Leveraging Confucian and Daoist Wisdom for Biodiversity Education: A Pathway to Sustainable Decision Making

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Abstract: The vitality of biodiversity, an essential pillar of a thriving biosphere, is currently at risk. This paper investigates the potential of ancient philosophies, specifically Confucianism and Daoism, as pathways to mitigate this issue. We delve into the intricate connections between these philosophies and the natural world, and how they can inform our understanding of biodiversity threats in the context of cultural and technological evolution. Recognizing the inevitable progression of technology and its influence on human evolution and the biosphere, we turn to traditional philosophies to establish guiding principles for sustainable decision-making. We advocate for the principle:" Decisions must not result in the artificial reduction of biodiversity within the framework of evolutionary time." This principle is substantiated by reciprocal arguments that lay the foundation for the essential analyses to protect biodiversity. By adhering to this principle, we can ensure a sustainable biosphere conducive to ongoing human evolution. This study underscores the importance of integrating ancient wisdom with modern decision-making processes to address the pressing issue of biodiversity loss.

Keywords: biodiversity education, Confucianism, Daoism, evolutionary time, sustainable decision-making

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Introduction

Biodiversity is under threat from a myriad of directions. Much has been written about the importance and significance of biodiversity, but the attacks continue, slowly eroding the health of the biosphere (Alho, 2008; Duffy, 2009; Herndon & Butler, 2010). While learned individuals have long bemoaned the loss of biodiversity and warned of the consequences, little progress has been made to protect or preserve it. Worldwide, the general populous continues to demonstrate a basic lack of knowledge of the importance of biodiversity and the consequences of its loss to the existence of humankind. While this phenomenon has likely been the situation, many philosophies and religions embraced the importance of nature, and these philosophies guided decision-makers of the day. There was a reverence for nature as it was realized that as the natural world went, so did the survival of the human species (Herndon & Butler, 2010).

Biodiversity and Ecosystem Stability

Biodiversity, in its simplest form, is the number of species in existence. However, as described by Swingland (2001), there are actually many definitions of the term without consensus. For this discussion, we define biodiversity as the number and variety of organisms within any defined area. This seemingly simple concept becomes exponentially more complex when we incorporate the concept of evolutionary time into the definition of biodiversity.

In the context of daily life, biodiversity is generally considered on a local scale and limited to a single ecosystem. Humans have difficulty comprehending concepts or the significance of ideas such as biodiversity on a larger scale. This is a significant limitation to recognize, particularly in developing guiding principles to address such a complex issue (Folke et al., 2011). Without a clear understanding of the importance of biodiversity, it is challenging to convince decision-makers of the need to protect, preserve and enhance biodiversity.

Why is biodiversity important? Imagine a place where only two species exist, both dependent upon each other for survival. Then, one species becomes extinct. With no other resource from which to draw sustenance, the second species inexorably drives to extinction. Now imagine that same place with three species, all partially dependent upon each other. If one species should die, the other two still have a chance to survive as they can continue to rely on each other for support. It may not be a healthy existence, but life can be maintained and the system can survive. As you continue to build this scenario by sequentially adding additional species, the dependence of any single species upon another is reduced. In this way, the system's health continues to improve as the loss of an individual component no longer threatens the existence of the whole.

Carried forward, as a highly integrated matrix of species is formed, this diversity acts as an internal defense mechanism for the system. The protective nature of diversity is like an intertwined ball of thread, and multiple strands of the matrix can be lost without materially damaging the system as a whole. The greater the variety leads to the greater the system’s ability to defend against perturbations. In other words, a system of 100 threads is more able to maintain its integrity than is a system comprised of 10 threads when multiple threads are lost. The 100-thread system is more resilient than is the 10-thread system. In the context of ecosystems, the greater the biodiversity, the healthier and the more resilient the ecosystem.

The biosphere is a series of intertwined systems (Folke et al., 2011) linked to the others. Extrapolating the previous idea across this milieu of interconnected ecosystems, the significance of global biodiversity starts to come into focus. As one can envision from the thread analogy, it is easy to understand how an ecosystem with limited biodiversity can become unraveled and begin to fail. Similarly, if

enough ecosystem threads become weakened, the interconnecting threads begin to weaken, which means regional systems become unhealthy and less able to resist perturbations.

When such interrelated systems include vast areas that humans use for food supplies and the weakened systems threaten the viability of food crops, the consequences of the loss of biodiversity to humankind can be thrown into sharper relief. One only needs to look at the effect that the loss of pollinators (bees) can have on agricultural production as an example (Aizen et al., 2009; Gallai et al., 2009).

Individual, Population, and Biodiversity Dynamics

What does it mean to biodiversity when a single individual of a single species is lost? Nothing. Provided that the population and the supporting system are healthy. Biodiversity is not dependent upon an individual, rather it is populations that become the focal point of biodiversity. A healthy population is not reliant on a single individual or species. Again, the loss of a single thread within a population of 100 threads will not jeopardize the entire ball. However, just as the loss of a single thread in a ball consisting of three threads has an entirely different outcome, the loss of an individual in an unhealthy population may significantly affect the ability of that population to survive. Such is the fate of the Northern White Rhinoceros (*Ceratotherium simum cottoni*). Short of a technological Hail Mary, the loss of the last remaining male has doomed the species to inevitable extinction (Ceballos et al., 2015; Cumming et al., 2014; Piccolo, 2017). In a healthy system, where the ball of thread is dynamic and always changing, the loss of a single thread allows for the interweaving of a new thread or threads into the matrix of the ball and the species can survive the loss.

Evolutionary Impact on Biodiversity Loss

Evolution is a harsh master. Individuals, populations and species that are unable to adapt to an environment are summarily dismissed to exist only in the archaeological record. However, in a healthy system, the loss of a local population or even an entire species does not necessarily harm ecosystems or the biosphere. The ecological space created by such a loss instead provides additional niche space that allows for the immigration of new populations into an ecosystem or the evolution of new species. The biosphere has been witnessed five previous mass extinctions where biodiversity was dramatically reduced, and the structure of the biosphere re-ordered subsequently. These mass extinction events did not result in the end of life, but instead restructured the biosphere.

If the great evolutionary process results in the continual, dynamic mixing and changing of species, why should we be concerned about reduced biodiversity? If extinction and the creation of new species happen routinely, what is the source of consternation with the current situation? In a word, time. For over 4-billion years, evolution has pushed species forward, but in evolutionary time. A time frame that is species-specific, driven by the generation time of an individual species. Evolutionary time allows for organisms, even keystone species, to evolve, develop and disappear in an orderly fashion. In other words, there is time for the ball of thread to move and adjust to the loss of multiple threads.

We have now entered into a 6th Mass extinction event (Ceballos et al., 2015; Piccolo, 2017). However, the traditional evolutionary rules are not the same as those found during previous events in today's world. Specifically, the evolutionary time has been disrupted. Humans have adjusted the variable of time in the evolutionary equation. We have altered the rate of change...the speed of time, with respect to evolution.

Technology offers the ability to complete activities in hours or days that even only 100 years ago would have taken months, years or even decades. Technology affords humans the ability to seemingly manipulate time. While this de facto compression of

time has tremendous benefits for humans, it does not benefit the biosphere. The evolutionary equation does not work at the pace of technology and one casualty of this inequality is a rapid decline in biodiversity. Within the context of compressed time, the re-establishment of diversity following a human-induced mass extinction is completely unpredictable.

Technology-Driven Changes in Population-Biosphere Interactions

Technology has resulted in enormous changes in how the human species lives. Technology has increased our lifespan through medical advances and through environmental controls, allowing humans to survive in ever more challenging environments. There is no environment on earth that humans cannot inhabit or manipulate to exploit resources. Technology has and will continue to alter how we live, and more importantly, how we interact with the biosphere and all the organisms which inhabit it.

Human civilization is a long history of evolution. Moving in a circuitous route from hunters and gatherers to agriculture to urbanization (Cumming et al., 2014; Kennett & Winterhalder, 2006). This indeed has been facilitated by new advances in technology. Larger population centers demand changes in technology to produce and transport food to support the inhabitants of cities that could no longer forage for themselves.

As humans began to become more technologically advanced, we increasingly became more separated from the environment. Modern living means that the average person never has to see where their food comes or where their waste goes. Society has provided an artificial environment so complete that there is seemingly no connection with the environment at all. This disconnect results in a fundamental lack of understanding related to the source of all the resources necessary to support such a protected existence. Technology has developed to such a degree that people seemingly no longer have any need for the environment. This fact results in thought processes that often push resource management to the fringes of decision-making. Technology has fundamentally changed human existence and consequently altered how we think about our place in the biosphere.

While technology may be at the root of our ever-changing relationship with the environment, this is not an argument to pursue a Luddite solution to the problem. Far from such a perspective, as humans continue to evolve, we will continue to develop new technologies and processes. Humans will continue to push the boundaries of existence. Failure to recognize the fact that humans will continuously pursue technological advantages and that technology will be an ever-increasing part of the evolution of the human species will doom any attempt to stay the assault on biodiversity and the biosphere. Instead, what must occur is a shift in how we make decisions regarding the development and implementation of technology.

Time in Biodiversity Risks

While the threats to biodiversity are many and varied, there is one common theme…time. Specifically, the inability of humans to consider the time, or more exactly, the consequences of time in decision making. Humans have evolved the extraordinary capability of cognitive thought to a degree that separates us from other animals. The ability of humans to continue to develop new technologies puts the biosphere under continued pressure. Further, this ability to develop new technologies comes at a rapid pace. A pace that does not equate to evolutionary time.

To complicate matters, we continually fail to project the consequences of decisions on long-term natural processes. Much like the limitation of understanding complex concepts such as biodiversity on a planetary scale, humans have a significant limitation in understanding long-term consequences of decisions. It is the decisions made to utilize resources on a time frame that is incongruent with evolutionary

time, and the inability to understand the consequences of such decisions that is pushing the ever-increasing loss of biodiversity and with-it bringing ecosystems to the brink of collapse.

Biodiversity's Role in Biosphere Peril

The loss of species diversity, genetic diversity and ecosystem diversity have the potential to weaken ecosystems worldwide to the point that even a minor perturbation of the biosphere could have catastrophic effects due to the reduced resilience of global-scale systems. However, when viewed through an anthropogenic focused lens, what does this mean? What are the consequences of the loss of 25% or even 50% of the current level of biodiversity? Several examples are routinely cited as indicators of potential human impacts of reduced biodiversity. These include the reduced pollination from the loss of honeybees, economically unsustainable fishing industry and increased water pollution from the loss of wetlands and other natural remediation systems.

Some of these issues may be overcome through technological innovation. However, as we lose more and more natural resources, we begin to limit the resources we can depend upon for sustenance. As we restrict the variety in resources, we limit the ability to respond to an unexpected loss of a resource. History provides the classic example of such a crisis in the form of the Irish Potato Famine. The unexpected loss of a single resource leads to the death of up to 1,000,000 people. Little species and genetic diversity within the food system of Ireland at the time magnified the impact a potato specific blight (Phytophthora infestans). This same fungus was more easily managed in other infested areas that had a greater species and genetic diversity built into their food system (Fraser, 2003). The reliance of a system on only a few threads is much less resilient than the system with 100 threads. This same concept is in play with the intertwined ecosystems found on a regional and global scale. Failure to maintain diversity can lead to trophic cascades such as seen with the kelp forests of Alaska and California (Estes et al. 1998).

On the opposite end of the spectrum, enhancing the biodiversity of a region can have unexpected positive benefits. The most visible example of this is the reintroduction of the Gray Wolf (Canus lupus) into Yellowstone National Park. The reintroduction of this single species resulted in an entire ecosystem becoming healthier by increasing the biodiversity of both plants and animals as well as altering the abiotic environment of the region (Ripple & Beschta, 2003, 2012).

As a loss of biodiversity weakens the health of individual ecosystems, the biosphere begins to become unhealthy. Impacts on a regional and global scale result in overall lower fitness for humans and increase technology dependence to compensate for lost natural resilience. This cycle, resource overconsumption-technological fix begins to stress adjacent ecosystems, continues to reduce the health of ecosystems worldwide and necessitates new strategies to limit the damage.

The Humanistic View of Confucian Philosophy

Confucianism has conventionally been regarded as a humanistic tradition that focuses on the roles and responsibilities of people regarding individual, family and society, a profoundly religious ideology (Tucker, 2009). Confucianism is distinguished from its concern for cultivation of human relations towards a harmonious society. The context of harmony is very extensive, including the harmonious society, harmonizing the world, and the triadic harmony in the cosmos – its inclusiveness of heaven, earth, and the human order (Li, 2013). Therefore, Confucianism would not be totally anthropocentric, as the relations between people and the natural world are also intrinsically connected in Confucianism, it is rather anthropocosmic (Nuyen 2011; Havens, 2013; Li, 2013).

The Trinity of Heaven, Earth and Humanities

Confucian thinkers characteristically regard nature as holistic, and each factor would play its dynamic role within specific systems. This holistic environmental philosophy aligns with preservationism and non-anthropocentric statements, encompassing the three key components of cosmos: Heaven, Earth, and Humanity.

Heaven and earth unite: the image of peace
Thus the ruler
Divides and completes the course of heaven and earth
He furthers and regulates the gifts of heaven and earth
And so aids the people – Book of Changes (Wilhelm, 1951)

This notion is known as Confucian "Triadic Harmony" Earth is the living entity with a life its own, which is also the virtuous being that sustains myriad life forms, and humanity refers to the moral consciousness (Li, 2013). The conception of humanity is that even though it has the capacity to transform the world, humans are only one member of the biotic community. Humans' responsibility is to achieve harmony with earth and heaven, which was viewed as a leading force in the Triad. However, the notion of heaven is more complicated, connotated by various streams of Confucian scholars. Firstly noted in Analects XVII (2018), Confucius said, "Does Heaven speak? The four seasons pursue their courses, and all things are continually being produced, but does Heaven say anything"(p. 72), and heaven is the living nature independent of humanity.

Furthermore, Confucius' disciple, Xunzi (circa 310-219 B.C.) represents heaven as a natural order. Tiandao, "heaven's process", operates according to unchanging principles; and Tianming, "heaven's mandate", means not to intervene in extraordinary ways in human affairs but rather providing the context within which all living things exist" (Goldin, 2018). On this basis, Tian imbues its morality, not only physicality. In today's environmental discourse, saving the environment's great value acquires more than physical actions, but also reverence and duty to nature itself. It would be ignorant to blame heaven for causing human misfortune.

Further reflecting on the doctrine of the unity of heaven and the human being, the human ethical responsibility goes beyond the human environment and the relationships embodied in the wider dimensions of existence. Evidence can be seen from the Neo-Confucian philosopher Zhuangzai. In his essay Western Inscription (1963), "Heaven is my father and Earth is my mother, and even such a small creature as I find an intimate place in their mindset" (p. 497). Furthermore, from the writing of Cheng Hao, it says, "the human person regards Heaven-and-earth and all things as one body" (De Bary & Bloom, 1999). The element of humanity evolved beyond the meaning of the human world and extended into the whole ecological domain.

The confucian notion of nature would question the current role of humans and nature. Through the growing reformation and advancement of human technology, it is rational to place humans as the master of nature. Modern society has engaged in science and technology that brought new forms of social organization and local polity that do not fit well with the religious reverence toward nature. Even when ecological problems are clearly identified, measured and mitigated, whether the technology would enable humans to alter the relationship with nature is still debatable.

The Principle of Equilibrium

Confucian ecological ethics would not give humans domination over nature, but also it does not encourage the sacrifice of human development to maintain the pristine nature. The oneness of humankind, nature, and harmony with the interrelation between those two are described as equilibrium and centrality. In order to maintain the vitality and flourish

of nature, people should also act upon the principle of equilibrium. In The Doctrine of the Mean Zhong (centrality) is the great foundation of the world, and harmony its universal path. When centrality and harmony are realized to the highest degree, Heaven and earth will attain their proper order and all things will flourish (Confucius, 2017, pp. 2-3).

To maintaining equilibrium and centrality is to economize the use of natural resources. Confucians proposed that humans should control and restrict their own desires and rationally explore natural resources to balance production and consumption (Li, 2003). As stated in Analects I, Confucius said "to rule a country of a thousand chariots, there must be reverent attention to business, and sincerity; economy in expenditure, and love for men; and the employment of the people at the proper seasons" (p. 6). Xunzi also emphasized human responsibility towards nature by responding to it with peace and order, and good fortune will result, whereas responding with disorder and disaster will follow.

The Principle of Benevolence

Under the realization of equilibrium and centrality, nature and environment create and provide all the material human beings live on. Therefore, humans are morally obligated to establish an intimate relationship with extending love. The two prominent philosophers, Mencius and Xunzi, formulated and codified Confucian philosophy, affirmed benevolence as the intrinsic value, and called for a universal moral for the ecosystem (Cui & Cuo, 2012). Mencius, the fourth generation of Confucius' disciples, advocated his political views to the rulers to constrain their own desires and materialism, as he said,

> If the agricultural seasons are not interfered with, there will be more grain than can be eaten. If close-meshed nets are not allowed in the pools and ponds, there will be more fish and turtles than can be eaten. And if axes are allowed in the mountains and forests only in the appropriate seasons, there will be more timber than can be used (Mencius, 2009, p. 3).

Similarly, Xunzi held the eco-ethic thoughts that humans must live in society and seek a linkage between social harmony and harmony with nature and in natural sustainability. He adopted a sociological approach and views an inevitable tension between the consumption of society and what nature can provide.

> Wherever the rivers and waterways are deep, fish and turtles will settle there. Wherever the mountains and forests are luxuriant, birds and beasts will settle there (Xunzi, 2014, p. 141).

With the spirits of humanities and relationships between self and others, Confucians never disregarded the intrinsic value of plants and animals. For the value exchange, humans are merely one of the many manifestations of the moral order (Cui & Cuo, 2012). Only human beings can turn tension into a creative force in harmonizing society and nature with benevolence and equilibrium. A thriving natural world, in turn, serves as the foundation for the development of human society.

The Ecocentric Perspective of Daoist Deep Ecology

Elite Confucian discourse cannot represent the whole of Chinese imagination of nature and environment. There are nuances of interpretation made in the volumes of Confucian and Daoism literature. The comparison of two traditions outlines the differences in the socio-political world and the position of individuals within nature (Lai, 2015). Confucians favored being philanthropic. However, a biocentric and ecocentric ecological worldview can be grounded in Daoism, which resonates with deep ecology. The moral depth of deep ecology lies in its insistence on viewing ethical goods not as the product of individual actions but as something emerging from the integrity of a more extensive system that incorporates that interest of many species (Adler, 2014).

Dao (the Way) and De (Virtue)

Dao refers to the inner logic of all existence, which permeates the universe (Yu et al., 2014). An observation can be made in the dialogue of Peng and Chen. In Chen's contribution, However, Chen affirms the Daoist perspective that moves the universe, the world, or "nature" in the modern sense is Dao, as it begets everything. This ethical holism is also supported in the Daodejing, the classic text credited to Laozi, the founder of Daoism, which sees them in a symbiotic relation. Dao originates time and space and yet transcends, or subsists beneath them, remaining ineluctably mysterious to human perception. Chen argued that Dao is the ontological source from which all things derive their existence. The concept extends into the realm of gods and spirits, more simply biological life.

> Dao (the way) is without beginning or end, but Wu (things) have their lives (Zhuangzi, 2013, p. 132)
>
> All that have faces, forms, voices, colors these are all mere Wu (Zhuangzi, 2013, p. 146)

Wu (matter, things) is the sensible phenomenon of Dao and the consequence of Dao for existence. From Dao, Wu have their birth, reach their completion and return. Laozi said "The myriad creatures rely upon it (Dao) for life, and it turns none of them (Wu) away" (2003, p. 34).

Additionally, De means virtual and integrity, referring to the cultivation of the distinctive characteristics of an individual, which seems to provide the specifications for an individual's integrity in the context of its relations with other individuals (Lai, 2003). In this latter sense, Dao is an abstraction, not an actual existence. It also functions as a conceptual tool or a psychological device to assist in the visualization of an ideal state of affairs whereby particulars come together in the fulfilment of their particular De.

Wuwei (Non Action) and Ziran (Spontaneity)

As discussed, De is that distinctiveness and integrity of each thing that can be realized only in the ideal Dao. The maintenance of the integrity of each individual also espouses in two integral Daoist concepts, non-action (Wuwei) and spontaneity (Ziran).

Wuwei, interpreted as "non-intrusive action" or "non-interfering action" is more philosophically pertinent compared to "effortless action". Non-interfering action at an ecological level defends against the imposition of artificial, conformist, and universally binding norms. On the other hand, Ziran extends the meaning of spontaneity it entails notions of De with Wuwei (Lai, 2007). In detail, Zi refers to "self", and Ran refers to "so". Thus Ziran is translated as "self-so", as "the unconditional and spontaneous self" (Waley, 1958, p. 174). Those concepts provide a coherent picture of Daoist non-assertiveness – allowing for the spontaneity of any one individual requires other people without unnecessary constraints on this individual (Lai, 2003) . Meanwhile, the value of individual beings within the environmental context urges the integrity and interdependence of individuals. Daodejing recognizes the integrity of individuals within the whole and seeks to promote their well-being within the context of the whole.

> Heaven and earth are not benevolent,
> They regard all things as straw dogs (disposable items used in sacrificial rites).
> Sages are not benevolent.
> They treat the people as straw dogs (Laozi, 2003, p. 5).

The holism in Daoist philosophy maintains a sense of individual integrity. The balance between the interdependence of all things and the maintenance of their De, their individual excellences, allows for the realization of a whole that is not merely the sum of its parts.

At the most basic level, Daoism supports a conceptual system that recognizes the integrity of each individual and allows for their spontaneous

development within the parameters of its environment. It bypasses debates on whether individuals, entities, or species possess intrinsic or instrumental value, proposing instead to understand the value in terms of the individual's place within the whole. Different from Confucianism, Daoism rebuts the shortsightedness of anthropocentricism, asserting no grounding to human independence or dominance over nature.

Educational Principles for Biodiversity Preservation

The question that emerges is what means exist to be able to slow and reverse the loss of biodiversity. One potential solution is to embrace and embed concepts of human/nature interactions embodied in traditional philosophies to help guide decisions in the modern world. All organisms modify and control their immediate environment to ensure their success and improve fitness. Humans are no different in that concern except that we extend the magnitude of that control and modification beyond what is necessary for existence. The level of control and manipulation exerted by the human species on the biosphere is far beyond what is necessary for mere survival. We do it because we can, because we can derive some short-term economic benefit, not because we need to.

This level of control has significant implications for the biosphere. Irrespective of the merits related to the biosphere, the human species is likely never to revert to an existence based on the Daoist ecocentrist view or as espoused in such modern philosophies as "Deep Ecology". While these ideas would surely preserve and enhance biodiversity, they are not practical within the context of human development. A more pragmatic view that maintains a respect for the environment can be found in the Confucian philosophy. Although the Confucian school of thought is often criticized as anthropocentric, within its core tenants, there is reverence and respect for nature and how humans fit within the broader biosphere. Utilizing this core Confucian philosophy, imbued with aspects of Daoism, a path forward can be elucidated. As we look to the past, these traditional philosophies clearly intertwine the existence and survival of the human species with the success and health of nature.

Relating to the Confucian Principle of Equilibrium, the integration of humans and human development with nature is what will allow the continued health of the natural environment which, in turn enables the continued development and evolution of human civilization. When contextualized within the idea of "the whole" as set forth in Daoist tradition, this principle provides the basis for assessing the continued development of the human species while maintaining and enhancing biodiversity.

This brings us to the development of a guiding principle for decision-making to preserve and enhance biodiversity. Specifically:

> *Decisions must not result in the artificial reduction of biodiversity within the framework of evolutionary time.*

In other words, we must not take any actions that will result in biodiversity being reduced at the local, regional or biosphere level that would not occur naturally.Implementing this overarching principle leads us a set of reciprocal decision arguments:

> *Decisions related to the one, must consider the whole*

Each decision that is related to "one" (defined as any population) must understand the consequences to the entire system, the whole. It is realistic to have a decision that may have a direct impact on one population that does not jeopardize the sustainability of the species, but due to reduced (or increased) census, the decision has effects throughout the trophic system which reduces the fitness of one or more other species to the point they are not sustainable. The ripple effects of decisions are frequently not considered. In order to sustain or enhance biodiversity, the integrated nature of the biosphere must be taken into consideration. In the Scripture of Great Peace in

Daoism:

> When heaven and earth are sick, this causes humans to also become sick; when humans are without sickness, then heaven is also without sickness. If humans are particularly sick, then heaven becomes partially sick. When humans are the slightest bit sick, then heaven becomes the slightest bit sick (Wang, 1960, p. 356)

Decisions related to the whole, must consider the one

Each decision made must look and evaluate how it impacts not only a system but also each component of the system. It is straightforward to picture a scenario where a decision will not substantially impact an ecosystem. However, it is also realistic that although a system may not be substantially affected, individual components may in fact be significantly harmed or lost. With no immediate effect to the system, it is easy to assume that there will not be any impacts at all. However, just as with ball of string, the loss of even a single string can affect the overall integrity of a system over a long period of time. Because of this, it is important to assess not only the whole but also the individuals that constitute the whole.

These are effectively reciprocal arguments which by their nature address the breadth of issues that must be considered when assessing consequences of decisions related to biodiversity. Together, they form the basis of a traditionally based decision-making process that drives consideration of the biosphere. Implementation will force us to better understand and relate to the environment. But by themselves, they are not sufficient to stem the tide of biodiversity loss. To be effective, these arguments must be put forth within the context of time, specifically evolutionary time.

The analysis suggested by these arguments is complex. It becomes significantly more difficult when the consequences of decisions are made over decades or centuries. A legitimate question is "Why?" Why evaluate decisions over long periods of time? A brief review of history of the use of pesticides and antibiotics, not to mention the carbon driven economy, provides the answer. The negative effects of these technologies only became obvious decades after the implementation of the technologies. Understanding the potential consequences of decisions may lead to a more sustainable use of technology.

Adopting this principle, and the subsequent reciprocal decision arguments within the context of evolutionary time require a retuning of how humans think. Specifically, it is not the short-term gain that is most critical, but the long-term sustainability and evolution that becomes the guide to decision making.

Summary

Biodiversity is key to perpetuation of the human species. Every technology has, at some core point, a reliance or impact on the biosphere. Inherent in that statement is that a healthy biosphere is necessary for continued development of technology and a continued evolution of the human species. From a purely anthropocentric viewpoint, in order for humans to continue exploiting the natural environment, it is vital that humans protect and enhance biodiversity, which maintains a healthy biosphere. To do this, we must reconnect with the natural environment. As we have continued to move further away from the environment, we need to look to the past to re-educate ourselves in this type of thought that embraces the integration of humans with the environment. It is this type of thought that has propelled the success of the human animal for millennia.

To that end, the principles articulated in the Confucian philosophy as enhanced by a Daoist perspective, provide the basic framework for reconnecting humans with the biosphere. When these principles are embodied within the context of evolutionary time, this approach provides the framework to evaluate decisions with the outcome being more aware of the ecological process, an outcome which has the potential to reverse our

current, unsustainable assault on biodiversity…the key to a healthy biosphere and a fit human species.

References

Adler, J. A. (2014). 'The Great Virtue of Heaven and Earth': Deep ecology in the Yijing. In *Religion and Ecological Sustainability in China.* Routledge.

Aizen, M. A., Garibaldi, L. A., Cunningham, S. A., & Klein, A. M. (2009). How much does agriculture depend on pollinators? Lessons from long-term trends in crop production. *Annals of Botany, 103(9),* 1579–1588. https://doi.org/10.1093/aob/mcp076

Alho, C. J. R. (2008). The value of biodiversity. *Brazilian Journal of Biology,* 68, 1115–1118.

Ceballos, G., Ehrlich, P. R., Barnosky, A. D., García, A., Pringle, R. M., & Palmer, T. M. (2015). Accelerated modern human–induced species losses: Entering the sixth mass extinction. *Science Advances,* 1(5), e1400253–e1400253. https://doi.org/10.1126/sciadv.1400253

Chang Tsai (Zhang Zai). (1963). "The Western Inscription" Translated by Wing-tsit Chan. *A Source Book in Chinese Philosophy.* Princeton, N.J.: Princeton University Press, 497.

Confucius. (2017). *The Doctrine of the Mean.* Translated by James Legge. 1st edition. Lazy Raven Classics.

Confucius. (2018). *The Analects.* Open Road Integrated Media, Inc.

Cui, T., & Cuo, Q. (2012). The Values of Confucian Benevolence and the Universality of the Confucian Way of Extending Love. *Frontiers of Philosophy in China,* 7(1), 20–54. https://doi.org/10.3868/s030-001-012-0002-5

Cumming, G. S., Buerkert, A., Hoffmann, E. M., Schlecht, E., von Cramon-Taubadel, S., & Tscharntke, T. (2014). Implications of agricultural transitions and urbanization for ecosystem services. *Nature,* 515, 50–50. https://doi.org/10.1038/nature13945

De Bary, W. T., & Bloom, I. (Eds.). (1999). *Sources of Chinese Tradition: From Earliest Times to 1600* (second edition, p. 944 Pages). Columbia University Press.

Duffy, J. E. (2009). Why biodiversity is important to the functioning of real-world ecosystems. *Frontiers in Ecology and the Environment,* 7(8), 437–444. https://doi.org/10.1890/070195

Folke, C., Jansson, Å., Rockström, J., Olsson, P., Carpenter, S. R., Chapin, F. S., Crépin, A.-S., Daily, G., Danell, K., Ebbesson, J., Elmqvist, T., Galaz, V., Moberg, F., Nilsson, M., Österblom, H., Ostrom, E., Persson, Å., Peterson, G., Polasky, S., …

Westley, F. (2011). Reconnecting to the Biosphere. *Ambio,* 40(7), 719–719. https://doi.org/10.1007/s13280-011-0184-y

Fraser, E. D. G. (2003). Social vulnerability and ecological fragility: Building bridges between social and natural sciences using the Irish Potato Famine as a case Sudy. *Conservation Ecology,* 7(2), 9–9.

Gallai, N., Salles, J.-M., Settele, J., & Vaissière, B. E. (2009). Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. *Ecological Economics,* 68(3), 810–821. https://doi.org/10.1016/j.ecolecon.2008.06.014

Goldin, P. R. (2018). Xunzi. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2018). Metaphysics Research Lab, Stanford University.

Herndon, C. N., & Butler, R. A. (2010). Significance of Biodiversity to Health. *Biotropica,* 42(5), 558–560. https://doi.org/10.1111/j.1744-7429.2010.00672.x

Kennett, D. J., & Winterhalder, B. (Eds.). (2006). *Behavioral Ecology and the Transition to Agriculture.* University of California Press.

Lai, K. (2007). Ziran and Wuwei in the Daodejing: An Ethical Assessment. *Dao,* 6(4), 325–337. https://doi.org/10.1007/s11712-007-9019-8

Lai, K. (2015). Daoism and Confucianism. In X. Liu (Ed.), *Dao Companion to Daoist Philosophy* (pp. 489–511). Springer Netherlands. https://doi.org/10.1007/978-90-481-2927-0_21

Lai, K. L. (2003). Conceptual Foundations for Environmental Ethics: A Daoist Perspective. *ENVIRONMENTAL ETHICS,* 25, 20.

Laozi. (2003). *The Daodejing of Laozi* (P. J. Ivanhoe, Ed.). Hackett Publishing.

Li, C. (2013). *The Confucian Philosophy of Harmony.* Routledge.

Mencius. (2009). *Mencius* (P. J. Ivanhoe, Ed.; I. Bloom, Trans.; p. 208 Pages). Columbia University Press.

Nuyen, A. T. (2011). Confucian Role-Based Ethics and Strong Environmental Ethics. *Environmental Values,* 20(4), 549–566.

Piccolo, J. J. (2017). Intrinsic values in nature: Objective good or simply half of an unhelpful dichotomy? *Journal for Nature Conservation,* 37, 8–11. https://doi.org/10.1016/j.jnc.2017.02.007

Ripple, W. J., & Beschta, R. L. (2003). Wolf reintroduction, predation risk, and cottonwood recovery in Yellowstone National Park. *Forest Ecology and Management,* 184(1), 299–313. https://doi.org/10.1016/S0378-1127(03)00154-3

Ripple, W. J., & Beschta, R. L. (2012). Trophic cascades in Yellowstone: The first 15years after wolf reintroduction. *Biological Conservation,* 145(1), 205–213. https://doi.org/10.1016/j.biocon.2011.11.005

Swingland, I. R. (2001). Definition of Biodiversity. In S. A. Levin (Ed.), *Encyclopedia of Biodiversity* (pp. 377–391). Elsevier. https://doi.org/10.1016/B0-12-226865-2/00027-4

Tucker, M. E. (2009). Confucianism. In J. B. Callicott & R. Frodeman (Eds.), *Encyclopedia of Environmental Ethics and Philosophy* (Vol. 1, pp. 163–166). Macmillan Reference USA; Opposing Viewpoints in Context.

Tzu, L., & Laozi. (2016). *The Way and Its Power: Lao Tzu's Tao Te Ching and Its Place in Chinese Thought* (A. Waley, Trans.). Martino Fine Books.

Waley, A. (1958). *The Way and Its Power: A Study of the Tao Te Ching and its Place in Chinese Thought.* New York: Grove Press.

Wang Ming. (1960). *Taiping jing hejiao.* Zhonghua Publishing Company.

Wilhelm, H. (Ed.). (1951). *The I Ching or Book of Changes* (C. F. Baynes, Trans.; p. 800). Princeton University Press.

Xunzi. (2014). Chapter 14: On Attracting Men of Worth. In E. L. Hutton (Ed.), *Xunzi: The Complete Text* (pp. 141–144). Princeton University Press. https://doi.org/10.1515/9781400852550-017

Yu, D. S., Miller, J., & Veer, P. van der. (2014). Introduction: The diversity of eco-religious practice in China. *In Religion and Ecological Sustainability in China.* Routledge.

Zhuangzi. (2013). *The Complete Works of Zhuangzi.* Columbia University Press.