

Can fine wines weather climate change?

RIISING TEMPERATURES IN THE COMING DAYS WILL SURELY CALL FOR GREATER EXPERTISE AND RESEARCH TO KEEP THE BEST VINTAGES ON OUR TABLES EVEN AS WE COPE WITH OTHER PRESSURES, WRITES S ANANTHANARAYANAN

Grapes are cultivated on 18 million acres worldwide, some 750 million quintals are harvested every year and the production of wine is nearly 30 billion litres. In comparison, the world production of wheat is 730 billion kg, or more than 20 times as much. But wine commands 10 times a higher price, on average, which makes it almost equally important a commodity. It is, hence, of economic, apart from great cultural interest to examine if global warming, which has threatened the survival of millions and the lifestyle of the rest, would spare this oldest of human industry.

Benjamin I Cook, climate scientist from New York, and Elizabeth M Wolkovich, biologist and ecologist from Boston and Harvard, describe in the journal *Nature Climate Change* their study of 400 years of vineyard records, mainly in France, and of one region in Switzerland, and also climate indicators covering the period, to assess the effect that changes in weather conditions have on the time of maturing of grapes and the implications these changes involve for the production and quality of wine.

While alcohol in the wine comes from the sugar content of grapes, the quantity of wine from an acre depends first on the sweetness and the quantity of the fruit. But apart from quantity, it is the quality of wine, as opposed to alcohol from other sources of starch or sugar, which lends wine its special place. And the unique quality comes from the thousands of other substances, acids, esters, aldehydes, aromatics, usually in traces, that form along with the alcohol to make up wine.

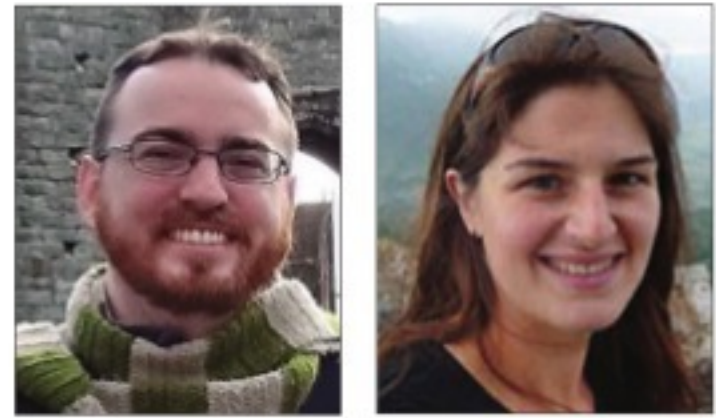
Traditionally, the quality of wine has depended on the strains of the grape, the nature of the soil, the finely developed process of wine making and, equally important, the timing of the budding of the vines, appearance of berries and their ripening, and also on a warm summer and



dry weather later in the season. Harvest dates, which are decided based on the maturing of grapes, have been consistently earlier during years with warmer summers, but delayed if there has been rain. And as for the quality of the wine, one source used by Cook and Wolkovich was Michael Broadbent's *Vintage Wine: Fifty Years of Tasting Three Centuries of Wines* that indicated that the best wines came from the years that had earlier harvests.

Growth of vines

In cold countries, where vines have traditionally been grown, budding, or the start of leaves, is soon after winter and a little later small flower clusters appear. While the energy for the budding is from the previous year's store, it is the new leaves and sunshine that drive further growth and the development of grapes. The first green berries that form are hard and high

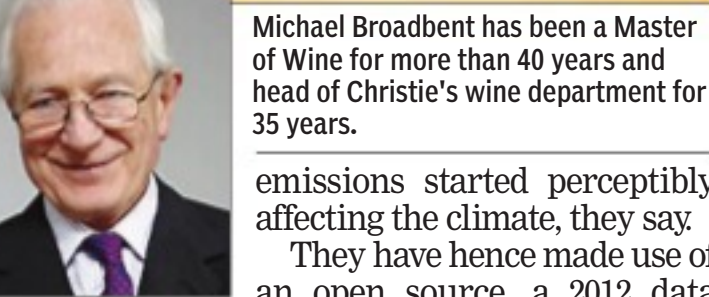
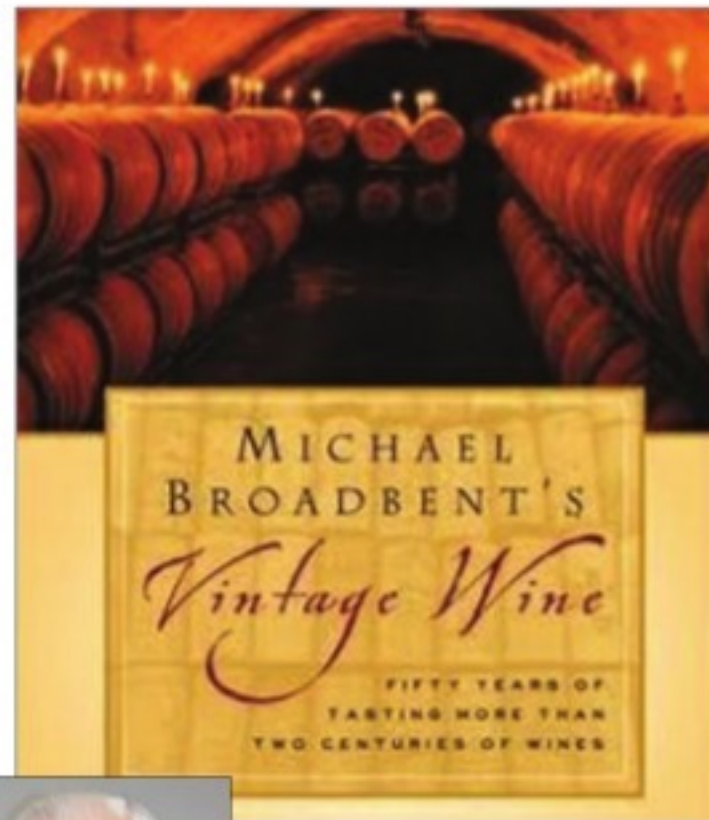


Benjamin I Cook and Elizabeth M Wolkovich

on organic acids till they reach about half their final size. At this stage, known as *véraison*, or ripening, there is a reduction of acidity and an increase of sugars and also the change of colour when chlorophyll in the green berries gives place to pigments, leading to light coloured or red and black grapes. As the sugar content increases, there are changes in cell structure that limit the uptake of water so that the sugar content is concentrated.

As can be imagined, a sunny, warm summer, accompanied by a dry later period makes for ample sugar formation and also limits dilution by water and, hence, readies the grapes for maturity. "This ensures the vines have sufficient heat and moisture to grow and mature early on, with dry conditions later in the year shifting them away from vegetative growth and towards greater investment in fruit production mid-season," the authors say in the *Nature Climate Change* paper.

There has been considerable research, the authors add, into how variations in the weather affect harvest dates and wine quality, but this has been only of recent time scales, some 30-40 years. Understanding how climate change could affect wine production would need study over a longer term, ideally earlier than manmade CO₂



Michael Broadbent has been a Master of Wine for more than 40 years and head of Christie's wine department for 35 years.

emissions started perceptibly affecting the climate, they say. They have hence made use of an open source, a 2012 data base, and a compilation on behalf of the European Geoscience Union, of harvest dates in different wine growing districts in France, Italy, Spain, Luxemburg and Switzerland, from 1600. The data base has been created from local vineyard and winery records, the oldest record seen being of 1354 in Burgundy. From this data, the researchers have created a table of average Grape Harvesting Dates over different regions in France (and one in Switzerland). The data of France, for the purpose of estimating the effect of climate change, has the advantage that cultivating practices in that country have remained almost unchanged (see box). In fact, the researchers say even irrigation, which would spoil the study by compensating for climate change effects, has not been used in France.

For the climactic conditions — of temperature, rainfall, soil moisture and drought — during all these years, data has actually been recorded since 2001 and this has been used. For the preceding period, they have derived the information from a variety of proxy sources; for example, a study of ring formation in tree barks is a record of annual rainfall in the region over the centuries. For the quality of wine during these years, during which the climate data had been collected, they used, as stated earlier, the 2002 compilation by Michael Broadbent. This record has the advantage of being an estimation of the whole series of wines by the same taster and, hence, a consistent standard of assessment.

The result of the data compiled is not basically different from what has been noted, that in the period from 1600 to 1980 and also for the period from 1981 to 2000, years of early harvest correspond to warmer than average conditions, getting more intense in the recent period when there has been major greenhouse gas-induced warming. But the difference is that the rainfall and the level of dryness or drought were consistently low during the good years, with high warming, during 1600 to 1980 — but not thereafter. After 1980, the need for dryness in the later part of the season, disappears — the rainfall is

Chaptalisation

Wine-making has been something of a sacred tradition, carefully controlled and preserved by regional communities in France. The protection of the name, or the appellation of products like cheese or wine of a region has been a practice even before such origin names were protected by law at the start of the last century. Wine-growers in a region, hence, had to abide by norms of a minimum separation between vines, control the use of water (which fattened the grape but diluted the juice), timely prune vines, and so on. Till after the French Revolution, even the dates of harvesting were prescribed by the community or the state.

The use of sugar to improve the quality of grape juice was strongly frowned upon and was even punishable by law. But recourse to adding sugar during the lean years was a necessity, as France would otherwise need to make huge imports if the summer was below par. Jean-Antoine Chaptal (1756-1832), comte de Chanteloup, was a man of science, later minister for the interior, under Napoleon, who perfected the process of adding sugar to poor grape juice, which was permitted when the vineyard had otherwise followed acceptable procedures. The process is now known as Chaptalisation.

marginally lower, but the drought condition, it actually gets a wee bit wetter!

This change is seen as a major one in the factors that drive the maturation of grapes post-1980. During this period, GHG gas forcing seems to be able to keep up the temperatures needed for maturation even without supporting low levels of soil moisture. There has, thus, been a "recent decoupling of wine quality and drought", the authors say. These observations, in the regions studied, are generally the same with other regions, they maintain. This is significant because the observations are being made over a range of conditions of growth of vines and grape, and sensitivity to changes in climate. Second, the consistency across sites rules out changed management techniques being responsible for the trends in harvest dates, rather than forcing by the environment.

Warm temperatures, thus, are the drivers for early harvests and quality wines and the relationship with drought appears to have weakened. This is not to say that drought or moisture would not be relevant, especially in dryer regions than France, there may even be the need for shading of vines when things get too warm, as is done in Australia. And there would always remain the need for monitoring and fine control measures after the grapes are crushed, to take care of the effects of a range of causes on the way from budding to harvest. Experience and knowledge at every stage, to guide the wine and its range of aromas and flavours to perfection, have always been valued and the role has been growing in its complexity. The rising temperatures in the coming decades in the world's wine-growing regions will surely call for greater expertise and research to keep the best vintages on our tables even while we cope with other pressures!

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PLUS POINTS



Total recall?

Researchers from the Massachusetts Institute of Technology and the Riken Institute in Japan report that they have been able to restore lost memories in mice using flashing lights and say that the lost memories of people with Alzheimer's may be retrievable.

The mice, which were genetically engineered to display Alzheimer's-like symptoms, were placed in cages and given mild electric shocks to their feet. This would cause healthy mice to respond with fear if they were put back into the cage, but the genetically modified animals appeared to have forgotten the experience and showed no fear when placed in cages again.

Patients with Alzheimer's will display shrinkage in the hippocampus region of the brain, which plays a part in the formulation of memories, so the researchers used flashes of blue light to stimulate cells in this region, encouraging the growth of neural pathways. Following light stimulation, the mice that had displayed evidence of "lost" memories began to show fear when placed in the cage — indicating the memories had returned.

Professor Susumu Tonegawa, who led the research, told *The Times*, "Even if a memory seems to be gone, it is still there. It's just a matter of how to retrieve it." The method of stimulation used is invasive and cannot safely be used in humans, but he said the research was "proof of concept" and indicated that supposedly "lost" memories in Alzheimer's patients may be recoverable if a safe treatment can be developed.

ELSA VULLIAMY/THE INDEPENDENT

Bhutan's quest

Shrinking glaciers, a changing economy and environmental worries are forcing the Bhutanese to question whether their dependence on hydropower is the



realistic way forward. The winner of the INASP/SciDev.Net data challenge is a story of a Solar Water Heater installation at the Tenzinling hotel in Paro. The hope is to encourage similar domestic installations throughout the country.

30 years ago, Bhutan, a country of around 780,000 people, saw an opportunity to move away from an agriculture-based economy by harnessing fast-flowing rivers and mountainous gullies to produce valuable hydroelectricity. Mainly funded through grants and loans from India, five major hydroplants around Bhutan now produce up to 1,500 MW, about five per cent of its potential hydroelectric capacity of 30,000 MW. As part of an ongoing cultural and economic relationship between the two countries, during 2015-16, Bhutan will receive just under \$100 million from India. In return, Bhutan exports roughly 75 per cent of its hydroelectricity to its energy-hungry neighbour.

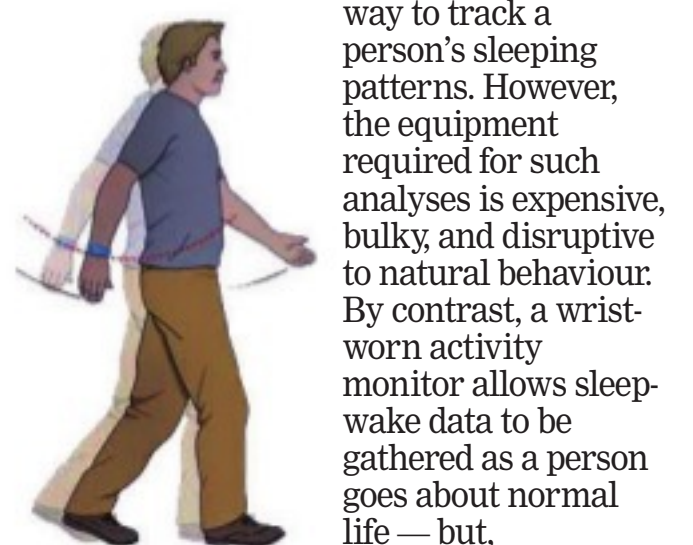
This large supply of clean energy encouraged the two countries to commit in 2009 to producing 10,000 MW in Bhutan by 2020, including plans to build an extra 12 plants. The first, Dagachhu in Dagana, began operating in 2015.

SCIDEV.NET

Tracking sleep

Polysomnography — the combined assessment of brain waves, heart rate, oxygen saturation, muscle activity, and other parameters — is the most precise way to track a person's sleeping patterns. However, the equipment required for such analyses is expensive, bulky, and disruptive to natural behaviour. By contrast, a wrist-worn activity monitor allows sleep-wake data to be gathered as a person goes about normal life — but, unsurprisingly, the information is far less accurate.

With researchers searching for ways to improve the accuracy of wearable devices while maintaining user-friendliness, Maria Angeles Rol of the University of Murcia in Spain and her colleagues have now discovered that by using a device strapped to the patient's upper arm that measures both arm activity and position (the degree of tilt), they can more precisely detect periods of sleep. That is, when individuals wore both a wrist activity monitor and the upper-arm monitor for a period of seven days, data from the latter correlated better with the subjects' own sleep diaries.



THE SCIENTIST

SPECIALISED PARASITES

TAPAN KUMAR MAITRA DWELLS ON FUNGAL AGENTS THAT CONTROL HARMFUL INSECTS

There are more than 530 known species of microscopic fungi that infect insects and this process mainly occurs through the integuments of insects' bodies and, to a smaller extent, with their food. Of great significance in limiting the population of harmful insects and the origination of mass diseases are entomophorous fungi of the class of phycmycetes. These are specialised parasites and kill insects of 12 orders. Fungi cause mass diseases of locusts, brown-tail moth caterpillars, pine noctuids, diamond-back moths, grapevine and various species of aphids, apple tree leaf-hoppers, etc. These can scatter their conidia over considerable distances, which facilitates the rapid spread of the infection, and are capable of surviving in unfavourable ecological conditions even in the absence of the objects infected owing to the presence of dormant phases in their development cycle.

Muscardin fungi relating to the class of imperfect ones are encountered widely in nature. The mass diseases these fungi caused are observed quite often and the prerequisites for their development are a weakening of the population and favourable conditions (temperature, humidity) of the environment. One of the most widespread pathogens of this group is the fungus *Beauveria*, infecting about 175 species of insects, including apple worms, stalk borers, Colorado beetles and pentatomids. The green muscardine fungus infects 75 species of insects whose pre-imaginal stages of development are associated with the soil.

Among the fungal agents, beauverin is recommended for plant protection. This control agent is a white powder consisting of conidiospores of the white muscardine fungus *Beauveria bassiana*, Vuill and a kaolin carrier. One gram of the agent contains 2,000-6,000 million spores of the fungus causing the insect disease white muscardine. Beauverin must be stored in premises at humidity not over 70 per cent and temperature from 15°-18° Celsius, and storage period does not exceed six months. It is especially sensitive to increased humidity because the swelling and germination of the fungus spores in these conditions leads to their losing vitality. Beauverin may be used in combination with most insecticides and acaricides but its combination with fungicides is prohibited. It has a low toxicity to humans and warm-blooded animals, but when it gets into the respiratory tracts in the production of the formulation, its spores cause allergic diseases in some people.

Upon germination, the fungus *Beauveria* penetrates through the cuticles of insects into the hemolymph. In this connection, plants must be treated so

that the formulation gets onto the insects' bodies. When beauverin is applied, insects perish as a result of toxicosis, because of the active development of the fungus in their bodies and because of the growth of the mycelium in the hemolymph and the tissues. The effectiveness of beauverin may also manifest



Grasshoppers killed by *B. bassiana*.

itself in its after-effect: the infected insects perish in subsequent stages of development (pupa, imago). The formulation may lower the fertility of insects and their resistance to low temperatures in winter. Beauverin can also act as a stomach toxicant, killing weakened insects, so it should be used in combination with small additions of insecticides.

To control the Colorado beetle, beauverin is applied by spraying crops with a suspension mixed with small doses of trichlorfon. The components are mixed when preparing the working suspension and the dose is one-two kilograms and of 80 per cent trichlorfon (the technical product or wettable powder) is 0.4 kg/hectare.

The use of beauverin in combination with small doses of insecticides ensures the death of 90-96 per cent of the larvae of Colorado beetles.

BIP is an active ingredient that consists of the live spores and insecticidal crystals of the bacterium *Bacillus thuringiensis* var. *causasicus*. It is formulated as a dry powder or a liquid substance. It is harmless to humans and warm-blooded animals and its storage period is one year at not over 40° Celsius. It is recommended for controlling cabbage and fruit pests with ground spraying.

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A homophobia row

SALLY GUYONCOURT REPORTS ON CLAIMS BY CERN'S LESBIAN, GAY, BISEXUAL AND TRANSGENDER MEMBERS THAT ABUSE HAS BEEN GOING ON FOR YEARS

One of the world's largest projects for scientific cooperation, the Cern laboratory in Geneva, has become embroiled in a divisive row over homophobia. The European particle physics laboratory has garnered international fame for its work at the Large Hadron Collider; a vast underground circular tunnel where, in 2012, scientists used a particle accelerator to prove the existence of the sub-atomic Higgs boson particle. But its reputation as a cooperative community of scientists from all over the world has been dealt a blow after allegations emerged that a spate of homophobic incidents had taken place at the laboratory.

At least one researcher is reported by *The Sunday Times* to have been formally disciplined after CCTV cameras caught them defacing posters advertising Cern's Lesbian, Gay, Bisexual and Transgender club events. Cern's LGBT group members claim the abuse has been ongoing for years, with posters defaced with words such as "Schwein" (German for pig) and Old Testament biblical quotations describing sexual relations between men as an "abomination" for which they should be "put to death".

British physicist and founder of LGBT Cern group Aidan Randle-Conde told the newspaper, "The continuing defacing of our posters is an unacceptable campaign of hate and intolerance. We do keep a track of how many posters get taken down or defaced and over a two-week period roughly one-third can be removed. I don't know who is responsible, although it is probably the work of a few people. In some cases there have been religious texts attached to the posters."

The abuse became so bad last year that Cern's then director-general Rolf-Dirter Heuer warned all staff that they would be "dealt with accordingly" if there were further "acts of defacement to the LGBT community's posters". Despite the warning, problems appear to have continued and last month

Cern's director of human resources issued a second caution to all staff.

A recent blog posted by the LGBT Cern group marking its fifth anniversary also referred to the problem on site. It read, "In a lab of thousands of people from all over the world and of all ages, it is not surprising to find a small minority who have a problem with our group. They have always been at the lab; the difference is that now they are making themselves known."

A Cern spokesman told *The Sunday Times*, "Cern really cannot accept something like this and it is why we have taken disciplinary measures against at least one person we could identify as being responsible for these disrespectful actions. Homophobic behaviour is not and will not be tolerated at Cern." Both Cern and LGBT Cern were unavailable for comment when contacted by *The Independent* on 20 March. Cern, the European Organisation for Nuclear Research, was created in 1954 on the Franco-Swiss border to investigate the basic structure of the universe by studying what makes up matter.

The laboratory now has more than 10,000 scientists and engineers from 21 countries working on the project. One of the most significant by-products of its work has been the creation of the world wide web by the British scientist Sir Tim Berners-Lee.

THE INDEPENDENT



A scientist at Cern's Large Hadron Collider, which in 2012 proved the existence of the Higgs boson.