4 004	7 %
Other northern counties	362	1 %
Total, North	30 345	56 %
Total	54 656	

Source: CAC



P

roduction system

Highly traditional alongside high-tech

The small size of the orchards is one of the main characteristics of the Californian production system. The average planted area owned by a grower in 2019 is around 15 acres. We can estimate that only around twenty plantations cover more than 500 acres, with the latter representing approximately one third of total planted areas. The statistics from the 2017 survey reveal that more than 50 % of orchards cover less than 10 acres, with medium-large orchards (more than 20 acres) representing only just over 25 % of planted areas. Planted areas are even more limited in the south than in the north. Hence the production fabric is highly heterogeneous, based in large part on “gentlemen farmer” smallholders, often alien to the world of agriculture. They are alongside a minority of arboriculture professionals, with larger orchards and often cultivating the lemon in addition to avocado. The technical level of the plantations is proportional to their size. Cropping practices among smallholders are highly traditional. The average age of the trees is high, though the plant stock is good quality (big share of clonal plants). The planting density is rather low (approximately 109 to 130 trees/acre). Annual pruning is rather scarce, although it has tended to increase over the past fifteen years. Fertilization practices are variable, ranging from fertirrigation to a very basic system of manual application, sometimes very infrequent

(once a year). Conversely, those growers with large orchards use modern production techniques (higher density, annual pruning, fertirrigation, etc.). It is reported that approximately 10 % of planted areas are organically cultivated. The technical management of this cropping mode is not very complex in the dry Californian climate (except for weed control). Conversely, economic returns are often lower than for the conventional segment.



Water resource – Irrigation: the number 1 constraint, especially in the south

Irrigation is essential in all the zones, with the limited precipitation level not covering requirements: 22 inches in the wettest part located in the north. The agricultural water supply system is complex, and involves considerable local specificities. It is based on two main sources, their respective proportions varying between regions: groundwater pumping and the public supply network. The latter is supplied by large-scale infrastructures made in the 1970s, bringing water from the north of the State or neighboring States, with the quality varying between sources. Agricultural water availability has always been under strain throughout the production zone. However this constraint, increasingly prominent since the 1990s, has become a major factor since the drought of 2014-2015. It is particularly severe in southern Los Angeles, supplied by hard-hit supply sources. In the face of increasingly restricted water sources, environ-

mental protection measures also tending to limit their use and increasingly tough competition for use (agricultural or domestic, with the population having grown by 10 million in 30 years), the public authorities are tending to impose control measures. Water has become the main expense in calculating the variable production cost, with a price of up to 1 500 USD/acre foot in the San Diego region. This burden is endangering the economic survival of certain plantations. On top of the lack of availability, water quality is often problematic in certain zones. Requirements vary between zones (from 2 to 5 acre foot/acre). The doses applied often do not enable production to reach its full potential. The irrigation technique used in nearly all plantations is micro-spraying. It is not the most water economic, but is well-suited to the problem of salinity and to the fairly sandy nature of the soils, while requiring limited investment.



Labor: a major problem, with a two-fold negative impact

The cost of labor exerts a lot of pressure on operating expenses. The minimum hourly wage varies in agriculture between counties and, as of 01/01/2020, is 12 USD for less than 26 employees and 13 USD for 26 or more employees. However it is generally between 25 and 30 USD including bonuses: a record for the agricultural world! Labor availability remains problematic. The pay is unattractive compared to the high living costs and wages offered in other sectors of the economy. Most harvesting is done by farm labor contractors through which small growers can access the workforce. There is also the problem of replacing a high proportion of older workers about to retire. Finally, the tougher measures on receiving immigrant workers are weighing increasingly heavily, with the vast majority of employees coming from Mexico or other South American countries. These constraints have a two-fold negative impact on production costs, by directly increasing expenses and forcing growers to opt for low labor-intensive cultivation practices, which conversely reduce productivity and increase the alternate bearing phenomenon (annual pruning reduced or non-existent, low-density planting, no selective picking).



Phytosanitary problems: low constraints

There are few sanitary problems, especially because of the dry climate. The main pathology is *Phytophthora*, with two strains present: *Phytophthora citricola* Sawada, which infected approximately 20 % of trees in the late 1990s, and *Phytophthora cinnamomi* Rands, by far the most common and problematic with 60 to 75 % of trees affected at the same period. It is controlled thanks to a locally developed technique: using a combination of metalaxyl injections and resistant rootstocks (clonal rootstocks such as Duke 7, Toro Canyon and Dusa). There are other diseases present, but their spread is limited (sunblotch, *Verticillium* wilt, oak root wilt). There are also few pests: mainly thrips and the perseia mite (controlled thanks to one annual treatment, generally applied in early spring). Herbicide is generally applied three times a year (February, May and August).

Soils

The soils vary greatly in their nature. Nonetheless, some common traits can be distinguished. They generally have low depth (often less than 20 inch). Sandy-loamy is the most common texture, though there is often a layer of clay limiting drainage. The organic matter content is generally low (1 to 3 %).



Gem variety

Metalaxyl injection



Varieties: Hass predominant

Hass is by far the dominant variety, with 95 % of planted areas planted in 2017-2018. Lamb, a later variety, comes in second position with approximately 3 % of planted areas, declining in recent years. The other varieties represented less than 2 % of the avocado planted area. Nonetheless, Gem is rising fairly rapidly, representing approximately 25 % of plant sales in 2019. This variety, developed by University of California Riverside, is patent free in California. It is of particular interest to fairly high-tech growers, who apply a high planting density. It appears to be slightly more cold-tolerant than Hass, an important asset in certain production zones in the State.





Yields: big margins for improvement

Despite the region's good pedoclimatic attributes, the average yield of California's avocado plantations is low, at 6 000 pounds/acre from 2010 to 2019 (ranging from 4 200 to 8.5 pounds/acre). However, there is high variability, given the great heterogeneity of the production systems. Productivity fluctuates between 8 800 and 9 680 pounds/acre on orchards with a decent technical level. It can be as high as 14 000 to 16 000 pounds/acre for the best managed systems, a level reflecting the real productivity potential of this region, blessed with good natural attributes. The alternate bearing phenomenon is generally highly marked. Control cropping practices, such as pruning, are not yet widespread. Furthermore, the harvest period is often late for marketing-related reasons (strong competition from Mexico until June) or physiological reasons in certain cool zones (northernmost production areas, such as San Luis Obispo).

Production costs

Production costs in California have set record levels for the avocado world, and are constantly rising, mainly because of the water and labor costs. The cost of irrigation water varies greatly between production zones and supply sources. In certain northern zones, where groundwater is available for free, the irrigation cost may be restricted to that of the electricity required for pumping, which varies between 250 and 500 USD/acre foot for average requirements of 2 to 3 acre foot/acre. In the southern zones (San Diego County), the cost of imported water can climb to more than 1 500 USD/acre foot for the much higher requirements, sometimes in excess of more than 4 acre foot/acre. Hence the total cost of



irrigation can vary from 600-1 200 USD/acre to more than 6 000 USD/acre in the most extreme cases. Labor costs are also among the highest in the world, with an official minimum rate of 12 USD/hour, often rising to 25 to 30 USD/hour due to worker bonuses and incentives in a context of strong competition from other sectors of the economy. Conversely, because of a low phytosanitary pressure, the cost of treatments has little impact. Hence the total production cost can vary greatly according to the context: estimates for the northern regions lie between 4 000 and 5 000 USD/acre, while for the south they are in excess of 8 100 USD/acre.

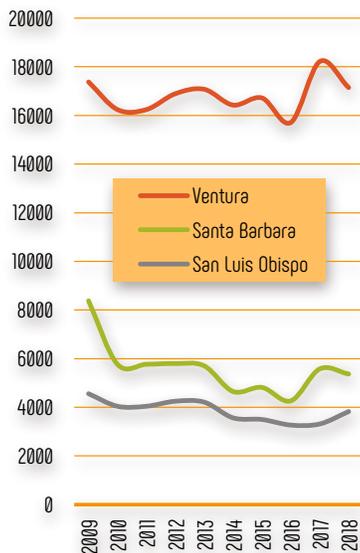
North of Los Angeles production area

This zone has become the State's leading production area in recent years, now accommodating nearly 60 % of planted areas. The cropping system is traditional, and the plantations remain limited in size, through production costs are lower than in the south, especially thanks to the presence of free groundwater and to a productivity level above the State average. Furthermore, local real estate regulations have helped preserve agricultural land from rampant urbanisation. The shrinkage trend has been interrupted, with the cultivation area actually gaining a few hundred acres in recent years.

Location: Ventura, Santa Barbara and San Luis Obispo

The cultivation area, covering nearly 30370 acres (i.e. approximately 57 % of the State's total planted areas), was not spared by the general planted area shrinkage trend of the 1990s. Nonetheless, in recent years it has tended to stabilize, or even expand slightly. The California Land Conservation Act, in force in this part of California, is playing its part. Production is concentrated mainly in three counties. Ventura is by far the main production centre in this zone, and in recent years has become the country's and State's biggest too. It has approximately 20 000 planted acres, divided between three main zones: Santa Clara valley (from east Ventura to Fillmore), the Las Posas and Simi valleys, situated further south just the other side of the Santa Susana mountains (from Somis to Simi Valley, by way of Moorpark), and a bit further north in Ojai valley.

California avocado
North Los Angeles
Evolution of producing areas
(in acres | source: CAC)



North Los Angeles avocado production area

- Main production zones
- Other zones



Santa Barbara county comes in second position, with approximately 6 650 acres, with plantations concentrated in the strip of land situated between the Pacific Ocean and Santa Ynez mountains (from Goleta to Carpinteria). The rest of the cultivation area is located primarily in San Luis Obispo county (approximately 4 100 acres), mainly near the coast between Santa Maria in the south and Morro Bay in the north, by way of Arroyo Grande. Some recent plantations representing anecdotal areas are situated further north (250 acres or so around Monterey and Salinas), and in San Joaquin valley (100 acres or so in Tulare county). The climate is Mediterranean, with temperate to cool summers, in the three main counties, with average temperatures of 59 to 61°F. The rainfall level, of between 15 and 20 inches, is higher in the north than in the south, unlike the temperatures. The rainy season is concentrated between October/November and April. The mountainous barrier situated behind the production centres maintains the ocean's influence over the climate, and also provides partial protection against heatwaves or cold spells coming from the east or north. Conversely, the zone is exposed to large-scale fires which are hard to control, occurring from May and above all between September and October.

Production structure: average planted areas and a generally moderate technical level, albeit above average for the State

The average plantation size is above average for the State, but is still small (approximately 20 acres as opposed to 15 acres). It is slightly bigger in San Luis Obispo county than in Ventura and Santa Barbara (30 acres as opposed to 20 to 20.5 acres). Besides the historical reasons mentioned above, a law limiting land parcelling in successions has been in force since 1986. The orchards are often located in sloping zones, generally on the upper part (last zones available for this "recent" crop, often also less exposed to frost). Anti-frost machines are often installed in the lowest zones. A significant proportion of growers also produce lemons. The average technical level of the plantations remains moderate, but is still above average for the State.

Strengths:

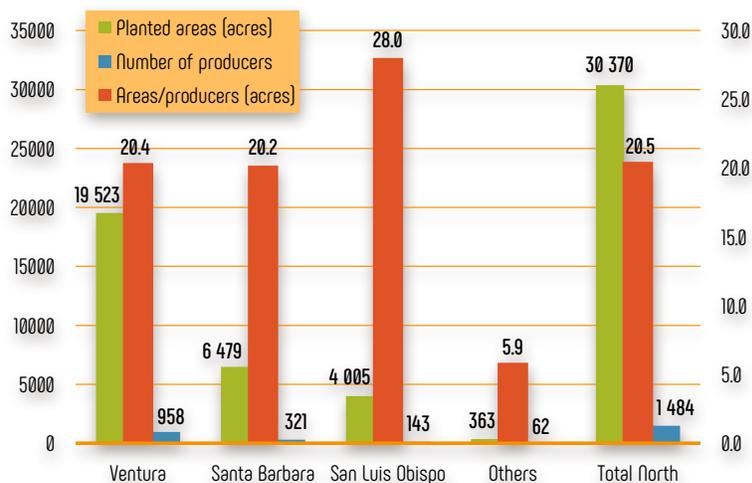
- Excellent climate conditions.
- Lucrative local market, and proximity of consumption areas.
- Free, high-quality ground water.
- Later production calendar, less exposed to the competition.

Challenges:

- Production costs high, and rising.
- Small plots, often on sloping ground.
- Traditional production techniques.
- Extreme climate events more frequent (drought, fires, frost).



California avocado - North Los Angeles - Production structure
(source: CAC)

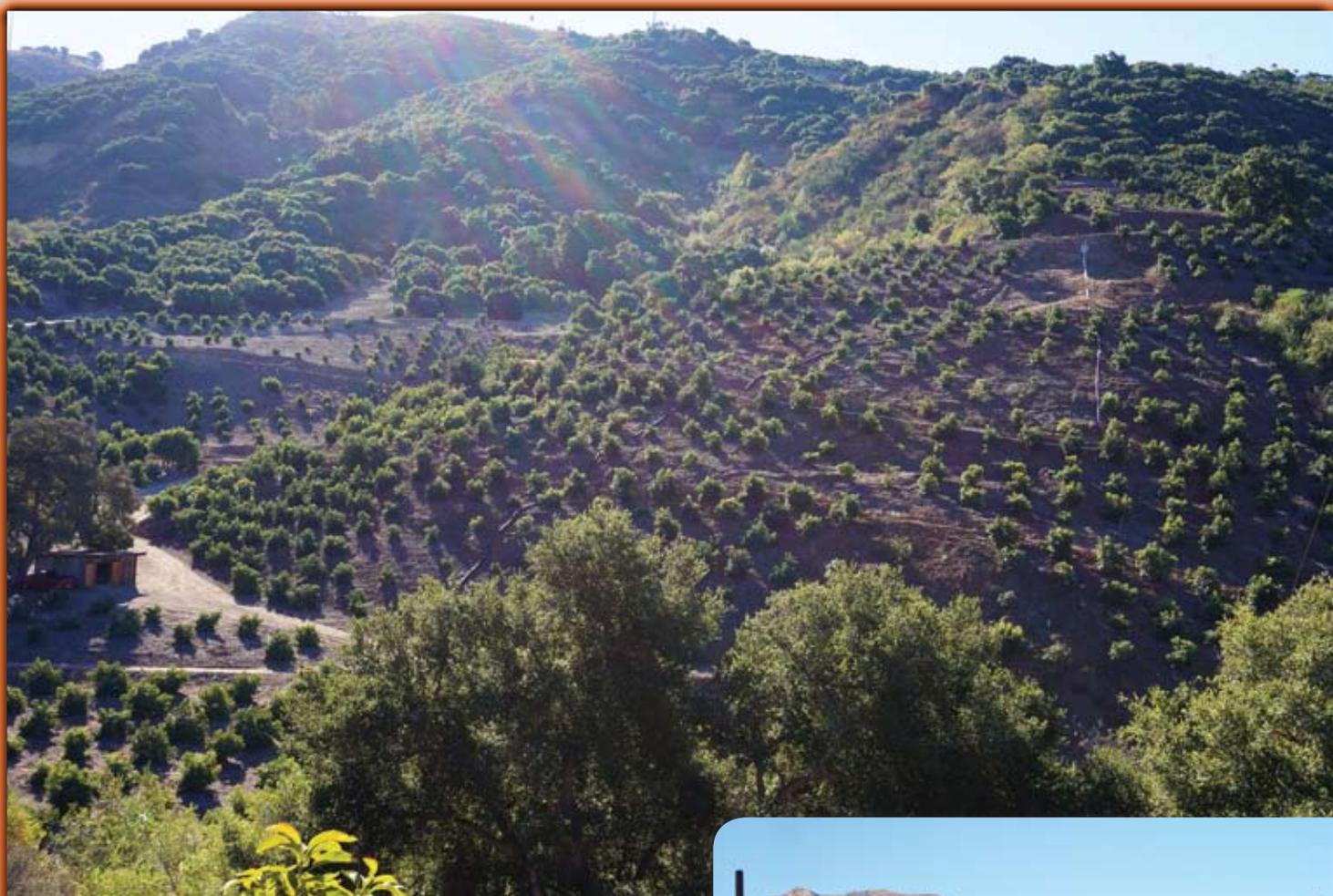




Irrigation: a two-fold comparative advantage, in an evolving regulatory framework

The region has big comparative advantages in terms of irrigation over the production situated south of Los Angeles. On the one hand, water requirements are more limited, and around 2 to 3 acres feet/acre/year). On the other hand, while the pressure on the water resource is rising, availability is higher, the cost lower and quality better overall. Agricultural water comes primarily from groundwater pumping, itself supplied by rainfall (more than 80 % of requirements in 2013). Its cost is limited to that of the energy required for pumping (variable with depth, and around 250 to 500 USD/acre foot). The quality of this water is tending to deteriorate, due to the intrusion of salt water into parts close to the sea, but remains decent overall. In 2014 the public authorities launched a programme aimed at regulating use of this groundwater (Sustainable Groundwater Management Act). At present, there are only measures prohibiting digging new wells in so-called “stressed” zones, but the introduction of quotas is under examination. The remainder is mainly supplied by those reservoirs present (Lake Casitas, Lake Cachuma and Lake Piru). In this zone, agriculture makes little use of water from the public network, highly expensive. It comes primarily from snow melt from the Sierra Nevada, and is carried from the north by the California Aqueduct (an infrastructure built under the State Water Project – a large-scale hydroelectric project).





Calendar earlier in the south than in the north

Overall, the zone is later than in the south of Los Angeles. This is a comparative advantage in commercial terms, with the competition from Mexico stronger during the first part of the season. There is a maturity gradient going from south to north, due to a temperature differential. Schematically, in the cooler San Luis Obispo/Monterey zone, the harvest extends from April to January, with a peak from May to November. The calendar runs from March to November in the Ventura/Santa Barbara zone, with a peak from April to October.

California avocado – North of Los Angeles – Hass production calendar

Counties	M	A	M	J	J	A	S	O	N	D	J
Ventura, Santa Barbara											
San Luis Obispo, Monterey											

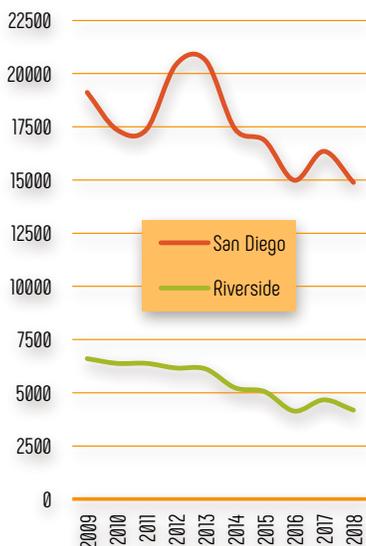
South of Los Angeles production area

This historic area, formerly number one in terms of production, has declined to become the State number two, with approximately 40 % of planted areas. Loss of competitiveness has become a major challenge, since the zone is highly dependent on irrigation water imported from North California or from other States, prices of which have soared. In addition, its production system and structure are more traditional than in the north. The sector has lost a great deal of land to the high urban pressure. Nonetheless, the drastic shrinkage trend of the 2000s has given way to a gentler decline in planted areas.

Location: a large main zone, straddling San Diego and Riverside counties

The historic production area situated south of Los Angeles has seen a big decline, with its planted area practically halving over the past twenty years. While it is no longer dominant, it nonetheless maintains a major role, with planted areas of around 25 000 acres (i.e. approximately 45 % of the State's planted areas). The cultivation area is concentrated in a strip of land 30 to 60 miles wide, between the Pacific Ocean and the coastal mountain barrier formed from south to north by the Laguna Mountains, Palomar Mountain and the San Bernardino Mountains.

California avocado
South Los Angeles
Evolution of production areas
(in acres | source: CAC)



The zone ranging from Escondido in the south to Temecula in the north, straddling San Diego and Riverside counties, is the largest. The orchards are located either side of the “avocado highway” (Highway 15), near the districts of Poway, Escondido, Valley Center, Pauma Valley, Fallbrook, Temecula and Murrieta) from south to north. There are also significant planted areas east of San Diego (between El Cajon and Alpine), and in Riverside county around Moreno Valley. The climate, hotter and drier than in northern Los Angeles, ranges from Mediterranean, with hot summers, to semi-arid, with an average temperature of 63 to 64°F. Rainfall lies somewhere between 10 and 14 inches per year, and is concentrated mainly from November to March (a few inches in April and October). The zone is often subject to hot winds in autumn (Santa Ana winds), though fires are less frequent than in the north of Los Angeles.

Production facilities: a larger proportion of smaller and lower-tech orchards than in the north

The plantations are small in size, and below average for the State (10 acres per grower, as opposed to 15 acres). Riverside county’s plantations are slightly smaller than San Diego’s (7.5 acres as opposed to 10 acres). Consequently, the technical level and cropping practices are on average more basic than in the north. The average slope of the plantations is greater than in the north.

Strengths:

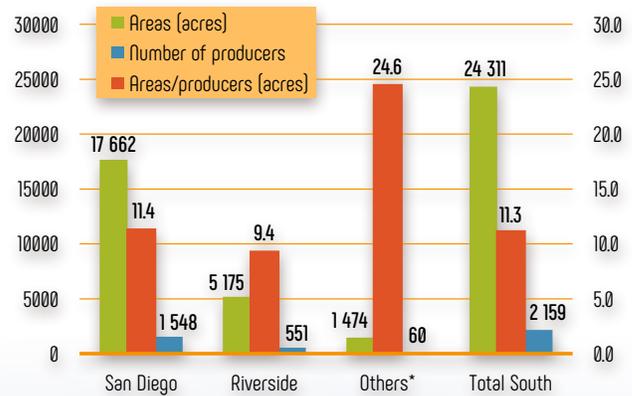
- Good climate conditions.
- Lucrative local market, and proximity of consumption areas.

Challenges:

- Very high water stress.
- Production cost high, and continuing to rise.
- Small plots, often on sloping ground.
- Very traditional production techniques.

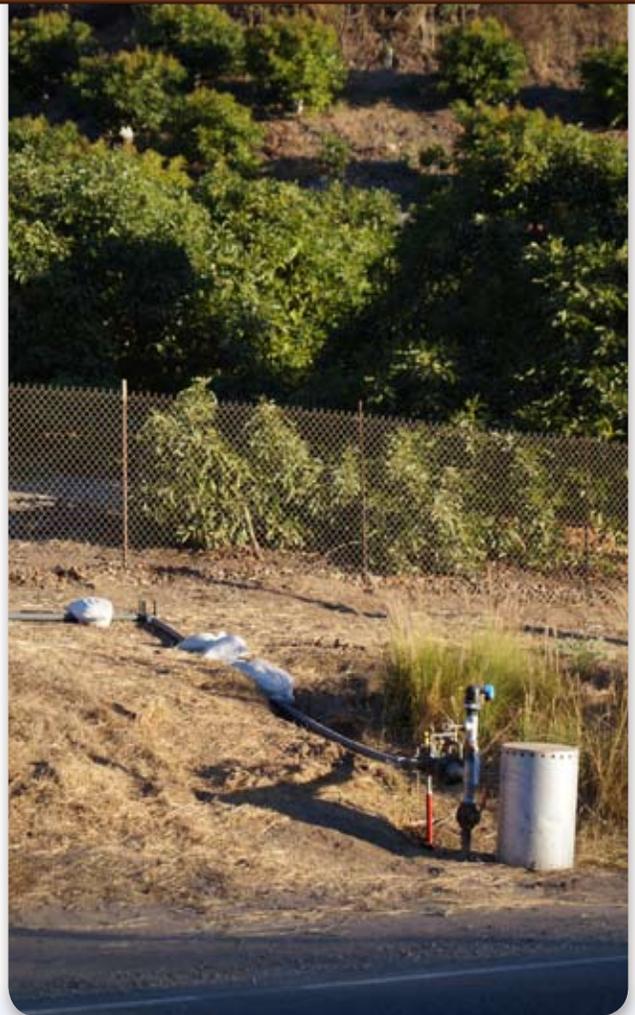
California avocado - South Los Angeles
Production structure

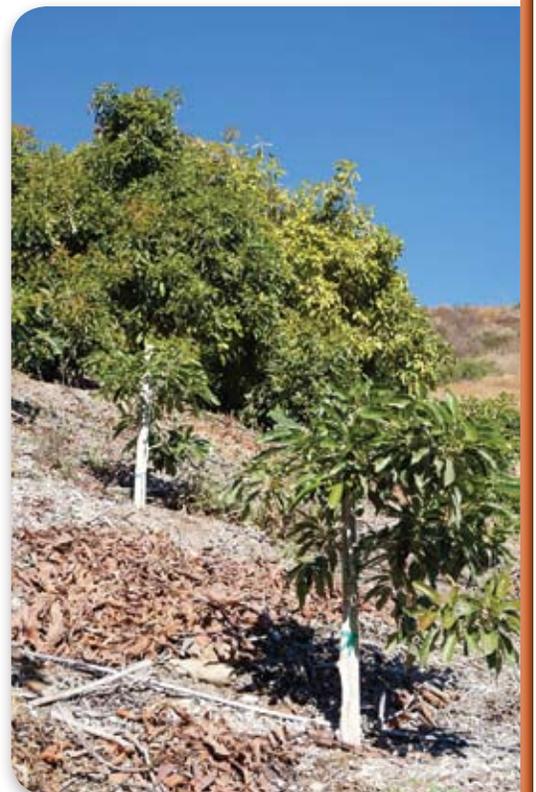
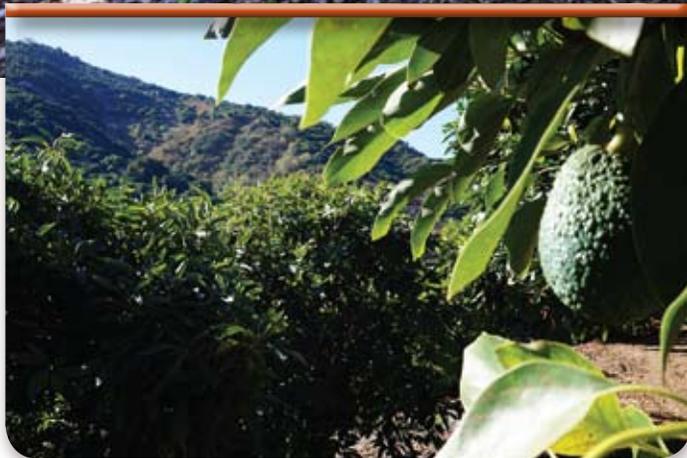
(*Orange and San Bernardino counties | source: CAC)



Irrigation: supply sources, and a much greater constraint than in the north

The water stress is high, both in terms of volumes available and water quality or cost. It is more of a burden for growers than in the north of the State. On the one hand, due to the lower rainfall and higher temperatures, water requirements are greater (3.5 to 4.0 acre foot/acre, or even 5 acre foot/acre). On the other hand, the local supply sources are very limited, in terms of both surface water and groundwater. Hence irrigation is based practically entirely on water imported from the north of the State or neighbouring states, via the main water systems in place (more than 90 % in 2015). Two sources are exploited: water from the Colorado, arriving mainly via the Colorado River Aqueduct, which represents approximately three-quarters of the supply, and water from the north of the State via the California Aqueduct under the State Water Project. Unlike the groundwater supply, use of which is still under-regulated, and access to which is free, imported water is paid for. Its price has soared as pressure on the resource has risen, in both California and other States using water from the Colorado. Southern California is particularly hard hit, since the region is at the end of the line. The price per acre foot can be as much as 1 500 USD, with the irrigation item representing up to two-thirds of the total production cost. Quality is also posing problems. Saline sediments, present in the Colorado basin, are dissolved in the water, affecting its quality (salinity, approximately 650 mg/l in 2014, is twice the salinity under the State Water Project).





Calendar: a hotter and earlier zone

Since temperatures are higher, the region has an earlier calendar than the north. The harvest runs from February to September, with a peak from March to August.

California avocado – South of Los Angeles – Production calendar

	J	F	M	A	M	J	J	A	S	O
Hass										

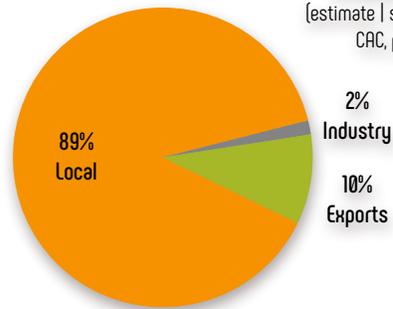
Marketing

A premium product, on a mainly local or regional market

The local and regional market takes in 90 % of production, forming the industry's natural outlet. Sales are concentrated in the State of California and the neighboring West Coast States: Nevada, Arizona, New Mexico, Colorado, Oregon and Washington. In the rest of the USA, California can be obtained solely from a few select supermarkets. Thanks to the predominance of category 1 fruit (95 %), the proximity between the production zones and consumption centres and to the CAC's marketing strategy focused on freshness and local consumption, California stands out from its competitors due to its top-end positioning, resulting in a price premium (sometimes + 0.30 USD/pound on average), which is essential in order to cover the highest avocado production



**California avocado
Breakdown by outlet**
(estimate | sources: US Customs, CAC, professionals)

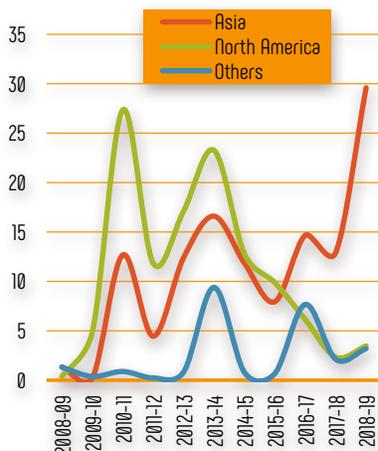


costs in the world. Nonetheless, on its core regional and local markets, the Californian avocado can be obtained from all supermarkets, whether mid-range or top-end. Californian fruit occupies the same market segments as fruit from competing origins, with segmentation under-developed in the USA (loose, ripened or ripen-at-home, and net bag, which has seen great growth in recent years). The Californian avocado can also be found in the food service chains, which procure direct from the packers or via intermediaries.

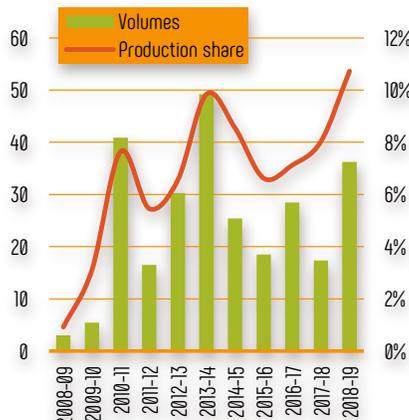
The proportion of exports is low, fluctuating between 5 and 10 % depending on the scale of production, i.e. approximately 17.6 to 37.5 million pounds in recent years. Since 2015, an increasing proportion of volumes is aimed at the highly lucrative Asian markets (South Korea, Japan, Hong Kong). These destinations represent a useful high added-value alternative, particularly at the beginning of the season (in March), when the competing import origins still have a strong presence on the local market. The export cost to Asia is 6 000 USD/container out of the port of Los Angeles, with an estimated voyage of 15 to 20 days.

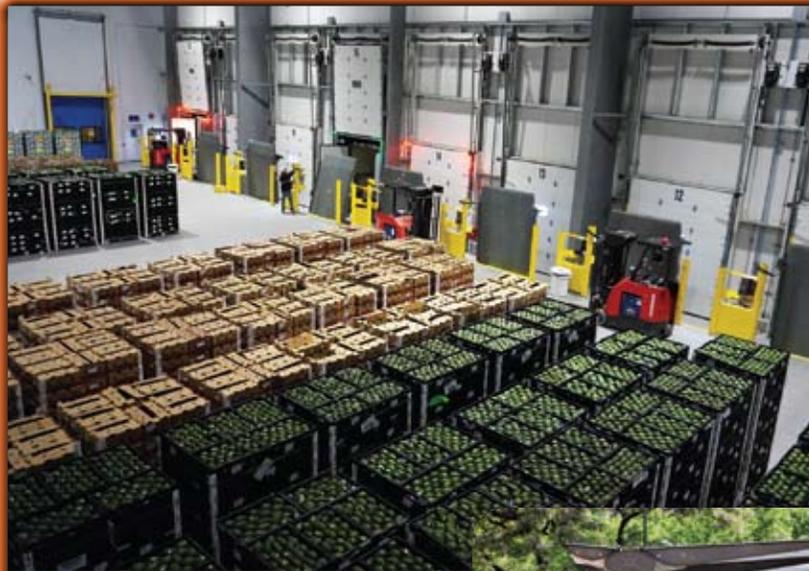
The processing sector is limited, in view of the small volumes produced. In addition, the fresh market is highly attractive and sorting rejects are low (just 1 to 2 %). The State has an oil factory.

Avocado - United States - Exports
(in million pounds | source: US Customs)



**Avocado - United States
Exports: volumes and production share**
(million pounds | sources: US Customs, CAC)





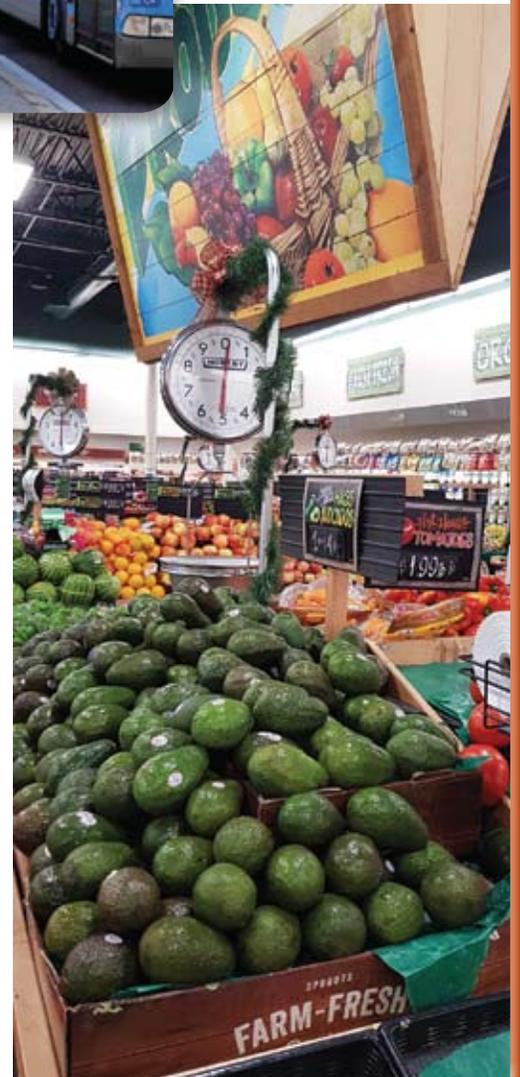
Packing

Whether for the local or export market, the fruit is primarily packed in 25-pound lugs, although there is also a 12.5-pound version. The sizing is shown in number of fruits per 25-pound lug, generally 28 to 84, with 40 representing the equivalent of a size 14 in 4-kg boxes. Use of RPCs (Reusable Plastic Containers) and display cartons (14-17-kg boxes with bags) is a developing trend among certain retailers. Nearly 50 % of volumes is marketed ripe and sold either in top-end supermarkets, or on the growing food service sector.

Players

There are sixteen registered players in the world of Californian packing. However, the supply is relatively concentrated, with the top three covering 50 % of the supply. Then come five intermediate-sized operators, followed by ten or so modest-sized ones.

For historical reasons, the sector's traditional big packers are also production players in California. However, their volumes are derived primarily from purchasing from other Californian producers. There is no annual contract between growers and packers. Fruit is purchased on a weekly basis. Growers assign their available volumes depending on the price lists published every week by the packers. Nonetheless, relationships are a big factor, and growers are often loyal to a particular packer (especially since certain growers are shareholders in the packing stations). The major Californian players have become major players in the world avocado trade, to harness growth in consumption in the USA while topping up their trade calendar, and to obtain a return on the often high-tech facilities. They have practically all become importers, firstly of fruit from Chile in the 1980s, and then from Mexico, Peru and more recently Colombia. The biggest have invested in production in these countries, where they are often major players.



Prospects

Methodology

The Californian avocado industry has major assets, the main two being favorable pedoclimatic conditions and a local market where the Californian origin is rated more highly than its competitors. Nonetheless, it also has to face multiple constraints, set out in the first part of this document. Hence, unlike most big producer countries on the planet, planted and producing areas are tending to shrink. Over the last decade, the producing area went from approximately 50 160 acres in 2010 to 45 467 acres in 2018 (- 4 700 acres), according to CAC statistics. This particularity increases the uncertainty of the projection. When the industry is growing, the dominant vari-

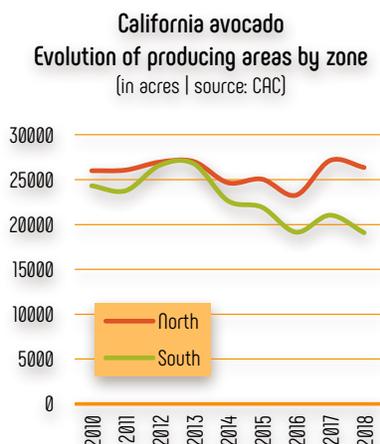
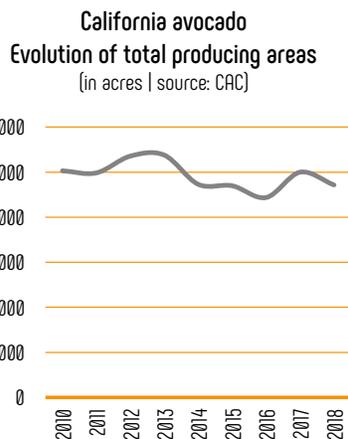
able is the planting level. This makes it possible to anticipate, under certain hypotheses (long-term yield, rate of attainment of prime production) but with a degree of reliability, the production until the maturity of the trees (i.e. over a period of 7 to 8 years in general). Hence the planting level when the projection is made represents a solid basis for projecting the medium-term evolution of production. Conversely, when the industry is shrinking, the dominant variable is the shrinkage rate of the cultivation area. Unlike planting, the effect of this variable is not gradual, but immediate. Evolution of productivity is also a major factor for analysis.

1. Estimating evolution of producing areas

This is a more qualitative than quantitative approach. It is based on analysing the trends from the last few years, and on the evolution of constraints weighing down on the industry.

Evolution trend of the Californian cultivation area

As stated above, the producing area has shrunk over the past decade, going from approximately 50 160 acres in 2010 to 45 467 acres in 2018 (- 4 700 acres). However, the downward trend seems to have eased off since 2017. On the one hand, the decline is less intense in the south, and on the other hand a minor bounce-back has been seen in the north. This trend is in accordance with plant sales. The State's main nursery, which on its own accounts for nearly 90 % of plant stock production, has registered record sales in recent years. However, this recovery seems insufficient in scale to represent a real turnaround in trend. The plant volumes in question remain relatively modest, also in part since the production capacity of the nurseries is currently limiting. According to CAC statistics, in 2018 the State had less than 4 448 acres of young orchards (corresponding to planting carried out between 2015 and 2018, i.e. over 4 years). Hence professionals surveyed believe that these volumes are only enough to offset orchard losses, which have also increased (aggravated problems of profitability, as well as the impact of fires, devastating significant planted areas in certain zones).





Evolution of constraints

Water availability

Water has been a major constraint in recent years, with the State going through a severe period of drought, especially between 2011 and 2017. However, the situation appears to be very changeable, since the rainfall level in 2019 was very good. So projections seem to be a fairly complex matter. The models consulted (UCLA in particular) are reckoning on an increase in temperatures, which could cause higher precipitation levels but more concentrated in time, with an accompanying accentuation of dry periods. While evolution of availability remains rather hazy, evolution of demand is much clearer. All the demographic projections are reckoning on an ongoing growth trend in California's population, i.e. in urban water requirements. The temperature increase trend should also increase requirements, in terms of both agricultural and urban water. Furthermore, the increase in water salinity (aquifers and also water from the Colorado) should also lead to an increase in irrigation dose requirements. Finally, the regulatory framework should continue to evolve, with in particular the implementation of stricter controls on water use from aquifers in the north (quotas), under the SGMA.

Labor availability

The current administration has implemented stricter control measures on migrant workers, who make up the bulk of the agricultural workforce. In this context, there should not be any increase in the labor supply, which will continue to be attracted mainly by operators with the biggest plantations - since they are able to offer regular work, the accommodation necessary for a temporary work contract, and can deal with these additional administrative constraints. Also minimum wage will continue to increase until it reaches 15 USD per hour in 2023. There is a twofold adverse impact for small growers, who will not have the human resources required to develop their production system.

Avocado – California – Evolution of producing areas in acres
Hypothesis: zero growth in the north, and 4 % decrease in the south

Years	2018	2019	2020	2021	2022	2023	2024
Total	47 158	46 300	45 500	44 700	43 900	43 200	42 500
North	26 597	26 600	26 600	26 600	26 600	26 600	26 600
South	20 561	19 700	18 900	18 100	17 300	16 600	15 900

Land availability

Pressure on the coastal zones, where climate conditions are favorable for the crop, will continue to increase, with the ongoing population growth trend. The price of agricultural land is already in excess of 80 000 to 100 000 USD/acre in these zones. In this context the risk of changes in agricultural land use in favor of real estate remains very high in unprotected zones. Furthermore, big financial groups have made major investments in avocado plantations in recent years, which could eventually be earmarked for real estate.

Overall, availability of the three main production factors should not see any major changes, and will remain restricted. Furthermore, climate models are reckoning on an increase in extreme phenomena (violent winds, fires, etc.). Conversely, plant availability could be a bit less limiting than at present (up to two years' wait), with at least one major grower establishing their own nursery. So overall, we have favored a hypothesis of the current trend continuing for the north (stability), and of a slowdown in the rate of decrease in the south (4 % shrinkage instead of the 7 % registered over the period 2013-2018).



2. Evolution of productivity

The current State average yield, of around 5 300 to 6 150 pounds/acre in recent years, does not reflect the very good pedoclimatic potential of the Californian industry (8 800 to 9 700 pounds/acre, with a medium technical package, and 14 000 to 15 800 pounds/acre if the system is more advanced, not to mention cutting-edge orchards). So production has a big growth lever. There is a considerable modernisation trend in the industry, at least in medium to large orchards. Nonetheless, productivity exhibited a rather downward trend in the first part of the 2010s, with a degree of stabilisation arriving in recent years. On the one hand, cyclical factors played a very unfavorable part (severe drought). On the other hand, a good many of the many smallholdings, which to this day represent a large proportion of the production facilities, are barely modernising (gentleman farmers growing it as a cash crop, reinvesting little or nothing in the orchards). So we have adopted the following hypotheses:

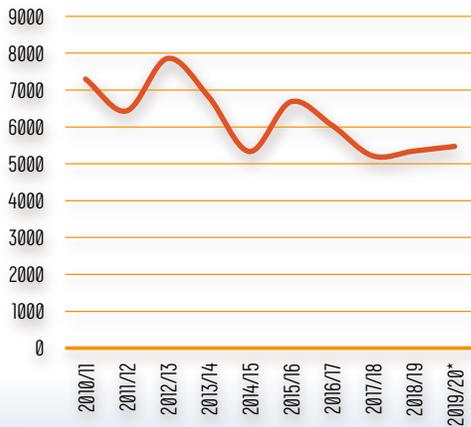
Nominal yield

We considered two scenarios, relating to the rainfall level which is evidently a crucial variable. The first reckons on ongoing drought, following the trend of recent years. The second considers a return to a less restricted rainfall level, as currently seems to be the case.

Evolution of productivity

We opted for the hypothesis of productivity picking up in the coming years, due both to the modernisation trend on medium to large plantations, and to some of the smallest and most fragile plantations closing down, in the face of increasingly tough profitability problems, in particular in the south.

California avocado - Evolution of productivity
Smoothed over 2 years
(* forecast | in pounds/acre | source: CAC)



Avocado – California – Nominal and potential productivity in 2024 under two hypotheses

		Nominal yield	Potential productivity in 2024
Hypothesis 1	Ongoing drought	5 500 pounds/acre (2015-2018 average)	6 100 pounds/acre
Hypothesis 2	Rainfall less limited	6 100 pounds/acre*	7 300 pounds/acre

* Projected yield for 2019-2020 (back to more abundant rainfall), factoring in a positive alternate bearing swing



3. Summary

According to the hypotheses above, long-term production (2024) could vary between 287 and 344 million pounds according to the rainfall, i.e. practically unchanged from the period 2015-2018, or a rise of around 60 million pounds.

However, certain factors could have a considerable impact, in the medium and long term:

Structural change in irrigation practices

Drip irrigation, associated with cropping practices aiming for better water use (mulching, etc.), has proven effective for at least one large-scale grower (good yield level and water saving). The nature of the Californian soil requires several rows of drippers, while the salinity requires regular servicing (clogging). This technique could considerably mitigate the water constraint, which weighs heavily on both yields and production costs.

Extension of the crop to zones in the State which are cooler but with a better water supply and less expensive land

Trials are currently underway in San Joaquin Valley. For now, the results seem to be mixed with the present plant stock. Gem could maybe provide additional cold tolerance and a parallel gain in productivity.

Evolution of citrus HLB

This serious citrus pathology present in California is currently contained. Its spread could lead to conversion of some of the big citrus orchards present in the avocado zone (in particular in Ventura County). However, the lemon, which makes up the bulk of citrus plantations in this zone, is less sensitive to HLB than sweet citruses.

