

# CASE STUDENT HANDOUTS

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*for*

## **“His lips drink water but his heart drinks wine”: Groundwater availability, access, and governance in the Guadalupe Valley, Mexico**

*by*

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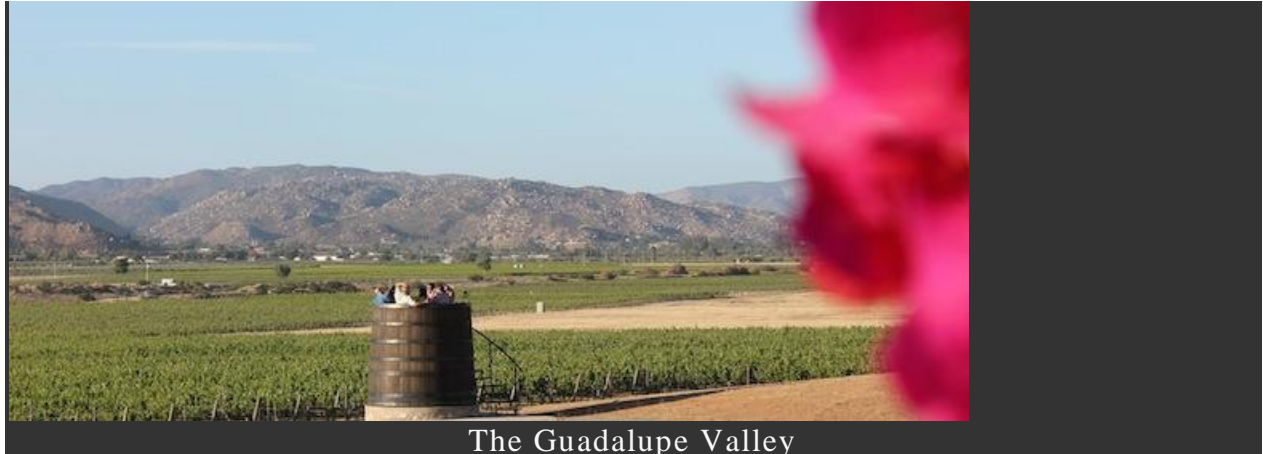
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Handout #1: Mexico's Wine Woes: Attempting Water into Wine  
Michael Cervin

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Beer and tequila are the traditional alcoholic beverages of Mexico. But the wine region of Mexico's Baja Peninsula is changing dramatically, receiving many high scores from the American wine press, and a new breed of winemaker there is dedicated to producing premium wine. But the Mexican wine industry faces uphill battles in two countries. Does it have the stamina to prevail?



The Guadalupe Valley

The majority of wine production is located in the Guadalupe Valley, a 30-minute drive east of Ensenada, on the Baja Peninsula. Baja accounts for over 90% of all wine in Mexico. There is some wine production on what is known as the "mainland," meaning the entire country except for Baja. But it is the Guadalupe Valley which supports wine tourism, including lodgings and terrific restaurants like the highly-regarded Laja and the new Finca Altozano.



The Gravity Flow Winery at La Lomita

A decade ago it was a different story. Wine production was dominated (and still is) by the larger wineries like L.A. Cetto, and Santo Tomas (which started grape growing in 1888) and smaller wineries were content selling cheap jug wine to an unimpressed Mexican market. Now Hacienda La Lomita, Adobe Guadalupe, Las Nubes, and Villa Montefiori are just four of over 70 wineries, only a handful of which are dedicated to crafting exceptional wine. “Americans have a very negative opinion of Mexican wine,” says Don Miller, owner of Adobe Guadalupe, the only American-owned winery in Baja. “But our renaissance is world-class. The Guadalupe Valley is like Napa to the Mexicans,” he says. If the analogy works, then like Napa, the Guadalupe Valley will face its own persistent problems.

### [The View from the U.S.](#)

My April 2013 visit showed a marked surge in quality and winemaking techniques over my previous visit in 2011. “Right now it’s about good wine at the right price, not \$100 bottles,” says Victor Segura, co-owner of Las Nubes Winery. “Yes, there is a market for high-priced wine, but the value market is bigger.” Very few Americans will drop \$80 for a Bordeaux blend from Baja but many of the wines I sampled were under \$40 and represented significant bang for the buck. Adobe Guadalupe, Villa Montefiori and Hacienda La Lomita, for example, all export about 2% of their production to California retailers and some restaurants. “It’s more of a hobby to export to the U.S. because we can sell all our wine currently in Mexico City,” says La Lomita owner Fernando Perez Castro. But Castro understands the necessity of securing a future niche in the American market, as does Las Nubes, which will begin exporting wine in late 2013.



Victor Segura at Las Nubes

The border states – California, Arizona and New Mexico and to a lesser degree, Texas – provide the bulk of visitors to the emerging wine region, but the majority come from California, where the drive to the Guadalupe Valley is less than two hours from San Diego. But visitors from the Golden State run into a thorny legal issue. California residents cannot cross the border back to the U.S with more than one liter of wine every 31 days, according to the California Department of Alcohol

Beverage Control, whereas non-California residents can cross the border with up to five cases. The reason? It all goes back to the 1994 North American Free Trade Agreement and pressure from San Diego area distributors concerned cheap Mexican wine would flood the market. But that's nothing compared to how punitive Mexico is to its own industry.

### The View from Mexico

Inside Baja there are a slew of issues confronting the wine industry: water, clonal selection, salinity, taxes, lack of infrastructure, and aggressive land development. La Lomita and its modern holistic tasting room reflect the positive changes underway in Baja. A three-story gravity fed open-air facility perched on a barren hill, this winery uses native yeasts and estate fruit to craft beautiful wines including Pagano, a Grenache from 55-year-old vines. Villa Montefiori's focus on estate-grown Italian varieties, using rootstock from France and Italy, is located six miles from the ocean at 1,300 feet. There they have 12 varieties in the ground, including nebbiolo, barbera and tempranillo. Las Nubes and Adobe Guadalupe are crafting smooth and balanced Rhone and Bordeaux-style wines.



The wines of Adobe Guadalupe

But even with compelling Baja wines taxes for wineries in Mexico are as high as 40%. There is little research of clonal rootstock and how it performs at the university or state level. Real estate development is beginning to drive up land prices. To winemakers in Baja it's still very much a Wild West vibe. "At this moment in the Guadalupe Valley there are no rules, so we can plant whatever we want," Victor Segura tells me. "Maybe in 20 years we'll know what excels in this region." But two decades hence might force the Baja wine industry into a constant state of playing catch-up unless they can compete now.

Regardless, competition is not the elephant in the room. It is water. What little water that does exist is subject to salinity, which was evidenced in some of the wines I tasted. Don Miller told me he ripped out his syrah because the briny water killed it, then replanted using rootstock resistant to

the salt. “The water we do get is rain water which comes from underground streams, deposits some into wells, but very little is captured and it flows to the ocean.” There is no capture rate, no aquifers and no money to build reservoirs. And the average of 8-10 inches of annual rainfall is more valuable than gold. Of necessity, many wineries and farms are reverting to dry farming.

An additional hurdle is that there are no viable sources to obtain winemaking tools like pumps, hoses and barrels. Everything must therefore everything be imported, making wine expensive to a beer and tequila culture used to cheap booze. Americans visiting the Guadalupe Valley must contend with poor winery signage and in many cases hideous dirt roads guaranteed to strain the axle on your car. It’s peculiar, therefore, that situated in mid-valley is a new, \$4 million (US) wine museum. I asked everyone I visited if that money could have been better spent on addressing the real issues in the Valley. No one wanted to speak about it on the record, but the frustration was clearly evident. The museum was a political trophy but it did little for the pressing economic needs. “We want this to truly become one of most visited regions of Mexico,” President Calderón said during the inauguration of the museum in summer 2012. But Mexico’s president completely missed the point. Instead of providing tax credits, water infrastructure or scientific study to build up the fledgling industry, Calderón spent money on a shiny building.

But both Mexicans and Americans are visiting the Guadalupe Valley in ever-greater numbers. The valley stands at a crossroads with formidable obstacles in its path. “What is in our best interest?” Victor Segura asks me rhetorically. “Water, development, research, taxes?” He uses the analogy of a burgeoning family outgrowing their house. “You need more rooms to support your growing family, but instead you buy a new car.”

In spite of the frustration, the potential of Baja wine is impressive. Segura sums it up as he surveys the Valley from his modern stone winery perched on the hillside, looking across first leaf vines, his own field of dreams. “If you build it they will come,” he says.

## Handout #2: Valle de Guadalupe

By Lorena Mancilla, June 29, 2011 San Diego Reader

Imagine a valley filled with vineyards surrounded by olive trees. The weather is dry and warm and there's hardly any wind. There are only a couple of paved roads and people mostly walk or drive on dirt roads bordered with shrubbery. The sounds and sights of the country are subtle: birds, mountains, desert plants — wait, there's also drama: a turkey vulture devours a squirrel. Oh, well.

One could be standing in California or it could be Italy, but this place is Mexico; actually, it's Ensenada, but without the breeze of the Pacific. The place is Valle de Guadalupe, a region with a Mediterranean climate where 80 percent of Mexican wine is produced. The valley is the same size as Napa Valley, but Napa has 40,000 acres of vineyards. Compared to other regions, Mexico's production is still small. In all of the different wine-producing regions of Baja, including San Vicente Valley, Guadalupe Valley, and Santo Tomas Valley, only 6200 acres are used for wine production.

The history of Guadalupe Valley has been touched superficially by few historians; the original population was indigenous, mainly Kumeyaay. There were also Dominican missionaries, but they didn't stay for long. In 1904, a group of Molokan Russians colonized parts of the valley and with them came the first grapevines.



Molokan Russians in Guadalupe Valley

During the 1950s, groups of farmers demanded farming land from the government and created ejidos. The ejidos were groups that collectively owned land, which was given to them by the government in order to promote agriculture. At the beginning of the ejido era in the valley, they grew alfalfa, wheat, and other crops. In 1927, an Italian named Angelo Cetto came to Baja California and started to explore the valley. He grew different kinds of grapes and founded a company that mainly focused on the production of brandy. In the 1940s, Cetto produced one commercial wine, but it wasn't until the late 1980s that the company began concentrating on wine. The serious wine industry in Baja is fairly young, 20 years old.



Angelo Cetto came to Baja California in 1927.

Now, L.A. Cetto is the largest wine company in Mexico, with a production that exceeds one million cases annually; right behind are Pedro Domecq and Santo Tomás, which produce 200,000 and 50,000 cases, respectively, every year. These companies are the main exporters of Mexican wine and the most involved in international wine competitions.

### [Any Warehouse Can Be Turned into a Boutique](#)

The Valle de Guadalupe is considered a laboratory of experimental wine production because there are so many varietals being grown: Zinfandel, Cabernet, Grenache, Chardonnay, Merlot, Syrah, Sauvignon Blanc, Malbec, Sémillon, Tempranillo, Chenin Blanc, Mourvèdre, Petit Verdot, Carmenere, Muscadelle, Nebbiolo, and many more. There are at least 40 different kinds of grapes producing wine in the valley. Thomas Egli from Casa de Piedra says: “It’s a valley that has huge diversity. You find a wide range of French, Spanish, and Italian varieties, even German and Swiss. Since it’s a wine country without a long tradition of winemaking, there’s a lot of innovation. There are no rules, and you find a huge range of blends, which for a traditionalist might sound strange: for instance, what about a Tempranillo blended with Cabernet Sauvignon?”

The potency and concentration of flavors in Mexican wine come from the way the grapes are grown. Ambitious winemakers submit the vines to intense pruning, which diminishes production but adds richness and complexity to the wine; this technique and others have won many medals for Mexican wines. Another factor that makes Baja’s wine different from the production in other parts of the world is that the dryness of the weather makes Baja’s grapes less exposed to pests, so the need to fumigate drops to almost zero. Egli says, “[Wine] quality is acquired in the vineyard. Therefore, we apply a rather classical, respectful enology: we interfere as little as possible but as much as necessary.”



Vines at Vinisterra

Since the '90s, the Mexican market was invaded with cheap Chilean, Argentinean, and French wines. There's a well-known aspect of certain Mexicans' character that is called *malinchismo*; these people, called *malinchistas*, prefer anything that comes from outside of Mexico. (*Malinche* was an indigenous woman in central Mexico who served as guide and interpreter to Cortez in his conquest of Mexico.) But then, there's a patriot inside every Mexican. The coexistence of these traits creates a contradictory collective personality. The *malinche* side of the Mexican welcomed foreign wines to be sold in Mexico at cut-rate prices. Young wine-drinkers would ban Mexican wine because of its price and because they thought that the foreign production was better. Still, right now there are some good restaurants, particularly in Mexico City, that only list foreign wines. But, little by little, the quality of the local product is gaining a reputation, and although the price barrier is still high and the government doesn't help (there's a 25 percent tax on wines, which are considered luxury items), there are good bottles sold for \$8 to \$20.

Winemaking in Mexico is not an easy enterprise. There are many factors against it: taxing, exporting regulations, ambiguity and uncertainty in property ownership, and misconceptions with water rights. Also, the valley's dry weather and its mild winters (which winemakers rave about) come with a price: there's little water. Lack of water has been a problem among all those who have used the valley for farming, including the Indian tribes who feel cornered by some of the wineries. Lately there has been mild criticism against winemaking in the valley. Historian Rogelio Ruiz says, "Winemaking is an expensive activity that requires a big investment. It has become a trend, and we can say there's a boom. The new producers will hardly be able to compete further than in the boutique circle. I believe that in most cases it's a matter of snobbism or personal satisfaction."

With all of its disadvantages, there are many individuals that have decided to take the risk. The Guadalupe Valley now gathers around 80 winemakers; Monte Xanic, Tres Mujeres, Casa de Piedra, Bibayoff, Doña Lupe, and Vinisterra are a few of the many with a small artisanal production.

Switzerland-born enologist Christoph Gartner founded Vinisterra, a small winery that's located in San Antonio de las Minas. He came from Switzerland to work for Santo Tomás, and he produced ambitious projects such as a binational wine called Duetto, which brought together grapes from the Santo Tomás winery and from Wente Vineyards in California. When asked about the reason he decided to move to Baja in 1996, Gartner says he believes in the potential of the region and that he liked the challenge. "There's a spirit of experimentation and freedom in the new world; there's an absence of being chained to the previous industrial production. And we have the climate on our side; the aridity and warmth of the valley gives us wines of high concentration and maturity."



## Guadalupe, the Newest Telenovela Star

The majority of Baja wine-country visitors are local middle-class Mexican citizens, cultured and well-educated between the ages of 35 and 45 who can afford the rather expensive local production. One of the tour guides at L.A. Cetto mentioned that the winery receives around 800 visitors on a weekend, with only about 10 of them from the U.S. According to the numbers of the Comité Provino, last year during harvest season the Guadalupe Valley received 45,000 visitors, but only 3 percent were from the United States.



The telenovela has attracted a less-sophisticated consumer.

In order to attract consumers, some wineries offer free tours through the vineyards and wine-tastings at little or no cost. They have open areas that are used for weddings, concerts, and picnics. Many families and groups of friends spend their Sundays enjoying the local produce and wine at what is called the Ruta del Vino. There are bed-and-breakfast hotels and tiny lodges, even luxury camping. The valley's popularity is growing and, recently, it became the main backdrop for *Cuando Me Enamoro* ("When I Fall in Love"), a popular Mexican soap opera. Many ensenadenses worked as extras. The telenovela brought popularity, but it also attracted a less-sophisticated consumer.

The biggest event of the year happens in August, during harvest season. Fiestas de la Vendimia offers concerts, wine-tastings, and food competitions. Most of the events are expensive (a ticket can cost from \$50 to \$300) and some are invitation-only gatherings, but there are also public events. In downtown Ensenada, in front of Bodegas de Santo Tomás, a popular nighttime street festival brings together art from many Baja artists. Local produce and gourmet food is sold, and lots of live music is presented on indoor and outdoor stages. Many thousands gather for this wine festival. It is attractive, indeed, but when in the late hours the hordes of men and women drinking straight from the bottle become a huge zigzagging crowd, one can only wonder what is so wrong with exclusivity after all.

Handout #3: Ensenada confronts water shortage  
Pipeline from Colorado River being considered

By Sandra Dibble APRIL 6, 2014 U-T SAN DIEGO



The low water levels at Emilio López Zamora Dam, seen earlier this year, contributed to a water crisis in Ensenada. — *David Maung*

ENSENADA — On the days her taps run dry, Minerva Altamirano makes do with a collection of buckets and pots filled with water. Others on her quiet block of well-tended row houses have installed *tinacos*, rooftop water tanks, or dip into 50-gallon bins, known as *tambos*.

Here in the sprawling hillside development of Villas del Prado and across Ensenada, residents have been learning to live with rationed water, as the port city of 400,000 residents confronts an unprecedented shortage.

Since January, most residents count on receiving water a fraction of the time; service to Altamirano's area is scheduled for Mondays, Wednesdays and Fridays. "Sometimes the water is clean, and sometimes it's dirty," said Altamirano, 63.



Ensenada resident Minerva Altamirano stores water in her back patio for the days when her taps are dry.— *David Maung*

The only municipality in Baja California that is not supplied by the Colorado River, Ensenada depends largely on aquifers for its supply, with a small portion provided by rainwater held behind the Emilio López Zamora Dam. But as a lack of rainfall and high temperatures emptied the reservoir and lowered the aquifers to dangerously low levels, authorities have been forced to implement a rationing plan.

The shortage has prompted an intensive search for new sources that run the gamut from treated waste water to desalinated ocean water to importing water from the Colorado River. The state's immediate solution is adding new wells.

“Come summer, if we remain the same, this is going to be a very severe crisis,” said Arturo Alvarado González, head of the state's water agency in Ensenada, known as Cespe. An aging infrastructure makes the problem worse, with leaks and broken pipes that need frequent repair, he said. “It is very uncomfortable, and we understand that citizens are upset. ... My answer is that we are working to resolve this.”



Arturo Alvarado González, head of the Cespe, Baja California's water agency in Ensenada, holds up a timer being distributed to encourage water users to limit their time in the shower.— *David Maung*

According to the agency, the rationing has lowered Ensenada's per capita water consumption from 66 gallons a day to 43.

The shortages are not just affecting city residents, but raising alarm in adjacent agricultural areas such as the Valle de Guadalupe, a key state tourist attraction that produces 90 percent of

Mexico's wines. The valley has for years shared its underground water supply with Ensenada's domestic users — and growers are increasingly worried about their diminishing supply being siphoned off for urban uses.

Yet tourists visiting the city might not even be aware of there is a problem, as any hotels and restaurants affected by rationing use their own water reserves for their guests, said Jean-Loup Bitterlin, owner of El Rey Sol Restaurant and the adjoining Posada Inn. "Everybody has a pila or water storage space," Bitterlin said.

Those most affected are residents, such as Altamirano and her neighbor Daniel Ibarra Tribolet, 39, who was busy filling all available receptacles with water Wednesday — from kitchen pots to the washing machine.

"Supposedly we get water Mondays and Wednesdays, but sometimes it's not there Monday, and there it is on Tuesday," he said. "Sometimes we don't even have enough to bathe."

Baja California is an arid region, much like San Diego County, with Ensenada long the most hard-pressed for water among the state's five municipalities. Tijuana, Mexicali, Tecate and Rosarito Beach all are supplied by the Colorado River. Ensenada has rights to a small portion of the state's allocation, but there is no pipeline to carry the water.

"We have a problem that we live in a desert and that has not been assumed as such," said Joaquín Bohigas, an astronomer and member of Red Calidad de Vida, a network of organization for civic groups in Ensenada. "I think the same thing happens a bit in California, but here it's more dramatic because it's a dryer zone."

Bohigas and other critics lay much of the blame for Ensenada's current shortage on federal and state governments, saying they failed to prevent a crisis long in the making.

Ensenada's water shortage has been known for years, as aquifer levels have suffered from saline intrusion and their levels have dropped. Proposed solutions have stagnated for a range of reasons — from a lack of funds to objections raised by environmental groups. Some critics say government authorities are largely responsible for not making Ensenada's water issues a greater priority.

"There has been a lack of planning on the part of the state and federal governments to foresee the needs of the population," said Wenceslao Martínez, president of the umbrella group known as the Business Coordinating Council. "There are many businesses that would like to locate in Ensenada, but we don't have the ability to provide water," said Martínez, who favors construction of a pipeline from Tecate to deliver Colorado River water to Ensenada.

While everyone agrees that Ensenada needs to increase its supply of drinking water, there is little leadership toward reaching a solution, said Rogelio Vázquez, a geophysicist who studies water at CICESE, a government-funded scientific research institution in Ensenada. He recommends desalination plants as the most viable future water source.

With changes in administrations both at the state and federal levels, many in authority are new to their jobs.

“I can talk about November on out,” said Enrique Ruelas, head of the State Water Commission, Baja California’s overall planning agency for water resources. Baja California’s governor, Francisco Vega de Lamadrid “is very much aware of the situation,” Ruelas said. “He has given instructions that there is no priority greater than the water supply.”

The Cespe serves some 110,000 municipal customers in the city of Ensenada, and about 90 percent of them are affected by the rationing measures, said Alvarado, the agency’s director. In its rationing plan, Cespe divided the city into five zones with different water delivery schedules — some are told to expect water four days a week, others three days, one zone every day for 12 hours. But the schedule can vary “according to climate, consumption or repairs to the systems,” reads a flyer.

The addition of four new wells is expected to end the need for rationing by late May, said Alvarado. An emergency declaration by the governor last month for Ensenada made available 27 million pesos in state funds — about \$2 million — to open the wells.



“The desalination plant is insufficient; by the time it’s completed, we’ll need another desalination plant,” said Ensenada geophysicist Rogelio Vazquez. — *David Maung*

In August, construction is scheduled to begin on a desalination plant designed to convert seawater to drinking water at a rate of 5.7 million gallons a day. Built at a cost of \$46 million and scheduled for completion in 2015, it would be first large-scale plant in the Baja California.

“The desalination plant is insufficient; by the time it’s completed, we’ll need another desalination plant,” said CICESE’s Vazquez.

Ensenada’s crisis is not simply one of quantity, but of quality, Vázquez said. His studies have show that salinity levels in the municipal water supply in the southern part of the city are often more than twice the federally recommended levels.

## Handout #4 Baja Wine Region Faces High Taxes, Low Water Supply

**VALLE DE GUADALUPE, MX** - This [wine growing valley](#) near Ensenada lacks Napa's rolling, oak-studded hills. But it does look a lot like some of the wine valleys of Southern California. Sparsely vegetated, rocky slopes give way to rows of planted vines and occasional groves of olive trees rolling down towards the valley floor.

Baja California's budding wine industry has been gaining recognition in recent years. Mexican wines — mostly from Baja — picked up 12 medals at last year's [International Wine and Spirits competition](#) in Spain. But the region faces big obstacles to becoming the world-renowned winemaking region it aspires to be: high taxes and — the bane of all western farmers — a scarcity of water.

"We have good land and a very suitable climate," said Isabel Morales Ríos, coordinator of the [viticulture and oenology post-graduate program](#) at the Autonomous University of Baja California (UABC) in Ensenada. "But if we want to grow as an industry, we need water."

More than 60 wineries have sprung up here since the early 1980s. Morales puts the number of wine producers in the region at around 150, but not all have their own vineyards, and only about half are registered businesses.

The wine program at the university is one of the ways the region is trying to professionalize. [Victor Manuel Torres-Alegre](#) teaches at the school. He has a doctorate in oenology, or winemaking, from the University of Bordeaux in France. He also runs [his own vineyard](#), along with his family.

Torres-Alegre is a leader in the local industry's efforts to move from one filled with passionate, but mostly amateur artisans, to one recognized for its world-class, professional winemakers.



Photo by Jose Luis Jiménez

Above: "La Escuelita" winemaking school in Valle de Guadalupe, MX.

"We have producers here who are making really high quality wine," Torres-Alegre said. "But there aren't many of us."

Beyond educating the next generation of winemakers, the region has other, perhaps bigger problems: It competes for water with the growing [city of Ensenada](#).

A number of solutions to the region's water needs have been proposed in recent years, including building a desalination plant to supply Ensenada. The latest proposal is to pipe in gray water — water leftover from sinks and washing machines — from Tijuana to use for crop irrigation.

But concrete plans to deliver the precious liquid have yet to materialize. Without water, grape growers can't expand.

Baja California has about 8,000 acres of vineyards, compared to Napa's 45,000 acres. While there simply isn't as much land suitable for growing grapes in arid Baja, there is a lot more that could be planted.

Salt buildup is also a problem in the lower parts of the wine valleys. Salty soil can damage grapevines and decrease crop yield. It can also affect the flavor of the grapes.



Photo by Jose Luis Jiménez

Above: Victor Manuel Torres-Alegre in his newly constructed winery, which is made of adobe to keep the wine cool in hot weather.

And then there are the taxes. Currently, the sales and excise tax on wine in the state of Baja California is 41 percent. It was set to jump to 45.5 percent in February but the governor signed a last minute decree that postponed the tax on local producers for a year.

That tax “makes our wine a little more expensive compared with many other wines,” said Torres-Alegre.

In comparison, sales and excise tax on an equivalent bottle of California wine sold just north of the border, say in San Diego, is between 7 and 10 percent.

Alberta Ceja Medina is another leader of the Baja wine industry. She's president of the state grape producers guild, and she runs the [Xecue winery](#) with her husband.

Ceja is realistic about the possibility of getting taxes reduced for the industry.

“In the history of Mexico, a tax has never been removed,” she said, chuckling. “We're business people, we know we have to pay taxes.”

But she said there are other ways the government could help, for instance, by simplifying the paperwork winemakers are required to keep. And it could reinvest the taxes paid by winemakers in the form of credit back to the industry, she suggested.



Photo by Jose Luis Jiménez

Above: The cellar at the Torres-Alegre Winery in Valle de Guadalupe, MX.

Plus, they could speed up plans to find a new water source for the region.

There's a big market at stake. According to Ceja, only about 30 percent of the wine consumed in Mexico is produced in the country. The wineries around Ensenada make the vast majority of that wine.

“If we don't meet the demand, another country is going to meet it, or another state, another region,” she said. “The market is there. We're the ones who have to get moving — the state, academia and the businesspeople.”



## Handout #5: Mexico's Water Resource Governance

### Legal Framework

In 1992 Mexico made significant constitutional revisions that created the framework for the decentralization of water resources. The nation is deemed the owner all hydrological resources and sublevel entities are responsible for the provision of water and sanitation services. In conjunction with the constitutional changes a new water law (LAN *Ley de Aguas Nacionales*) was established that provided the policy, objectives and mechanisms for the management of water resources: The following principles summarize the new approach to water resource management in Mexico[Footnote].

- ***Water is the property of the nation:*** Article 27 of the Mexican constitution designates the federal government as the owner of all hydrological resources (rivers, aquifers, lakes etc...) within in the nation's boundaries. In addition the government maintains the authority to transfer water rights as water titles and thus operate as private property.
- ***River basins management:*** Water administration authority and management is transferred and divided into 13 hydrological administrative regions called "Organismos de Cuenca" (Figure 1). These administrative bodies are mirrored versions of the federal CONAGUA with the same structure and function. However, these bodies are not financially autonomous and thus depend on the support of the federal body.
- ***Integrated water resource management:*** Water management planning is coordinated between different sectors, agencies and administrative units. Each sublevel is responsible for integrated planning and reports that reflect the federal government's 2030 Water Agenda.
- ***Organized participation:*** Within these administrative units a variety of water user stakeholders representing different sectors are organized into "Consejos de Cuenca" (Figure 1). Irrigation users are responsible for managing irrigation networks through water user associations (*Asociaciones Civiles de Usuarios*). In areas where groundwater is the primary water source citizen-based groundwater user association (*Comites Tecnicos de Aguas Suterraneas--COTAS*) are organized to inform water users on aquifer conditions and regulations as well as monitor groundwater levels especially in overexploited basins.
- ***Federal concessions and public registry:*** In adherence with the LAN, the allocation of water rights is done through federally deemed concessions to private users and municipal and state entities; this also includes permits for wastewater discharge. Permits and titles are made public and thus transparent through the Public Registry of Water Rights (*Registro Público de Derechos de Agua—REPGA*).
- ***Priorities for water provision:*** As part of the National Water Agenda directive of universal coverage, a priority of use ranks water use by categories to ensure human consumption has precedence over all other uses. The following lists the priority order by category: Domestic, urban, livestock, agriculture, ecological conservation (environmental use), electric energy generation for public services and industrial use
- ***Water rights trading*** of concession titles. In areas where water resources are limited especially where new concession titles are prohibited, the transfer of water rights is made possible to maximize the economic value of the resource.
- ***Municipal provision of water and sanitation services:*** In alignment with the decentralized structure, Article 115 of the Mexican constitution designates municipalities as the providers and managers of water and sanitation services through direct management, municipally owned companies or private providers.
- ***Water use management to maintain or achieve water balance:*** government water management planning and actions attempts to address water sustainability through environmental regulations

and permits through CONAGUA. All levels of government have a role in determining environmental standards for water use and discharge.

In 2004 reforms were made to the National Water Law that gave greater administrative authority and legitimacy to the regional river basin organizations and river basin councils that are just now being played out on the ground in the policy planning and administrative duties arenas. The changes to the law were enacted to strengthen the roles and duties sub-national agencies and to fulfill the promise of decentralized governance. For example, the Baja California river basin council newly appointed presidency is no longer occupied by a CONAGUA official but instead a local resident and agriculturalist signifying a move toward greater authoritative autonomy.

Figure 1. Administrative-Hydrological Region 1: Baja California and River Basin Councils (*Consejos de Cuenca*)<sup>[Footnote]</sup>.

### Policy Instruments for Managing Hydrological Resources in Mexico

The 1992 new water law ushered in a suite of legal reforms that support the overarching policy objective of decentralized governance of environmental resources. CONAGUA is the federal agency with the greatest responsibility of administering and enforcing the laws related to water. Listed below are the policy tools, laws and management plans most relevant to the governance of water resources in Mexico.

### Water Management Tools

There are a variety of tools for managing water resources in Mexico that can be summarized into the following five categories: *Regulatory, enforcement, economic, participative*<sup>[Footnote]</sup> and *integrated*.

- **Regulatory measures** through concession titles, water use rights and in the case of groundwater systems there are three instruments to conserve overexploited basins and aquifers: prohibitions, reserves and regulations. Some of the more important federal regulations related to water resource management are listed below:
- **Enforcement measures:** Enforcement of the water sector regulations to control and manage the use and discharge of water resources is undertaken through field inspections, measurement of use and quality, and sanctions for misconduct.
- **Economic mechanisms:** The use of economic instruments to incentivize adherence to the established water resource policies and regulations follows the principles of “water user pays” and “polluter pays”. Some of the mechanisms used to manage water resources include but are not limited to: water fee collection, water rights transfers and water bank operations.
- **Participative institutions:** Participation across scales, sectors and society in the management of water resources is an important policy tool. Participation in the planning, policy development, and management takes place in a variety of contexts such as water user associations in irrigation districts, river basin councils (*Consejos de Cuenca*) and technical committees for groundwater resources (COTAS--*Comites Tecnicos de Aguas Subterranas*).
- **Integrated planning:** Each entity—Federal, state, regional, municipal and watershed (and in some cases urban centers) have their own hydrological planning reports that are integrated across institutional levels and agencies. Examples of some of the primary planning documents related to water resource management in the Ensenada Region are described by institutional level in following sections.

In these regions under prohibitive use status groundwater users are encouraged to organize and form a groundwater user association (COTAS). The local groundwater association is civilian based but receives financial and technical support from State and federal water agencies (CONAGUA). COTAS mostly function as advisory bodies to the local groundwater users on groundwater regulations and information on groundwater conditions. COTAS also conduct experiments and monitor groundwater levels and quality. However, there are some significant challenges to COTAS. First, COTAS are limited in their capacity to self-govern since they do not have the power to make and decide upon the rules to meet the needs of the local conditions and community. Second, COTAS are vulnerable to 'elite capture' particularly in regions of high economic development.

Local governance is a common approach to addressing environmental issues especially in rural areas in less developed nations experiencing 'Tragedy of the Commons' (Hardin 1968) or natural resource deterioration due to overuse. Local governance is promoted by researchers, development agencies (i.e., World Bank) and governments as a more democratic and efficient method for sustainable resource management (see Ostrom 1990). Local governance is also known as participatory management, community-driven development, collaborative governance among others. This case study takes a closer look at the conditions under which local governance may arise and some of the potential outcomes.

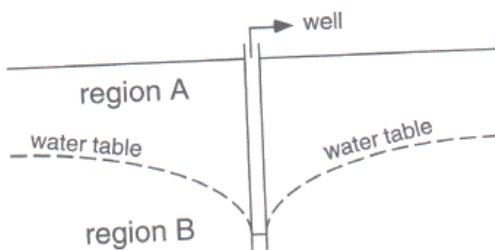
#### References

OECD, 2013. *Making Water Reform Happen in Mexico*, OECD Publishing. Available at: <http://dx.doi.org/10.1787/9789264187894-en>.

## Handout #6: Groundwater Hydrology Quiz

1. What is the process by which water enters the small pore spaces between particles in soil or rocks
  - a) transpiration
  - b) infiltration
  - c) precipitation
  - d) sublimation
2. How much of the Earth's water is stored in underground aquifers?
  - a) less than 1%
  - b) about 5%
  - c) about 10%
  - d) about 20%
3. Which of the following terms is a measure of the amount of water vapor in the air as a proportion of the maximum amount the air could hold at the same temperature?
  - a) dew point
  - b) sublimation point
  - c) evaporation rate
  - d) relative humidity
4. The percentage of a rock's total volume that is taken up by pore space is called the \_\_\_\_\_
  - a) permeability
  - b) recharge
  - c) aquifer
  - d) porosity
5. Permeability is \_\_\_\_\_ .
  - a) the ability of a solid to allow fluids to pass through
  - b) the process by which plants release water vapor to the atmosphere
  - c) the amount of water vapor in the air relative to the maximum amount of water vapor the air can hold.
  - d) the percentage of pore space in the rock
6. The best groundwater reservoirs have \_\_\_\_\_ .?
  - a) low permeability and low porosity
  - b) low permeability and high porosity
  - c) high permeability and low porosity
  - d) high permeability and high porosity
7. The ability of an Earth material to transmit water is a measure of its:
  - a) porosity
  - b) aquifer characteristics
  - c) chemical cement
  - d) permeability

8. The lowering effect on the water table about the base of the well stem is called a(n):
- aquiclude
  - artesian surface
  - cone of depression
  - speleothen
9. What is the difference between the saturated and the unsaturated zones of ground water?
- the saturated zone has a higher porosity than the unsaturated zone
  - the saturated zone has a lower porosity than the unsaturated zone
  - the pore spaces in the saturated zone are completely full of water; the pore spaces in the unsaturated zone are not completely full of water.
  - the pore spaces in the saturated zone are not completely full of water; the pore spaces in the unsaturated zone are completely full of water
10. The boundary between the saturated zone and the unsaturated zone is called the \_\_\_\_\_.
- water table
  - aquifer
  - aquiclude
  - porosity



11. In the diagram above region A is the \_\_\_\_\_.
- discharge zone
  - recharge zone
  - saturated zone
  - unsaturated zone
12. In the diagram above region B is the \_\_\_\_\_.
- discharge zone
  - recharge zone
  - saturated zone
  - unsaturated zone
13. Excessive pumping in relation to recharge can cause \_\_\_\_\_
- the water table to decline
  - a cone of depression
  - the well to go dry
  - all of these

## Handout #7: Communal and Indigenous Fact Sheet

Ejido El Porvenir:

Ejido Emiliano Zapata:

San Antonio Necua: [http://www.kumeyaay.info/san\\_antonio\\_necua.html](http://www.kumeyaay.info/san_antonio_necua.html)

<http://www.bajabound.com/bajaadventures/bajastoryteller/kumiai.php>

<http://www.kumeyaay.com/san-antonio-necua.html>

Gives a map of the region with other important hydrologic and geographic data (in Spanish); helpful for locating residential and ejido zones:

<http://gmaps.imipens.org/piame/>

Population statistics (you can use English version):

<http://www.inegi.org.mx/>

[http://www.inegi.org.mx/sistemas/consulta\\_resultados/iter2010.aspx?c=27329&s=est](http://www.inegi.org.mx/sistemas/consulta_resultados/iter2010.aspx?c=27329&s=est)

For water permit amounts (in Spanish—use internet Spanish translator and then select—city, aquifer etc:

<http://www.conagua.gob.mx/Repda.aspx?n1=5&n2=37&n3=115>

## Handout #8: Residential Fact Sheet

Residential use of water for San Antonio de las Minas (Villa Juarez), Ejido El Porvenir, Francisco Zarco (Guadalupe)

Some basic facts: [http://en.wikipedia.org/wiki/Guadalupe, Baja California](http://en.wikipedia.org/wiki/Guadalupe,_Baja_California)

Gives a map of the region with other important hydrologic and geographic data (in Spanish); helpful for locating residential and ejido zones:

<http://gmaps.imipens.org/piame/>

Population statistics (you can use English version): <http://www.inegi.org.mx/>

For water permit amounts (in Spanish—use internet Spanish translator and then select—city, aquifer etc.): <http://www.conagua.gob.mx/Repda.aspx?n1=5&n2=37&n3=115>

## Handout #9: CONAGUA Fact Sheet

Overview (can use English translation):

[http://es.wikipedia.org/wiki/Comisi%C3%B3n\\_Nacional\\_del\\_Agua\\_%28M%C3%A9xico%29](http://es.wikipedia.org/wiki/Comisi%C3%B3n_Nacional_del_Agua_%28M%C3%A9xico%29)

Website:

<http://www.conagua.gob.mx/home.aspx>



Handout #10: COTAS Fact Sheet

Local Groundwater Association/COTAS

Guadalupe Valley COTAS:

<http://www.cotasguadalupe.com/>

Article about Baja COTAS and link to wine industry:

<http://www.psmag.com/environment/vineyards-in-the-desert-15759/>

## Handout #11: Urban Users of Ensenada Fact Sheet

Intro to Ensenada:

[http://en.wikipedia.org/wiki/Ensenada,\\_Baja\\_California](http://en.wikipedia.org/wiki/Ensenada,_Baja_California)

Overview of issues and context of urban users in Ensenada:

<http://www.utsandiego.com/news/2014/apr/06/ensenada-mexico-water-shortage-desalination/>

Information on Ensenada's aquifer:

<http://www.reclaimedwater.net/data/files/239.pdf>

## Handout #12 Agriculture and Viticulture fact sheet

You tube video on viticulture and wine tourism in GV:

<https://www.youtube.com/watch?v=3Lr3Zkk6lCU>

and more of the same type of stuff:

<http://www.bajabound.com/destinations/bajawinecountry>

more on ag. in general:

<https://www.youtube.com/watch?v=q-bW1TxPe6o>

Ag. statistics:

<http://www.siap.gob.mx/cierre-de-la-produccion-agricola-por-cultivo>

Gives a map of the region with other important hydrologic and geographic data (in Spanish); helpful for locating residential and ejido zones:

<http://gmaps.imipens.org/piame>

Population statistics (you can use English version):

<http://www.inegi.org.mx/>

[http://www.inegi.org.mx/sistemas/consulta\\_resultados/iter2010.aspx?c=27329&s=est](http://www.inegi.org.mx/sistemas/consulta_resultados/iter2010.aspx?c=27329&s=est)

For water permit amounts (in Spanish—use internet Spanish translator and then select—city, aquifer etc:

<http://www.conagua.gob.mx/Repda.aspx?n1=5&n2=37&n3=115>

more info on water usage by water use category

<http://www.cotasguadalupe.com>

