# Eco-agriculture and Farming in the Anthropocene Epoch: A Philosophical Review

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**Abstract.** This article examines the complex interactions between agriculture, farming, and the Anthropocene environment. It discusses the challenges facing modern agriculture as a significant contributor to land degradation and climate change related to the planetary boundaries scale. Criticism of current agriculture is the effort to approach a philosophical view in considering eco-agriculture as part of environmental ethics. The holistic resolution that aligns the sustainability orientation for future agriculture is necessarily needed by social and political transformative movement. Therefore, the result finds the human moral value of land farming responsibility that agriculture is an ethical act requiring reflection at all planetary aspects, including food resilience, socio-economic changes, climate change adaptation, and natural preservation.

**Keywords:** Environmental movement, planetary boundaries, sustainabilization, utilitarianism.

## 1 Introduction

The future challenge of the 21$^{st}$ century concerns current global agriculture and food management, which are following an ideal consensus to produce food good quality in terms of a sustainable goal. Geologically, modern agriculture has impacted the beginning of the 'Anthropocene,' a new geological epoch, represented by the fact that human intervention changes the Earth's surface structurally [1]. It recognizes that agriculture as a counterpart of the Anthropocene is at the point of anthropogenic activities in natural cycles (phosphorus, nitrogen, carbon, water, etc.) [2]. It means that the Anthropocene narrative draws the turning point of the agriculture revolution, from hunter-gathered to modern agriculture.

In the last Holocene epoch transition, the 'stable conditions' have allowed humans to develop their basic civilization communities [3]. This stability is possible to evolve agriculture innovation. However, this frame has drawn attention related to asynchronous interconnected phenomenon in terms of global ecological change during the last century based on the anthropogenic footprints such as the rate of extinction and climate changes [4, 5]. Several significant human impacts on the environment are used to the indicator or potential point of the Anthropocene beginning; one of them is farming impact. The origins of agriculture have estimated in the Neolithic revolution of the Neolithic Demographic

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Transition (NDT) as an evolutionary concept of agriculture about 8 000 yr ago [6]. Agriculture significantly increased as the way for a transition from hunter-gather society to agriculturalist, as the vision to widespread the process of land usage and changes. On the other hand, the notion of ultrasocial revolution can lead to an understanding of the relation of agriculture and the Anthropocene [7].

Modern agriculture is one of the most significant contributors to greenhouse gas emissions. The issues of climate change from agriculture also supply a negative impact on land use. Farmers are aware of the climate change impact, and they deal directly with capricious seasonal patterns such as floods, drought, soil degradation, waste, and damaging pollutants. In most critical cases, anthropogenic behavior intertwines with and impact cyclical activity on Earth [8]. Thus, human actions collectively at the planetary level align with the natural cycle's interaction. The role of agriculture also correlates to deforestation in driving the carbon cycle under the various issues by region found around the world.

Given the nature of Anthropocene discourse being the concerning issues of this article, especially pertaining to the question of the human-nature relationship, agriculture on the planetary context, then it is sound to state that this issue needs a philosophical reflection. Precisely, the specific inquiry on how a philosophical approach examines a prudent and safe practice of agriculture to sustain humanity, without compromising issues pertinent to ecological damage and the consequence of climate change? However, despite its philosophical nature that perhaps often regarded to enshrine a problem-solving tendency, this paper is purely hypothetical and thus, potentially inspiring a set of real practical importance that eventually produce an appropriate praxis of agriculture. Orienting this 'hard-science' notion such as in this case, agriculture, in a philosophical manner has become an accepted norm within the scientific community to introduce alternative perspective or reinforcing the importance of praxis that this so-called 'science' is simply a mere idea without human intervention to be considered along the way. In brief, this paper aims to examine the philosophical concept of subjectivity and solidarity to understand how humans deal with the ecological risk and planetary boundaries of the Anthropocene based on the concept of eco-agriculture, especially in the evolving moral status of the decision making in the agriculture sustainability and food resilience.

## 2 Literature review

### 2.1 Eco-agriculture and environmental ethics

Eco-Agriculture emerged in the 1970s, a fundamentally a self-aware movement, and alternative to agriculture in response to the dominance of 'conventional agriculture' due to its accepted practice of dependence on chemical biocides and energy intensiveness [9]. From a philosophical point of view, this movement is fundamentally a holistic system, meaning that it complies with the natural order law as an ecological creativity movement rather than the merely mechanistic industrial end. Farmers' roles, as nature's partner, is under the responsibility and obligation to be a respectful and caring steward of life [9]. Agriculture, therefore, becomes an art of farming that needs the dynamic interplay of science and technology to adapt to the environment. Soil is a separate entity with its complexity that is organic and fragile and relies on external protection and care.

As a movement, eco-agriculture is a radically individualistic action. Each farm is its separate realm and heavily personalized. Hence, they have their unique methods and materials in order to meet the specific need and the natural condition of the land. This means that every single farm has its own 'philosophical' finesse, yet the real problem is situated in the development of a self-awareness movement that is based on previous learning and experience. Eco-agriculture is a fundamental concept that can be traced back to the history of human civilization itself, stretching as far as the prehistoric (the soil community and spiritualistic farming), ancient (basic methods of irrigation, crop rotations, cultivation), and modern (mainstream agriculture—controversial 'organic' vs. chemical) [4, 10]. On the positive side, however, archeological evidence shows that ancient farmers often preserve topsoil and rebuild damaged land [10, 11]. Furthermore, contemporary agriculture is possible to conserve the land in order to anticipate the loss of biodiversity and climate change. Nevertheless, this movement subsequently generates a significant deal cost for transforming global understanding of future agriculture ecologically.

Specifically, environmental ethics inspire Eco-Agriculture perspective [12, 13]. This paper will bring the context of geological time—the Anthropocene to specify the spatial and temporal scale in framing the right philosophical approach. According to the Ruddiman hypothesis, greenhouse-gas has driven climate change since the Neolithic revolution, then initiated the Agriculture revolution as a part of the Anthropocene thesis [14, 15]. The two dominating moral paradigms that were implemented in the discourse of environmental ethics: deontology and utilitarianism, began to emerge in the 1990s [16]. In the present day, there are dissolved into holistic and affective ethics [12, 17].

Agriculture within the discourse of Anthropocene is the pinnacle of anthropogenic activity that is radically altering the natural relationships of the biome. In responding to the Anthropocene relations, Miles and Craddock propose the orientation of internal value called Biome ethics to anticipate a catastrophic global disequilibrium [18]. Some are optimistic and simultaneously pessimistic about human progress and the apex of society where prudent decision-making becomes the norm that can potentially affect the biosphere, particularly the possible collapse of global biome in the future. Moreover, in relation to prudent decision-making and ethical outlook in dealing with the environment, three ethical notions should be considered, such as i) conservationism (preservation natural spaces and wild species aesthetically), ii) environmentalism (against chemical industrial and preservation of diversity), iii) apocalypticism (global human catastrophe) [18]. The Anthropocene epoch presents a set of detrimental effects of anthropogenic activity on the life-sustaining capability. Therefore, it needs to extend beyond a focus on prudentialism or responsibility of this situation. The Anthropocene is holistic and primarily concerns with the natural cycle, thus the inclusion of past human activity in the narrative, as well as the product of colonization and capitalism that did not merely result in the production of the high carbon oxide. Still, the idea of various exploitation and oppression become the core of this issue that affected living- and non-living being. Economic factors disrupted local farming by opting for the most fertile land for industrial agriculture industries without ethical reasoning and its impending consequence. Such considerations may pertinent to the political-ecological connectivity, human-nonhuman continuum, and shared suffering to portend the possibility of life rather than apocalyptical peril.

## 2.1 Planetary boundaries in the Anthropocene view

The new realities of the Anthropocene face the issues of limited global natural resources. Johan Rockström (the Stockholm Resilience Centre) proposes the central concept of Planetary boundaries to define the notion of safe operating space for humanity [19]. It evaluates the human impacts on the biosphere, indicating a planetary scale that anthropogenic activities are substantially altering four out of nine crucial Earth system indicators in ways that affect the stability conditions of Earth's life [20, 21]. Planetary boundaries include climate change, biodiversity loss, biogeochemical flows (nitrogen and phosphorous cycle), stratospheric ozone depletion, ocean acidification, freshwater use, land-system use, atmospheric aerosol loading, and the introduction of novel entities. These four of the earth-system processes that have been transgressed to its critical condition are i) climate change, ii) biodiversity loss, iii) land-system use, N-P cycle, and iv) change in land use. Based on Table 1. and Figure 1., the current value due to transgressions of planetary boundaries are particularly alarming for two reasons: first, it is causing the severe adverse effect of future of global resource and human well-being, and second, the boundary transgression will result in altering the other systems. Therefore, the sense of preserving a safe operating space for ecological resilience is the highest priority to limit the consequence of transition.

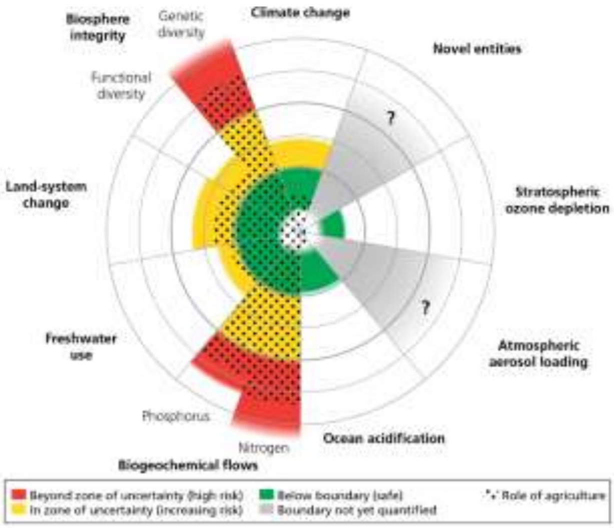


**Fig. 1.** The role of agriculture in planetary boundaries [2].

**Table 1.** The current value of planetary boundaries [22]

| Earth-system process | Control variable | Planetary boundary | Current value |
|---|---|---|---|
| Climate change | Atmospheric concentration of carbon dioxide change in radiative forcing | ≤ 350 ppm<br><br>≤1 W $m^{-2}$ | 396.5 ppm<br><br>2.3 W $m^{-2}$ |
| Biodiversity loss | Global extinction rate in E/MSY or one per million species per year | ≤10 E $MSY^{-1}$ | 100 E $MSY^{-1}$ to 1 000 E $MSY^{-1}$ |
| Nitrogen and phosphorous cycle | Reactive nitrogen removed from the atmosphere Phosphorus flowing into oceans | ≤62 Tg N $yr^{-1}$<br>≤11 Tg P $yr^{-1}$ | 150 Tg N $yr^{-1}$<br>22 Tg P $yr^{-1}$ |
| Stratospheric ozone depletion | Stratospheric concentration of ozone measured in Dobson units (DU) | ≤ 5 % below preindustrial levels (290 DU) | ~200 DU over Antarctica in Austral spring |
| Ocean acidification | Mean saturation state to aragonite in the oceans | ≥ 80 % of the preindustrial level | 84 % of the preindustrial level |
| Freshwater use | Freshwater consumption | ≤ 4 000 $km^3$ | ~ 2 600 $km^3$ |
| Change in land use | Area of forested land as a percentage of original forest cover | ≥ 75 % | 62 % |
| Novel entities | NA | NA | NA |
| Atmospheric aerosol loading | Aerosol optical depth | Regional limit of ≤ 0.25 | 0.3 AOD over South Asian region |

The role of agriculture in altering the stability at the Earth scale has fully transgressed two planetary boundaries at high risk from biosphere integrity and biogeochemical flows [23]. Agriculture is the prime factor at increasing risk level for an uncertain situation in land-system change and freshwater use, and even climate change. Several interventions will be needed in relation to agriculture and the food system in more comprehensive aspects. Biogeochemical use (nitrogen and phosphorous) as part of modern agriculture into terrestrial and aquatic ecosystem have affected the land-system and biodiversity loss. Whereas in the case of the zone of uncertainty, the N-P boundary related to agriculture is more than 200 % transgressed at high-level risk, including food processing-consumption [24].

Further, the concept of planetary boundaries is inspired by the Holocene environment, which relatively stable for the last 12 000 yr [25]. Still, it is now already been replaced by the Anthropocene due to the glorious human domination. Since the start of the Anthropocene epoch, the persistent utilization of chemical products on a global scale has contributed massively to the agriculture industries since the 1950s [26]. A recent Anthropocene research finds a novel and relevant stratigraphically distinct sediments contained persistent chemicals and radionuclides. Thus, there has to be an agriculture reform within the framework of public policy on a global scale to collectively assume responsibility, especially in reducing land degradation and global ecological change.

# 3 Results and discussion

## 3.1 Agricultural sustainability as the Anthropocene context

Visualizing the condition of the Anthropocene becomes a way to contemplate the position of humans today. The focus of the Anthropocene discussion is often directed at geological time scale issues rather than considering aspects of the scale of resilience and sustainability of natural resources for humans. This idea may sound strange and seems to be anthropocentric. Yet, the development of sustainability in the agricultural system cannot be separated from the development of technology and practices that have a direct impact on the environment as a space for farming, as well as influencing improvisation in food production for farmers. However, the extraordinary progress in modern agricultural productivity has led to increased use of fertilizers, irrigation systems, agricultural machinery and equipment, pesticides, and land expansion [27]. It is one of the most fundamental considerations of how relations between farmers, communities, and the environment can guarantee stability conditions in the future. Therefore, to answer these challenges, a philosophical and ethical approach that integrates biological and ecological processes in food production is needed to reduce the use of non-renewable resources, environmental damage, and public health.

Archaeological evidence shows that agricultural development is attached to the community's perspective in determining survival choices. For example, marginal zone theory claims that humans tend to choose agriculture when the most optimal areas for hunting and gathering are no longer sufficient to meet the needs of the community [11]. Whereas a 'feasting model' further explains the development of technology that can dominate the origin of agriculture. The development of agriculture became very intense after humans began to develop the division of labor and knowledge in managing seeds and soil so that the issue of farming has become an interesting perspective in the analysis of origins of farming and agricultural intensification. Based on the social anthropological view of farming, three things underlie the agricultural perspective in an area, which are related to i) power and capital relations, ii) social relations dependency with values, race, and gender, and iii) physical environment [11]. However, anthropologically speaking, farming undergoes different approaches related to the severe planetary change conditions due to the dominant influence on the environment and climate, all of which stem from anthropogenic activities, capital, and plantation agriculture. This condition directs the political agenda in overcoming the ecological crisis based on the logic of environmental modernization, homogeneity, and control, which are developed on the history of plantations. Haraway argues that the emerging Plantationocene as a critique of the dark side of the system of human control over nature and racial policy in terms of ecological justice [28].

The interpretation of agricultural sustainability as an ideology is to fulfill the continual strategies of land stewardship-integrated with agriculture. In 1996, Hansen criticized the concept of agricultural sustainability as a property of agriculture and motivation of changes about threats to agriculture itself [29]. For sustainability agriculture, its characterization should be following i) literal (consistency), ii) system-oriented (an objective property reform), iii) quantitative (quality of human health and earth-wellbeing), iv) predictive (future orientation), v) stochastic (variability recognition), and vi) diagnostic (an integrated measure of sustainability and its weakness and threats). Furthermore, Table 2 shows a comparison between conventional agriculture and sustainable agriculture.

**Table 2.** The characterization of conventional and sustainable agriculture approaches

| **Conventional** | **Sustainable** |
|---|---|
| Symptoms | Causes, prevention |
| Reductionist notion | Holistic view |
| Eliminate 'enemies' and narrow focus (neglects side-effects) | Respond to indicators (planetary crisis) and Broad focus |
| Short-term / Instant | Long-term / Future responsibility |
| Competitive and centralized (value secondary) | Co-operative and decentralized (human scale with higher values) |
| Dependent on chemical | Self-maintaining for bio-ecological |
| Homogeneity | Heterogeneity |
| Oriented towards imported management and products | Oriented towards locality management for work and service and processes |

Organic farming orientation trends have been quite popular among the people today due to its practicality and its credulity of ideal values that aim to protect the environment. As a concept and ideal, organic agriculture movement began in the 1960s, at the height of the counterculture with its idealist and agriculturist readily prepared to resolve the perennial problem of agriculture, such as low quality of food and livestock feed, erosion, soil-degradation, and rural poverty. Inexhaustibly, the reason people trust in organic farming because of two enduring questions, for example, i) is organic food healthier? and ii) do organic crops resist pests? [30]. So, it needs a soil management strategy called humus farming by integrating cultural and biological adaptation, advanced green technology, promoting ecological balance, and biodiversity conservation. The organic farming and products must meet a check and balance in terms of the quality standard; that is, organic certification system plans to record the land integrity management.

Thompson [31] clarifies the hidden philosophical assumption of agricultural sustainability in two main substantive approaches: resource sufficiency and functional integrity as sophisticated alternatives for conceptualizing the nature of human responsibility. It is; therefore, the concept of sustainability has associated with democracy and social justice. These principles also help to develop an agricultural system for improving natural capital rather than social capital. Both modern biological approaches and agronomic management address the operation of resilience energy flows and nutrient cycling for food productivity. Primary challenges, however, persist in terms of the relationship between Anthropocene and the sustainability concept that can be followed these two possible case scenarios [4]. First, society should live with a new perspective in human-nature relations within the planetary boundaries of the physical Earth, including water resources, biogeochemical cycles, biosphere, and land use. Second, sustainability has its anthropogenic limitation. In the future, agriculture will always depend on the physical earth condition and in the dynamic interplay of the socio-political systems. Therefore, the sustainability goal could be the measurement of the natural resource's management like social well-being, eco-green urban movement, environmental ethics, carbon footprint, water management, food consumption, waste, renewable energy, and recycling in terms of improving agricultural and farming in the Anthropocene context.

### 3.2 Future agriculture: A philosophical reflection

In this section, a thoughtful review will be applied to analyze the future of agriculture. This paper follows two studies: in Indonesia, it is mainly concerning the nature of the agricultural production system in Syuaib [32] and coffee farming in the Anthropocene research by Naponen et al. [33]. First, Syuaib argues that the challenge of agricultural sustainability in Indonesia is because of the shifting agriculture paradigm in the last four decades, as well as the growing population, industrialization, and urbanization. On the other hand, the problem of modern farming technology in developing countries is due to a high dependency on chemicals in several intensive farming systems. Second, Naponen et al. solve the general problem of chemical farming by changing the perspective of coffee farming in facing global issues. If Syuaib focuses on the local problem, so Naponen et al., primarily demonstrate that the reality of climate change is the underlying fundamental problem of future agriculture, farming, and agro-forestry. Sustainable coffee production, for example, has been a subject of the agriculture research network. It means that this target area needs extraordinary efforts to support farmers, especially in terms of maintaining soil fertility, water supply, and control of pests and disease in traditional farm-management challenges.

According to climate-smart agriculture (CSA) [33], sustainable agriculture should integrate the three dimensions of economic, social, and climate challenge, and extended to environmental protection, and sustainably increasing productivity and resilience. Its concept is assisting farmers to adapt the global climate change and secure sustainable well-being, economic, and social justice. For example, CSA projects have been applied in Oaxaca, Mexico, with smallholder coffee farmers to develop community-based CSA. In response to the market challenges affecting the coffee supply chain, both in short- or long-term adaptation strategies for increasing productivity and resilience of sustainability agricultural. Recent research in flowering plants as the political agenda brings agriculture as geopolitical issues [34]. It is because human civilization depends on flowering plants in a retrospective view of evolution, even crucial for providing biomass for social needs. Conversely, human appropriation of biomass is altering planetary boundaries, therefore, agriculture plan in the future involves long-term resilience rather than short-term performance.

The discussion of ethics in agriculture is the reason for the ethical life action that needs the attention of agriculturalists by being aware of the reality of the embedded value in the agricultural practice. There are several ethical approaches that can be a model for the best agriculture practice as a policy or new science. In this paper, the implicit utilitarianism of agriculture will be examined as the common ethical justification for action, to improve and develop the greatest good for the greatest number of people [35]. It will consider utilitarian ethics as retaining essential notions to solving agriculture moral dilemmas. The Multiple Strategies Utilitarianism suggest that the focus of ethics recognize two critical matters: maximize the goal of general welfare and the future-oriented rather than favoring the established status quo. Zimdahl [36] suggests that agriculture should judge the value of farming technology and practice, and all agricultural action is maximizing the general welfare. Therefore, Table 3 shows 11 criteria for approaching the agriculture ethical decision, but all value may not be applicable in a particular case.

**Table 3.** The Value Criteria Suggested for Agriculture

| No. | Value Criteria | Goal |
|---|---|---|
| 1 | Equity | Questioning fairness of all species |
| 2 | Food security | Not only for human needs, but also security includes nutritional adequacy, availability, and access |
| 3 | Environmental soundness | Evaluating agricultural technology and practice as a cause of environmental degradation |
| 4 | Profitability | Investigating the real cost of non-technological user |
| 5 | Safety and risk | Measuring risk is an empirical scientific activity, but judging safety is a normative political activity |
| 6 | Quality of life and human dignity | Minimizing the conflict of interest |
| 7 | Aesthetics | Agriculture should appear better aesthetically |
| 8 | Human and animal health | Providing eco-friendly technology |
| 9 | Consent | Developing agricultural democratic |
| 10 | Sustainability | Protecting human well-being, species, biodiversity, and environmental as highly valued |
| 11 | Institutional roles | Evaluating the decision making and role of agriculture institution |

Lastly, this paper improves the efforts in applying the value criteria above based on the logic in reality (LIR), which defines the basis of the logic of moral responsibility known as sustainabilization. Hofkirchner in [37] develops this concept as a process of suppression and rejection of anthropogenic breakdown and alternative safeguard development of the threshold of endangering biodiversity and the maintenance of society. Thus, by understanding the logical relationships between the human and non-human as the domain of nature, it will be fundamental strategies for evolving the socio-epistemology of society in real transformative action. Alternatively, the agrobiodiversity knowledge framework [38], for example, is essential to guide the transformative planetary for sustainable development goals with socio-economic changes, biodiversity conservation, social justice, and food security. Nevertheless, there needs to sharpen the kind of independent awareness related to the shift from subjectivity desires to solidarity collectively [39–43]. All movements must begin immediately because this condition is not only regarding human existence but also for owning responsibility for the uncertain fate. As a said wise-man, "you are what you eat." Eco-agriculture is an art that emphasizes moral responsibility, thus guarantee an appropriate and adequate human food consumption and also respecting non-human position as relevant to human development itself.

## 4 Conclusions

This article concludes that a philosophical review for eco-agriculture and farming in the Anthropocene epoch is based on the planetary boundaries concepts and environmental ethics to solve the challenge of global climate change. It is because the issues of the Anthropocene are not only challenging the geological finding but also the gradual emergence of the essential contribution to modern agriculture that is distressing for nature; such as those that caused land degradation, biodiversity loss, biogeochemical flow, and climate change. For environmental ethics, this research finds that future agriculture needs the fundamental value criteria to achieve the sustainability goal related to the logic of ecological reality. Finally, the future of agriculture depends on our action where humanity must be free from dominating egoism towards nature and replace capital-oriented decision to transformational policy in terms of agricultural resilience.

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