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# Land-use, abuse, and institutional attempts for correcting human-nature relationships: Europe vs The Americas

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**ABSTRACT**

Warnings regarding pollution, soil-fertility losses, mass extinction, Climate Change, and their effects on humans are widely known since > 50 years, still land-abuse pervasively remains. Looking into history and geography is needed for understanding the origins, environmental constrains, and ways for abandoning land-abuse. We explored all these guided by the following questions: (a) How the mentality transposed from the West into the Americas became dominant favoring non-sustainable land-managements? (b) How does the environment constrains the sustainability of mass agriculture? (c) Which events carried out by European decision makers, scientists, and activists generated their current support for more sustainable land-uses? We analyzed the importance of primogeniture and profit for transmitting land-abuse practices across generations. We looked into cultural adaptations and environmental constraints to agriculture among Temperate Oceanic Forests, Alpine Humid Tundras, and Neotropical Rain, Wet, and Dry-forests. Finally, we chronologically analyzed (A.D.1938-2018): major agricultural decisions collectively taken by West-European countries, and the development of environmentally-oriented thought and social movements. Primogeniture and profits culturally fixed the subordination of nature and people to a role of mere commodity-producers, making difficult for environmentalism to penetrate decision-making. Low-scale, sustainable agriculture remains traditionally practiced by Neotropical and Alpine indigenous peoples inhabiting fragile ecosystems, but became abandoned by lowland Europe-and-Americas' landlords. European environmentalism is related to research-and-teaching of Ecology and Conservation in universities training prospects of both activists and decision makers. Instead, Americas' environmentalists are grass-rooted movements influenced or led by indigenous peoples. Paying traditional, indigenous agriculture is a recent European practice to be encouraged for the Americas.

**Keywords:** Alps; Conservation Biology; Great European Plain; Multi-functional Agriculture; Neotropics.

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## SIGNIFICANCE STATEMENT

This paper discusses why non-sustainable land-uses persist in spite of half a century of claims by ecologists warning on an already started collapse. We historically assess the origins and cultural fixation of the practice of mass agriculture that converted both nature and humans into mere producers of commodities, generating profit but affecting living beings including humans. We comparatively address the environmental constraints to mass agriculture, as well as the cultural adaptations to such constraints for: the Great European Plain, the Alps, and the Neotropics. Then we chronologically show how the interplay between Ecology and Conservation Biology, on the one hand, and politics and decision making -on the other hand, determined the current European attempt to depart from the abuses of mass agriculture towards a finnancial and institutional support to the so-called multifunctional agriculture practiced by indigenous peoples. This paper is original.

## INTRODUCTION

The evidence supporting that well preserved environments enhance human's health and life quality can be reviewed from the recent to the distant past. Countries taking measures for enhancing air quality during the pandemics of coronaviruses-produced SARS and MERS[1] are among the less affected by COVID-19 (Bashir et al. 2020). At least one decade prior the start of COVID-19, scientists warned on bat-to-human transfer of coronavirus (e.g. Wong et al. 2007; Yang et al. 2014). Ecologists explained that land (ab)uses replacing forests by large crops, livestock and cities enhance the chances of humans to acquire disease from wildlife via domestic and farm animals (Plowright et al. 2015). Some thirty years before that, scientists persistently explained that extensive monoculture was becoming an abuse causing mass extinction, Climate Change, water pollution, and losses of soil fertility driving Earth to a catastrophe (e.g. Brundtland et al. 1987; Brook et al. 2003; Diamond 2005). Such warnings are widely known since at least 1970. On such a date the United Nations (UN) launched the annual commemorative of Earth Day (Cantú Martínez 2015). More recently, the UN changed the name of that memorial into *International Mother Earth Day*. This name was proposed by millions of Latin-American indigenous people using it for referring to our planet (Choquehuanca 2010). Thus, institutions like UN and its member states start to recognize that humans can successfully develop world-views and land-use behaviors departing from land-abuse and improving our relationships with Nature. Yet the just summarized environmental crisis shows that the voices of alarm by scholars have been poorly considered. Looking into history and geography is needed for understanding the origins, environmental constraints, and possible ways for abandoning land-abuse.

Land-abuse is a pervasive legacy from the Industrial and Green Revolutions (Garrido-Pérez and Tella-Ruiz 2016), but a change starts to occur in its place of birth namely Europe. In concrete, the European Union have started to finance farmers practicing what European institutions call *multi-functional agriculture* planting cash crops while protecting biodiversity and ecosystems (Romstad et al. 2000; OECD 2001). Certainly, that is an attempt to achieve sustainable development (sensu Brundtland et al. 1987). At the same time, *multi-functional agriculture* is an appraisal of land-use practices invented by indigenous peoples both inside and outside Europe (King 1987; Toledo et al. 2008). Here are some concrete commonalities between *multifunctional agriculture* (Comisión Europea 1997; Romstad et al. 2000; see also OECD 2001) respect to lowland, Neotropical traditional agriculture (hereafter LNT-agriculture) and and the multiple use of natural resources by indigenous peoples (Gómez-Pompa 1987; Cerón 1990; Castillo 2001; Toledo et al. 2008; Aweto 2012; Garrido-Pérez and Sidali 2016; Garrido-Pérez et al. 2018). (I): Production of food, even to be sold in the market. (II) Promotion of environmental quality by protecting landscapes, natural resources and biodiversity. These are considered as externalities that are beneficial for the society but rarely paid or introduced into the markets (Comisión Europea 1997; Romstad et al. 2000; see also OECD 2001). Some of such externalities are (III): keeping water quality and quantity, soil fertility, uptaking atmospheric $CO_2$ (e.g. by letting forests to regenerate), conserving or enhancing biodiversity, scenic beauty, and usefulness as scenarios for the health of people. Based on all these (IV): farmers making multifunctional agriculture can also receive tourists and sell food to them, host ill people for contributing to their healing, receive scientists for studying (agro) biodiversity, and -of course sell the variety of their food products after fulfilling their home requirements. We consider all these fits into the concept of multiple use of natural resources (Toledo et al. 2008) traditionally made by the indigenous peoples of the Americas.

Land management in the Americas use to follow European models; imposing the lowland-European

[1]SARS= Severe Acute Respiratory Syndrom. MERS= Middle East Respiratory Syndrome. Both diseases are caused by coronavirus.

practice of mass monoculture on fragile tropical soils is one of such models. Therefore, we seek to contribute to the Americas to enhance its conservation efforts, by means of encouraging Americas' decision makers to consider the following 'European' way: support and learn from our own indigenous knowledge, and look into it using a historical-and-ecological scope[2]. As a working hypothesis, we consider large-scale monoculture as: (a) a cultural heritage transmitted from one generation of landlords to the following (see detailed mechanisms in Garrido-Pérez and Sidali 2014). (b) Such a cultural heritage promotes land-abuse, since it is practiced in spite of the fact that the environment constrains its sustainability. (c) The homeland of the mentioned cultural heritage practiced in the Americas, namely Europe, learned from Ecology that such a land-abuse is risky for life quality. Therefore, the recent history of Europe includes a process of change of mind related to the rise and development of the ecological thought. As a corollary, ecologically-informed Europeans start to depart from large-monoculture for trying to rescue traditional, small-scale farming. Such Europeans scholarly coined the term "multifunctional agriculture" for farms resembling what we in the Americas call "multiple use" of natural resources (following Toledo et al. 2008). For this paper, we firstly look into colonial history in order to understand both the European origin and the reluctance of the Americas to reduce large monocultures in favor of more sustainable land-uses. Secondly, we make an overview of the environmental constraints to the sustainability of mass agriculture. We thirdly perform a chronological analysis of the means by which the European society and States began to switch from mere productivity to sustainable land-uses. Here are the questions guiding our work:

a) How the mentality transposed from the West into the Americas became dominant to the extent of favoring non-sustainable land-managements?

b) How does the environment constrains the sustainability of mass agriculture in both the Americas and Europe?

c) Which events carried out by European decision makers, scientists, and activists generated their current support to multi-functional agriculture?

## MATERIAL AND METHODS

For addressing our question a), we critically analyzed the primogeniture in Europe; that is, the first-born inheritance of land, from the point of view of its environmental and social impacts. We made this because children learn land-use practices mainly from their parents. We provide an insight into the primogeniture's consequences for land-acquisition, as well as on the use of natural and human resources (Hernán 2000; Bermejo 2009). For addressing our question b), we looked into the different cultural adaptations and environmental constraints to land-use among habitats based on the fact that environmental constraints comprehend factors influencing the suitability of land-use decisions taken by farmers (Garrido-Pérez and Glasnović 2014). In concrete, we compare the environments performing the scenarios of land-uses for: Temperate Oceanic Forests of the Great European Plain, Alpine Humid Tundras, and Neotropical Rain, Wet, and Dry-forests (sensu Holdridge et al. 1971). That comprises $> 2.5 \cdot 10^6$ km$^2$ of temperate areas, and $> 3.61 \cdot 10^7$ km$^2$ of tropical areas of the world. It is worth to warn that the comparison is not for supporting any place as a model for the others. On the contrary, the comparison is a method for enhancing the understanding of the complexities of a given place by means of contrasting it to others. Comparisons as such have been successfully used for holistically analyzing human-nature relationships across a wide range of societies and territories (e.g. Diamond 2005). Our comparisons focused on the following aspects, which were chosen because of their relationship with both safe farming activities and conservation of the environment:

- Risks of nutrient lixiviation
- Seasonal variation of temperature and precipitation
- Topography
- Necromass decomposition; formation of soil organic matter
- Soil depth
- Soil-nutrient accumulation
- Allowance (or not) of the restoration of soil fertility losses
- Tendency of farmers towards monoculture

[2]We recognize the just mentioned 'European way' as a mentality shift in Europe questioning the component of the European cultural heritage promoting mass agriculture. Mentality change has been largely considered an ellusive reseach field because of its complexity and subjectivities (Graus 1987). Fortunately, historiography has developed a long-standing method to assess complex phenomena in a way facilitating tests and discussions among scholars namely the chronology (D'Antine 1784, Nicolas 1840, Meeken 2021).

- Working effort and viability of the use of machinery
- Risks of loosing soil (e.g. landslides)
- Farm size and spatial combination with forests
- Existence of rituals fixing ancient, good agricultural practices

We addressed our question c) by means of a chronological analysis. We defined a study period (see further), then chunked time into decades, and then looked into our reviewed literature searching for the major events of the historical development of the following three aspects. Firstly: decisions collectively taken by West-European countries regarding agriculture. Secondly: the development of Ecology, Conservation and environmentally-oriented thought. Finally (thirdly): social movements interested in environmental issues[3]. Our chronology covered the 80-year period from 1938 to 2018. We chose 1938 as lower time limit because it corresponds to the first benchmark of the empowerment of what Europeans currently call "multi-functional" farmers in the Western Hemisphere. We refer, in concrete, to the distribution of $1.8 \cdot 10^7$ ha of lands by the Mexican government of Lázaro Cárdenas after $> 25y$ of armed fights by peasants and indigenous (Romero-Ibarra 2010). The chosen period also includes the benchmark of years 2006-2007, corresponding to the empowerment of multi-functional farmers in Bolivia (presidency of Evo Morales) and Ecuador (presidency of Rafael Correa). We considered the governments of Cárdenas, Morales, and Correa as good enough for framing our chronological analysis because of the following. (1) Cárdenas was voted for President by the indigenous, low environmental impact farmers fighting during the Mexican Revolution. He boosted an agrarian reform favoring such farmers as well as their own, traditional land-management organizations the *ejidos* (Flores Rodríguez 2008). During Cárdenas' government, extensive monocultures owned by single individuals were expropriated in order to favor State-supported low-impact, and highly biodiverse agriculture (see Toledo et al. 2008 for an example of such agriculture), as well as by cooperatives of indigenous and peasants (Romero-Ibarra 2010). (2) Morales and Correa propelled new constitutions in their countries for including the rights of *Mother Earth*, as well as the good living (*sumak kausay*) as a way for ensuring such rights (Estado Plurinacional de Bolivia 2009; República del Ecuador 2008). (3) President Morales himself is a multi-functional, Aymara-indigenous farmer, leader of the planters of a plant considered sacred by his nation. All these enables the mentioned governments to be used as good units for framing our chronological analysis of the ongoing European mentality change.

## Question a): How the mentality transposed from the West into the Americas became dominant to the extent of favoring non-sustainable land-managements?

### Rural colonialism, and the role of primogeniture for settling and maintaining land-abuse

From the $16^{th}$ century onwards, Europe exports a land-use policy that we call *rural colonialism*. Colonialism has been defined as the domination of one people against another (Kohn and Kavita 2017). We expand this idea by saying that rural colonialism is a way of surrogating both peoples and ecosystems of the cultivated areas to the role of mere producers of food and commodities[4]. Such products were sent for consumption by the metropolis, large cities, and local oligarchies. In the European chiefdoms, the main actors of rural colonialism were landlords known as *lords, high clergy*, and *nobility* as well. Only the oldest male child inherited all properties of his family (Bermejo 2009). By means of this, landlords effectively obliged their own relatives, kin, and vassals in general to produce food and commodities. Moreover, vassals even had to fight wars in favor of the landlord. The names of the highest positions in the chiefdom hierarchy were the kings, queens, and emperors. Meanwhile, the rest of the nobility had the right of lobbying at the court for influencing the decisions of the ruler. After winning wars, major rulers prized brave vassals in two forms: stakes of conquered lands, and nobility titles introducing such vassals into the court (Hernán 2000). These conflagrations expanded the geographic range of rural colonialism, yet were to be made cautiously because implied rationing, re-

[3]Worth to say, the formulation of our question c) was made assuming that the just mentioned decision makers, scientists, and social movements are key actors (*sensu* Garrido-Pérez and Glasnović 2014) of the european decisions towards institutional attempts to depart from land-abuse. We based the mentioned assumption on three reasons. (1) Decision makers are bureaucrats and rulers whose decisions are extremely influential compared to other, single individuals (Fredericksen 2002). (2) Scientists are scholars able to alter the thought of prospects of rulers by means of teaching at universities (see also Fredericksen 2002). (3) Activist seek to to alter decisions made by rulers throughout political action, and even try to get the power in order to replace rulers taking decisions considered as wrong (see for instance Hosbawm 1998).

[4]Not all authors supply the same definition of colonialism. For instance, Horvath (1972) defines colonialism as the domination of one people and its territory by others; such a definition is similar to our rural colonialism. For this paper, we keep using the term "rural colonialism" in order to put emphasis on the geographic context we are analyzing namely the agricultural zones.

duction of farms' manpower, and even famine (e.g. Baumgartner 2010). Nevertheless, the high nobility always found upstarts able to explore and conquest new lands to be exploited. Once in the Americas, such prospects of landlords remained linked to their countries of origin for selling commodities there. Therefore, the New World landlords increasingly replaced the indigenous, highly agro-biodiverse agriculture by the extraction of resources like gold and silver, and by the settlement of large-scale livestock and monoculture for feeding cities (Mena García 1984; de Magalhães Godinho 1953).

Let us consider sugar cane (*Saccharum officinarum* L., Poaceae) as an illustrative example[5]. Such a cash crop was introduced by the Europeans in the Americas, planting clones covering large plains (e.g. Robles Bermúdez 2018) otherwise inhabited by hundreds-to-thousands of other plant species (Anderson-Teixeira et al. 2015). That reduces the genetic, species, and landscape-components of the biodiversity of the zone as well as the capture of Carbon Dioxide (CO2) (see also Garrido-Pérez and Sidali 2016). Moreover, the production, harvest, and processing of sugar cane demand extensive fire and numerous personnel (e.g. Robles Bermúdez 2018). Indeed, indigenous peoples and Africans were imposed to work as slaves in a way that both the land and its occupants were properties of the landlord (e.g. Figueroa Ledón 2011; Castañeda Fuertes 1991). The later process generated and accumulated discontent to the extent of contributing to the rise of revolutions (e.g. Romero-Ibarra 2010; Castañeda Fuertes 1991). On the contrary, traditional, LNT-agriculture does not colonize Nature or people because it's made for self-consumption and selling the few surpluses (see further). If all these are true, then rural colonialism replaced land-use by land-abuse, reducing Nature to a kind of "slavery" by means of a non-sustainable appropriation of resources. The same was made to Africans transported to work, and to indigenous peoples by means of the "encomiendas": the direct distribution of the inhabitants of the conquered lands among the conquistadors (Araúz and Pizzurno 1997). The formidable profits after selling (e.g. Castañeda Fuertes 1991; CNA 2020) encouraged landlords and their children to continuate land-abuse, culturally fixing rural colonialism across generations. Thus, rural colonialism became a cultural heritage that remained, evolved, and was transmitted across generations of the landlords of the Americas and their followers (Garrido-Pérez and Sidali 2014), becoming the fundamentals of the current culture of land-abuse. Some expressions of that cultural heritage are mass agriculture, abusive land-hoarding, racial violence, and discrimination.

## Environmental consequences, and biological implications of rural colonialism

Both rural and internal colonialism (sensu González Casanova 2006) have generated the following. (a) Wars for land usurpation also known as conquest (e.g. Hosbawm 1998). (b) Deforestation affecting biodiversity and carbon capture (Kaplan et al. 2009). (c) Air pollution; for instance, by throwing heavy metals to the environment (Brännvall et al. 1999; Austruy et al. 2019). (d) Eutrophication reducing water quality (Tilman 1999; Le Moal et al. 2019). As a result from all these (e): a reduction of peoples' life quality respect to the one supplied by less-polluted ecosystems with comparatively closer biogeochemical cycles (e.g. agroforests instead large monoculture). In fact, more than 200 studies confirm enhancements of humans' health and welfare when *Homo sapiens* (Primates: Hominidae) contacts natural and rural plants, animals, ecosystems, and landscapes (see review in Russell et al. 2013). Some examples include reduced risks of hearth attack (Donovan et al. 2013), allergies (Ownby et al. 2002; Hanski et al. 2012), and stress (Kaplan 2001). All these contributes to longevity (Takano et al. 2002). Informed on such advantages of good environmental quality, current West European mentality starts to depart from rural-colonialism and mass productivity towards better payments to multi-functional farming. But rural colonialism does not only damage the environment and public health but also its practitioners. Two practices made by colonialists are racism (detailed by Memi 1969) and its related consequence: inbreeding throughout generations in order to reinforce the holding of their properties (Vilas et al. 2019). That occurs despite the well documented biological depletion suffered by inbreeder families (see Charlesworth and Willis 2009; McQuillan et al. 2012; Vilas et al. 2019). In short, abusing natural resources, usurping the lands of locals, and even the inbreeding depression of colonialists not willing to mix with the colonized belong to the irrationalities of one single rural colonialism. Only the big profits obtained by exporting commodities (e.g. CNA 2020) prompts the renewal of a long-standing mentality that "justifies" own-species-destructive behaviors like anthropocentrism, racism and elitist inbreeding.

Stop figthing each other became the first Euro-

[5] Although some of the papers we citate also consider other cash crops like coffee (*Coffea* spp, Rubiaceae), and cotton (*Gossypium* spp, Malvaceae).

[6] Western Europe's political behavior is not the same outside Europe. For instance, France uses to bomb and invade countries in Africa and Asia (e.g. Mali, Syria, sub-Saharan Africa) without any censorship from the EU. A detailed analysis of European

pean step towards a reduction of rural colonialism. At least for the present, land-usurpation wars among Western European countries have ceased[6], being replaced by a joined, institutional effort called the *European Union* (EU). The EU is replacing rural colonialism by trans-border land-use initiatives like the network of protected areas *Natura 2000* (Evans 2012). Recall that EU's financial support to large monoculture is switching into payments and incentives to traditional, multi-functional agriculture protecting the environment (Romstad et al. 2000; OECD 2001). Consequently, the indigenous peoples of the Alps, previously confined by landlords to remote, steep, hard-to-work lands, are now getting appraisal (Comisión Europea 1997; Bianchi 2011).

## Question b: How does the environment constrain the sustainability of mass agriculture in both the Americas and Europe?

### Why temperate soils resisted mass agriculture per longer than tropical soils

Mass monocultures require abundant lands, agrochemicals, energy, and machinery. Soils of the Great European Plain resist all these better than tropical soils. The Great European Plain (hereafter GEP) occupies $> 4.0 \cdot 10^6$ km$^2$, from the Urals on the East to the Pyrenees on the West. The higher altitudes of the GEP are only c.a. 200 m.a.s.l. Also, GEP precipitations reach about 1000 mm year$^{-1}$ which is very few compared to the humid Tropics (Holdridge et al. 1971). A great fraction of such precipitations consist of slowly-falling snowflakes instead of strong rainfall. Therefore, nutrients' lixiviation on GEP soils is slow compared to the steep Alps and torrential Tropics (Jenny 1941; Six et al. 2002). Furthermore, the GEP freezes every winter so necromass decomposition by soil microorganisms is intermittent and proceeds more gradually compared to the Tropics (Jenny 1941; Six et al. 2002). Spring melting gently adds water to GEP soils. Meanwhile, the temperature smoothly increases, activating soil microorganisms and invertebrates adding organic matter to the soils, particularly in the summer. Then, decomposition slows down again during the fall, and virtually stops in the winter. All these produces a higher yearly accumulation of nutrients in GEP soils compared to the all-year-round warm and humid tropics (Jenny 1941; Six et al. 2002). Consequently, deep soils of the GEP spent longer time resisting the severe manipulations related to mass agriculture.

Yet lixiviation and erosion occurs on GEP soils. Repeated harvests, heavy machinery, winds, and precipitation resulted in nutrient losses beyond the capabilities of Lowland Europe soils. That imposed land-users to add high doses of fertilizer. Weat fields of the EU, for instance, receive almost $4.0 \cdot 10^6$ ton of Phosphorus Pentoxide ($P_2O_5$) (Tóth et al. 2014). Losses of soil fertility became high enough for becoming a business: the EU industrially produces $1.4 \cdot 10^7$ ton of Nitrogen in form of fertilizers (van Egmond et al. 2002). In spite of all these, GEP soils reach depths of c.a. one meter and this contributes to them to resist land abuse better than the shallower soils of the Tropics. In contrast, traditional farming of the tropics had to invent the practice of replacing forests by small cropslands per less than three years in order to avoid excessive losses of soil fertility (see further).

Shortly speaking, mass agriculture typifying rural colonialism reduces soil fertility to an extent that even West Europe decided to compensate damage by financing multifunctional agriculture. This implies payments for Alpine indigenous farmers whose land-use practices have successfully faced environmental constrains, as we proceed to describe.

### Alpine land-use

Alpine agriculture and livestock began at least 2500 years ago and occur on both valleys and slopes (Stolz 1985). Terrains of the valleys are flat, well drained, easy-to-work, and very fertile due to thousands of years accumulating nutrients coming from the mountains (see Jenny 1941; Six et al. 2002). Therefore, Alpine valleys and small slopes nearby did not escape from the Green Revolution. For instance (Hanni 2017), the apple (*Malus domestica* Borkh (Rosaceae)) monocultures of South Tyrol cover just 16500 ha from which only 5% are organically cultivated. Yet such apple production consists on only three cultuvars and reaches $> 1.0 \cdot 10^6$ ton representing almost 10% of all apples produced by the European Union (Hanni 2017). In contrast, the few lands able to be used on slopes are located on steep terrain ($> 30°$ respect to the horizon) used by the indigenous for producing cereals and pasture besides fruits and other items (Leiterfilm 2018). The steep terrain imposes huge working efforts, currently mitigated by modern machines (Mik 2013; Rheinwelter Brücke 2017). Sloped terrain also generates high risks of soil losses, and nutrient lixiviation (Berteni et al. 2021). Agriculture is indeed practiced only in low scales: no more than 18 cows per farm spending three quarters of the year inside barns. Mountain farms occupy small pieces of land generally some 10ha of clear-cut area including houses, totally or partially surrounded by thick forests, which also mitigate the yearly hit of storms (e.g. Leiterfilm 2018; Garrido-Pérez et al.

imperialism goes beyond the goals of this paper.

2021). This land management is symmetric to the one applied by Neotropical indigenous peoples whose long-standing cultures emerged on fragile ecosystems too[7]. In concrete (Gómez-Pompa 1987; Cerón 1990; Castillo 2001; Toledo et al. 2008; Garrido-Pérez and Sidali 2016), LNT-agriculture agriculture is usually made by clear-cutting small areas ($\leq$ 0.5 ha), then planting for only $\leq$ 3 years, then let forests to fallow. Such a fallowing also favors the closure of biogeochemical cycles restoring soil fertility and plants for fuel, housing, furniture, and medicines as well (Gómez-Pompa 1987; Guariguata and Ostertag 2001; Garrido-Pérez et al. 2018).

However, the low profits earned by means of subsistence-oriented land-use make people prone to replace traditional agriculture by monoculture (e.g. Lechón and Chicaiza 2019; Feintrenie et al. 2010). Therefore, reasons other than the profit need to be considered for understanding why "environmentally-friendly" agricultural practices persist in spite of "money-temptations".

### Alpine and Neotropical rituals fixing good agricultural practices

Avoiding famine and natural disasters have been considered so important that both Alpine and Neotropical indigenous peoples developed widely practiced rituals for conserving good agricultural uses. The mentioned peoples perform exuberant, annual celebrations reaffirming the land-use traditions ensuring their lives, farms, and food security. People ostentatiously show the results of a year of successful agriculture, and give thanks to supreme forces for the survivorship achieved by means of hard work. Tyroleans pay for expensive bells, elaborate complicated crowns, and take aesthetically considerable images of saints to put all these to their cows at the end of the transhumance. Then move the cows down to farms, wear expensive leather-made clothes, pass in front of villagers, and celebrate the success of their cows to remain alive in spite of all the dangers faced during the year (Tirol Werbung GmbH 2012). Mexican Mayans celebrate the fertility of Land every December $8^{th}$, just after the end of the Hurricanes' season. They offer food to everyone passing in front of their houses, march in organized groups, make a religious service, and kill one of the few pigs produced by the family as part of their multiple-resource farming. After grilling the pig, Mayans wear luxuriusly -particularly the women, take the pig's head, put it into a beautifully decorated bucket so people do not look at the animal's head, and go to the holy place for dancing wile showing the pig's head to the sky (Koyoc 2017). Thus, the dance offers the head of the pig to the supra-world for both giving thanks for a successful agricultural year and asking for a similar fate for the next year. These two examples ilustrate how far both Alpine and Neotropical traditional land-users depart from the anthropocentric world-view of rural colonialism (see also Memi 1969)[8], while ancient, rural traditional practices tend to get extinct in relation to enhanced urbanism (e.g. Antorp 2004; Król et al. 2019).

## Question c: Which events carried out by European decision makers, scientists, and activists generated their current support to multi-functional agriculture?

We identify (Figure 1) a period from WWII until c.a. 1969 where European decision makers promoted productivity on large monocultures. Afterwards, there was a period from c.a. 1987 onwards where the preferred approach looked onto the "rural" and "multifunctional" aspects of human-nature relationships (Figure 1). In other words, during such a period decision makers were not only thinking on food production; they started to think on the "land". The later means to think on the "territory" including its culture and ecosystem services (Bianchi 2011). Inbetween (c.a. 1970-1987; Figure 1) we identify a period where a set of scholars, namely the ecologists became very influential. During that period, even the United Nations started a still ongoing campaign proposing humans to change their relationships with nature. For explaining these results, we propose there has been an interplay among: (a) social needs and movements, (b) Ecology and Conservation Biology, and (c) politics and decision making.

### A gradual departure from rural colonialism

Compared to 1938's Mexico, the European minds' departure away of rural colonialism is being a top-down, gradual, and non-violent process. Towards 1938, Mexico's President Lázaro Cárdenas (Silva Herzog 1995; Romero-Ibarra 2010): (1) expropriated rural colonialist's large farms, (2) recognized the importance of low-scale traditional agriculture, (3) distributed 18 million hectares among collectively-organized peasants, and (4) created a bank to finan-

[7]The same is valid for the indigenous farmers of the Palaeotropics (Aweto 2012). As a matter of fact, the symmetries between tropical and temperate traditional farmings have been recognized since decades (e.g. King 1987).

[8]Yet the higher profits obtained by means of mass production remain attractive for farmers (e.g. Feintrenie et al. 2010). That explains why the European Union literally decided to give money to traditional, Alpine farmers in order to them to feel compensated for the environmental services provided by their ancestral land-uses.

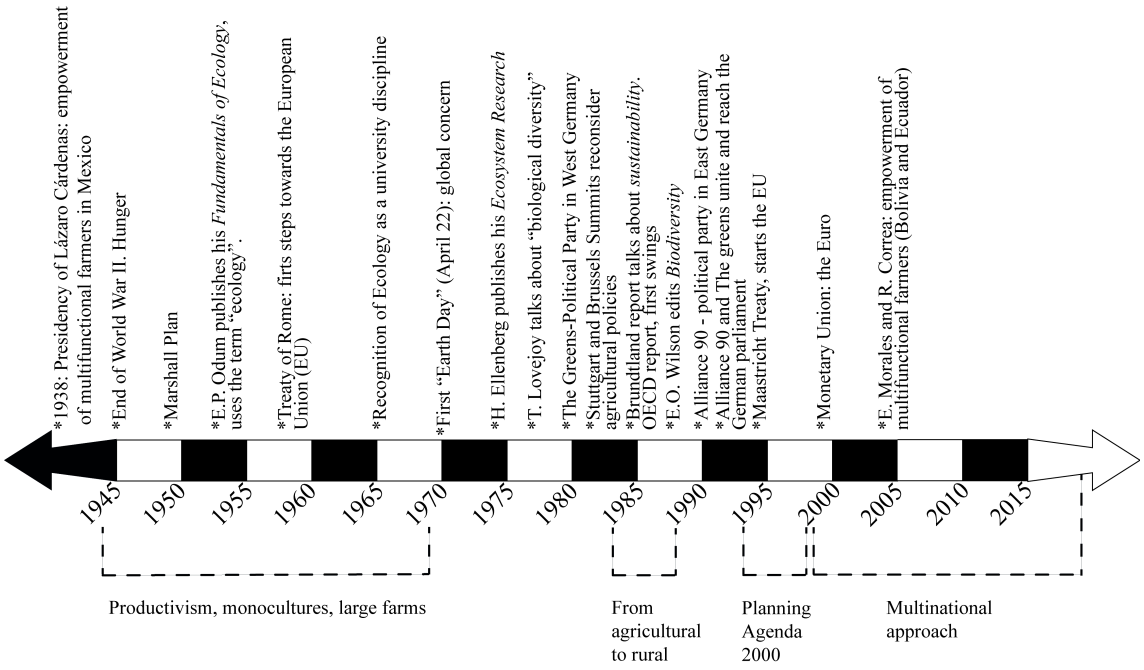


**Figure 1.** Agriculture, Ecology, and their correlated histories in West Europe (1938-2018). The low-impact, highly biodiverse cultural heritage of multi-functional farmers started to get supported late in Europe compared to Mexico (early 2000s vs 1938). However, the mentality switch in Europe arrived during the same period than in Bolivia and Ecuador (early 2000s). In-between, Ecology rose-up as a university discipline and indigenous 'eco-friendly' life styles gained influence. Abbreviations: WW II= World-War two, EU= European Union, OECD= Organization for Economic Cooperation and Development.

cially support them. That occurred because such peasants kept figthing from c.a. 1911 until Cárdenas' arrival to power (Romero-Ibarra 2010). During that time, Ecology, Conservation Biology, and their warnings did not exist. Therefore, universities were neither producing "green" advisors to orientate any decision maker, nor generating information for social movements in order to claim for better human-nature relationships. In contrast, our chronology shows that European decision makers are promoting the values of "multi-functional agriculture" only from c.a. 2000 onwards. This means four decades after accumulating the following. (a) Information recurrently produced and divulged by Ecologists and Conservation Biologists, (b) technical advisors finishing university studies for orienting rulers, and (c) peaceful, yet persistent struggles made by ecologically informed, green parties (Figure 1)[9]. Before all these, European rulers had to face other problems like hunger and (post)war difficulties, as we proceed to discuss.

## Famine, loss of geopolitical influence, and the switch from rural colonialism to top-down environmentalism in Europe

Before the 1950s, Ecology was not developed into a university-taught discipline. Therefore, there was no group of scholars able to propose the inclusion of environmental issues on the political agenda (Figure 1). Instead, famine was one of the main concerns of European decision makers. Hunger in Europe was an output of World Wars I and II: the european paroxysm of rural colonialism. During WWI (1914-1918), for instance, Austria-Hungarian villages far away of the front suffered famine because they were forced to send food to the battle fields (Santer and Überegger 2006; Baumgartner 2010), and Russian farmers joined workers for making a revolution. Survivors after WWI and their children as well engaged in the traumas of WWII which end came with two aftermaths: the loss of many European colonies in Asia and Africa, and -once again hunger inside Europe (Hosbawm 1998). That hunger was the first problem attended by the post-war financial support

[9]We believe the gradual, peaceful origin of the European departure from rural colonialism towards multifunctional agriculture has a deep historical explanation. In concrete, the violent attempt of the European peasants to abolish rural colonialism was crushed at the end of the Peasant's wars in Central Europe (1524-1525) (Press 1978).

program known as the Marshall Plan (1948-1951) (De Long and Eichengreen 1991; Figure 1). Probably because the West lacked environmentalist ideas, Europe made what it considered viable on its Great Plain: sponsoring mass, extensive, monocultures according to a productivity mentality inherited from rural colonialism. Such a paradigm dominated the Western thought throughout the *Green Revolution* until c. a. 1970s (Figure 1). During that period, technologies like (agro)chemistry and auto-mechanics (tractors) were developed enough for making the Green Revolution possible, while Ecology still ignored the magnitude of their effects. Yet new powers namely The Soviet Union and the United States became the major geopolitical actors of the world. Squeezed in-between such superpowers, European countries centennially practicing rural colonialist warfare decided to stop fighting each other.

## Ecology: its rise, and influence on European states and the 'civil society'

The Marshall Plan was just giving its first results in Europe when US biologist Eugene P. Odum published his *Fundamentals of Ecology*. As well as other systems, Odum's *ecosystem*s have inputs, outputs, pools, flows, and cycles of matter and energy (Odum 1953; Bormann and Likens 1967). Forests biomass and soils became conceived as pools of nutrients, having slow outputs by means of processes like erosion. Therefore, the exposed, agricultural soils are comparatively more prone to loose nutrients and fertility (Frink 1969). Still impressed by its hunger and successful Green Revolution, Europe kept mass agriculture (e.g. van Egmond et al. 2002). From that period onwards, Europeans started to learn ecological concepts from books and lessons like the ones by Ellenberg (1973) and Begon et al. (2008). Examples of such concepts are *primary production*, which is the transformation of atmospheric $CO_2$ into *biomass* by means of photosynthesis; just what we now call *carbon capture*. Lessons from ecologists predisposed both decision makers and the public opinion to further understanding of terms like *greenhouse effect* and *Climate Change mitigation*.

Four years after Odums' book, West European countries converged into an Economic Community by means of the Treaty of Rome (1957; Figure 1). At the morn of the 1960's, Ecology became firmly recognized and thought in universities starting to produce technicians and citizens with basic knowledge of ecosystem ecology. Towards 1970, some of these professionals worked for the UN and took a globally relevant decision: the memorial of the first, yearly repeated Day of Earth (April $22^{th}$; Figure 1). Since then, world's countries annually assess the situation of the environment from the local to the global levels. Shortly afterwards (1973), the German ecologist Heinz Ellenberg edited a book used in many universities to date: *Okosystemforschung* (Research on Ecosystems; Ellenberg 1973) contributing to enlarge the ranks of university-educated cohorts. Between 1980 and 1990 these people funded environmentalist, green parties like *die Grünen* (The Greens, 1980) and *Bündnis* 90 (Alliance 90, 1990; Figure 1). These organizations promote a rescue of what they consider "rural", "natural", and "organic" as alternatives to land-abuse. Notice that Western's mentality change is based on recent discoveries by scholars, unlike the millenarian, de *facto* more sustainable land-uses developed by indigenous peoples.

## Conservation Biology and activism pursue to influence decision-making

Ecology continued its discoveries, development, and interactions with the society. On 1978 five ecologists organized a meeting with tens of others in La Jolla, California: the First International Conference on Conservation Biology (Soulé and Wilcox 1980; Meine et al. 2006). Since then, Conservation Biology (CB) emerged as a multidisciplinary field combining both natural and social science. Conservation Biology provides technical advise too. Major examples of the later are how to settle and manage areas for protecting wildlife (e.g. van Dorp and Opdam 1987; Pardini et al. 2005), as well as how to mitigate the effects of Climate Change (e.g. Trabucco et al. 2008). Conservation Biology harvested good results for informing the society: nowadays it is rare to find anybody not aware of environmentalists warnings. From the viewpoint of biologists, CB was an autonomous, self-generated initiative. Yet from the point of view of the society conservation biologists became an elite of scholars using one single discourse for telling heterogeneous people what to make for preserving nature. We believe the later reduced the chances of biologists for moving people to press decision makers. An evidence is that CB spent more than 40 years warning on the risks of rampant deforestation, soil nutrient losses, eutrophication, and Climate Change, but all these have globally increased instead of declining.

After achieving a fairly good understanding of ecosystems, ecologists moved forward towards a better understanding of the role of the variety of living beings. Thus, during the aforementioned conference of 1978 Thomas Lovejoy talked on 'biological diversity' and such a term started to circulate among scientists (Lovejoy 1980; Figure 1). After another scientific meeting (1988), one single, iconic term 'biodiversity' became widely used for referring to the variety of ecosystems, species, and genes (Wilson 1988).

Thus, the western thought started to focus not only on biogeochemical processes and system theory, but also on the role of species and varieties of species as well as on how do they react to land-uses. European environmentalism quickly assimilated all these into its programs for both excerpting political pressure (when in the opposition) and guiding decisions when sharing political rule (e.g. Swedish Green Party 2018; Die Grünen-Austria 2020)[10]. As a result, on 1987 the United Nations published *Our Common Future*; a document better known as *The Brundtland Report* -honoring its senior author. The report recognized Climate Change and other consequences of land abuse while proposing an alternative to mass, rural colonialist productivity: *sustainable development* (Brundtland et al. 1987). Since then, 'sustainability' was recognized to comprehend three dimensions: environmental, economic, and socio-cultural. Consequently, private and governmental managers were corporatively encouraged to consider these dimensions at the local, regional, and national levels in order to favor the functioning and renewal of nature, the economy and the culture (Brundtland et al. 1987).

Only towards the end of the 20th century the western thought began to recognize humans as tightly bound together with nature. Yet considering Earth as a (kind of) *mother*, which is a biogeochemically correct idea, had to wait until 2009 (Cantú Martínez 2015; see also Choquehuanca 2010). Immediately after the Brundtland Report key European countries started to depart from the mass productivity paradigm in favor of a so-called 'rural' point of view (Figure 1). Such a departure results from the pressure applied by green parties like the one of Germany which arrived to the federal parliament on 1983. The 'rural' concept considered both nature and the society as a unit. Inside that historical context, the two Germanies reunited (1990) so Alliance 90 and the Greens came together into a single political party (1993). This was only one year after the Treaty of Maastricht originating the European Union (Figure 1). Off course, the rural point of view did not last for eradicating consumerism, mass production, and their concomitant pollution and losses of soil quality (e.g. van Egmond et al. 2002; Tóth et al. 2014; Le Moal et al. 2019). But the rural perspective became reflected in the so-called *Agenda 2000* (Comisión Europea 1997; Figure 1) when 'Bündnis 90-Die Grünen' was a key member of the German government. Agenda 2000 gave impulse to multi-functional agriculture.

After looking into this chronology, we stress on the following. (a) The creation of the European Union became an alternative to intra-European, rural colonialist warfare. (b) Current West Europe inherited mass productivity from the previous history of its countries. (c) European core states like Germany rapidly became pressed by well informed, ecologically educated activists to start a departure from mass monoculture towards a top-down, corporative environmentalism. The later includes financial support to the indigenous tradition of multi-functional agriculture, yet as a top-down decision made by rulers.

## CONCLUSION

Historically accumulated environmental damage have resulted in: current natural disasters, global disease, and life-quality reduction for humans; all these were warned per more than 50 years. There must be heavy reasons explaining why such voices of alarm did not manage to radically change economic policies. A proximate reason are the billionaire profits generated by land abuse; rural colonialism corresponds to an ultimate cause. Rural colonialism was introduced in the Americas some 500 years ago and considers soils, plants, animals, and people of conquered lands as mere objects, surrogated to produce for the profits of their "owners"; not as subjects with the right of healing. Rural colonialism is a tightly rooted cultural heritage: it was already an European tradition before getting into the Americas, then continued being transmitted across generations of commodity exporters. The productivity of the Green Revolution of the $20^{th}-21^{st}$ centuries enhanced profits contributing to fix the tradition among many entrepreneurs and decision makers. All these explains why land abuse has remained supported by a number of rulers of the Americas.

For starting to depart from rural colonialism, European ruling classes needed to be shaked by loosing geopolitical influence, deadly wars, widespread hunger, and fear to revolutions. The rise and development of Ecology and Conservation Biology started to provide alternatives to land-abuse, but it is not given for granted that sustainable land-use will become dominant. However, Europeans began to reinforce their scholarly-made conservation plans with enhanced financial protection to their indigenous peoples practicing a more sustainable, multiple use of natural resources. The Americas need to stop imitating the old European productivity, and deepen their learning from indigenous good practices instead. For pushing forward such a process, Conservation Biology should get closer, borrow ideas, and invite indigenous naturalists to share us their knowledge. Five decades are gone since the memorial of the first *Day of Mother*

[10]Similarly influential green parties are lacking in The Americas. Instead, some social and indigenous movements decided to participate in elections in order to get access to political power. Once there, they modified the constitution recognizing the rights of Mother Earth as part of a wider agenda (Bolivia with Evo Morales and Ecuador with Rafael Correa).

*Earth.* Our Great Mom does not deserve other fifty years of futile ecological warnings for replacing land-abuse by sustainable land-use.

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## DATA AVAILABILITY

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

## CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

## CONTRIBUTION STATEMENT

Conceived of the presented idea: EIG-P, KLS, DT-R.
Supplied information and wrote sections on the different countries: all authors.
Wrote the first draft of the manuscript: EIG-P, JGL-V, LMV-S.
Review and final write of the manuscript: EIG-P, LDA-A, KLS.
Supervision: DT-R.

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