Mediterranean

Warm M: mild winters, hot dry summers, high levels of sunshine

- Southern France (Languedoc-Roussillon)
- Cornas: warm Medi bc natural south and east facing amphitheater with some steep slopes - first Syrah to ripen in NR
- Southern Rhone
    - Provence: dry warm Mediterranean
- Greece except inland (continental)
    - Macedonia - plains: warm Mediterranean, rain shadow of mountains drier
    - Nemea: most rainfall in fall (can dictate harvest times) & winter but varies year on year (400~900mm) -> in dry years vineyards on clay are better able to cope than those on more free-draining soils
- Chile: warm long dry sunny growing season, cooler/wetter further south
    - low alt: intense sunlight
    - Rainfall: northern/inland drier 80mm in Elqui, coastal/southern wetter 1200mm in Bio Bio (as do other Pacific countries, affected by) El Nino - rainfall; El Nina - drought +increasingly planting in more climatically extreme parts of the country => vintage variation significant
    - most vineyards within valleys east to west thus most of the climatic variation in Chile's wine-growing regions also occur from east to west
    - Pacific Ocean and Andes: cooling influence at either end -> longer growing season -> retain acidity and aromas
    - a significant stretch of the coast runs a range of low mountains (300-800) forming a barrier against the ocean influence <- vineyard to the west of these mountains are fully exposed to ocean influences
    - Humboldt Current flows up from Antarctica bringing cold water -> cool air, warm air rises from the land during the day, this cool air is sucked inland -> morning fog that moderates temp,increases humidity

    - The coastal range and the Andes effectively merge to the north of Santiago (in Coquimbo andAconcagua) but to the south they part to create a large, dry, warm and sunny central valley forbulk wines
    - fogs and cool breezes can enter the valley via gaps in the coastal ranges, moderating close vineyards
    - Planting on the slopes of the coastal ranges or on hills in the valleys: cooling influences by altitude or aspect: higher quality
    - east: a number of vineyards planted on/near the foothills of the Andes. Cool mountain air descend overnight -> high diurnal ranges, and altitude moderates temperatures
- east coast from Catalunya in the north to the Levante further south in Spain: warm Mediterranean
- much of coastal CA
- South Eastern Australia
    - Fleurieu Zone, south of Adelaide, of warm Mediterranean climate with a strong maritime influence
        - McLaren Vale
- South Africa
    - most regions cooled by proximity to ocean
    - main cooling influence cold north flowing Benguela current from South Pole plus warmer
    - Mozambique current from Indian Ocean: lower water temps between Cape Town and Cape Agulhas
    - large diff temp diff btw ocean/land: regular beneficial coastal fog/cooling breezes
    - Cape Doctor: south-easterly wind during spring/summer: extends impact of Benguelacurrent, inhibit disease, bring rain to South Coast, damage leaves, affect photosynthesis, ripeness, flowering process, berry set, reduce yields
    - spring frost a problem esp in Breedekloof ward (not regular)
    - lack of winter breeze: vines failing to rest over winter
    - rains in May/August, normal years adequate for grape growing >700mm but reduces in the north (Benguela current, mountain rain shadow) thus irrigation or old vine essential
        - drought made water a priority
        - drip irrigation

        - Swartland dry farming dominant
- Central Italy
    - Tuscany - warm M
        - adequate rainfall most in autumn and winter, normally during growing season too
        - summer drought and high temps (cessation of photosynthesis -> incomplete ripeningof skins and seeds) can be hazards in some years
    - Marche: hot summer, little rainfall
        - inland west of Ancona more continental with dry summers
    - Lazio: warm M
        - moderated by alt on low hills by cooling winds from sea: thus grapes ripenregularly
        - hazards from climate: occasional spring frost, hail, excessive heat in summer and rain duringharvest
        - rainfall normally adequate with little falling in summer months, reducing threat from fungaldiseases
    - Abruzzo:
        - hillside continental
        - Coastal: maritime or Mediterranean, lower risk of spring frost and rain at harvest,
- Southern Italy
    - Compania: warm M, inland sites at alt 600m
    - Basilicata: warm M cooling influences from alt ~600m: wide diurnal range; breezes fromBalkans another cooling influence — retain acid, extend growing season, high aromaticintensity
    - Puglia: HOT M moderating breezes from sea, suited for bulk production as lowrainfall low risks of fungal fertile soils irrigation permitted
    - Sicily, Sardinia: warm M
- south/east of Spain faces onto Mediterranean close to sea, moderated climate, warm dry summers, mild winters
    - Rioja: northwest to southeast along River Ebro - Mediterranean influence on eastern side of Rioja
    - Navarra: influnces from Atlantic Ocean, Mediterranean Sea, Pyrenees to northeast

- Catalunya - northeast Mediterranean coast + alt inland moderating influence
- Penedes: warm M
  - Penedes Maritim
    - btw sea and coastal range of hills
    - low altitudes, close to sea: warm climate without temp extremesfull body reds from late ripening grapes eg Monastrell
    - some Xarel-lo Macabeo, Parellada for inexp wines
  - Penedes Central
    - flat plains "Pre-Coastal Depression" btw coastal range and inland mountains
      moderately high altitudes ~500m: some cooling influence
    - large plantings of Xarel-lo, Macabeo, Parellada, Merlot, CS,Tempranillo, Chardonnay
  - Penedes Superior
    - alt 500-800m - cooling inf, high diurnal range, spring frost - inland whites Chard, SB, (smaller amounts) Riesling and Gewurztraminer, PN
    - rainfall 500mm dried in summer - irrigation allowed with authorization from Consejo Regulador if vines suffer from water stress
    - loamy soils with calcareous components: can store enough water through ripening
    - many (large) vineyards trellised for mechanization but many bush vinestoo
- Montant: more Mediterranean than continental Priorat of high elevation plateau
- Alicante: hot summers and cold winters, growing season extremely dry withavg 250mm of rainfall per year
- Dao: overall Mediterranean climate: warm dry summer mild winters, high rainfall 1600mm per annum west of region, 1100mm east, mainly in autumn and winter
- Alentejo:

        - Mediterranean, hot summers, mild winters; inland parts with extreme temps;
        - rainfall 500mm south 800mm north mainly in autumn/winter -> long periods of dryweather, drip irrigation widely used;
        - plains and gentle slopes, some mountains in the north, south, east of the region;
        - wide range of soils: granite, schist, limestone textured from sand to clay;
        - double cordon with VSP mostly, replacement cane systems on decline due to greater skillsrequired during pruning
    - Peninsula de Setubal
        - Mediterranean: hot dry summers, mild wet winters: Mountains in the south provide cooler sites at higher altitudes on clay-limestone soils. Much of the land in the region is flat and sandy, with more clay and schist further inland
    - Tejo: inland from Lisboa
        - M, 750mm
        - north higher rainfall with clay-limestone and schist soils -> red wines
        - around the river, fertile alluvial soils -> vine vigour carefully managed -> white wines
        - south - driest and hottest, poor sandy soils -> red and white wine
    - Valencia: warm M with cooling inf from alt or close to coast, rainfall low at 450mm, irrigation widely used
        - Alto Turia sub zone:
            - southern foothills of Sistema Iberico mountain range in upper valley of River Turia
            - alt 700-1100m, coolest area and almost exclusively produces white wines, most notablyfrom Moscatel de Alejandria and Merseguera [low intensity aroma if high vigor notcontrolled, oft blended with other varieties]

            - wines made from dry farmed vines at high alt in VP El Terrerazo owned by BodegaMustiguillo can show more concentration and texture esp matured in oak
        - Valentino sub zone
            - alt 200-650m, warmer than Alto Turia, cooled by sea breezes
            - grows a diverse range of local and int'l varieties eg Garnacha Tintorera (AlicanteBouschet), Tempranillo, Cabernet Sauv, Monastrell for red/rose, Merseguera and Macebeofor white wines
        - Clariano subzone
            - south of Valencia, ~Valentino sub zone
- Australia coastal: Mediterranean influence
- California overall
    - Central Valley: Lodi AVA
        - HOT M, moderated by cooling afternoon winds from SFB and Sacramento-San Joaquin delta

Continental

Moderate C: cold winter, hot summers

- inland Greece eg spring frost in north is Amyndeon
- Central Otago of NZ: sheltered from ocean influences by mountains Southern Alps on all sides is semi-continental
    - dry 360mm rainfall: irrigation necessary, reduced risks of fungal diseases - good conditions for organic/biodynamic
    - warm dry summers, long daylight hours, high UV levels: canopies carefully managed withgrapes shaded on west facing side to protect from sunburn
    - most sites > 300m alt, shelter from maritime influence: high diurnal range to preserveacidity, delicate fruit/floral aromas
    - cold nights - spring frost: helicopters to mix colder and warmer bands of air to prevent frostdamage

    - gravel to clay, with schist as the parent rock, low in organic matter: compost and covercrops widely used to improve nutrient levels and soil structure
- NZ: South Island - Marlborough
    - 2410 sunshine hours per year, cool continental, moderaely warm summers and mildwinters, protected from rains by mountain ranges, 650mm rainfall, free draining alluviasoils - irrigation important and underground aquifers providing the main source ->grapes onvine well into autumn -> intensely flavored fruit with long dry growing season less fungaldisease pressure
    -
- Burgundy:
    - **Chablis** - cool continental
        - uncertainty about ripening
        - vintage variations [Chard - early ripening being an advantage]
        - 670mm annual rainfall throughout the year -> high threat fungal diseases and difficulties leading to harvest (threat of rot)
        - region vulnerable to spring frosts and hail storms
    - Cote d'Or - moderate continental:
        - cold winter, warm summer, short summers make early ripening Chardonnay and Pinot Noir suitable varieties moderated by the protection of the Morvan hills to the west 700mm rainfall
        - Early autumn is typically dry, rain can be a threat at harvest
        - climate of the Mâconnais is typically slightly drier and hotter than Côte d'Or
- Northern Rhone: moderate continental: cold winters, warm summers, adequate rainfall in autumn and wintercold Mistral wind from north: reduces fungal disease, vine vigor -> lower yields, higher concentrationin wines at lower production; better ripening in the southern part
    - Croze-Hermitatge:
        - north sector of AOC: steep slopes, continental climate with marked Alpine influences: extremelycold in winter, with

strong influence from Mistral, long growing season, high diurnal range,moderate sugar accumulation, retained acidity
        - southern sector: more temperate, heavy rainfall in late autumn and through winter, flattervineyards used to be dominated by orchards and farmsteads, soils deeper more fertile than inHermitage thus lower concentration
- Beaujolais: moderate continental: slightly warmer than rest of Burgundy adequate rainfall 740mm, Saone River as a moderator of extreme temps, subjected to cold Mistral winds affecting flowering in cold damp spring weather -> damage leaves and grapes towards end of ripening when Gamay's naturally thin skins most vulnerable <- vine orientation and training low to the ground important to reduce;
    - northern part hilly (Crus and Villages AOCs) at 200-500m with fast draining granite,schist, and sandy soils;
    - south and southeast facing slopes for max sun exposure -> harvest usu earlier thanBeaujolais AOC from flatter southern part where richer soils
- Champagne - cool continental
- Languedoc:
    - Pic Saint-Loup AOC: more continental than elsewhere in Languedoc: cold winters, warm summers,1000mm per year rainfall: ~northern Rhone; Syrah does well here: min >= 50%; red/rose only
- Alsace: cool to moderate, semi-continental
    - continental climate with cold winters and warm, sunny summer, Westerly winds carry rain clouds but much of the rain falls on the western side of the Vosges Mountains -> 600mm rainfall (august, sep, oct -> issues at flowering and fruit set,less so harvest) - less than half on the other side -> summer drought [irrigation is not permitted for AOC wines]
    - high sunshine hours, important to ripen grapes at this northerly latitude
    - drying influence is the Föhn wind - a warm wind that both raises the temperature andreduces the incidence of fungal diseases
    - marked diurnal temperature difference esp on higher sites -> retain acidity

- Central vineyards of Loire (except Nantais): cool continental
    - Touraine (continental, not as extreme as central vineyards) 700mm
    - Central vineyards: continenal high rainfall 750mm spring frosts, summer hailstorms; long growing season day lengths [vs Bordeaux, Marlborough] with low light intensity, low heat -> restrained flavors
- Jura(, Savoire)
    - continental, high rainfall at 1100mm per year during growing season (exacerbated by heavy claysoil) -> threat to flowering and fruit set -> reduce yield;
    - extra work to control weeds and combatfungal diseases; spring frost; hail; vineyards on west-facing slopes;
    - altitude 250-400;
    - soils mainly clay and marl, limestone someplaces grassed between rows to reduce erosion and limit herbicide use (such that herbicides can belimited to the ground immediately below the vines) mostly replacement-cane pruned at some height above the ground to mitigate frost risk;
    - VSP to encourge air flow to reduce fungal diseases machine harvest more popular except steep slopes
- Canada wine regions
    - Ontario and inland British Columbia: extreme continental climate -> most Canadian vineyards around planted near lakes which moderate temperatures [Winter: the lake effect reduces the risk of winter freeze. Spring: the waterheats up slowly delaying budbreakusually until after the risk of spring frosts has passed (though occasional frosts late in thespring cansometimes be an issue). It then retains summer warmth into the autumn,extending the growing season.]
    - Snow from moisture from lakes evaporating/meeting ambient cold air -> protect vines and insulate from cold air, tho in coldest areas eg Prince Edward County, winter freeze is aconcern
    - climate change -> unpredictable winters, sometimes minimal protective snow cover
    - lakes: higher levels of humidity -> risk of fungal disease

- drought a regular concern in inland regions of BC in rain shadow of two mountain ranges,could be an issue in hotter drier years in Ontario
- 41-51N, northerly limit for viticulture: northerly lat esp in BC makes for a shorter growingseason but compensated for by longer daylight hours in summer than more southerly wineregions eg US
- Ontario: vineyards mainly planted on or near the shores of two of the Great Lakes - Erie and Ontario
    - moderating the extreme continental climate, further away from the lake would be too coldfor vinifera to survive
    - Soils: clay, sand, less of gravel and rocks, areas around the lakes have a high concentrationof limestone
    - Niagara Peninsula
        - largest wine producing region in Ontario >= 80% of vineyards
        - major influence from Lake Ontario and Niagara Escarpment: (Ontario thedeepest of the Great Lakes thus takes longer to cool down in autumn) aid aircirculation; during winter land away from lake cools quickly, cold air flowsdown slopes of escarpment, warm air from lake rises and flows inland thuswarming air flow in winter and cooling air flow in summer -> prolong growingseason, reduce risks of fungal disease and frosts
        - escarpment also protects from southwesterlu winds
        - on top of escarpment, climate more continental with warm summer temp andcold winters
- British Columbia: Okanagan Valley:
    - wide range of climates from cool northern end to hot desert south, most soils are glacial deposit esp loams, increasingly sandy in south thus irrigation essential
    - a chain of lakes moderate hot summer and cold winter temp, most important the deep Okanagan Lake the northern half of vineyard area much smaller than the Great Lakes in Ontario thus smaller moderating effect

        - lakes also provide water for irrigation essential as annual rainfall 300mm south400mm north tho dry conditions reduces pest/disease pressure thus organicviticulture on the rise
        - Extreme continental climate: cold winter not so cold to bury vines, spring frost aconcern thus vineyards on mid-level slopes to reduce risks
        - growing season short with long days, hot summers despite lake effect
        - alt 300-600m cool nights and wide diurnal range
        - northern end of valley where east facing slopes shadede from afternoon sunconditions more suited to cool climate varietals eg PN, Chard, PG, Riesling,Gewurztraminer
        - hotter southern area better suited to black varieties
- China: marked continental climates with very cold and arid winters
    - in most regions vines have to be buries as early as Nov to survive low winter temp and aridconditions as vines underground retain more water
    - heavy summer rains also affect most regions though in some total rainfall small
    - very different climates bc vastness
    - Beijing, Heibei - coastal: humid continental warm humid summers and cold winters with torrential rainin Aug-Sep, overall rainfall low at 200-300mm per year, cool Pacific breezes moderate the warm temp and reduce the humidity level
    - Shanzi and Shaanxi: Inland, central: dry continental, <500mm per year, higher humidity in more southerly Shaanxi - more fungal diseases
    - Ningxia: well inland, arid continental, climate ~200mm per year with monsoon rains, very windy conditions, exacerbating dryness, essential irrigation water drawn from Yellow River, best area considered to be in the Helan Shan (Helan Mountains) where mountains protectfrom the worst of the northwest desert winds
- Argentina:
    - combined influence of altitude and latitude: at low lat, altitude ensures cool - vineyarads infoothills of Andes in west of country

except Patagonia, 500->1000m above sea level(highest ~3300m), most vineyards on flat or gently sloped sites
- key effects of altitude: wide diurnal temp range (>20C in many places), cooler night time temp extends growing season and allow grapes to retain acidity/aroma
- combined effect of low lat and high alt results in intense sunlight, a relatively high proportion of ultraviolet radiation due to high altitude -> grapes with higher levels of tannins/anthocyanins
- majority region: continental climate (tiny number of plantings in coastal areas)
- in the rain shadow of Andes -> rainfall very low some places <200mm/year - desert-like ->irrigation essential; drier air reduces disease risks
- zonda blowing down from mountains along the valleys - HOT DRY POWERFUL WINDin late spring and early summer - lowering humidity, induce water stress in the vine, affectflowering, fruit set, or grape damage if strong thus reduce crop <- trees as windbreaks
- Rain usu in summer, hail is constant threat, reducing yield in some years <- netting(expensive), and many growers in Mendoza own vineyards in different parts of province tomin risk of hail damage
- Frost significant problem in some areas of Mendoza usu flat or bottom of slopes throughoutthe region regardless of alt affected by El Nino phenomenon every 2-10 years: much higher rainfall, hailstorms,damaging crop, increasing disease risks, reducing harvests
- alluvial soils deposited by rivers down from Andes
    - texture varies: larger stones with calcareous deposits dominate higher alt closer to Andes;
    - middle areas dominated by gravel, sands, silts; lower areas: deeper loamy-clay soils, richerin nutrients
    - bc dry continental climate: little organic matter from decomposed flora and fauna -> poorsoils in higher alt, optimal for naturally low yielding vines and high quality

viticulturewith increased investment, increased interest in how texture/composition of soil affectswine
        - Deposits of calcareous soils in Gualtallary and Paraje Altamira in the Uco Valley, the
        - Pedernal Valley in San Juan -> high quality wines
- Portugal inland
- South Africa
    - Breede River Valley Region
        - warm dry region produces the most wine in SA at high yields, high vol grapes for wine andspirits (distillation industry), also some high quality estates
        - irrigation with water from Breede River
        - District: Breedekloof
            - upper Breede River, ample rainfall, irrigation not needed - diff fromWorcester/Robertson
            - Winter/spring snows delay budburst and spring frost damages buds
            - warm continental: long hang time, later harvest
            - cooling summer southeast winds moderate temp and reduce fungal diseases
- Central Spain
    - Priorat
        - warm continental, protected from cold wind by Serra de Montsant to north andfrom Mediterranean influence by Serra de Llaberia to south
        - hot summer, high diurnal range, cold winter spring frost a problem
        - rainfall 500-600mm mainly heavy storms in winter/spring, dry summers,irrigation permitted in driest years for newly established vineyards
        - River Siurana runs through - broad range of alt/aspects, rugged topographyjust under 2000ha under vine
        - many sites on slopes "costers" 5-60% gradient, narrow terraces: reduce soilerosion and allow rainwater to better iinfiltrate soils, reduce surface run-off
        - no machine access

        - old vineyards planted to low density with bush vines, newer vineyards VSP trellised where terrain makes it possible, but large areas of high densityplantings rare
        - varied soils largely poor and stony but some outcrops of clay
            - slate-based llicorella: thin rocky low in nutrient with mica reflectinglight and heat back onto vines
            - bedrock of slate splits into vertical layers: vines can grow deep in searchfor water
            - low nutrient and water levels: low yields per vine esp old vines
    - Monstant
        - more Mediterranean than Priorat bc proximity to coast despite some shelter from Serra de Llaberia so not as extreme temps
        - warm dry summers, most rain in winter/spring
        - some vineyards in more mountainous north at higher alt 300-700m cooler tempmix of soils
    - Costers del Segre DO
        - further north, 7 subzones
        - continental climate hot summer, cold winter, annual rainfall 500mm
        - alt 200-700m, cooler higher sites for Cava, whites, early ripening blacks for still wines
        - sandy soils free draining, low annual rainfall: irrigation needed in most sites
- Spain:
    - North/northeast sheltered somewhat from Atlantic by mountains, continental, tho some maritime or Mediterranean influences
        - Ribeira Sacra DO
            - further inland, along River Mino and River Sil
            - continental climate, can have maritime influence
            - many sites on deep valley sides at various alt and aspects
            - stony slopes: good drainage, conduct heat during the day but make viticulture labor intensive

        - Valdeorras DO
            - further up River Sil
            - most easterly of Galician DOs
            - continental climate plentiful rain 700-1000mm
            - sites at 300m
            - known for slate mining, but soils diverse
            - known for very good Godello: citrus, stone, herbal, wet stone, med+ acid, some $$$$ ferment/agein oak for texture/toasty/spicy
            - Mencia most important black but little planting cf Godello
        - Monterrei DO
            - south of Ribeira Sacra bordering Portugal
            - inland and sheltered from ocean influence by Sierra de Larouca mountains: continental climatewith hot summers, low rainfall
            - most inexpensive but starting to make good quality Mencia usu riper than Ribeira Sacra
            - some fruity Godello
    - Castilla y León
        - high alt plateau with mountains north/southcontinental, with maritime influences towards west
        - Toro DO
            - inland, continental, high altitude 620-750m, large diurnal range, without any moderatinginfluences, spring frost can be a problem
        - Castilla y Leon VT: northern part protected by mountains from any Atlantic influence to the north continental moderated by alt
    - Meseta alt 600-900m, continental, hot days, cool nights
    - Topography: a high plateau tilted from north-east (Pyrenees) to south-west (Andalucia), withlower ground formed by several major rivers along which many wine-growing regions
    - Rioja Alta
        - largest, south of River Ebro, west of city Logrono continental with some maritime influence

        - area around River Ebro low alt, warm, alluvial soils northwest corner cooler wetter, calcareous clay southern higher alt 700m, cool wet, ferrous clay
    - Aragon
        - Somontano DO: at the foot of Pyrenees
            - warm continental climate, rainfall slightly higher than Carinena, CdBorja, Calatayud, and more evenly spread over time
            - 350-650m alt, slightly lowering temp large diurnal range, cold breezes from Pyrenees moderates temp too
    - Murcia & Valencia: Mediterranean or continental depending on exposure to coast: all with hot summers and low rainfall
        - Utiel-Requena DO:
            - inland from northern part of Valencia DO, western limit bordering La Mancha 34,000 ha
            - continental climate with hot summer days and very cold winters
            - avg alt relatively high at 750m: cooler summer nights, risks of spring frostrainfall low at 450mm
            - 95% black, Bobal
        - Jumilia DO
            - warm continental with hot summers, cold winters
            - alt 400-800m with cooling influences and large diurnal range in highest sites
            - ~25000 ha vine plantings
            - annual rainfall extremely slow between 250-300mm
            - Soil: sand over limestone, aiding retention of ground water, making grape growing viable andmany vineyards with no irrigation
        - Yecla DO
            - ~Jumilia more moderation from Mediterranean
            - alt 500-900m a cooling influence
            - rainfall low ar 300mm per year
            - soil similar: mixture of sand with limestone: water retaining

    - Castilla-La Mancha: large south/southeast of Madrid, landlocked locked on southern part of Spain's meseta/plateau: extreme continental climate
        - La Mancha DO: large flat meseta 500-700m alt
            - Climate: continental with extremely hot summers and max temp up to 45C, winters verycold -20C
            - rainfall low at 300-400mm
            - Limestone and chalk within soils: water retention but drip irrigation common - ~40% vineyards irrigated
            - planting desities low
        - Valdepenas DO
            - South of La Mancha, similar continental hot dry summers
            - known as a source of red wines from Cencibel with ripe red fruit, soft tannins, med acidity,spice from oak, good quality, inexpensive/mid-priced
    - Other Spain: Sierra de Gredos
        - mountain range to the west of Madrid
        - no own DOC, wines labelled as, depending on location: Vinos de Madrid DO, Mentrida DO (within Castilla-La Mancha), Cebreros DO, Castilla y Leon VT
        - used to produced cheap high vol wines until recently a number of new producers focuse onquality
        - mostly from old vine Garnacha at high altitudes of 600-1200 m
        - continental but altitude provides a cooling influence with high diurnal range -> retainsacidity and fresh fruit
        - Style of Garnacha lighter
- Inland Italy:
    - Trentino: moderate continental climate with cooling influences - mountains protect again northern winds, LakeGarda to the south, wide diurnal range -> retain acidity, prolongs growing season -> flavors intensify
    - Alto Adige: mild Alpine continental climate
        - protected from cold winds by the mountains to the north,
        - 300–700 m of altitude,

        - warm air currents,
        - 300 days of sunshine a year,
        - large diurnal difference oftemperature -> ripen, retain acidity, sufficient rainfall throughout the year with a low amount in winter, can be a concern at harvest soils: volcanic porphyry, quartz, mica rock, Dolomitic limestone
        - pergola or Guyot: leaf picking to encourage exposed bunches to ripen (has been practiced for some time) -> lessnow with global warming to avoid the risk of fruit burn or drying out
        - Growing zones:
            - Bassa Atesina (south) with warmer climate: all main varieties grown except Schiava,Muller Thurgau at high altitude
            - Oltradige including Lade Caldaro area for Schiava, Cab Sauv and Merlot in valley, PN andwhites at higher altitude
- Veneto: continental moderate rainfall, cooling influences from altitude, trunk disease Esca an increasing threat, fertile soils -> high yields esp plain - where Valpolicella and Soave DOCs extend to; hillside forquality production bc better drainage + less fertile soil
- Northwest Italy: Piemonte: moderate continental
    - protected from cold northern winds and excessive rainfall by Alps to the north and from weathersystems from the Mediterranean by the Apennines
    - low rainfall June-Sep: allows grapes to ripen and reduces risks/threats of fungal disease; rainfallincrease in late Sep-Oct: threat late harvested varieties eg Nebbiolo
    - and other Nebbiolo denominations: often blended with small % of local vareties in scattered historic denominations innorth of Piemonte closer to Milan: Gattinara DOCG, Ghemme DOCG: continentalclimate with greater diurnal variation than Barolo -> higher acid, south facing sites at300m -> fruit ripen, light body, intense perfume; also at ~750m in Valtellina in Lombardy
- Central Italy: Marche

    - broadly Mediterranean but inland west of Ancona more continental with dry summers
    - Verdicchio di Matelica DOC
        - higher zone in foothills of Apennines
        - protected form influence of sea by mountains -> continental climate - hot days, coldnights -> longer ripening season,
        - higher retained acidity than vines closer to seasoils: mixture of sandstone with fossils, less clay than in Castelli di Jesi -> faster draining
- Umbria: warm mildly continental climate:
    - Hot summers -> heat stress for the vines
    - 800mm of rain falls mainly in autumn and winter -> enough water to be stored in winter to keep vines supplied through the growing season, lessens the risk of fungal diseases
    - The risk of rain in September and October -> affect the harvest period
    - sufficient dry autumns that allow picking for late harvested and botrytised styles
- Abruzzo:
    - hillside vineyards under high Apennines and the flatter coastal zone
        - hillsides: continental climate, cold snowy winters, warm short summers with coolinginfluences from mountains -> longer season for ripening grapes thus sugar accumulation isslowed allowing greater time for aromas/flavors development where risks are late springfrosts and autumn rains at harvest
        - coastal zone is maritime and Mediterranean: lower risk of spring frost and rain at harvest,
        - higher temp than hillside soils more fertile, vineyards better suited to high vol production
        - planting density low 2500 vines per hectare and pergola typical for training, high yield -> lowconcentration
        - higher quality rose with denser planting, newer training and lower yields

        - Cordon-trained spur-pruned or Guyot more common in coastal zone, allowing working withmachines and mechanical harvesting -> lower prices
        - Hillsides mostly worked by hand, some able to use tractors to work the land, hand harvest
- Austria - cool continental
    - north eg Weinviertel influenced by cool northerly winds
    - south eg Steiermark more influence from Adriatic thus warmer
    - east eg Burgenland near Hungarian border, influenced by warmer Pannonian climate
    - west: on Danube, cool breezes from the Alps
- Germany: cool continental 49-50 N except Baden [warm dry, spring frost can still be a problem in its coolareas tho] vineyards along the river Rhine and its tributaries - rivers radiate heat, moderate temperature,extned growing season;
    - best sites on steep, south-facing slopes to max sun exposure, some onextremely steep slopes with gradients >= 70
    - cold winter -> Eiswein, frost being major risk in spring, mitigated by rivers and planting onslopes; wet summers, avg rainfall 500-800mm mostly in summer -> fungal disease, dilution,heavy storms, hail
    - long, dry autumn -> allow sugar accumulation; morning mists along rivers ideal for botrytismountain ranges eg Taunus, Haardt shelter sites from cold winds and worst of rains; 200m abovesea level at such high latitudes
    - Franken: further east the most continental climate: warm summers, shorter growing season with coolerautumns harsh winters -> spring frost a hazard
- Hungary - moderate continental:
    - north eastern corner of Hungary, from Tokaj into the foothills of the Zemplen Mountains towards the Slovakian border
    - sheltered from northerly winds by forested mountain peaks
    - mainly planted on south-west/south-east facing slopes: reduce risks of winter cold and frost damage
    - 48-49 latitude, sunshine hours 1400-1500 hours

    - rainfall 500-600 mm per year, rather low but half during growing season. Irrigation NOT PERMITTED
    - Rivers Tisza and Bodrog (floods regularly creating shallow marshes and water meadows -> moist air ->morning fogs in autumn, ideal for botrytis; warm sunny afternoon control the development of botrytis,and limit grey rot) meet in the town of Tokaj
    - Tokaj - warm continental
- Greek inland: inland: continental; spring frost a problem in northern Greece ie Amyndeon
    - Macedonia: northern border, wide range of conditions from mountains in north & west to plains in east mountains: continental climate, cool temperature due to altitude, 650-700mm rainfalls - PDO Naoussa and PDO Amynteo - both can produce 100% Xinomavro
- Portugal: mountain ranges protect many inland northerly regions with a continental climate (warmer drier), warmer drier south: rolling hills and plains
    - Vinho Verde: moderate maritime bc Atlantic coastal river valleys that funnel Atlantic winds inlandlands -> east: soils poorer, climate more continental where warmer drier sub-regions egBaiao, Moncao e Melgaco -> late ripening grape varietals eg Avesso and produce wineswith more body and alcohol esp Alvarinho
        - marked vintage variation yield/ripening - 2017 at 936,000 hL dropped to 727,000 in 2018- largest DOC producers rotate between Vine Verde or Port depending on vintage
        - Most vines on granitic bedrock with a shallow topsoil of decomposed granite with a sandytexture -> good drainage, natural fertility of soil is slow and mature common
        - high rainfall ~1500mm: fungal diseases - rot and mildew ->>> training method:
        - traditional - vines up trees for air circulation, or on trellises over terraces
        - most modern vineyards are planted in rows, single/double Guyot (replacement cane)with VSP or Lyre system; all high from the ground for air circulation reducing rot

        - summer pruning eg removal of lateral shoots, leaf removal, green harvesting forproductive varieties to enhance fruit ripening and improve air circulation
    - Douro
        - mountain shields the Douro region from the worst of the cooler, damper Atlanticweather -> warm continental - huge range of microclimates
            - follows Douro river over 100km, start at Spanish border, ends west of Mesao Frio(100km inland from Oporto)
            - Douro Superior (Upper Douro east) hot and arid 450mm per annum
            - Cima Corgo (centre) warmer and drier 700mm per annum
            - Baixo Corgo (west) [western limit marked by Serra do Marao, 1415 m highest]: more
            - Atlantic influence, coolest wettest 900mm per annum
- Oregon:
    - western part of state inland from Pacific Ocean
    - Coast Range provides some protection from cold ocean currents and winds from PacificOcean
    - cool to moderate climate: 42-46N latitude (~France's Mediterranean coast up to Macon)
    - Long daylight hours in the summer and autumn -> ripening
- Walla Walla Valley: arid continental, hot dry summers
- Washington
    - Cascade Range creates an arid-like area which receives ~150-250mm of rainfall per annum ->irrigation essential <- water sourced from Columbia River and its tributaries + deep underground aquifers;
    - DRIP IRRIGATION most common, some overhead spraying
    - continental climate with hot summers, rapid cooling in autumn/cold winters
    - Latitude 45-50N: daylight during growing season are long (~1 hour longer than CA) -> sugar accumulates rapidly in summer but

much cooler autumn temp allow flavors/tannins to develop assugar accumulation slows
    - High diurnal range: retain acidity; hot summer temperatures: climate change is a concern andgrape growers are beginning to look for cooler sites
- NY Finger Lakes AVA (continental) & Hudson River Region AVA (continental with warm summers and cold winters: spring frost and winter freeze -> piling soilsaround the trunks of the vines in the winter; most vineyards are located within a few miles of it on glacial deposits of shale, slate, schist and limestone)
- Australia
    - inland vast Murray-Darling Basic: host continental climate but most other regions rely oncooling influence from Indian/Southern Oceans
    - South Eastern Australian Zone hot continental slight cooling influence from rivers
    - Northeast Victoria Zone: from warm flat plains of Rutherglen to cool upper King Valley in the foothill of GDR
    - New South Wales: **subtropical** climate, moderate/high temp, high humidity/rainfall all year erratic
        - most other regions protected from tropical by GDR: inland continental hot dry esp BigRivers Zone - includes Riverina
    - Central Range zone:
        - Mudgee: adjacent to Hunter Valley Zone but diff climate: lower rainfall, irrigationnecessary , continental with cooling influence from altitude, wide diurnalrange, intense sunshine, altitude make spring frost an issue - site selection
    - Western Australia - southwest Australian Zone
        - Margaret River:
            - southwestern corner of Aussie, best known, lat 34S
            - Indian Ocean (north, west; warm - temps do not drop much at night -> longerripening than regions with cooler nights -> ripe fruit character typical inMargaret River wines), Southern Ocean (south) moderate so that spring frost rare

            - rainfall high >1000m most in winter, dry growing season at 275mm
            - flat region of gentle hills/valleys 40-90m elevation
            - long ridge through center of region: shelter vineyards to the east thus slightly warmer conditions
            - free draining gravel soils: irrigation essential (water from dams from winter rainfall), infertile: reduce vigor
    - Southern New South Wales Zone
        - sheltered by hills and Snowy Mountains, continental climate, cooling influence from alt
        - Canberra District
            - 500-850m alt, diurnal range, high sunshine intensity helps ripen
            - winter/spring cold: frost - thus site selection
            - summer dry irrigation necessary
            - mostly blacks - Shiraz mostly planted: deep color, ripe black cherry, high ripe
            - tannins, high acid Shiraz-Viognier blends common g/o: $$-$$$$
            - Clonakilla, Ravensworth
            - most imp white: dry Riesling
            - Hilltops
            - recog+++, various alt
            - Shiraz, CS, ChardTumbarumba
            - recog+++, various alt
            - cooler, PN, Chard, still/sparkling

Tropical

- Canary Islands
    - off the coast of Morocco, ~500km south of the island of Madeira
    - 28 latitude
    - tropical influence on the climate
    - hot humid conditions in the growing season

    - many islands mountainous with vineyards at altitudes ~1500m -> cooler days wide diurnal ranges
    - rugged topography -> no machine
    - a range of altitudes and aspects -> a variety of grape varietals
    - no need for grafting as phylloxera is not present
- Yunnan
    - far south, subtropical humid climate
    - vineyards typically on slopes at high alt 1600-2900m including in the foothills of theHimalayas -> moderate temp and reducing humidity
    - a long frost free season where vines do not need to be buried in winter
- Australia: mountain ranges like the Great Dividing Range from Queensland to western Victoria: barrier protecting many southeastern vineyards from tropical weather systems from PacificOcean to the northeast; those in its rain shadow gets little rainfall eg Riverland 135mmwhereas Hunter Valley the only major region to the east of mountain range gets 500mm HOT and HUMID
    - New South Wales: **subtropical** climate, moderate/high temp, high humidity/rainfall all year erratic
        - most other regions protected from tropical by GDR: inland continental hot dry esp BigRivers Zone - includes Riverina
    - Hunter Valley Zone
        - OLDEST region: Hunter with 2300 ha planting slightly smaller area than HunterValley Zone
        - 3 official subregions but unofficially into Lower Hunter and Upper Hunter
        - lat 32-33, tropical, one of hottest most humid in Aussie, hot summer days, cool nights, low lat: intense sunshine, afternoon cloud provide covers
        - Lower Hunter: closer to coast w/ sea breezes thus cooler than Upper Hunter, hill atlow alt, sandy/clay loams over clay base
        - rainfall during growing season humid: fungal disease, irrigation not needed

        - eastern side of GDR, no protection from late summer tropical storms: warm climate thus start ripening early, and harvest first due to possible late summer storms
        - 50/50 white/black
        - Semillon: dry light body high acid 10-11%, delicate citrus, neutral in youth, age for decades into toast, honey, hay; best wines not released until >=5 years
        - grapes picked early, must gently pressed w/o ANY skin contact to avoid extraction of phenolic compounds eg tannins, must ferment at moderate temp in SS then finished in bottle shortly after, no oak, g/o, $$$-$$$$

Maritime

- New Zealand except Central Otago
- Bordeaux: moderate maritime
    - Atlantic ocean just west - cooling influence
    - best years: gentle heat throughout the growing season, sufficient rainfall for growth and ripening,fine/dry/warm early autumns for steady/complete ripening -> excellent balance of tannins, sugar,acidity -> longevity of great vintages
    - Left bank partially protected from Atlantic storms by pine forest - the Landes
    - estates fringing forests are cooler -> more marginal eg Domaine de Chevalier (Leognan), and many in Listrac in Medoc
    - northern Medoc: forest less of a feature, more open to maritime influence -> cooler than southernMedoc and Graves
    - rainfall variable avg 950mm a year with marked variation from year to year and the times within a year
    - excessive rain at key moments important in vintage variation:at flowering: poor fruit set
    - throughtout growing season: fungal disesase

    - at and following veraison: unripe fruit, fungal diseaseat harvest: dilute flavors
    - climate change -> hot dry summers with insufficient rainfall
    - hardy grape varieties here can resist extremes of temperature
    - but hot dry years 2003 can lead to red/white wines with low acidity lacking balance, morealcoholic than in the past as growers wait for phenolic ripeness before picking
    - Frost at times: 1956, 1991, 2017 when crops decimated
    - Hail widespread, destructive
    - In Medoc most prestigious wines close to the Goronde estuary - moderating influence on the cliamteand protects vines from frost (but another mile or two to the west can be devastated)
    - Vintage variation by volume is marked -> significant financial implications
    - frost-affected 2017: 33% less than 10-year average, 40% less than in large 2016 harvest
- Southwest France: The Dordogne - tho less moderating maritime
- Pays Nantais of Loire: cool maritime - cool springs, warm humid winters, rain throughout growing season esp March/April affecting flowering, and September affecting harvest
    - btw Atlantic Ocean influence decreases progressively in Anjou Saumur (maritime effect) and then Touraine (continental, not as extreme as central vineyards)
- Most Portugal except for inland
- Spain - Basque Country, aka Euskadi or Pais Vasco
    - main vineyard areas split in two by Cantabrian cordillera
    - sheltered conditions to the south are of Rioja Alavesa
    - sheltered to the north around Bilbao and San Sebastian are 3 DOs making Txakoli
    - unsheltered from the influences on the Atlantic
    - the Txakoli (or Chacoli) DOs - moderate maritime climate - rainfall ~ 1600mm per annum -> canopy well ventilated a major concernto combat fungal diseases [VSP aids air circulation~]
- north-northwest coast of Spain: Atlantic influence, maritime climate with high rainfall, North/northeast sheltered somewhat from Atlantic by mountains, continental, tho some maritime or Mediterranean influences

    - Galicia
        - Ria Biaxas DO: most westerly DO bordering Atlantic Ocean: maritime
        - Ribeiro DO: most westerly just east of southern RB, slightly more sheltered than RB, maritime with temperate conditions and high rainfall
            - mainly whites: Treixadura the most planted as single variety or as lead component in a whiteblend with Galician varietals
- Abruzzo - coastal zone is maritime and Mediterranean: lower risk of spring frost and rain at harvest, higher temp than hillside soils more fertile, vineyards better suited to high vol production
- Friuli esp south near Adriatic Sea: high rainfall 1200mm 30% > Bordeaux
    - south: flat plain near the Adriatic Sea - warm maritime climate where warm air from the AdriaticSea meets cooler influences from the Alps; high rainfall 1200mm per year - 1/3 more thanBordeaux, humidity -> extra work to combat diseases and organic viticulture challenging
- Long Island AVA - the North Fork and the Hamptons sub-AVAs; > 1000 ha under vines; the larger LongIsland AVA captures the wineries located outside of the sub-AVAs
    - surrounded by water - Atlantic Ocean, Peconic Bay, Long Island Sound -> maritime climate, long growing season -> able to ripen black Bordeaux varieties, with Merlot in particular as thesignature variety of the region, also a range of varieties eg Chardonnay and Sauvignon Blanc
    - high humidity -> fungal diseases though windy weather in coastal sites alleviate <- spraying, leaf removal to improve air circulation around grapes and sorting grapes in the vineyard/winery |organic grape growing difficult but there are
    - North Fork slightly warmer more protected from Atlantic Ocean's weather events <- where most~65%~ vineyards are [vs 5 in Hamptons]
    - North Fork - sandy soils; Hamptons silt loam soils; both free-draining and low in fertility ->limits vine vigour

- Portugual - Vinho Verde
    - moderate maritime due to Atlantic coast, river valleys that funnel Atlantic winds inlandlands -> east: soils poorer, climate more continental where warmer drier sub-regions egBaiao, Moncao e Melgaco -> late ripening grape varietals eg Avesso and produce wineswith more body and alcohol esp Alvarinho
    - high rainfall ~1500mm: fungal diseases - rot and mildew
    - training method:
        - traditional - vines up trees for air circulation, or on trellises over terraces
        - most modern vineyards are planted in rows, single/double Guyot (replacement cane) with VSP or Lyre system
        - all high from the ground for air circulation reducing rotsummer pruning eg removal of lateral shoots, leaf removal, green harvesting forproductive varieties to enhance fruit ripening and improve air circulation
- Portugal - Bairrada
    - west of Dao, maritime climate bc proximity to coast
    - 800-1200 rainfall per annum, some areas 1600mm, mainly in spring, autumn ->problematic for late ripening varieties like local Baga
- US - California, still Mediterranean but in Monterey County there's maritime influence
    - Santa Lucia Highlands AVA
        - vineyards ~350m near Monterey Bay exposed o winds and fogs -> vines stomata close,slowing ripening
        - morning sunshine, afternoon maritime breezes
        - Chard, PN, Syrah in more sheltered sites -> fresh fruit, high acid
- British Columbia
    - 1/3 Canada's vineyards split into two distinct areas
        - close to Pacific coast of a cool maritime climate
        - inland sheltered from any maritime influence by mountain ranges where Okanagan Valley being the largest
        - further north (48-51N) than Ontario: shorter growing season but longer days, long hotsummer days and cool nights

create a wide diurnal range: ripe fruit flavors while retaining acidity
        - Vancouver Island, Gulf Island, Fraser Valley
            - small coastal regions: cool maritime climate moderated by the Pacific Ocean, mildwinters, cooler wetter summers than elsewhere BC thus fungal disease
            - only early ripening varieties do well esp PN in parts of Vancouver Island
- China
    - Shandong: east coast, warm maritime, much wetter with rainfall coming before/during harvest (worst time) -> rot persistent
- New Zealand
    - cool maritime lat 36-46 S
    - North/South separated by Cook Strait
    - cool Pacific Ocean moderates thus most regions maritime except Central Otago sheltered from ocean influences by mountains on all sides is semi-continental
    - cool climate in South Island
    - moderate climates in North Island eg lower lat Auckland and Gisborne
        - Greater Auckland: once the heart of NZ wine industry tho most moved to Marlborough/Hawke's Bay
            - Waiheke Island: close to central biz district, specialize in Cab Sauv and Syrah, slightly warmer than most Auckland with low diurnal range - helps mid/late ripeningblack varietalsto ripen fully - due to surrounding water, $$$$ bc close to aucklandland price and transportation+++ Man O'War and Stonyridge
            - West Auckland: Kumeu River vineyard area probably will decrease bc urbanization and high cost of land, thus most source fruit from Marlborough/Hawke's Bay Matakana: further to the north, a range of varietals to sell to strong local tourist trade
            - moderate maritime, high humidity - fungal diseases

- Hawke's Bay
    - Moderate maritime ~ Bordeaux, 2180 sunshine hours, 1000mm rainfall
    - Gravel, alluvial soils ~Medoc thus Bordeaux Merlot blends
    - small amount of Cab Sauv bc difficult to ripen in cooler years but potential bc improvedplanting materials, viticultural understanding, warm years' high quality fruit
        - Gimblett Gravels: stony topsoils get very warm during day and release heat into eveninghelping Syrah, Cab Sauv ripen, free draining: irrigation necessary even with high rainfall
        - Bridge Pa: deeper topsoil of sand/clay loam aiding water retention, limiting need forirrigation
        - both inland: warm days, little moderating coastal influence: frost an issue
        - Both on alluvial terraces with gravelly soils where closer to coast the moderating influence of Pacific breezes cool daytime temps thus slower ripening/fresher Chard/Syrah
- Wairarapa: low yielding vines bc strong winds from the Cook Strait during flowering and fruit set, and frost (wind machines help)
    - wine tourism: close to Wellington
    - cool maritime, large diurnal range, warm summer, slow ripening retains acid
    - small grape with thick skins: PN with higher levels of fine grained tannins than other NZ regions
    - Dominant soil: free draining alluvial gravel terraces with silt loam and loess: cooling influence as take longer to warm up than rocky soils: slow ripening, elongate growing season -> concentration/complexity+++
    - Wellington Wine Country
        - Masterton

            - Gladstone
            - Martinborough
    - NZ vineyards on east of islands: southern Alps protect vineyards from rains/winds in Tasman seadespite mitigation of rainfall by mountains still ample rainfall at 650mm
    - high UV radiation (bc hole in ozone layer and low level of air pollution) -> color/tannin+++ long hoursof sunglight -> increasing the viable ripening period, large diunral range
    - South Island - Nelson
        - northwest of South Island, not as protected as Marlborough from cool/wet winds from westthus 970mm rain per year as sudden heavy storms so still long sunshine hours
        - cool maritime climate, close to coast: cooling sea breezes during day and warm at nightsmall production
- Australia
    - inland vast Murray-Darling Basin host continental but most other regions rely cooling influence from Indian/Southern Ocean
    - rather flat, cooling influences of oceans spread inland: eg Coonawarra in South Australiahas a maritime climate despite 100km from coast
    - Western Australia
        - Southwest Australian Zone
            - Margaret River: southwestern corner of Aussie, best known, lat 34S
                - Indian Ocean (north, west; warm - temps do not drop much at night -> longerripening than regions with cooler nights -> ripe fruit character typical in Margaret River wines), Southern Ocean (south) moderate so that spring frostrare
                - rainfall high >1000m most in winter, dry growing season at 275mm
                - flat region of gentle hills/valleys 40-90m elevation
                - long ridge through center of region: shelter vineyards to the east thus slightlywarmer conditions

            - free draining gravel soils: irrigation essential (water from dams from winterrainfall), infertile: reduce vigor
        - Great Southern
            - Coast: Albany and Denmark maritime climate, rainfall 350m
            - north of Denmark, Mount Baker, Porongurup, Frankland River: altitude 300m moderates
            - Frankland River: continental wide diurnal range, rainfall 220m
            - many vineyards dry farmed or minimal irrigation except Frankland River but irrigation difficult in low lying areas bc high salinity levels in soil thus water pumped from further away
    - South Eastern Australia Zone
        - Riverland has a slight maritime influence less hot
    - Mount Lofty Ranges Zone
        - rainfall 280-320mm during growing season bc maritime influence, majority inwinter/spring sometimes disrupt fruit set
        - collected in dams for irrigation later
        - humidity high, fungal diseases and rot a concern <- most spray crops to reducing for sustainability
    - Tasmania: cool maritime bc southerly lat 41-43S
        - westerly prevailing winds from Southern Ocean: high rainfall mostly on west coast tho
        - Tasmania being a single GI but regions with distinctive climate/topograph/soils
            - Coal River Valley: southeast close to capital Hobart
            - Tamar Valley
            - Piper's River: north
        - southern cooler bc lat [site selection to face north/east for max sunlight, southeast drier lesshumid, northwest humid - fungal], but some slightly longer hours of sunshine which helps ripening, spring frost a problem: frost fans or sprinklers