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Review

The Agro-Meteorological Caused Famines as an Evolutionary Factor in the Formation of Civilisation and History: Representative Cases in Europe

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Abstract: Throughout history, food adequacy has been one of the most critical parameters for the survival of human societies. The prevailing atmospheric conditions have always been recognised as the primary and most uncontrolled factors that determine crop production, both quantitatively and qualitatively. However, this is only a part of the effects chain. In order to assess the magnitude of the potential cultural impacts of weather changes in a region, it is crucial to comprehend the underlying mechanism of successive consequences that relate the proximate causes, which in our case are the adverse Agro-Meteorological Conditions (AMC), to their effects on society. The present study focuses on the analysis of the impacts' mechanism on human societies. Moreover, several characteristic agro-meteorological events that have led to significant changes in European civilisation are presented as case studies. The results highlight the linkage between weather and its impact on history evolution based on Agro-Meteorological Famine (AMF). The proposed concept and its analysis by the schematic presentation are in corroboration with the documented historical events of European history. Moreover, the presented connections between weather, agricultural production, and society revealed the significant contribution of the short-term adverse weather conditions on the mechanism of the human civilisation evolution.

Keywords: weather impacts; atmospheric conditions; food; civilisation; history; famine

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1. Introduction

Civilisation is causally linked to food production. It was when organised groups of people remained at a location for a prolonged period of time, thus developing their first settlements, when the agricultural activity began to appear in the historical proscenium [1]. This development enabled humans to store food, to defend themselves from enemies, and in general, to create civilisations resembling modern cultures in their fundamental structures [1,2]. As long as the technology was unable to sustain food and support its rapid transportation from places of food sufficiency to places of food shortage, sustainable food production was essential for the survival of the societal groups. Agricultural production was directly linked to the weather conditions, given that water availability, thermal resources for the production, and the atmospheric environment could not be adequately regulated by man [3]. The above may be a geographical determinism's approach on human evolution [1–3].

Through their direct and indirect effect on food adequacy [4–6], the Agro-Meteorological Conditions (AMC) form a determining factor for the stability and peaceful coexistence in an area. Several references, so far, involve the effects of climate on the prosperity or the decline of civilisations. It seems that the AMC, and principally their abrupt changes constitute a non-anthropogenic parameter in the shaping of history [7–9].

However, the impact of agro-meteorological conditions as a determining parameter of social transformations, conflicts, epidemics, and alterations in both civilisation and historical evolution has not been sufficiently investigated [9,10].

Famine has been studied in an interdisciplinary manner, and extensive research has been conducted from an economical, sociological, climatological, and political point of view [8–16]. The nature of the differentiation between each case of famine lies on its determination by numerous factors related to the social structure and organisation, the economy, the human institutions, the technology, the environment, and so on.

Famine has always resulted in high mortality and the destruction of the pre-famine social structure, thus resulting in radical alterations in the livelihood of the survivors. Furthermore, famine may be progressively devastating, but it also generates the necessity for developments through the population's adaptation. The phenomenon of famine may be considered as comparable to war in terms of its destructiveness, while the reality that arises after its cessation is of similar significance to war [17–19].

Even today, fundamental queries concerning the phenomenon of famine have not yet been resolved. Slavin [20] points out that "Climate and environment do play a pronounced role in human societies, and especially in the pre/non-Industrial world, but their impact often tends to be exaggerated" and considers that the human institutions and the culture of a region are of great importance. However, he concludes that climate and nature are indeed the first elements in a perplexing chain of factors that lead to famine. Nevertheless, is the famine an outcome of adverse climatic conditions or even an outcome of a short period of 2–3 successive years with abnormal weather that may trigger the mechanism of local or regional-scale famine?

Engler [21] developed the famine vulnerability analysis model (FVAM) to achieve a more comprehensive approach by involving all the factors that generate famine. He suggests the distinction between social vulnerability (SV) and the environmental vulnerability (EV) factors and considers as initiating drivers the climate, the political failure, the wars, and the microbial shocks. Subsequently, he includes in the model the coping capacity and the adaptation phase. Engler's approach (FVAM) is integrated and focuses on the factors that primarily prevailed the onset of famine. Both Engler [21] and other scientists [12,22–26] who have studied famines underline that the scientific research on this particular field is of great significance, given that it enriches our knowledge on the course of human civilisation, the evolution of history, while it also offers us the analysis tools to manage future crises of food shortage.

Studies so far often refer to climate and principally to the abrupt changes of the climatic factors. However, scientists seem to realise these variations as a rapid drop or increase in temperature, or as changes in rainfall that cause floods or drought [27–29]. However, they do not proceed to a more extensive analysis in order to describe the simultaneous multiple effects of the atmospheric parameters on plant and animal production as well as everyday life.

For example, a sudden drop or increase in temperature can cause stress in a crop or in the livestock, but it will also engender uncontrollable stress on the grower. The "health" status of the harvest and the grower will deteriorate simultaneously, thus forming a situation that may have a cumulative effect on the reduction of production. In addition, variations of the same parameter, such as humidity, may cause considerable damages to a crop, by preventing, for example, pollination and by enhancing the ability of a pathogen for rapid spreading.

The AMC play a significant role in creating the circumstances that will lead to famine since they concurrently affect the nutrition resources, namely agriculture in the broadest sense, but also the grower and the society.

The aim of this study is the presentation of the interaction mechanism between AMC and civilisation by focusing on European historical facts. For this purpose, systematic research of historical events was implemented, in which the influence of weather conditions on civilisation was apparent. This research was further supplemented by representative descriptions involving the relations between AMC and characteristic aspects of civilisation.

2. The Agro-Meteorological Conditions as a Civilisation's Driving Force

Adverse atmospheric conditions that evolve on a small spatiotemporal scale during plant development determine the course of agricultural production and therefore food production. In situations where food availability is highly vulnerable, famine seems likely to occur. In turn, famine triggers the gradual disorganisation and degradation of the family and society primarily by altering the physiological and psychological nature of the individual. The societal consequences during famine incidents caused by the adverse weather stimulate chain reaction mechanisms that are accompanied by important events that influence civilisation evolution and shape history.

2.1. The Agro-Meteorological Conditions in the Famine Mechanism

Scientists have been focusing on the possible effects of climate change on human civilisation for decades. The scientific community explores climate change, both spatially and temporally, while attempts have been made on the assessment of its impacts on various areas of human activity [30–32]. Great scientific concernment lays in improving the forecasting of climatic conditions that will prevail in the forthcoming decades, considering various scenarios on the anthropogenic greenhouse gas emissions [33,34]. Furthermore, significant efforts in investigating the impact of historical climate variation on human history have been achieved by using conventional and contemporary techniques in the fields of archaeology, palaeontology, and anthropology [7,35–37]. The study of climate, typically described as the average state of the atmosphere recorded over prolonged periods ($\geq$30 years), can shed light on significant events, yet on the dramatic and extensive alterations in both the natural and anthropogenic environment. However, research on a climatic scale basis cannot provide answers concerning events or situations that have evolved during smaller spatiotemporal scales.

In order to highlight the importance and effects of weather on the formation of civilisation, the relation between weather conditions and food production must be clarified. After the development of agriculture and animal husbandry, food resources of the inhabitants in the historical past consisted mainly of neighbouring crops and livestock. The ability for processing was negligible, and food was only preserved by curing, salting, or smoking techniques or rarely by ice storage if the ice was readily available [38,39]. So, the food production and supplying chain was fragile, and this high vulnerability was a matter of life and death in a local or national scale. The most obvious and known causes of famine were conflicts, natural disasters, or plagues [38–41]. Nevertheless, when we focus closely, we may reveal another subcutaneous factor: the short-term atmospheric conditions.

Agro-meteorology constitutes a science relevant to crop production because it mainly deals with the interactions between meteorological and hydrological factors on the one hand and agriculture, in the broadest sense including horticulture, animal husbandry, and forestry, on the other [42,43]. As depicted in the flowchart (Figure 1), weather affects cultivation both directly and indirectly. The direct effects result as a consequence of the atmospheric elements' contact with the cultivation, fundamentally referring to the effects of precipitation (heavy and/or prolonged rainfall, hail and snow), extreme temperature, and increased wind speed. Adverse weather may cause varying degrees of destruction and reduction of agricultural production, affecting thus, food availability in local societies. Weather conditions are also highly responsible for the development of phytopathology (pests), resulting in significant yield reductions [9,11,44–47].

The abnormal increase or decrease in temperature is mainly reported in most studies where reference is made to the effects of climate change. However, the crops are sensitive not only to the extreme values of the cardinal parameter (e.g., temperature) but also to their temporal distribution and to their thresholds. Therefore, an area's climatic suitability is estimated by cumulative thermal parameters such as the Growing Degree Days (GDD), the Diurnal Temperature Range (DTR), the number of days with extreme cold, etc. [43,46].

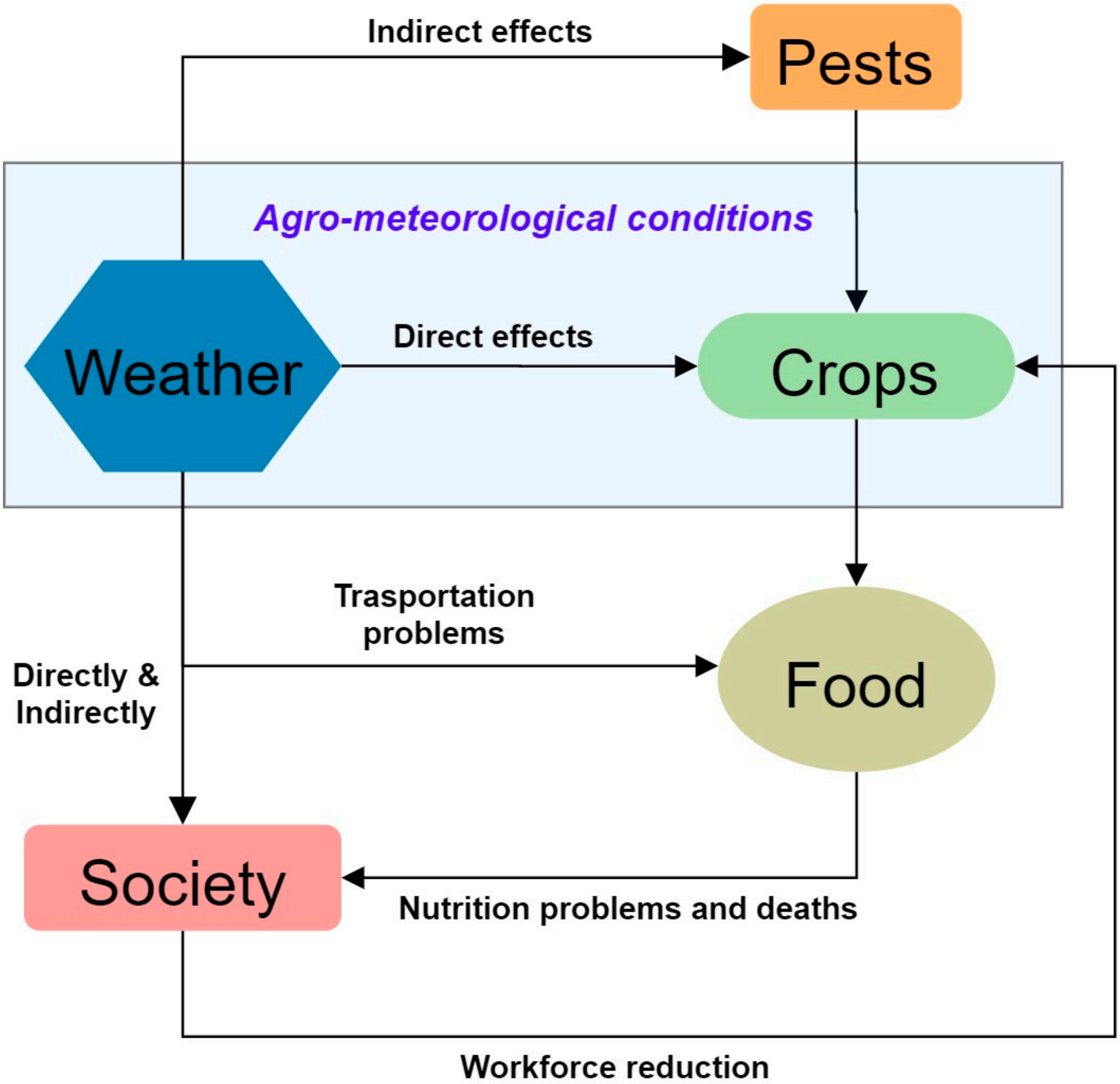

Figure 1. Flowchart depicting the linkage between weather, crops, food production, and society.

Furthermore, crops are not only affected by individual atmospheric parameters but also by the parameters' interactions. Thus, the individual knowledge of a single parameter's fluctuations (e.g., the temperature's increase) is not sufficient enough, but the integrated information on additional parameters that determine plant growth (e.g., solar radiation, humidity, wind speed, etc.) is substantial [44,48].

Other phenomena, such as volcanic eruptions, are mentioned as determinative in many cases where the causes of starvation are being investigated. Through the history of famines, these ubiquitous geophysical phenomena reduced solar radiation drastically, resulting in the significant reduction of crop production [7,30,46,49,50]. So, it is once again demonstrated that the cause of famine could be the abnormal variation of the existing AMC. It is possible that the required correlation between starvation due to reduced agricultural production and weather conditions has falsely not been implemented, given that the estimation of the weather conditions prevailing centuries ago on specific days is difficult and most likely inaccurate.

The coexistence of crop damage attributed to both the direct and indirect effects of weather or the successive development of the aforementioned effects is not uncommon [43,48]. Crop damaging weather conditions may also put pressure on the grower's health. Thermal stress (either generated from a cold or hot environment) reduces productivity, primarily when activity is performed outdoors [51–53]. If it is further assumed that habiliments in the past did not provide the grower with their contemporary protection potential, then the possibility of the enhancement of the environment's harmful effects was likely to occur.

At the same time, the meteorological conditions are directly and indirectly related to the spreading of diseases (pests). More and more studies from different scientific fields reveal that the epidemiology of hazardous diseases depends mostly on the atmospheric parameters (e.g., temperature, humidity, rainfall) as they determine the staying of people indoors (for their heating or cooling) as well as the viability of pathogens on surfaces [51–55]. In times when medical science had not been developed, and therefore effective action in the absence of vaccines and effective drugs was impossible, public health was clearly exposed to the meteorological conditions [1,9,49].

Another process of influence of meteorological conditions on food production is through the psychological state of the grower. Adverse weather conditions were often thought to be the result of the God's punishment. A sharp drop in temperature or an unusually dry period at times when no sciences had evolved was often interpreted as a bad omen. The psychological and mental state formed after or during an extreme weather event triggered the process for reduced productivity, while it also created insecurity. According to most research findings, meteorological conditions can directly affect a person's psychology, his emotional state, and judgment, while in some cases, they have been shown to affect the severity and frequency of crimes [56–59]. Societies characterised by high levels of illiteracy had not developed medical sciences or other fundamental scientific fields such as geotechnology. Thus, nature in the minds of the people often expressed the "wrath" of the Gods, and any unusual change in the weather parameters was a direct and indirect cause for the reduction in food production.

All the above mechanisms, which are triggered by the adverse weather conditions, may result in a severe reduction of agricultural productivity. So, if this limited food production is far below the crucial level of the demand, there is an Agro-Meteorological caused Famine (AMF). This famine is triggered by the short-term atmospheric disturbances that affect directly and indirectly the agricultural yield, in contrast with other types of famine caused by conflicts, natural disasters, or the economy's failure.

2.2. The Agro-Meteorological Famine (AMF) and Society

The root of the progressive disorganisation and deterioration of the family and society, and thus the evolution of civilisation, lies in the psychosocial nature of the effects on individuals from famines, which are often triggered by the adverse environment. Figure 2 briefly illustrates the personal and societal impacts of famine. The impact on individuals is compounded by apathy, irritability, depression, lack of initiative, decreased libido, dulling of emotions, and low concentration [60,61]. The dramatic alteration of personality and human mentality are experimentally confirmed effects of the hunger that precede the biological exhaustion at the early stages when all human energy and ingenuity focuses on the search for food [61]. Vivid descriptions of the social consequences of famine refer to gradual behavioural changes. Initially, altruistic behaviour [62], solidarity, and preferential concern for the most vulnerable can be seen among kinship groups or friends [63].

On the contrary, as the famine crisis intensifies, social degradation phenomena begin to be distinguished. Deterioration of the society is reflected by the typical increase in the self-centred "survival of the fittest" antisocial behaviour [60], which focuses solely on personal survival, while human dignity and the sense of basic family bonding is progressively eliminated. The social impacts of family breakdown include the increasing disintegration of social structure, lack of cooperation between sufferers and lawlessness (e.g., thefts of food by individuals, plundering by groups, exploitation), peaking to hideous social sequences (e.g., children abductions, murder, slavery, cannibalism, murder cannibalism) as famine reaches its later stages [60,62–64].

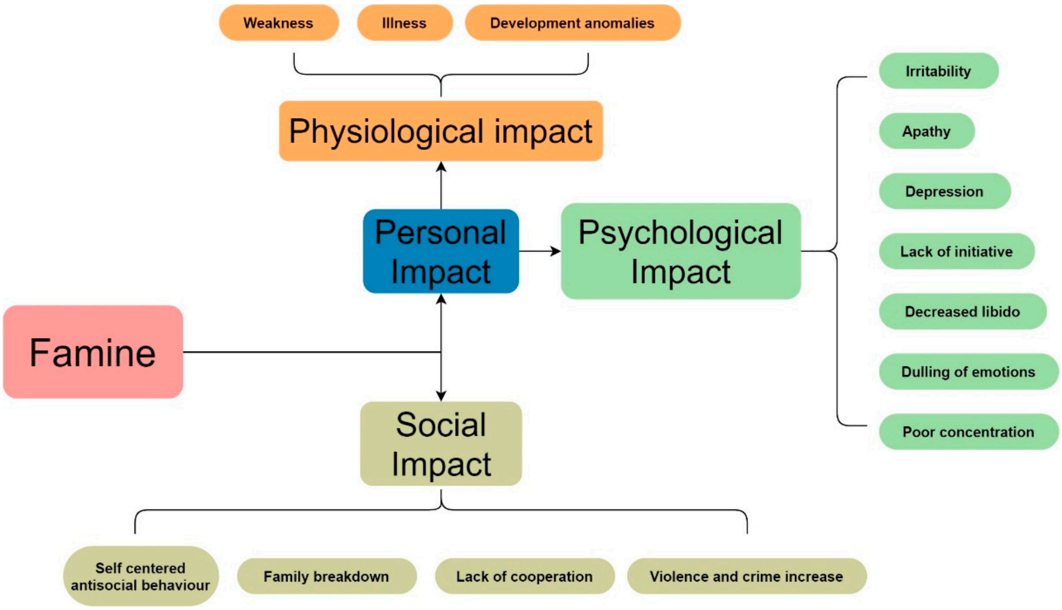

Figure 2. The impacts of Agro-Meteorological Famine (AMF) on individuals and society.

2.3. *Agro-Meteorological Conditions and the Societal Chain Reaction*

Food production losses inevitably lead to the qualitative and quantitative decline in nutrition, thus impacting directly on the survival of communities and therefore procure internal unrest and the deterioration of public health [17,46,47,64,65]. The search for food in neighbouring areas can lead to social strife or even war conflicts and consequently to excess mortality [8,47,66]. If there is a great reduction in food availability, then famine is likely to occur.

In general, the deterioration of public health or the loss of human lives, due to both conflicts and famine, create the lack of manpower that plays an indispensable part in the implementation of agricultural activity [67–69]. As such, problematic food production may result, even if the weather conditions are more favourable or even optimised in subsequent years.

Adverse weather conditions can simultaneously affect transportation and the community. That is because the atmospheric conditions that have led to the direct or indirect food reduction may impede on food transportation between neighbouring areas (through the destruction of infrastructure) or may cause high mortality in the community such as prolonged extreme temperatures and floods [3,15,60,70].

Figure 3 represents the characteristic routine that briefly describes the linkage between the unfavourable environment and irreversible situations that ultimately affect civilisation evolution and may lead to events sometimes designated as turning points in history. More specifically, the direct crop damage due to the adverse AMC may result in reduced food production and therefore, food shortage. Food deficiency and deprivation fundamentally trigger the socio-economic processes that may regenerate a new cycle of food production declination, thus resulting in the accumulated lack of food. In general, when institutions and technology do not allow the long-term storage of food, but also its rapid transportation and therefore the provisioning of the consumers, changes in adequacy fuel social insecurity and unrest [1,39,40].

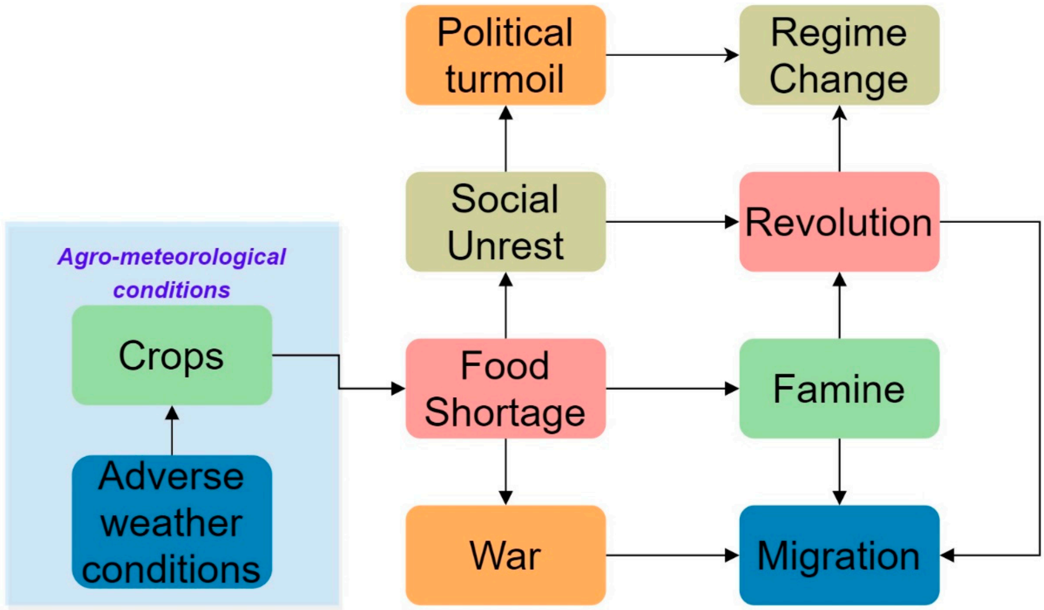

Figure 3. Flowchart of the linkage between agro-meteorological conditions, food shortage, and the consequences of food shortage.

Reduction of the available food may lead to starvation directly, thus resulting in numerous deaths or probably in social unrest. Depending on the appropriate management and the capability for controlling the disorder, there may be political instability or even revolution manifestation, and in some cases, the violent overthrow of a prevailing regime. Another collective impact of food shortage is the search for resources outside the affected area and eventually, the initiation of warfare with the neighbouring areas. The incentive for the famished to search for food leads to significant migration and inevitably to demographic problems involving a considerable population decline but also the redistribution and restructuring of the remaining population in an area. In most cases, manpower inadequacy is also typical and contributes to the exacerbation of the area's reduced productivity potential [2,7,11,24,38,60,71,72].

Consequently, AMC are potentially destructive environmental components considering that they may engender multiple adverse developments, as food inadequacy, in a community. The linkages depicted in the flowchart (Figure 2) are evidenced in many historical cases that have been recorded in Europe, therefore confirming the hypothesis that weather conditions and their impact on crops may lead to or influence significant historical events that may shape the evolution of civilisation. Scientists have linked several parameters of a region's social, technological, and institutional status to its ability to obviate famine or quickly recover from it [20,21,73].

3. Selected Agro-Meteorological Famine Incidents in European History

Over the years, experts representing diverse scientific fields discover new facts concerning the everyday life of citizens, the economy, the adequacy of commodities, and the political and social status during adverse weather conditions. Concurrently, the continuous enrichment of scientific knowledge supports the study of the weather conditions occurring in the past and even during periods preceding the invention of meteorological instruments. The comparative study of scientific data can outline or confirm the mechanisms linking AMC and crop development to food production and to the impacts of food shortages on society and civilisation.

3.1. The "Great Famine" of 1315 AD

During the summer of 1315, extreme meteorological conditions consisting of unusually low temperatures and continuous rainfall prevailed in almost all over Europe [22]. The continuous rainfalls began in England in 1314 AD and lasted for over ten months, while during July and August, the rains were heavy and incessant. Crops were completely destroyed by the consequent floods, and agricultural production was minimised. The intolerable hunger led to the consumption of inappropriate food (e.g., horses, dogs, cats, and vermin), while cannibalism was also evident. Furthermore, as the result of starvation, corpses filled the streets, while prisons were overcrowded due to the intense lawlessness. In addition to the abundant rainfall of the summer of 1315, unusually low temperatures were recorded in Ireland and France, while the extremely cold environment extended up to Poland and Estonia [74]. The severe cold and high rainfall recorded for two consecutive years (1315–1317 AD) resulted in the severe damage or the destruction of crops and thus in the sharp drop of the plant and livestock production. During the famine, it appeared that there were no commodities that could cover even part of the nutritional needs of the inhabitants. The food market had collapsed as a result of the dearth but also due to the rapid rise in the prices of all kinds of foodstuffs. These circumstances lead to the exhaustion of food reserves and finally to the occurrence of famine, which was historically termed as the "Great Famine of 1315–1317". The extensive malnutrition successively led to the deterioration of public health and thus to a significant increase in mortality, reducing Europe's population by approximately 10% in the forthcoming years. This tragic reality motivated great social turmoil and increased crime. Many researchers consider the ensuing Hundred Years' War (1337–1453) as the outcome of this particular famine. Finally, this famine led societies and governments to seriously consider storing more food in order to avoid or reduce the consequences of future incidents of reduced productivity [19,21,69].

3.2. The Northern European Famine (1693–97 AD)

Extreme cold during several consecutive years (1693–1697) also prevailed in northern Europe and especially in northern England and southern Scandinavia. It is characteristic that much of Scotland was covered in ice for an unusually long time. The progressive destruction of crops and the reduction of agricultural production resulted in significant food shortages and in the origination of famine, which accounted for high mortality rates. During this period, several historical records found in northern Europe (e.g., Estonia, Finland, Germany, Poland, Czech Republic, etc.) document the absence of crop production and specifically the inability of annual crops and fruit trees to produce [75,76]. So widespread was the famine that it led to massive deaths. According to documentations, whole families perished, rendering, thus, their farms abandoned and unexploited. In addition to the collapsing of the food system, the governments did not receive taxes and were thus characterised by a non-existent financial capacity for food imports. Furthermore, many farm owners, having lost much of their workforce (workers, together with their family members), had nothing to anticipate for. Therefore, they abandoned their properties and searched out for work elsewhere, most probably in other farms, or survived as mercenaries. As a result, in much of Europe, the large landowners took possession of the abandoned farms and therefore increased their properties but simultaneously generated the existence of numerous landless inhabitants. So, the distinction between the rich and the poor was more evident than ever and formed the most favourable environment for social revolutions [76,77].

During this period, in the southern regions such as France, conditions of prolonged rainfall prevailed during the spring, which caused significant crop damage directly due to floods and indirectly due to the severe development of plant pathogenicity. Historical records from various parishes in Scotland reveal massive deaths amounting up to the 1/3 to 2/3 of the population. Reports on extreme and widespread poverty often describe hideous social consequences, including the exploitation of children, which were often sold as slaves by their parents for both the children's and parents' survival. Hunger and disease epidemics drove to social disorder, while general lawlessness, including thefts and plundering, was prevalent. The inhabitants of the famine-stricken areas sought help from important institutions and primarily from the Church [9,78].

3.3. Agro-Meteorological Conditions and the French Revolution

An event of great historical significance that determined the evolution of the European civilisation and presumably of cultures globally is the French Revolution (1789). Grove [13] reports that the French Revolution, which had itself been much stipulated by prolonged bad weather, led to the destruction of European crops. The severe winter of 1788 caused famine and widespread starvation throughout the province, and therefore the dramatic increase in the price of bread that led to bread riots in Paris [46].

It seems that the El-Niño of 1789 played a decisive role in the destruction of crops worldwide. Accurately, Grove [79] describes an unusually cold winter (1787–1788) in Europe, which was followed by a delayed but particularly wet (due to heavy rainfall) spring and dry summer. The lack of food and the often uprisings led to mass migration, which is accompanied by the transfer of yellow fever on the east coast of the nowadays United States, where the disease spread rapidly due to the high concentration of vectors (mosquitoes).

Precursor phenomena of an agro-meteorological nature also may have affected the conditions that led to the French Revolution. It seems that a prolonged drought, most likely associated with the El Niño of 1785, had caused damage to the production of grapes in the wine-producing regions of Normandy and Picardy. During the reduction in grain production throughout the country in the following years, the price of wine dropped dramatically, causing a severe economic decline in areas where wine was the main product (e.g., Champagne, Bordelais, Beaujolais). The reason for the low demand for wine was that the substantially low income of the population was exclusively consumed for bread and cereals, which were essential for its survival [13,30,80].

Although warm conditions during spring are favourable for cereal cultivation in northern France and southwestern Europe in general, the abnormally high temperature and low humidity conditions, at the late spring of 1788, caused the destruction of grain production. However, these extreme conditions enhanced the production of wine both quantitatively and qualitatively. At the end of the summer of 1788, short but severe hailstorms took place. In some cases, hailstone sizes were such that hares and partridges' deaths were recorded.

The apparent decline in production and the impending poverty were probably the primary causes for the uprising of farmers and of the rural populations in the summer of 1788, which subsequently led to the revolution in the following year (1789). These hailstorms that followed the hot, dry summer of that year transformed the central and northern part of France to an arid desert field. From historical records of the Church, it is estimated that approximately one-fifth of the population in Paris was directly dependent on beggary and breadlines for survival [41,79–83].

The famine of 1787–1789 is typical since 90% of the French population belonged to the poorest class, 75 to 80% of which were farmers, while only one-third of the arable land was in the farmers' possession. Even the landowners possessed very small pieces of land that hardly produced the necessary food for the family's survivor [84].

The status described above clearly demonstrates a high degree of dependence of the population and the state on the annual food production. Consequently, the extraordinary AMC that prevailed in the years 1787–1789 led the majority of the people to great despair. The urban population, which had no direct access to agricultural food production, was most affected. This resulted in serious conflicts between the sufferers and the state security forces that were trying to maintain order and limit crime, during a period when an enormous part of the urban population could not fulfil their nutritional demands. It must be taken into consideration that the French Revolution, which seems to have been influenced or even caused by food shortages, was the culmination of many decades of poverty and hunger, which were both usually generated by the abnormality of the weather conditions that reduced food production [13,47,85]. The connection between this historical event of globally significant importance and the prevailing AMC that significantly reduced agricultural production is apparent.

3.4. Agro-Meteorological Conditions and the Two Irish Historical Famines

During the "Year of the slaughter" (1740–1741), 13% to 20% of Ireland's population died of starvation. The famine of 1740 was the result of the severe cold that prevailed throughout northern Europe that year. More precisely, the unsustainable conditions for both humans and crops that lasted for three consecutive years culminated in 1740. Crop production was low for cereals and especially oats during the years preceding 1740, while the almost complete loss, at that year, of the potato crop that was predominant in the Irish diet, led to one of the greatest famines in history [83].

The interaction between the inconceivable food shortages and the abnormal cold environment deteriorated the health status of Ireland's population, resulting, thus, in the generation and outspread of incurable illnesses. Before the "Great Frost" of 1740, a decade of relatively mild winters had proceeded, resulting in the widespread cultivation of the potato crop over that of the grain crop (cereals), which is a farming practice that eventually turned out to be fatal in the year 1740.

The causes of the abrupt decrease in temperature have not yet been confirmed [22,81,83]. The prevailing AMC characterised by an extremely low-temperature regime severely damaged the potato crops also due to soil freezing. This resulted in the inevitable destruction of both the stem and the tubers (the subsoil edible part of the plant). In addition, the mass destruction of the potato production deprived the next growing seasons of the crops' reproductive potential [84–88].

A representative case in which the prevailing AMC triggered a series of chain reactions initially by limiting the available food was that of the "Great Irish potato famine" in 1846. The summer of this year was unusually hot and humid, thus forming the ideal conditions for the development of the potato blight disease caused by the fungus Phytophthora infestans, which had probably entered Europe by ship the previous year. According to the pathogen's epidemiology, its germination, infection potential, and distribution evolve rapidly under conditions of plant surface wetness, high humidity, and moderate temperature [89,90]. From Ireland, which functioned as the epicentre of the potato blight's dispersal, given that potatoes were now the predominant edible plant species, the disease rapidly entered England, southern Scandinavia, and northwestern Europe.

The potato was the staple food mainly of the lower social strata, including the rural population. Poverty in conjunction with almost the destruction of the staple food inevitably led to famine, which furthermore resulted in political unrest and the massive migration from the affected countries to the whole of Europe and mainly to the American colonies. This particular historical incident led to the uprisings of the peasantry who demanded the democratisation, the redistribution of land, and the government's liberalisation [9,23,91].

4. Summary and Future Perspectives

The Agro-Meteorological Conditions (AMC) demonstrate an essential role in the history of man and the development of his civilisation, given that they affect food adequacy and physical and mental health.

The prevailing adverse AMC are potentially destructive environmental components since they engender multiple adverse developments and therefore determine the stability and prosperity of civilisations. It seems that the abrupt changes in weather constitute a non-anthropogenic parameter in the shaping of human history by the Agro-Meteorological caused Famines (AMF). The adverse environment may generate a complex chain reaction mechanism with long-term effects on cultural characteristics and historical developments. The extreme food shortage caused population reductions, migration, social instability, political regime changes, a new balance between population and resources, and finally advances on food security.

It is possible that AMC are just as an essential environmental factor as climate change since, despite their short duration, their multiplicative effects are equally significant. The mechanism described in this study reveals that the adverse AMC dramatically affect human life, both directly and indirectly. The modern worldwide society is in a high alarm level to prevent food crises. Moreover, food transportation, the stock, and the distribution chain have established a steady flow of food, giving us an optimistic point of view. In addition, the atmospheric and agricultural sciences and technology are at a high level to secure an adequate quantity and quality of food. The challenges of overpopulation and climate change are the two core issues we face in the effort for adequate agricultural productivity [91–94].

This study is a first attempt to systematically study and depict the relationships between food availability and weather conditions that determined human activity, development, and health as well as the survival of populations in the European continent.

Our forthcoming aim is the broader study of similar events on a global basis, their extensive recording, and an attempt to standardise the mechanisms of the influence of AMC on the course of the civilisation's evolution by the phenomenon of the Agro-Meteorological caused Famine (AMF).

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