Try the G*i*ESCO EcoMetaEthical Charter !

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This article summarizes a synthesis and an extension of the three communications accepted by the 22th GiESCO congress and presented at the *i*AVW session:
- The universal EcoMetaEthical 4.1C charter used in an interconnected network (Giovanni Cargnello & Alain Carbonneau).
- Climate change: valorization of the global "4.1C" resources of the territory and creation of the highest vineyard in Europe (Giovanni Cargnello).
- What canopy management innovations can be made in traditional vineyards? Adaptations or changes? Examples in Italy and France (Giovanni Cargnello & Alain Carbonneau).

I – *international* Academy of Vine and Wine : what is *i*AVW ?

The *i*AVW of the G*i*ESCO deals with any field at the interface of Viticulture.
Our major actions, to some extent beyond Viticulture, are:
1/**Philosophy-Sociology-Economy-Ecology**: Why and in what spirit do we work? Which are the priorities? Can we adopt a metaethics attitude ?
2/How to ensure the future? The 3 awards offered to **young scientists** or **entrepreneurs**.
3/ Privileged interaction with **Enology**. Example: Tasting of Pinot Noir from around the world and typicity groups (see G*i*ESCO proceedings).

II – The G*i*ESCO EcoMetaEthical Charter :

1/ Definitions :
Ethics is a reasoned reflection of any people in order to establish their moral values considered good for society: standards, limits, duties. Those choices are dependant on the society.
Meta-Ethics (thanks to Giovanni Cargnello who is a pioneer): these are those values shared by the greatest number of societies or people, often consensual, and freely accepted as above all decisions or practices.
Examples. In the current *ethical standards* of Organic Viticulture there are:
- *metaethical consensual elements*: respect for the environment and for people, preferential use of local or natural products, saving natural resources...
- *non-metaethical elements of refusal* : harmlessness of any natural product compared to synthetic products, main use of copper which is toxic to the environment and to humans...
- *non-metaethical elements of questioning* : are many principles of biodynamics scientifically proven ?
Metaethics is the only reasonable position a scientist, a technician, a grower, may have !

2/ The G*i*ESCO EME 4.IC Charter – Generalities:
Meaning and Basis of the G*i*ESCO EcoMetaEthical Charter 'EME4.1C'.

Eco : Ecology
ME : MetaEthics
4 : 4th industrial revolution

4.1C : application as universal Charter to Viticulture

Since 2015, GiESCO has proposed a MetaEthical Viticulture Charter which is based on the following three consensual principles by declining them according to the diversity of viticultural situations:

1- **Man placed as the main challenge.** Who can oppose favoring all human aspirations: well-being, of course, but also work, education, culture, life in society and in nature?

2- **Rule of least impact on the environment** (ie: priority of qualitative resistant grape varieties ; or prefer, for protecting vineyards against downy mildew, 3-4 applications of phosethyl-Al than 9-12 with copper products which are more dangerous for soil environment and human health).

3- **Objectivity** and reliance on **scientific** knowledge and **traceability** of operations. Who can ignore the achievement of science and follow the directives of an esotericism, even if the objectives are laudable? Who can hide that some natural products are dangerous for man and environment ?

Replacing Organic or Biodynamic with Sustainable Ecological Agriculture and adapting it to wine-growing specificities: **this is the aim of the G*i*ESCO EME4.1C Charter !**

3/ New advances in the EME4.1C Charter :

In terms of applicability :

*** Place the couple 'producer-consumer' in front,** because it is the center of exchanges, and the key of efficiency by establishing a **direct** evaluation.

*** Promote actor networks,** profiting by modern communication tools, with transparent information and self-assessments (ie : as for free scoring of satisfaction of restaurants).

*** Allow Official organizations to integrate the network and serve as a reference, if they accept the previous principles; the G*i*ESCO at first !**

4/ Applications of the EME4.1C Charter to the main challenges in Viticulture :

Absolute priority : **adaptation to the climate change** just because it is the most universal !

* Change in **psychological attitude** when dealing with '**Terroir'**:

Up to now, we mainly talked about **soil** because it is important, and above all, it was convenient to justify a particular land ownership. Now, we must first think about **climate** which is a shared resource.

* Knowing the new regional climate, we have to optimize the **mesoclimate**:

exposure, altitude, proximity to water, to allow cooler and less dry conditions.

In that field, some useful guides may be used such as **whitness vineyards**

5/ **Whitness vineyards** :

Observing the evolution of vines and wines in particular vineyards situated at any pedoclimatic limit is very useful to understand the impacts of the climate change. Besides, some specific adapted techniques can be applied and tested in order to find some efficient solutions either under too cool or too warm or too dry situations.

Giovanni Cargnello established an high altitude vineyard in the Veneto Alps to check the evolution of responses at a limit of berry maturity, and propose new keys of development to the region.

Alain Carbonneau experiments in a family vineyard in the Haut-Languedoc region the change due to the reinforcement of drought, concentrating on adaptation of new qualitative resistant varieties and of the stability of the wine type expressing the 'terroir' characteristics. Results are expected on the following years. Figure 1 thereafter illustrates those two whitness vineyards.

Figure 1. Whitness vineyards

Personnal implications in these two projects :

- Giovanni Cargnello : valorization of the '4.1C' resources of the territory and creation of an top-high altitude vineyard in Europe as a warming witness (2 up)
- Alain Carbonneau : test at a drought frontier of sustainability of some new resistant qualitative varieties and maintenance of 'terroir' expression in wines (1 down)

Veneto : territory valorization in plain (left), and in mountain (right) as whitness vines among the highest vineyards in Europe (1396m).

Whitness vines in Terrasses du Larzac –Salagou : resistant Marselan in rocky soil and Lyre culture.

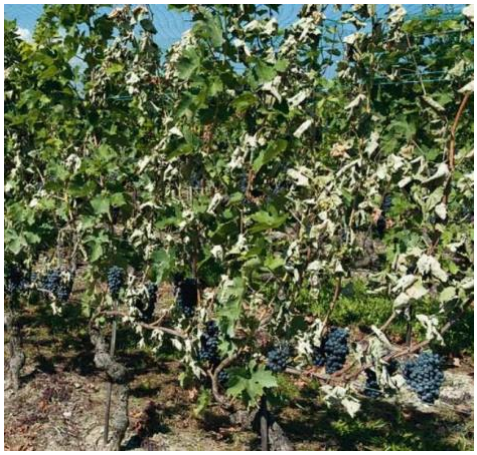
6/ **Microclimate /** architecture & canopy :
It is important to protect the clusters, while avoiding mixing them with the foliage and optimizing leaf exposure, never too low, at least avoiding leaf crowding to maintain good CO2 assimilation and water efficiency.

4/ **Water control** (function of climate and soil) :
First of all it is useful to take drought adaptation measures : deep rooting in relation to soil management or rootstock ; strong rooting optimized by Lyre training system combining wide row spacing and good canopy exposure.
If irrigation is necessary, it is necessary to use controlled drip irrigation, and to develop two major tools for insuring water resource : network of hill lakes and/or use of treated wasted water.

5/ **New resistant and qualitative grape varieties adapted to the environment** . A key choice :
Resistance to parasites must be associated with adaptation to the environment and wine quality.

6/ Special techniques:
Pre-Harvest Half-Pruning ('Passerillage' on Vine, Poly-Double Maturation Reasoned) in cool areas, or **Second Adjusted Pruning in Spring** to delay harvest under warm situations

Figure 2 presents those two special techniques according to the limiting factors of the vineyards:
Too cool : Pre-Harvest Half-Pruning / improving berry concentration and maturity.




Left: 'Passerillage' on Vine in Changins ; right : Double Maturation Reasoned in Valtellina.
Too warm : Second Adjusted Pruning in Spring / Delaying berry maturity to harvest under cooler conditions.


Left : Experiment in Montpellier Institut Agro ; right : Production from current year-initiated buds.

7/ **New technologies** must be integrated into all viticultural aspects :
Regulation of machine functionning, Management of information and communication (warnings, cartography, precision Viticulture).

8/ **Physical methods** :
For many purposes, physical methods are more friendly to environment than chemical ones. In particular it is possible to use Ultra-Violet treatments of vines (ie : against powdery mildew) and wine (ie : to replace SO_2).

9/ **Promotion of EME4.1C values** :
This is the suitable general context in which we have to reason viticultural choices.

III – Application of EME4.1C to the evolution of training systems :

1/ **How to manage EME4.1C application ?** Here are some proposals for training systems in traditional vineyards in Italy and France allowing progress towards EME4.1C criteria.

In **France:**

Vase (excepted in steep slope) : change for *Erect Lyre* (trunk allowing ski positioning for shaking).
High (or Medium)-Density Espalier : change (or maintain) for Medium-Density Espalier (optimal ratio foliage height/row spacing) or (change for) Lyre (truncated or open).
Low-Density Espalier : change for Lily (easiest adaptation), Open Lyre (optimizing quality) or Minimal Pruning (minimizing costs)

In Italy:

Pergola or Tendone : changes concerning pruning simplification.
Free Cordon or Single Curtain : pruning adaptation using 'Spalle' or change for Minimal Pruning.
Terraces (narrow) : Espalier change for Harp/Arpa (particularly on the bank).

Figure 3 illustrates the example of the advantage of the Lyre training system over the classical Espalier in terms of adaptation to summer drought conditions.

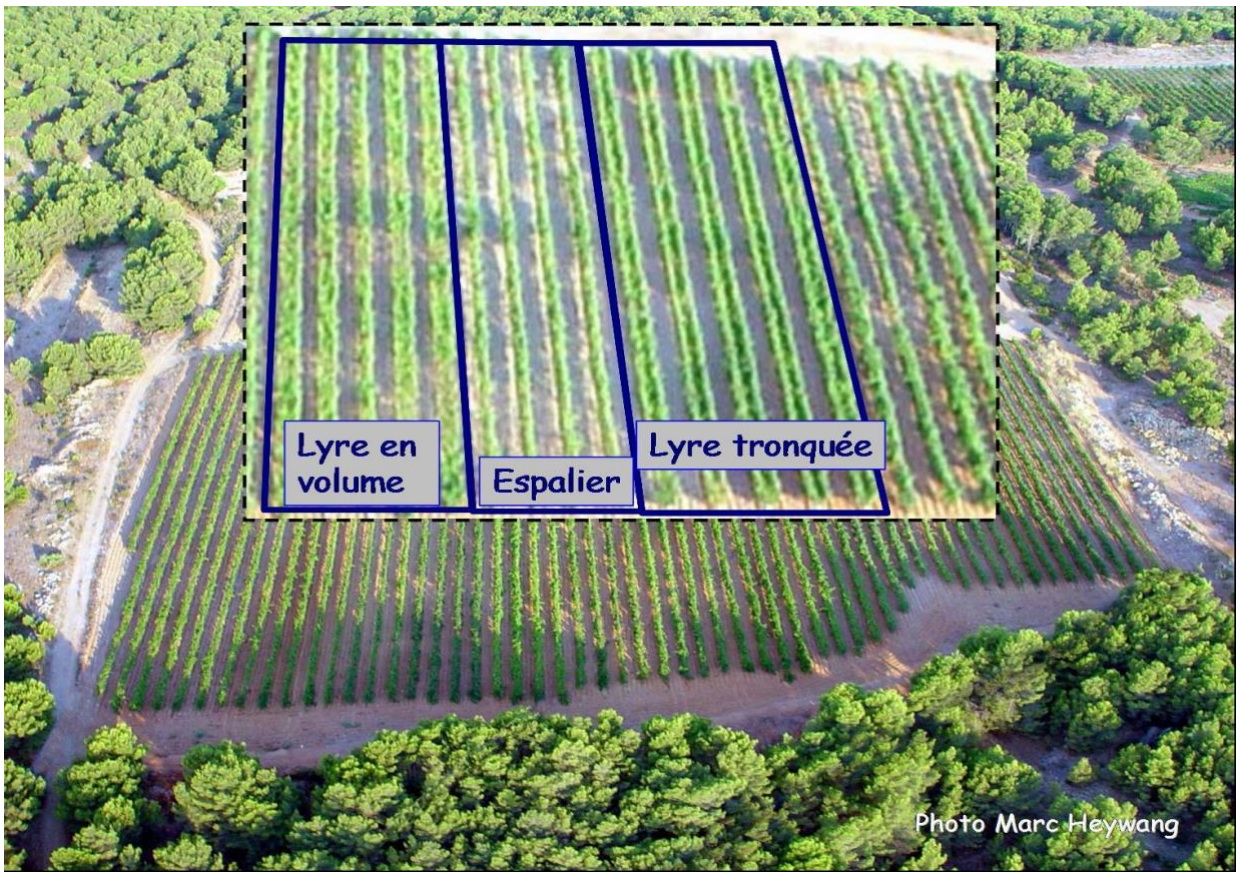


Figure 3. Aerial view of an experiment plot in August 2003 at INRA*E* Pech Rouge. Lyre architecture insures stronger rooting in spring than higher-density Espalier (combination of large row spacing and good canopy exposure), therefore a better adaptation to summer drought. Notice that the Lyre (particularly at right) has a greener foliage than Espalier, due to a better water status insured by a better water uptake in the soil depth by stronger roots. Besides, Syrah wines have more expressive typical aromatic profile.

Detailed training systems choices are presented in the following table 1.

Table 1. Adaptations and changes of canopy management in Italian and French traditional vineyards.

Training system: traditional or current	Mechanization: associated to harvest (V) and pruning (T)	Sustainable choices / EME4.1C criteria: Conservation, historical control or change	Adaptation of pruning for change	Change of training under expériment	Change of training directly
France (proposed evolution)	* Open architectures (Lyres) are recommended over vertical planes to optimize the microclimate of leaves and grapes and rooting depth, with the aim of qualitative excellence. If necessary, the mechanization of the harvest can be done by vibrating the trunk, or by lateral shaking with the installation of a double articulated trellis (foldable Lyre). Lyres are generally recommended for growing table grapes.				
Vase (Gobelet) plain, slope	V: difficult mechanization; preferable change T: prepruning	Maintaining as historical control	Lyre*: 2 arms, horizontal eccentric Trunk enhancement/ Trunk mechanical vibrating	Erect Lyre* (E#3m) cordon pruning Test of harvesting by trunk vibrating (Cargnello-Studer)	Espalier (E:1,8-2,5m) NB: for all Espaliers, optimal adaptation of H/E (>= 0,6)
Vase (Gobelet) steep slope	V: manual T: manual	Conservation			Narrow Vase with irrigation if necessary
Tutored Vase steep slope	V: manual T: manual	Conservation or change	Short vertical cordon		Tutored Vase or Vertical cordon with irrigation if necessary
Espalier (density: 6000-#10000 ceps/ha) T: Guyot, Cordons, Champagne fans	V: lateral shaking T: prepruning	Conservation in historical crus & changes elsewhere	cf. Lyre*	Foldable Lyre* (E#3m) or Erect Lyre* (E#3m) if vigour is moderate	Espalier (E:1,8-2,5m) or Truncated Lyre* (#3m)
Espalier (density: 4000-6000 ceps/ha) T: Guyot, Cordons	V: lateral shaking T: prepruning	Conservation or changes	cf. Lyre*	Foldable Lyre* (E:3-3,6m) or Erect Lyre* (E#3m) if vigour is moderate	Espalier (E:1,8-2,5m) or Open Lyre* (E:3-3,6m)
Espalier (density: 2000-4000 ceps/ha) T: Guyot, Arched, Cordons	V: lateral shaking T: prepruning	Changes: 1/reorientation for quality or 2/reorientation for economics	cf. Lyre* Lys: 2 superposed pruning zones or Cordon with up, down, spread bearing(Spalle test)	Foldable Lyre* (E:3-3,6m) or Precise Mechanical Pruning (+/-Spalle) (E:2,5-3,6m)	Open Lyre* Lys (E:3-3,6m) or Minimal Pruning (E:2,5-3,6m)
Espalier (terraces)	V: manual or small machines T: prepruning	Changes	cf.Lyre* cf. Lys	Test of small harvesting machines on Lys and Foldable Lyre*	Open Lyre* or Lys (terrace) & Lys (bank)
Espalier (narrow	V: manual	Change	Harp (2 superposed shifted pruning		Harp (bank)

terraces)	T: prepruning		zones)		
Italy (proposed evolution)	* Training systems in experimentation or in development which are pruning modifications in traditional training systems in order to improve their adaptation to sustainability, to facilitate cultivation operations and the mechanization of pruning or harvesting (NB: tests of mechanical feasibility, ie : for the vertical shaking or hedge pruning, must be achieved in some systems).				
Vase (Alberello) plain, slope	V: manual T: prepruning	Conservation as historical control	Trunk enhancement/ Trunk mechanical vibrating (Cargnello-Studer)		Narrow Vase with high tutored trunk
Vase (Alberello) steep slope	V: manual T: manual	Conservation			Vase with irrigation if necessary
Raggi Bellussi	V: manual T: manual	Conservation as historical control or adaptation	Pruning simplification R10C		Bellussi-R10C
Pergolas	V: mechanical penetrating vibrating T: manual	Conservation as historical control or adaptation	Pruning simplification R36C		Pergolas-R36C
Tendone	V: mechanical penetrating vibrating T: manual	Conservation as historical control or adaptation	Pruning simplification R37C		Tendone-R37C
Pergolette or (Lyre-Pergola)	V: manual T: manual	Conservation mostly for table grapes, or adaptation	Pruning simplification R30C		Pergolette-R30C
GDC & Duplex	V: vertical shaking T: prepruning	Change or adaptations	Shoot positioning above cordons (#Lyre) 2 cordons with Spalle or 1 cordon with large lateral Spalle	Feasability tests: R8C*, R9C* R2C*	High Lyre (GDC-R30C & Duplex-R30C)
Simple Curtain	V: vertical shaking T: prepruning	Adaptations if downward bearing or change	Cordon with downward spurs or oriented Spalle	Feasibility tests: R200CRs* R220CRs*	Minimal Pruning (lateral shaking)
Cordon (non-trellised)	V: lateral shaking T: prepruning	Adaptations for economics or change	Mechanical pruning Spalle		Mechanized Cordon R5C R200C,R220C Minimal Pruning
Vertical Cordon	V: lateral shaking	Conservation as historical control	Spalle		Vertico (R100C, R800C)

	T: prepruning	or adaptations	Multitrunks		(R110C, R120C)
Espalier (medium-low density)	V: lateral shaking T: prepruning	Conservation with diversity of prunings	Guyot & Arched, (high prepruning), Cordon de Royat, Spalle		Espalier – Guyot Espalier – Arched Espalier – Cordon Espalier - Spalle
Sylvoz	V: lateral shaking T: prepruning	Adaptations or changes	Renewing spurs & Prosecco fan Lys (2 superposed pruning zones)		Modified Sylvoz & Prosecco Sylvoz Lys
Casarsa	V: lateral shaking T: prepruning	Adaptations or changes	Renewing spurs & Prosecco fan Lys (2 superposed pruning zones)		Modified Casarsa & Prosecco Casarsa Lys
Espalier (terraces)	V: manual or small innovating machines T: manual or prepruning	adaptation or change	Lys (2 superposed pruning zones) Harp (2 superposed shifted pruningzones)	Test of small harvesting machines on Lys and Foldable Lyre*	Lys or Lyre* (terrace) Harp (bank)
Espalier (small terraces)	V: manual or small innovating machines T: manual or prepruning	adaptation or change	Harp (2 superposed shifted pruningzones) & Prosecco fan Lys (2 superposed pruning zones)	 Test of small harvesting machines on Lys	Harp & Prosecco Harp Lys
Zero management	V: manual ou mechanical T: no pruning	new		R3000C* (sustainability test)	

Table 1 is a synthesis of the evolution of training systems proposed on the basis of results of 50 years of researchs in Italy and France : some traditional methods are confirmed and most of them have to be replaced by suitable innovations which are better adapted to sustainability, quality or profitability. The choice depends also on the situation : flat, slopy, steep slopy.

2/ **How to face a very deep climate change ?**

If the climate change becomes so important that adaptations are no more efficient enough, then Viticulture must completely change and a technological revolution has to take place. Some choices are presented in the joined synoptic table 2. This is an introduction to a 'Big Bang' Viticulture.

Table 2. The Big Bang Viticulture
Strategies of cumulative adaptations to deep climate change

Criteria	Universal viticultural choices	Adapted viticultural choices to change from different climatic zones							
		Too Cool → Cool		Cool & Temperate → Temperate & Temperate-Warm		Temperate-Warm & Warm → Warm & SubTropical		SubTropical & Tropical → Warmer Tropical	
		Dry cycle	**Wet cycle**	**Dry cycle**	**Wet cycle**	**Dry cycle**	**Wet cycle**	**Dry cycle**	**Wet cycle**
Water availability	Permanent checking , water reservoirs & treatment	Drought adaptation	Water excess control	Drought adaptation, Restricted Precision Irrigation	Water excess control	Precision Irrigation, or extensive viticulture	Water excess control	Abundant Precision Irrigation, or desert viticulture	Water excess control
New technologies	Information management, machine regulation, drone use	Mapping	Mapping	Mapping	Mapping	Mapping	Mapping		
Variety	Wine quality, attractive wines	Cold tolerant, early	Resistant, early	Resilient, Resistant, >late	Resistant, > late	Resilient, Resistant, >late, early	Resistant, >late, early	Resilient exception.	Resistant
Protection	Pesticides control, traceability	Decisions/ vineyard, plot	Decisions/ vineyard, plot	Decisions/ vineyard, plot	Decisions/ vineyard, plot	Decisions/ vineyard, plot	Decisions/ vineyard, plot	Decisions/ vineyard, plot	Decisions/ vineyard, plot
Soil management	Soil preservation, specific grass covering	Decisions / vineyard, plot	Decisions / vineyard, plot	Decisions / vineyard, plot	Decisions / vineyard, plot	Decisions / vineyard, plot	Decisions / vineyard, plot	Decisions / vineyard, plot	Decisions / vineyard, plot
Canopy management	Vigour control, good leaf exposure, bunch control	Lyres, optimal VSP	Lyres, optimal VSP	Lyres, optimal VSP, Minimal Pruning	Lyres, optimal VSP, Minimal Pruning	Lyres, optimal VSP, Minimal Pruning or Vase	Lyres, optimal VSP, Minimal Pruning	Lyres, optimal VSP or Vase	Lyres, optimal VSP
Particular Techniques	Yield adjustment, innovative pruning	Summer 1/2 cane pruning*	Summer 1/2 cane pruning*	Adjusted green shoot pruning	Adjusted green shoot pruning	2 crops, Spring second pruning**	2 crops, Spring second pruning**	Anti-transpirant	Growth hormones
Impacting Enology	Alcohol, pH monitoring	Specific choices	Specific choices	Specific choices	Specific choices	Specific choices	Specific choices	Specific choices	Specific choices
Key challenges	Transfer efficiency	Low temperatures limit, irregularity		High technicity, reputation challenge		Deep changes, water resources		High temperatures limit, excessive stresses	
Global naming	Sustainable viticultures	New or limit viticultures		Evolving viticultures		Mutant viticultures		Desert viticulture	Jungle viticulture
Examples		England, Belgium Poland, Quebec		Champagne, Burgundy, Trentino, Tokaj, New York, Moldova, & Friuli, Bordeaux		Languedoc, Rhône v., Toscana & Sicilia, Napa v., Barossa v., Maipo, Mendocino		Rio Grande S, Pernambuco	South China, Thaïland

3/ **Conclusion :**

To summarize, some 'flash technical ideas' :

→ High-Density Espalier has only historical interest. At first, it was designed in relation to layering.

→ Espalier is optimized at Medium-Density with a good ratio 'foliage height/row spacing'.

→ Lyre architectures optimize microclimate, water status, physiology, wine type/quality.

→ Minimal Pruning is a good alternative to minimize costs and insure good quality.

→ In any case, foliage crowding must be avoided, and vigour and yield controled. This is related to the general cultivation system and to the specific pruning methods.

→ A specific mechanical harvesting can be adapted to any kind of architectures : lateral shaking / vertical plan or free cordons or Minimal Pruning or foldable open trellis, trunk vibrating / erect open canopies, penetrating vibrating / high covering canopies.

→ New Technologies and Physical Treatments offer interesting applicable solutions.

References:

Basis of general informations published by the authors in preceeding G*i*ESCO congresses, and in the book « Treatise of the Vine. Physiology – Terroir – Cultivation. 2020. Dunod 3rd edition. 690p. Coordinators : Alain Carbonneau and Laurent Torregrosa, Professors at Institut-Agro Montpellier. Coauthors : Philippe Abbal, Alain Deloire, Benoît Jaillard, Eric Lebon, Aurélie Métay, Hernàn Ojeda, Florent Pantin, Anne Pellegrino, Charles Romieu. »