

The Correlation of the Changing Landscape and the Subsistence Patterns: Reviewing Archaeological Evidence of Prehistoric Human Resilience of Southeast Asia



Date Received: 12 Dec 2021

Date Revised: 11 Nov 2022

Date Accepted: 03 Dec 2022

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Abstract

This paper argues the correlation between the changing landscape and the changes in subsistence patterns. This paper will discuss how changes in the landscape are related to the changes in subsistence strategies. The changes in the subsistence strategies are related to the changes in the landscape. The literature on Historical Ecology and the cultural-ecological approach was reviewed to find patterns and relationships that would lead us to understand the relationship between the culture and its landscapes from the Late Pleistocene to the present. This paper argues the correlation between the changing landscape and the changes in past human culture subsistence patterns in Southeast Asia.

Keywords

resilience, niche construction, Pantropocene, Southeast Asia archaeology

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1. Introduction

This paper proposes a perspective of looking at the history of the relationship of humans to their environment. Before proceeding with this paper, it is necessary to see the three of the most prominent schools of thought available in archaeology in looking at human-environment relations: the (1) historical ecological approach, (2) behavioral ecology, and (3) cultural-ecological approach to understanding the relationships between humans and their landscape in Southeast Asia. In this paper, I attempted to review the knowledge about human adaptation strategies from the late Pleistocene and the Holocene to support the emerging perspective that humans, even during the "primitive times," can alter environmental conditions. This idea is emerging and inspired by the Pantropocene Project led by Patrick Roberts of the Max Planck Institute of Geoanthropology (see Amano et al., 2021; Roberts et al., 2021; Scerri et al., 2022). This perspective rose as a critique of the belief that the Anthropocene started only during the Industrial Revolution.

I chose Southeast Asia as a case study for this paper because it is established from the literature that it is a different case from the rest of the world with its association with the Pacific islands through the "island laboratory" concept (Fitzhugh & Hunt, 1997; Fitzpatrick & Erlandson, 2018; Kirch, 2007). Hunt and Rabett (2014) mentioned that the lack of niche in mainland and island Southeast Asia in subsistence strategies is an indicator of a recurring strategy used by its settlers- the use of a wide variety of strategies. Among the issues that need attention is the diversity of subsistence strategies due to its environment's vast array of options.

Another issue I will approach is determining the transition between the hunter-gatherers and identifying the Neolithic age. In this paper, I will try to relate how such dynamics have shaped humans and the environment.

In archaeology, the relationship of humans with the landscape is proposed by Gordon Childe and similarly by Leslie White when they suggested that culture is a means for humans to adapt to their environment, which eventually leads to its evolution (Steward, 1955). It was also said that all societies have lived in different environments and vicissitudes. Their traditions have varied, which could be correlated to the diversity of cultures. It implies that various environmental conditions have caused human populations to react differently. These different reactions or adaptation strategies are why culture differs across different human societies. In archaeology, this is described as the concept of the multilineal evolution of culture. This school of thought believes that the different environmental conditions that have resulted in different adaptation strategies have created many cultural traits. However, Steward (1955) argued about the differences in the environment and the certainty of the unilineal evolution of culture. Steward and his contemporaries suggested a parallel causality model in the development of cultures, which they refer to as a multilineal model of cultural evolution carried out by the processual archaeologists' tradition.

The anthropologist Julian Steward first proposed the cultural-ecological approach in his writings (Ford & Steward, 1954; Steward, 1942; 1929; 1960), and his contemporaries called this approach the cultural ecology. This school of thought was soon followed by writers such as Wolf (1984). The main position of this cultural ecology is that humans adapt to their environments. The concept of diffusion is central to the formation of cultures. It could be accounted for the uniqueness of each culture, as these are products of the different environments that have shaped them.



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Simply put, the idea of a cultural-ecological approach is grounded on ecological determinism. Sahlins (1964) asserts that cultural ecology has the potential to provoke thoughts regarding (1) acculturation and diffusion, (2) animal ecology, (3) rural sociology, (4) bureaucracy, stratification, and urbanization, (5) formal organizations, (6) technology, and finally (7) economy. Having ecological determinism as a theory for cultural development or change means assuming that the environment is the only variable in the formation of culture. This idea of Sahlins (1964) could also be related to what I mentioned earlier: a landscape is a physical environment valued for its aesthetic appeal and economic, political, social, and spiritual significance.

However, this concept of the environment is different from the idea of Sahlins (1964). Although the environment affects how humans form and reform their culture, human activities also modify the environment. It is contrary to the position of cultural ecology that humans are just adapting to environmental conditions. Also, in primitive societies, humans cannot modify environmental conditions. Similar to the historical ecology position proposed in the writings of many archaeologists (Balee, 1998b; Balee & Erickson, 2006; Crumley, 1994a; 1994b; 1998; 2003; Redman, 1999).

On the other hand, historical ecology argues that humans have been modifying the environment since the earliest times. And if anything, it is not the environment that changes culture but rather the opposite. It is human activities that have been modifying the environment. It is then argued that the landscape is a place of interaction with a temporal dimension that is cultural, historical, and evolutionary. It challenges the notion of pristine primitives. In its idea of history, there are three essential elements, namely (1) time, (2) cycle, and (3) empirical patterns. These three positions on the human-environment relationship have provided arguments and theories on how societies and the environment have evolved and formed through time.

There is a need to look at how the environment shapes culture and how culture shapes the environment in the form of the wide-range adaptation strategies employed in Southeast Asia. However, it is important to note that this paper does not intend to judge which of the previously mentioned theories is the most relevant, as these theories have provided their valid arguments and counter-arguments. However, I propose to find the middle ground through which we can have a fruitful conversation in our attempt to define and understand human resilience.

2. The Reciprocity of Culture and Landscape

In this paper, I argue that culture and landscape have a very dynamic relationship. Different factors are at work in the formation of both the culture and the landscape. I say that the variability of actors produces both the culture and the landscape, and culture and environment affect each other. Various scholars similarly express this idea (Caillon et al., 2017; Comberti et al., 2015; Gächter & Hermann, 2009; Hagen, 1972; Raymond et al., 2018) when they argue the reciprocity that exists between nature and culture. In this paper, one of my arguments is that the existence of pristine forests, even in the late Pleistocene period, should be subjected to criticism. However, I decided to focus only on the culture and landscape dynamics related to the subsistence strategies because of my limitations while writing this paper. This paper does not discuss the formation of societies, their politics, and spirituality.

Anthropocene, or the effect of human activity, caused the change in the landscape. In particular, I argue that the change in the floral and faunal population is due to the changing climatic conditions and human activities. I would say that the Anthropocene phenomenon started on a much earlier phase of human activity as early as the hunter-gatherer societies, or roughly the late Pleistocene to mid-Holocene, consistent with the idea being argued by the Pantropocene Project (Amano et al., 2021; Roberts et al., 2021; Scerri et al., 2022). Although it might still sound controversial for some, archaeological evidence has shown otherwise, as the widely accepted belief on the start of the Anthropocene is always associated with the Industrial Revolution. For example, Stephens et al. (2019) have demonstrated that as early as 3,000 years ago, hunter-gatherers, farmers, and pastoralists influenced changing the landscape. Ellis (2011) mentioned that although the majority of the changes in the biosphere happened in the past century, humans have already been altering the terrestrial biosphere for the past 8,000 years.

3. The Late Pleistocene to Holocene

I would argue that humans have shaped the landscape from the Late Pleistocene to the Holocene. That landscape and "culture" dynamics have already started among hunter-gatherer societies. It could be accounted for the vast diversity of resources in both the island and mainland Southeast Asia. Although there is a wide diversity in food sources, various literature like White (1943 & 1959), Piper and Rabett (2014), Conrad (2015), Cranbrook and Piper (2013), Ochoa et al. (2014), Hutterer et al. (1976), and Louys and Roberts (2020) argued that the food sources were not that easy to come by; and that these hunter-gatherers needed to employ a wide variety of subsistence strategies. However, the impact of anthropogenic activities in the late Pleistocene up to the Holocene was related only to the competition of humans with other predators in their access to the food source.

One special case that has shed light on this possibility is the extinction of large mammals in Palawan and Indonesia, specifically the tiger species present on the island around 10,000 years ago. If what I believe is true, then there is a possibility in the archaeological record that the taxa of the faunal food source diminished over time. The variability of human societies in how they dealt with a complex environment could be discerned by investigating the variability in settlement and technological choices (White, 1959). By investigating the evidence for the diversity of prehistoric environments and cultures, the data could be traced back to the late Pleistocene.

The range of exploited resources was so broad, from pig to mollusk, and was seen as evidence of how flexible human adaptation had been for thousands of years of occupying Southeast Asia. This width in the variation of the resources that were consumed was said to be part of flexible procurement and planning strategies. In the case of delayed-return strategies, detoxification of some nuts and yams was also employed. This diversity continued until the Holocene. This variability was also observed in other places within Southeast Asia (Piper & Rabett 2014; Conrad, 2015; Cranbrook & Piper, 2013; Ochoa et al., 2014).

Technological changes were also evident in the late upper Pleistocene to the Holocene that happened in Southeast Asia. These changes are interpreted as refinements and the advancement of economic methods and technologies.

This concept is already evident in the body of literature about Southeast Asia (Sinha, 2012). The paper of Hutterer et al. (1976) argued that human populations in tropical environments need adaptation, and these adaptations are different from those in temperate and cold climates. It can be reflected in how tropical people treat clothing and shelter, as there is little need for it. However, it is more challenging than it appears. The exploitation of resources is complicated because the resources are varied, and the people need a wide variety of necessary tools so that the energy they spend in gathering, manufacturing, transporting, and procuring raw materials is minimized.

While it can be evident in the literature that the environment is indeed a factor in shaping culture by catalyzing adaptive processes, the question still can be asked whether the landscape determines the culture of the human population at the time. One case we can look at is the paleozoology data of Magsanib Pasimbahan Cave in Dewil Valley, El Nido, Palawan (Piper et al., 2011). The changes in the composition, as well as the structure of the mammal community in Palawan, have been evident during the last 14,000 years. There is evidence of the disappearance of large taxa since the end of the last glacial period, estimated to happen around 10,000 years ago. Among the taxa that became extinct in Palawan are the tiger and the possible dhole. It was argued that the manner of extinction of these taxa is different from the extinction that happened around 50,000 years ago. It could be possible that cultural activities could have played a role in this, along with the environmental changes.

Louys and Roberts (2020) express the same thoughts. They claim that environmental factors drive megafauna extinction in Southeast Asia. This environmental setup caused the grazers and the extinction of browsers, and eventually, the savannah that emerged during the mid-Pleistocene disappeared during the Holocene. However, evidence from the literature (Ochoa et al., 2014; Piper et al., 2011; Piper et al., 2008) points out that although the environment played a large part in the extinction of the faunal taxa, human activity also played a critical role.

The hunting activities in the late Pleistocene could have affected both the predators and the prey. One thing that could have caused this is not necessarily the increase in the human population but rather the increase in population density. At the time of the last glacial maximum, the sea level rose, and the savannah was reduced to what it is today, the space in which the human population and the environment were reduced. This increase in population density and the reduction of space for resources could have affected both the environment and the human population. Cultural activities such as hunting and gathering have contributed to the ease of resource access. If this were true, the difficulty of accessing the resources humans need for subsistence might be a form of adaptation to the environment from human activities. These adaptations might be manifested through mammals being pushed further inland affecting the vegetation and, in turn, affecting the floral and faunal populations.

In studying this complex phenomenon, it is, therefore, necessary for an archaeologist to understand the ease of access/difficulty of accessing resources for humans. It may raise cautionary tales on estimating floral and faunal population estimates based on available assemblages. The caution is that the decrease in the appearance of faunal

remains on sites could not always mean a population reduction. Although the latter could be true, as has always been generally accepted, this decrease could also mean an increase in difficulty in accessing such resources as a means of landscape adaptation to human activities. In turn, with these, there will be the possibility that the human population will opt to utilize readily available resources instead of chasing difficult ones. It would fit the picture of the wide variety of subsistence strategies that early humans employed.

4. Age of Domestication

Instead of using the term neolithic, I will use domestication to refer to when humans started domesticating plants and animals in Southeast Asia. It is for clarity as the term neolithic in Southeast Asia is difficult to recognize in the archaeological record's insufficiency and the discrepancies with the ethnographic accounts (Hutterer, 1983). I have argued above the possibility that human activities have affected the environment as early as the late Pleistocene. Also, human culture is not only a product of its landscape; culture and landscape are affected by certain dynamics.

My second argument is the dynamics between culture and landscape during the Late Pleistocene to the Holocene period. The dynamics between landscape and culture now differed from what occurred during the Late Pleistocene. The start of the domestication of plants and animals helped the culture develop adaptation strategies. However, it could not be said that the environment predetermines the adaptation of humans. I say so because of the wide variability of adaptation strategies in one setting. In this shift of adaptation strategy, I see that humans can exploit the environment in various ways and that the environment does not determine cultural formations. What the landscape has, are its features. The Ifugao exemplifies this by adopting both swidden and terraced rice farming, the slope and water availability, and its effect on their subsistence strategies. However, the presence of resources is not the key element in these dynamics but rather the decision of human culture to exploit such resources. It is no case that the landscape determined the culture of the Ifugao. It could be seen that they could transform the landscape to help ease access to their needs (Acabado, 2008).

Headland (1987) proposed an alternative hypothesis about yam consumption in the rainforest of Southeast Asia, taking the Agta of Luzon as a case in particular. The hypothesis is that the rainforest is food-poor for humans. Headland (1987) meant that tubers and yam do not grow in the wild. The rainforest being food-poor for humans could give implications that early hunter-gatherers could not produce tubers for their consumption because access to it was difficult. The only alternative that could be considered is the reliance on hunter-gatherer communities in prehistoric times for the cultivated food source. Headland (1987) has correlated it to the adaptation strategies that humans have employed (see also Headland & Reid, 1989).

However, Headland's (1987) argument was critiqued by Dentan (1991), stating that the Malaysian rainforest is rich with tubers that could be used by early hunter-gatherers, thus invalidating the claim of an early presence of cultivated land. However, deficits in resources could come in two ways, namely (1) environmental deficits and (2) cultural deficits.



Environmental deficits refer to the deficiency of natural resources. On the other hand, cultural deficits refer to the deficiency of cultural knowledge to use the available resources. These two deficiencies are essential concepts for the cultural landscape dynamics in Southeast Asia. As the environments give deficits and difficult access to food sources, the early Southeast Asians were able to mitigate this by developing a wide range of strategies. Environmental deficits are the deficits that are related to the landscape; it is the access to resources. While it is established that the forests of Southeast Asia are abundant, it has environmental deficits, as could be reflected in the literature. Access to a food source is difficult, and they must have the necessary cultural knowledge to cope with these deficits, which they did. These observations are deviations from the concept of human niche construction.

Headland and Reid (1989) argued that up to the mid-Holocene, hunter-gatherers were not isolated, much like what was previously thought. But instead, these hunter-gatherers had been trading with a culture with agriculture for their subsistence. Eder (1978) observed this behavior among the Batak in his ethnographic works. Suppose the claim of Headland and Reid (1989) and Headland (1987) is true. In that case, it could be entirely possible that Eder (1978) missed an important point when he assumed that the practice of hunter-gatherer trading with food cultivators was a recent event. In a study conducted on the Batak indigenous group in Malaysia, Endicott and Bellwood (1991) argued that the hunter-gatherers could sustain themselves only in a small population in lowland tropical rainforests. This independence was made possible again by the diversity of resources in the environment, which was moderately abundant. It was suggested that the Batak were opportunistic rather than conservative and tended to exploit strategies they could use.

It was proposed that the development of agriculture in Southeast Asia is dynamic if the relationship between environment and culture is to be considered (Hutterer, 1983). The earliest belief in the development of agriculture in Southeast Asia is tied to two civilizations, China and India (Clark, 1965). However, after the Second World War, many scholars have begun considering this assumption (Sebring, 2015). Hutterer (1983) pointed out that increasing the carrying capacity of an environment requires human manipulation through directing environmental manipulation, transferring material to lessen competition with other species, or maintaining habitats. Hutterer (1983) suggested the non-linearity of the energy expended by the population and the food energy harvested. It was argued that the more the subsistence strategies were manipulated, the less profitable they became.

The works of Acabado (2012) among the Ifugao living in the North Central Cordillera suggested two subsistence strategies. The rice terraces are found on gentler slopes, while swidden farming is found in higher elevations. It was argued that these two systems are contemporary, and the practices correlate to the slope and the availability of technology. It was argued that the size of the land that was cultivated for swidden and rice agriculture was related to the population size as the larger basins can attract larger populations.

5. Perspectives for the Archaeological Record

Culture and landscape are in a dynamic relationship, and the key factor is the availability of resources. Access to these resources is crucial in these dynamics during the Late Pleistocene and Mid-Holocene.

There is a possibility that humans have competed for the resources not only among themselves; but also with the other landscape inhabitants, including non-humans. For this, I suggest that the variability in the faunal remains could be examined as evidence of the diversity of the previous cultures' subsistence strategies. The decrease in faunal assemblages could mean two things: (1) the population decline or (2) added difficulty in accessing them due to continued hunting practices. These two things, I believe, could be correlated to the diversity of technologies and subsistence strategies, and this could also explain the absence of niche construction in the subsistence strategies of Southeast Asia and the Pacific Islands.

During the age when Southeast Asians started the domestication of plants and animals, some cultures adopted a more sedentary lifestyle. There is still evidence of diversity in the subsistence strategies employed by the early settlers of Southeast Asia. There is evidence for the hunter-gatherers trading goods with those who practiced agriculture. Here it could be seen that the technologies have changed, and the variation is still present. In the case of the Ifugao, where swidden and rice paddies are found, it has shown how the environment shaped human culture, but it also shows human ingenuity. This ingenuity is the ability of humans to exploit the landscape to fit their needs.

Here I propose that the diversity of Southeast Asian assemblage could be viewed as shaped by the interaction of culture and landscape. During the Late Pleistocene, it could be possible that the landscape affected the human population through the availability and access to food sources. The human population affected the landscape by adopting various subsistence strategies that could have altered the faunal population and access, bringing some faunal taxa to extinction. The problem of identifying the Neolithic age in Southeast Asian sites could also be due to access to food sources. It could also be possible that even though the early human population in Southeast Asia had already discovered the domestication of plants and animals, they still used the hunting-gathering lifestyle. It was due to the climatic conditions that were sometimes insufficient to sustain their needs.

6. Conclusion

At the beginning of this paper, I made clear that my main aim is to establish an argument that landscape and culture are in a dynamic relationship. Also, neither one nor the other is the sole determinant of the fate of another. I argue that the variability in the assemblage of faunal remains (and possible faunal remains) are cultural means of adaptation to the complex environment. The variability in the subsistence patterns is not the sole product of environmental determinism but rather the ability of human culture to react to what the landscape gives and, in the process, modify the landscape to fit its needs. Thus, while it is true that human culture reacts to what the terrain provides, it is also true that humans tend to be manipulative and ingenious and can go beyond what the landscape gives them. Humans do not simply adapt to what the environment gives them, but they make every effort to try even to shape the landscape in their favor.

My aim in this paper is to present a science-based narrative about the interaction of humans and the environment in the past. I hope this narrative could help future resilience research redefine resilience in scientific discourse. Suppose humans are not only passive receivers of the changing environmental and climatic conditions even in the Holocene.

The ability of humans to modify the landscape has led to long-term ecological effects. Thus, in viewing the line of evidence presented in this paper, I suggest that resilience discourse should not only focus on human adaptation to changing environmental and climatic conditions but also on making the environment resilient from human activities. Also, human resilience is just as important as environmental resilience from human activities.

One good example of this is the adoption of indigenous knowledge and practices of indigenous people communities, which is already gaining attraction. While this contradicts the arguments that I have presented in this paper, a good argument was presented by Dressler (2005). It was argued that the legislation criminalizing swidden farming needs to be better grounded. The legislators who proposed the law failed to understand that *kaingin* farming is continuously shifting because the indigenous communities consciously or unconsciously give the land better chances to regenerate compared with monocropping and mining activities. Although we cannot deny that swidden farming can destroy the environment, learning from the indigenous people through their thousands of years of experience interacting with their natural environment can help us understand it. The bottom line for this is understanding the dynamics of the relationship between humans and their environment. The diversity of human adaptive strategies for subsistence in Southeast Asia is a resilience strategy for humans. The biggest lesson from the past is that we should look at biodiversity protection because building a resilient environment and biodiversity is necessary for human resilience. For thousands of years, the archaeological records of Southeast Asia have demonstrated that the broad range of subsistence options is a key to survival for human populations. Aside from this, many approaches can be formulated to help make the environment resilient to human activity.

Acknowledgments

The author acknowledges the contribution of Dr. Victor Paz of the University of the Philippines School of Archaeology for his insights and comments in the initial stages of the conceptualization of this paper. Dr. Michael B. Herrera has also made significant contributions in his lectures in his Pacific Archaeology class about the role of small islands in understanding human-environment relationships. Dr. Grace Barretto-Tesoro also contributed a lot to the arguments presented in this paper when she introduced me to the Pantropocene Project.

Declaration of Conflict of Interest

The author declares that there is no conflict of interest involved in the study.

Declaration of Funding

The researcher received no funding for this project.

References

Acabado, S. (2008). Landscapes and the archaeology of the Ifugao agricultural terraces: Establishing antiquity and social organisation. *Hukay*, 15(0), 31–60.

Acabado S. B. (2012). Taro before rice terraces: Implications of radiocarbon determinations, ethnohistoric reconstructions, and ethnography in dating the Ifugao terraces. In M. Spriggs, D. Addison, & P.J. Matthews (Eds.), *Irrigated taro (Colocasia esculenta) in the Indo-Pacific, Senri ethnological studies* 78 (pp. 285–305). National Museum of Ethnology.

Amano, N., Bankoff, G., Findley, D. M., Barretto-Tesoro, G., & Roberts, P. (2021). Archaeological and historical insights into the ecological impacts of pre-colonial and colonial introductions into the Philippine archipelago. *Holocene*, 31(2), 313–330. <https://doi.org/10.1177/0959683620941152>

Balée, W. (1989). The culture of Amazonian forests. In D.A. Posey & W. Balée (Eds.), *Resource management in Amazonia: Indigenous and folk strategies, Advances in economic botany* no. 7 (pp.1-21). New York Botanical Garden.

Balée, W. (1994). *Footprints of the forest: Ka'apor ethnobotany—the historical ecology of plant utilization by an Amazonian people*. Columbia University Press.

Balee, W. (1998a). *Advances in historical ecology*. Columbia University Press.

Balee, W. (1998b). History ecology: Premises and postulates. In W. Balée (Ed.), *Advances in historical ecology*, (pp. 13-29). Columbia University Press.

Balee, W. (2003). Native views of the environment in Amazonia. In H. Selin (Ed.), *Nature across cultures: Mews of nature and the environment in non-western cultures*, (pp. 277-288). Kluwer Academic.

Balée, W., & Erickson, C. (2006). Time, complexity, and historical ecology. In W. Balée & C. Erickson (Eds.), *Time and complexity in historical ecology: Studies in the neotropical lowlands* (pp. 1-20). Columbia University Press.

Caillon, S., Cullman, G., Verschuuren, B., & Sterling, E. J. (2017). Moving beyond the huma& am nature dichotomy through biocultural approaches: Including ecological well-being in resilience indicators. *Ecology and Society*, 22(4), art27. <https://doi.org/10.5751/ES-09746-220427>

Clark, J.G.D. (1965). *World prehistory: An outline*. Cambridge University Press.



- Combetti, C., Thornton, T. F., Wyllie de Echeverria, V., & Patterson, T. (2015). Ecosystem services or services to ecosystems? Valuing cultivation and reciprocal relationships between humans and ecosystems. *Global Environmental Change*, 34, 247–262. <https://doi.org/10.1016/j.gloenvcha.2015.07.007>
- Conrad, C. (2015). Archaeozoology in mainland Southeast Asia: Changing methodology and pleistocene to holocene forager subsistence patterns in Thailand and Peninsular Malaysia. *Open Quaternary*, 1, 1–23. <https://doi.org/10.5334/oq.af>
- Cranbrook, E. O., & Piper, P. J. (2013). Paleontology to policy: The quaternary history of Southeast Asian tapirs (Tapiridae) in relation to large mammal species turnover, with a proposal for conservation of Malayan tapirs by reintroduction to Borneo. *Integrative Zoology*, 8(1), 95–120. <https://doi.org/10.1111/j.1749-4877.2012.00319>
- Crumley, C.L. (1994a). Historical ecology: A multidimensional ecological orientation. In C. L. Crumley (Ed.), *Historical ecology: Cultural knowledge and changing landscapes*, (pp.1-13). School of American Research Press.
- Crumley, C. L. (1994b). *Historical ecology: Cultural knowledge and changing landscapes*. School of American Research Press.
- Crumley, C. L. (1998). Foreword. In W. Balée (Ed.), *Advances in historical ecology*, (pp. ix-xiv). Columbia University Press.
- Crumley, C. L. (2003). Alternative forms of societal order. In V.L. Scarborough, F. Valdez Jr., & N. Dunning (Eds.), *Heterarchy, political economy, and the Ancient Maya: The three rivers region of the East-Central Yucatan Peninsula*, (pp. 136-145). University of Arizona Press.
- Dentan, R. N. (1991). Potential food sources for foragers in Malaysian rainforest: Sago, yams and lots of little things. *Bijdragen tot de taal-, land-en volkenkunde (The Hague)*, 147, 420-44.
- Eder, J. F. (1978). The coloric returns to food collection: Disruption and change among the Batak of the Philippine tropical forest. *Human Ecology*, 6, 55-69.
- Ellis, E. C. (2011). Anthropogenic transformation of the terrestrial biosphere. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 369(1938), 1010–1035. <https://doi.org/10.1098/rsta.2010.0331>
- Endicott, K. & Bellwood, P. (1991). The possibility of independent foraging in the rain forest of Peninsular Malaysia. *Human Ecology*, 19, 151–185. <https://doi.org/10.1007/BF00888744>
- Ford, J. A. & Steward, J. H. (1954). On the concept of types. *American Anthropologist*, 56 (1), 42-57. <https://www.jstor.org/stable/664631>
- Fitzhugh h, B., & Hunt, T. L. (1997). Introduction: Islands as laboratories: Archaeological research in comparative perspective. *Human Ecology*, 25(3), 379–383.
- Fitzpatrick, S. M. & Erlandson, J. M. (2018). Island archaeology, model systems, the Anthropocene, and how the past informs the future. *The Journal of Island and Coastal Archaeology*, 13(2), 283-299. <https://doi.org/10.1080/15564894.2018.1447051>
- Gächter, S., & Herrmann, B. (2009). Reciprocity, culture and human cooperation: previous insights and a new cross-cultural experiment. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1518), 791–806. <https://doi.org/10.1098/rstb.2008.0275>
- Hagen, A. (1972). Man and nature. Reflections on culture and ecology. *Norwegian Archaeological Review*, 5(1), 1–22. <https://doi.org/10.1080/00293652.1972.9965153>
- Headland, T. N. (1987). The wild yam question: How well could independent hunter-gatherers live in a tropical rainforest ecosystem? *Human Ecology*, 15, 465–93.
- Headland, T. N., & Reid, L. A. (1989). Hunter-gatherers and their neighbors from prehistory to the present [and comments and replies]. *Current Anthropology*, 30(1), 43–66. <https://doi.org/10.1086/203710>
- Hunt, C. O., & Rabett, R. J. (2014). Holocene landscape intervention and plant food production strategies in island and mainland Southeast Asia. *Journal of Archaeological Science*, 51, 22-33. <https://doi.org/10.1016/j.jas.2013.12.011>
- Hutterer, K.L. (1983). The natural and cultural history of Southeast Asian agriculture: Ecological and evolutionary considerations. *Anthropos*, 78, 169–212.
- Hutterer, K. L., Allen, J., Arutiunov, S. A., Bayard, D. T., Bhattacharya, D. K., Bronson, B., Chlenov, M. A., Donkin, R. A., Ellen, R. F., Harris, D. R., Hayden, B., Higham, C. F. W., Kleindienst, M. R., Kress, J. H., Krzyzaniak, L., Moore, D. R., B., G. E., Morren, Pearson, R., ... Whyte, R. O. (1976). Evolutionary approach to Southeast Asian cultural sequence. *Current Anthropology*, 17(2), 221–242. <https://www.jstor.org/stable/27415>

- Kirch, P.V. (2007). Hawaii as a model system for human ecodynamics. *American Anthropologist*, 109, 8-26. <https://doi.org/10.1525/aa.2007.109.1.8>
- Louys, J., & Roberts, P. (2020). Environmental drivers of megafauna and hominin extinction in Southeast Asia. *Nature*, 586(7829), 402–406. <https://doi.org/10.1038/s41586-020-2810-y>
- Ochoa, J., Paz, V., Lewis, H., Carlos, J., Robles, E., Amano, N., Ferreras, M. R., Lara, M., Vallejo, B., Velarde, G., Villaluz, S. A., Ronquillo, W., & Solheim, W. (2014). The archaeology and palaeobiological record of Pasimbahan-Magsanib site, northern Palawan, Philippines. *Philippine Science Letters*, 7(1), 22–36.
- Piper P. J. & Rabett, R. J. (2014). Late Pleistocene subsistence strategies in island Southeast Asia and their implications for understanding the development of modern human behavior. In R. Dennell & M. Porr (Eds.), *Southeast Asia, Australia and the search for human origins*, (118 – 134). Cambridge University Press.
- Piper, P. J., Ochoa, J., Lewis, H., Paz, V., & Ronquillo, W. P. (2008). The first evidence for the past presence of the tiger *Panthera tigris* (L.) on the island of Palawan, Philippines: Extinction in an island population. *Paleogeography, Palaeoclimatology, Palaeoecology*, 264(1–2), 123–127. <https://doi.org/10.1016/j.palaeo.2008.04.003>
- Piper, P. J., Ochoa, J., Robles, E. C., Lewis, H., & Paz, V. (2011). Palaeozoology of Palawan Island, Philippines. *Quaternary International*, 233(2), 142–158. <https://doi.org/10.1016/j.quaint.2010.07.009>
- Raymond, C. M., Giusti, M., & Barthel, S. (2018). An embodied perspective on the co-production of cultural ecosystem services: toward embodied ecosystems. *Journal of Environmental Planning and Management*, 61(5–6), 778–799. <https://doi.org/10.1080/09640568.2017.1312300>
- Redman, C. (1999). *Human impact on ancient environments*. University of Arizona Press.
- Roberts, P., Hamilton, R., & Piperno, D. R. (2021). Tropical forests as key sites of the "Anthropocene": Past and present perspectives. *Proceedings of the National Academy of Sciences of the United States of America*, 118(40), 1–7. <https://doi.org/10.1073/pnas.2109243118>
- Sahlins, M. D. (1964). Culture and environment: The study of cultural ecology. In S. Tax (Ed.), *Horizons in anthropology* (pp. 132-147). Routledge.
- Scerri, E. M. L., Roberts, P., Maezumi, S. Y., & Malhi, Y. (2022). Tropical forests in the deep human past. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 377(1849). <https://doi.org/10.1098/rstb.2020.0500>
- Sebring, E. (2015). Civilization and barbarism : Cartoon commentary and "the white man's burden" (1898 – 1902). *The Asia-Pacific Journal*, 13(27). <https://apjif.org/-Ellen-Sebring/4339/article.pdf>
- Sinha, P. (2012). 'Changes in technology, subsistence strategies, and behavioral patterns during Late Upper Pleistocene in South and Southeast Asia: A microwear analysis. *Puratattva*, 42, 59-73.
- Stephens, L., Fuller, D., Boivin, N., Rick, T., Gauthier, N., Kay, A., Marwick, B., Armstrong, C. G., Barton, C. M., Denham, T., Douglass, K., Driver, J., Janz, L., Roberts, P., Rogers, J. D., Thakar, H., Altaaweel, M., Johnson, A. L., Sampietro Vattuone, M. M., ... Ellis, E. (2019). Archaeological assessment reveals earth's early transformation through land use. *Science*, 365(6456), 897–902. <https://doi.org/10.1126/science.aax1192>
- Steward, J. H. (1929). Diffusion and independent invention: A critique of logic. *American Anthropologist*, 31, 491–495.
- Steward, J. H. (1942). The direct historical approach to archaeology. *American Antiquity*, 7, 337–343.
- Steward, J. H. (1955). *Theory of cultural change*. University of Illinois Press.
- Steward, J. H. (1960). Carrier acculturation: The direct historical approach. In S. Diamond (Ed.), *Culture in history: Essays in honor of Paul Radin* (pp. 732–744). Columbia University Press.
- White, L. A. (1959). *The evolution of culture*. McGraw-Hill.
- White, L. A. (1943). Energy and the evolution of culture. *American Anthropologist*, 45, 335- 356.
- Wolf, E. (1984). Culture: Panacea or problem? *American Antiquity*, 49(2), 393-400. <https://www.jstor.org/stable/280026>

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