



The Catena Institute of Wine

In the late 1980's Nicolás Catena Zapata returned to Argentina from California, full of determination to fulfill his dream to make wines that could compete with the best in the world. His quest for knowledge and insatiable sense of curiosity cultivated a research-based company culture. In 1995, Laura Catena joined her father's initiative to revolutionize Argentine wine. Leveraging her background in science, Laura brought her father's work to a whole new level with the creation of Catena's Research and Development Department. Alejandro Vigil, Catena Zapata's Chief Winemaker, served as the department's first director.

In 2007 Fernando Buscema took over as director of the department, carrying out Nicolas' research-driven vision. Fernando earned a Master's degree from the prestigious University of California, Davis where he engaged in groundbreaking research of Malbec's growing potential in various geographic areas in Argentina and the United States. In 2013, the Department evolved into the Catena Institute of Wine.

The Catena Institute of Wine, in conjunction with the Catena Enology and Viticulture team, has the ambitious mission of making Argentine wines that can stand with the best of the world and of advancing Argentina's winemaking regions for another 100 years. Nicolás Catena Zapata's high altitude wine revolution led to the discovery of a new terroir for wine, the Adrianna Vineyard at almost 5,000 feet elevation. Today, the team of the Catena Institute of Wine is dedicated to studying every meter, every rock, every insect and microorganism in the Adrianna Vineyard, making it perhaps the most studied vineyard in the world.

In collaboration with University of California Davis and Universidad Nacional de Cuyo, The Catena Institute provides leadership for the university research and development programs. Through these academic partnerships, the Institute seeks to advance and promote wine knowledge for the benefit of wine technicians and the wine community as a whole.

Partnerships

The Catena Institute of Wine partners with many prestigious research institutions in Argentina and the U.S. who share a mutual interest in our vision. Together, we have published the largest, most prolific, Malbec study in the world carried out to date.



(The National Council of Scientific and Technical Research) is Argentina's main research institution. Catena and CONICET co-financed several Ph D studies on the effect of sunlight intensity on wine quality and its effect on Malbec vines grown at the Adrianna Vineyard. The results were published in several prestigious scientific journals.



This institute, founded in 2009, worked with the Catena Institute since the very beginning, in two joint studies: the characterization of Catena Malbec selections and the effect of sunlight at the Adrianna Vineyard. Additionally, we published a joint study on the nutraceutical values of fermentation residues.



The National University of Cuyo is one of Argentina's most respected universities. Its School of Agronomy has trained the best viticulturists in the region. Currently, we are working with its top graduate students in an effort to characterize Mendoza's Viticultural terroirs. As a result of these collaborative investigations we have discovered that the soils of Adrianna Vineyard are alive, and that in fact, the rhizobacteria present in Adrianna's soil contributes largely to grape quality and to a better adaptation of the plants to their environment.



The Catena Institute of Wine has developed a strong partnership with the Department of Viticulture and Enology of the University of California, Davis, focused on studying Malbec terroir. Through collaborative efforts, we have studied the characterization of Malbec Terroirs from Mendoza and California, Argentine phylloxera, and a comparison of Malbec clones from Argentina and France. To further this partnership, the CIW offers a scholarship to UC Davis post graduate students to conduct part of their research work in Argentina.

Malbec



"Malbec is an immigrant grape that has been lost in the old world despite being the grape of highest renown in Medieval Europe. If you think of the world's other main grapes such as Cabernet Sauvignon, Chardonnay and Syrah, they are still very important in the old world. Malbec was practically abandoned. It is a great story from a historical standpoint. Given that it is the main variety of our country we need to do everything we can to elevate it, to have people understand that it does have sophistication in terms of having different flavors in different climates, soils and regions."

Dr. Laura Catena



The History of Argentine Malbec

The history of Argentine Malbec involves a nineteenth-century man named Domingo Faustino Sarmiento, the soon to be president of Argentina, the man who would become known as the father of Argentine education. In his effort to acquire the refined ways of France in the mid-1800s, Sarmiento hired a Frenchman, Michel Aimé Pouget, to establish a vine nursery in Mendoza. The Quinta Nacional, as the nursery was known, was founded in 1853. In the 80's, the Malbec was a variety used to give color and body to the millions of liters that were produced for domestic consumption. Now in Argentina, Malbec can be glorious both as a single varietal and in a blend; it combines the dark, ripe, concentrated flavors and aromas of its famous French siblings Cabernet Sauvignon and Cabernet Franc, with a richness and smoothness on the palate that has turned it into the fastest-growing wine import in the world.

Malbec



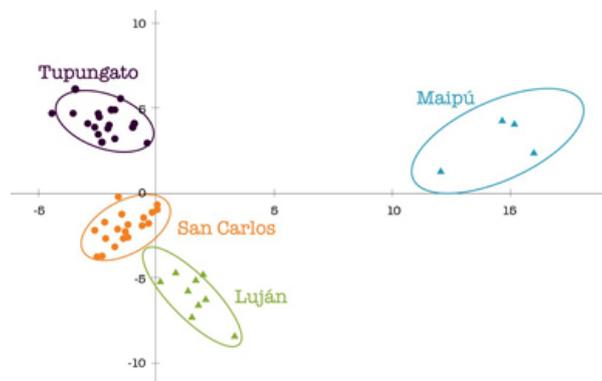
Catena Malbec Selection

The Catena Malbec Selection program started in 1995 when Dr. Laura Catena planted 135 selections of Malbec in Catena's La Pirámide vineyard. Plants were selected from the historic rows in Lot 18 of the Angelica Vineyard, planted circa 1930 on the shores of the Mendoza River.

After a few years, our team was able to harvest and vinify the grapes from the best performing plants, those with the smallest bunches and berries, lower yields and ideal balance between tannins, texture, aromatics and natural acidity. Nicolás and Dr. Laura Catena then planted only the best selections throughout the family's high altitude vineyards in Mendoza. There is also a complete replicate of the original selection at the Adrianna Vineyard.

Unique terroirs

In partnership with researchers from UC Davis, the Catena Institute carried out the largest study on Malbec Terroirs to date. We compared 42 vineyard sites from Mendoza and California, vinifying them in a standardized way, to allow the site differences to emerge. Then we analyzed the phenolic and aromatic compounds and conducted comparative tastings. Applying advanced statistical techniques (chemometrics), we found out that Malbec takes on a number of different flavor profiles depending on its origin. In general, the Mendocinian wines offered more complexity and ripe red fruit flavors compared to the Californian samples. In addition, certain vineyard lots produced wines with a very distinctive flavor profile, like lot 6 from Adrianna Vineyard. This study suggested that Mendoza has a wide variety of terroirs and can therefore produce "small lot" Malbec wines that are truly expressive of each vineyard site. Currently, we are working on a more in-depth study on this subject that we anticipate will lead to a more profound understanding of the uniqueness of Malbec from Mendoza.



Argentina versus France

In 1995, we planted a French Malbec clone (Cot) in La Pirámide Vineyard, next to our proprietary Malbec selections, the Catena Plant Selection. In 2003, we were able to confirm that the characteristics of the French clone differed greatly from the characteristics of our own Malbec selections, originally sourced from Catena's mother vineyard, Angélica. As a result, we asked ourselves if the vegetative material, in addition to soil and climate, was also an influence on the plant, which would explain why Argentine Malbec differed from Malbec planted elsewhere. To

test this theory, in 2007, we sent five Argentine clones from our collection to be planted in the UC Davis nursery next to other Malbec selections from France. In 2011 we observed significant differences between the yields and phenolic compounds of the French and Argentine clones. This initial study suggested that the Malbec selections brought from France to Argentina in 1853 were very different from other Malbec selections planted anywhere else in the world.

High Altitude



A high altitude vineyard has environmental conditions (temperature and sunlight intensity mainly) that affect the oenological quality of berries in a significant way, thus affecting the final wine. The number of meters above sea level (asl) varies depending on latitude and proximity to the ocean. In Mendoza, vineyards located above 1000 m asl, such as the regions of Altamira, Eugenio Bustos, El Cepillo and Gualtallary, are considered high altitude vineyards.

Temperature

Cool nights and a wide thermal amplitude also characterize high altitude regions. In fact, temperature decreases approximately 1°C for every 100m increase in height. Plant respiration at night is a key physiological process that is highly influenced by temperature. Cool temperatures in high altitude regions allow for lower respiration rates, which enhances the concentration of malic acid in the berries. Therefore, wines sourced from high altitude regions offer higher acid levels. Wines with higher acidity can be aged longer since acidity helps to reduce the effects of oxidation. Cooler temperatures also allow berries to maintain other quality such as anthocyanins and aromatics compounds typical of each variety.



Sunlight Intensity

As altitude increases, the atmosphere becomes thinner. This means there is a thinner barrier between the sun and the earth's surface in which causes an increase in sunlight intensity. At high altitude, ultraviolet-B light (UV-B, the most energetic fraction from sunlight) also increases. Since UV-B light is very strong at high altitude, it can damage living tissue. The plant defends itself against UV-B by producing certain components that are actually beneficial for grape quality. In fact, Mendoza's wine growing regions planted above 1000 m asl tend to develop higher quality berries due to the increased levels of UV-B. The UV-B results in a greater accumulation of polyphenols and aromatic compounds in the berry, caused by the plant's defense mechanism against sunlight to protect its seeds. A higher content of polyphenols and aromatics translates into a wine with a darker color, more complex flavors and longer aging potential.



Adrianna Vineyard

The Adrianna Vineyard is located in the Tupungato department of the Uco Valley, in the soon-to-be appellation of Gualtallary. The remarkable thing about this vineyard is its high altitude, at 4,757 feet elevation. Nicolás Catena decided to plant here to obtain wines from a cooler climate, like the most prestigious wines of Burgundy or Bordeaux. The combination of singular climatic conditions, carefully sought after plants, and great diversity of soils makes this vineyard unique, and it is our wish that it becomes recognized as the most studied vineyard in the world.



Plants

The Adrianna vineyard, planted in 1992, was initially Chardonnay, Pinot Noir and Merlot. Later on, after years of research to better understand the climatic conditions of the region, Sauvignon Blanc, Viognier, Cabernet Sauvignon, Cabernet Franc and Malbec were planted; today the vineyard is 120 hectares. There is a wide selection of plants for each grape variety, trained to a vertical shoot positioning trellis system and planted at different densities. Recently, a new Malbec lot was planted using the Goblet vine training system. The Malbec grown in the Adrianna Vineyard comes from selected plants in lot 18 of Catena's Angélica Vineyard, the Mother vineyard to Catena's Malbec clonal selection project. Other Malbec clones grown in Adrianna come from La Pirámide Vineyard; for instance, Catena Malbec clone 10 and clone 120. In order to study the behavior of Malbec in different "terroirs," we planted 125 Malbec selections in the Adrianna vineyard that were originally sourced from our La Pirámide vineyard in Agrelo.



Climate

Adrianna's climate is influenced by high altitude. The altitude causes cooler temperatures and higher sunlight intensity compared to wine growing regions in lower altitudes. The average annual temperature is around 13° C, and during the ripening months (February, March and April), the average monthly temperature is 20.2 °C, 16.5 °C and 13.2 °C respectively. Additionally, maximum temperatures during these months rarely exceed 30 °C. Low temperatures at Adrianna enable early ripening

grapes such as Chardonnay to reach low alcohol levels and higher acidity. High sunlight intensity, UV-B in particular, received by the berries (the levels of UV-B is approximately 38% higher than in regions located at 500 m a.s.l.) increases phenolic and anthocyanin contents, translating into wines with a darker color, richer mouthfeel and longer aging potential. High sunlight intensity also allows for late ripening grape varieties like Cabernet Sauvignon to achieve optimal ripeness despite the cold temperatures.

Soils

The soils of the Adrianna vineyard are particularly heterogeneous due to their alluvial origin, born of the flow of water from ancient rivers and glaciers combined with the Andes volcanic activity. Adrianna soils are so heterogeneous that you will find a difference in topsoil depths from 30 to 200 cm within 10 meters distance in the same lot in the vineyard. This means there is less water retention in parts of the vineyard, which results in differences in vigor and berry characteristics. The extensive work of identifying the more than 200 parcels was started by Dr. Laura Catena and was later continued by Alejandro Vigil and the Catena Institute of Wine team. The research has taken place over the last two decades and continues today. People always told us that due to the characteristics of Mendoza, our soils were just sterile matter. However, we have discovered that our soils are alive. Plant Growth Promoting Rhizobacteria (bacteria that live naturally in our soils) help plants to resist frost, diseases and grow properly in our extreme climate conditions.



More Studies



We have not only applied our knowledge and experience to understand the Adrianna Vineyard, but also to study other wine growing regions and grape varieties. We continue to explore our country in our quest to produce high quality Argentine wines. We also aim to be a strong partner to other entities working to elevate our wine region. We continue to share our findings with the Argentine wine community so our region will continue to make strides in sustainability and other innovations that will lead us into the future.



Sustainability

Our goal at the Catena Institute is to continue to offer research that guides the production of quality wines from our regions for at least another 100 years. In order to achieve this goal it is crucial that we are fully aware of the impact that our work has on the sustainability of our terroirs. Our viticulture team formed a partnership with The Bodegas of Argentina Technical Committee to create a sustainability code that is available to the entire wine region in Argentina, so that everyone can do their part to ensure that as a country, we produce sustainable wines for generations to come. This code is adaptable to fit the needs and challenges of each specific Argentine wine region.



Mendoza Appellations

The Appellation of Origin law, passed in 1999, set the framework for the creation of Argentinian Indications of Origin (IG), the quality distinction system for Argentina. The Catena Zapata family believes that the IGs are a key tool in helping wine consumers understand the unique characteristics of each of our regions. The Catena Institute of Wine, Catena viticultural team and INV Technical Committee team have worked to create the Paraje Altamira IG. We are currently working on delimiting the boundaries of the Gualtallary IG.

More Studies



New Varieties

Each region of Argentina has its own viticulture history which includes grape varieties that were grown in our country decades or even centuries ago but have not found a place in the market in Argentina today. The CIW is working to resurrect grape varieties that were traditionally grown in Mendoza's Eastern Region – where the Catena family first settled – such as Bonarda and Criolla. The CIW has also expanded its study to other varieties that Mendoza is not traditionally known for, including Cabernet Franc, Grenache, Caladoc, Nebbiolo and Petit Verdot. The results do not cease to surprise us and we hope that soon will surprise you too.



Phylloxera

Phylloxera is a grape vine pest caused by an aphid that feeds on roots. In Argentina it is present since 1878. Why this pest that destroyed many vineyards in Europe has not caused damage to our vineyards? In collaboration with UC Davis (EEUU) and IBAM (Argentina), we performed a genetic characterization of phylloxera present in all wine regions of Argentina. We found strains that were related to Californian biotypes, but not with European biotypes. We are currently assessing the aggressiveness of the strains in the most used rootstocks.



New Regions

Following our vision over the last decade to advance our wine regions to the First World of Wine, the Catena Zapata family has expanded beyond Mendoza and has planted vineyards in Salta, La Rioja, San Juan, and Patagonia, Argentina. The diversity of Argentina's landscape, viticulture, history and culture is illustrated by the difference of each of these regions. Malbec takes on different flavors and textures in each province, but there are also other varieties that particularly flourish within these regions, such as Torrontés, Bonarda, Syrah, Cabernet Sauvignon and Pinot Noir. The Catena Institute of Wine is applying its knowledge of the unique terroirs within these regions to produce wines that showcase the best quality of our regions, thereby elevating the entire country in the First World of Wine.

TIMELINE

1852 - Original French Malbec vines planted in Argentina.

1902 - Italian Nicola Catena plants his first Malbec vineyard in Mendoza - **Bodega Catena Zapata** is born.

1945 - The Second Generation - Domingo Vicente Catena, master blender, discovers the Uco Valley as his best source of Malbec.

1960's - Under the Saint Felicien label, **Nicolás Catena Zapata's and his father Domingo's** Cabernet Sauvignon is prized as Argentina's most age-worthy red.

1984 - The First Catena Revolution: Nicolás Catena challenges himself to make Mendoza wines that can stand with the best of the world.

1992 - The Second Catena revolution: Looking for cooler climate, Nicolás Catena Zapata dares to plant in Gualtallary, at 5,000 feet elevation, where vines had never been planted before.

1995 - Under **Dr. Laura Catena's leadership**, a 135 plant Malbec selection from the Angelica Vineyard - the Catena Cuttings - becomes the founding project of the Catena Institute of Wine.

1995 to present - Weather stations are placed in all the Catena vineyards at different altitudes to understand **high altitude climate variations**.

2002 - Winemaker **Alejandro Vigil** begins parcel selection work in the Catena Institute.

2004- High altitude research with **Agronomy School of Mendoza**. The effect of Sunlight Intensity is discovered.

2005 and onwards - The Catena family begins to explore and plant vineyards in regions outside Mendoza - **Salta, La Rioja Argentina and Patagonia Argentina**.

2007 - Fernando Buscema, as head of the Catena Institute, begins collaboration with local Institutions and the Universidad de Cuyo to focus on Malbec and sustainability.

2008 - The Third Catena Revolution: An in-depth study of all the parcels within the Adrianna Vineyard begins. **Adrianna White Bones and White Stones Chardonnay** first vintage.

2013 - Sustainability Protocol is developed by the Catena Institute of Wine in conjunction with Bodegas de Argentina and becomes the first vineyard sustainability protocol in Argentina.

2013 to present - Ongoing studies on soil microbiome, in-depth soil parcel composition as it relates to flavor and aroma, ageability, alternative varieties, phylloxera in Argentina, Bonarda plant selection.

2014 - The most extensive Malbec study that has been carried out to date is published in "Food Chemistry" and "the American Journal of Enology and Viticulture", as a result of a **joint study between the CIW and UC Davis** (Buscema, Boulton).

PRE-ARGENTINA, FRENCH MALBEC TIMELINE

A few Historic Highlights

1152

Malbec is drunk at the marriage of Eleanore of Aquitaine to Henry II, the future king of England and becomes the signature wine of Eleanore's court of Love in Troubadour France and England.



18th and 19th Century

Malbec makes up 40-60% of the Bordeaux blend alongside Cabernet Sauvignon.



1878's

Bordeaux vineyards are decimated by phylloxera and Malbec is mostly replaced by the earlier ripening variety Merlot.





KEY FACTS

- ▶ The Catena Institute of Wine is a research institute **founded** by Doctor Laura Catena in 1995. The Institute's **purpose** is *to continue elevating Argentina's historic variety, Malbec, and the Argentine wine regions for another 100 years.*
- ▶ **Microvinifications:** approximately 1.000 per year.
- ▶ **Focus Areas:** Sensory analysis in Malbec, Effect of High Altitude, Soil Composition, Vineyard Parcelization, Soil Microbiome, Ageability, Regions of Argentina, Sustainability, Alternative Varieties, Phylloxera, Climate Change.
- ▶ **Staff:** Eleven. Two PhD candidates and one Master of Science.
- ▶ **Board:** Dr. Laura Catena, Ing. Alejandro Vigil and Dr. Rubén Bottini.
- ▶ **Director:** Fernando Buscema MSc.
- ▶ **Partnerships:** IBAM (*Instituto de Biología Agrícola Mendoza*), CONICET, UNCUIYO (*Universidad Nacional de Cuyo*) and UC DAVIS (*University of California, Davis*).
- ▶ **Publications:** 22 papers since 2008. Published original research in *American Journal of Viticulture and Enology*, *Physiologia Plantarum*, *Food Chemistry*, and others.
- ▶ **A few of the most important Publications:**
 - Buscema, F., Boulton, R. B. (2015). Phenolic Composition of Malbec: A Comparative Study of Research-Scale Wines between Argentina and the United States. *American Journal of Enology and Viticulture*, 66: 30-36.
 - King ES, Stoumen M, Buscema F, Hjelmeland AK, Ebeler SE, Heymann H and Boulton RB (2014) Regional sensory and chemical characteristics of Malbec wines from Mendoza and California. *Food Chemistry* 143: 256-267.
 - Berli, F., D'Angelo, J., Cavagnaro, B., Bottini, R., Wuilloud, R., & Silva, M. F. (2008). Phenolic composition in grape (*Vitisvinifera* L. cv. Malbec) ripened with different solar UV-B radiation levels by capillary zone electrophoresis. *Journal of agricultural and food chemistry*, 56 (9), 2892-8.
 - Salomon, M. V., Bottini, R., de Souza Filho, G. A., Cohen, A. C., Moreno, D., Gil, M., & Piccoli, P. (2013). Bacteria isolated from roots and rhizosphere of *Vitisvinifera* retard water losses, induce abscisic acid accumulation and synthesis of defense-related terpenes in in vitro cultured grapevine. *Physiologia Plantarum*.

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PRESS ARTICLES

• *Microbial Terroir - Current Research Round-Up.*

Roundup of progress unravelling microbial terroir.

JANCIS ROBINSON - By Julia Harding MW, February 6, 2017

• *High Hopes in The Andes.*

Dan Rosenheck visits the vineyards and laboratories of Catena Zapata.

THE ECONOMIST - By Dan Rosenheck, December/January 2017

• *To Move Beyond Malbec, Look Below the Surface.*

The article takes an in-depth look at how the Catena family and the Catena Institute of Wine are unlocking.

THE NEW YORK TIMES - By Eric Arsimov, February 2016

• *The Future of Wine Science.*

The most in-depth study of cultivars ever attempted.

WINE BUSINESS MONTHLY - By Lance Cutler, November 2015

• *Catena Institute of Wine and UC Davis Host: "The Future of Wine Science",
A Joint Educational Conference*

Held at the Davis campus, the program highlighted the Institute's 20-year journey to elevate Argentine wine and its collaboration with UC Davis in the study of Malbec and phylloxera.

September 2015

• *Argentine Winery shares the results of its research in California.*

The study involves a comparative analysis of Malbec selections from Argentina vs Malbec selections from France.

Catena Zapata has been working on a formal basis with UC Davis since 2007.

LOS ANDES, September 2015

• *Catena Wine's Measure of Influence in Argentina.*

Catena identifies two goals of the Institute: to make Catena the best wine it can be, and to advance Argentina's winemaking regions for the next 100 years.

FORBES - By Cathy Huyghe, September 2015

• *Malbec Musings.*

The whole idea behind the Catena Institute of Wine is to elevate wine quality while finding sustainable innovations.

And while it has a direct impact on the Catena Zapata winery in Argentina, their findings will no doubt benefit the Argentine wine industry as a whole.

WESTENDER - By Michaela Morris, September 2015

• *Characterization of Malbec, a challenge for Argentina.*

The soil is not just an inert medium that supports the vine, but a rich environment -filled with abundant microflora.

The sunlight intensity in high altitude vineyards plays a vital role in the vineyard's development.

LOS ANDES - By Fernando Buscema, February 2015



• *IBAM celebrated its 5th Anniversary.*

CONICET - Mendoza, November 2014

• *Advances in Wine Innovations.*

CONICET - By Douglas Mac Donald, October 2014

• *The Catena Institute of Wine is Officially Introduced at Wine Summit in Mendoza.*

The Catena Institute of Wine is officially introduced at Wine Summit in Mendoza. Introduction comes as the Institute publishes key research in first cross-continent Malbec study and sets its sights on elevating Argentine wine for the next 100 years.

PR NEWSWIRE, September 2014

• *Developing the local regions, one of Catena Institute's aims.*

At the presentation of Catena Institute, Buscema talked about Adrianna vineyards, owned by Catena family, which they want to turn into "the world's most studied vineyard".

WINESUR, August 2014

• *Launch of the Catena Institute of Wine.*

LOS ANDES - By Soledad González, August 2014

• *Advancing our winemaking regions into the First World of Wine, the Catena Institute's Mission.*

CLARIN - By Pablo de León, August 2014

• *Why is Argentinian Malbec Unique in the World?*

Researchers explain why Argentine Malbec is different from Malbec wines from other parts of the world. "It is the most extensive Malbec study that has been carried out. We expect to achieve a full understanding of our regions, unveiling the uniqueness of each terroir, and tell the world about it", Laura Catena said.

LA NACIÓN - By Sebastián Ríos, July 2014

• *Dr. Laura Catena: "We can't be tempted to produce cheap, bulk wines".*

Bodega Catena Zapata's Managing Director insists on the fact that Argentina has to focus on selling high-end wines abroad. She believes it is necessary to study vineyards in depth and work on the next 100 years to come.

LOS ANDES - By Soledad González, June 2014