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Abstract: There is an ethical tradeoff between growing high-yield agricultural products and the integrity and goodness of an ecosystem. Why must we protect an ecosystem and prevent extinction of other organisms? One might claim that the human benefit gained from environmental destructions for the purpose of agriculture is more valuable than any life or structure that existed in the ecosystem. In the case of the Palouse Prairie in Eastern Washington, early white settlers in the area valued the monetary gains from agriculture more than any goodness of an intact ecosystem. Unlike the benefits gained from farming (which could be attained through more sustainable means), what is lost with the destruction of an ecosystem or the extinction of a species can never be restored. I will argue that humans are morally obligated to not destroy living lineages when altering a landscape. A brief case study of the Palouse Prairie will illustrate that the small-scale, land-altering decisions made by the few farmers of the Palouse have caused long-term harms for the current and future inhabitants of the ecosystem, and that humans ought to make reparations for those harms. Because evolution grants the potential for any lineage to advance and better its individuals, the processes of evolution must be respected in any ecosystem. Any lineage's process of perpetuation must be morally considerable, as is any living organism's will to live. To offer a practical guideline for land alteration, I conclude with the suggestion that all lineages of life receive freedom of environment, perpetuity, and adaptation.

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Agriculture allows human populations to grow exponentially but that comes at a cost as the former ecosystem perishes, and the surrounding land suffers – yet all of this killing has been justified by humanity's need to feed its growing population. In the case of agriculture, whether or not a destructive farming practice is necessary for human survival does not change the ethical impact of the consequential loss. In both cases of necessity and non-necessity, some thought

must be given to the ethical impact of that loss which goes beyond the benefits that wild ecosystems, or destruction of wild ecosystems, might supply to humans.

The Palouse Prairie grassland ecosystem in eastern Washington State is critically endangered, with less than 1% of the prairie remaining. The main causes of destruction include overgrazing of range animals, change in fire regime, new species introduction, and agriculture (Sims & Risser, 1988). Now an anthropogenic landscape, the Palouse consists of rolling hills covered in farmland. Could it be unwise to criticize a practice that once brought economic growth to a region and provided food for a growing population? In times like these, when only 5% of land on Earth has escaped human modification (Kennedy et al., 2019) the criticism is necessary. Any practice that modifies a landscape must be criticized ethically and not simply in terms of human survival.

Case Study: Palouse Prairie

The Palouse Prairie is characterized as having a variety of bunchgrasses and forbs growing in rich loess soils, with scatterings of drought-tolerant trees, scarce wetlands, and forested areas on shady northern aspects. Native plants such as Idaho fescue and bluebunch wheatgrass were common (Black et al., 1997; Sims & Risser, 1988). Today, 99.9% of what used to be the prairie ecosystem has been destroyed (National Biological Service, 1995). The Palouse, like so many other prairies that once were common in the United States, once supported endemic native and endangered life.

The story of humans on the Palouse Prairie begins with the Nimi'ipuu, or Nez Perce people, who occupied the Palouse region for hundreds of years before the arrival of Europeans. The Nez Perce would use frequent fire burning to aid with plant regeneration, deer driving, seed harvesting and animal forage (Boyd, 1999; Carroll et al., 2010). Frequent fires have significant

impact on ecosystems, and from this history it must be concluded that the Palouse Prairie was managed and influenced significantly by humans before the arrival of Europeans. The Nez Perce's land use demonstrates how humans can alter the ecosystem for their own benefit without causing long-term damage, and also that successful human development does not necessarily come at the cost of an entire ecosystem.

The arrival of white settlers eventually pushed the Nez Perce off of the prairie and onto reservations, causing a marked shift in the way the prairie was managed (Black et al., 1997). Between the 1870's and the 1990's, nearly the entire Palouse was transformed from prairie to farmland (Black et al., 1997). What was considered innovation at the time gave the illusion that the conversion of wild prairie into high intensity farmland was an act of human resilience. Yet, in reality the settlers were causing larger, long-term problems for the ecosystem as a whole. As Kyle Whyte wrote, resilience isn't defined only in terms of human endurance, but rather as the development of moral relationships between humans and the changing ecosystems in which we reside (Whyte, 2018). As the white settlers forced the Nez Perce from their homes, they also forced humanity away from its positive role in a diverse, resilient ecosystem. Today, the few remnants of the ecosystem are so fragmented that there is little hope for restoration of the once-flourishing prairie.

This change in land management demonstrates that a few individual landowners making decisions on private property can cause the destruction of an entire ecosystem. As Aldo Leopold argued, a farmer's actions on their land affect the entire community, but the farmer is more likely to choose the profit-maximizing option with demonstrable short-term benefits, rather than the long-term benefits for the whole (Leopold, 1949). These profit-driven actions might not have been considered unethical at the time of the destruction of the Palouse Prairie, but as we move

towards a more resilient world, we must analyze the decisions which led to such destruction and seek not to take the same path.

What was Lost

The destruction of the Palouse Prairie caused the loss of tangible ecosystem benefits that could potentially be restored, such as soil biodiversity, water quality, animal and plant populations, critical habitat, and much more. Those qualitative and quantitative aspects of what were lost have been explained in scientific studies (such as Brown et al., 2008; Pimentel et al., 1995; Potts et al., 2020; USDA, 1978, 1979), and although they are important and relevant to all that has been lost, in this paper I will focus on the intangible. This section will address the nuances of lineages and absolute loss.

Lineage is a perpetual string of life formed by the passing of genetic information between generations of living organisms. Lineage does not represent a single point in time, for it is the history (as well as present and potential future) of all genetic information that has been passed over time. Nor does lineage have a single identity; it is constantly changed over time through genetic variations and thus cannot be represented as a single static entity (even self-cloning fungi have evolved over time). Lineage is not one single genotype; it is the accumulation of about 3.5 billion years of life and death that have contributed to all living genotypes and created the diversity of life on Earth.

Moral theorist Paul Taylor suggested that we grant moral standing to any being which has a good of its own, raising the idea that living organisms have their own end towards which they advance, and reaching that end implies the organism has led a good life (Taylor, 2011). I will argue that this moral theory ought to be applied not only to living beings which seek an end, but to the lineage which drives that innate pursuance of an end in all living organisms – lineage which ties all life together on Earth. Lineage is life's call to purpose, whether purpose exists or

not in the sequential stages of evolution which have led to complex life. Because evolution has directed single-celled organisms toward complex, intelligent and sentient life, the highly controversial question must be addressed: does evolution have a purpose, and must that purpose be preserved? It can be deduced from the theories of evolution and natural selection that there is no end or purpose in evolution. Evolution and adaptation happen based on random mutations – some of which are 'selected' based on environmental pressures to an organism. Beneficial adaptations are not chosen, but rather won by those organisms who happen to have beneficial mutations and produce more offspring. It can be argued that evolution has not a purpose, but a consequential progression in which some organisms can become better-suited for their environments. Evolution grants a potentiality for better life for all organisms, through adaptation driven by natural selection. Note that evolution does not guarantee a better life but does grant a potential.

Returning to Taylor's theory, while organisms which seek an end are considered morally relevant, I argue that it is difficult to define – if it exists – a common end towards which all organisms purposefully advance. Humans do not have a common end. We share no overarching expectation for ourselves, especially when comparing human lives from different cultures, times, and locations. There is no evident end towards which we all are driven, but it is apparent that the process which leads us to pursue an end is more valuable, and more tangible, than the end itself. Biologically, our bodies and genetics are framed around reproduction, which translates to the passing of the lineage to the next generation. Perpetuation through time is integral to the process of all life, and evolution. Whether or not this perpetuation leads to an end is irrelevant to the moral relevance of the life or to the moral relevance of evolution; but because the innate call of all organisms is to perpetuate, it must be determined that this perpetuation has some moral relevance, much like the moral relevance given by Taylor to all organisms which advance

towards an end. Perpetuation, in this sense, does not mean basic reproduction, but it means the continuance and evolution of one's own species and all larger classifications: it is the continuance of all life. This is not to be mistaken for a 'pro-life' argument in which every individual human life must be preserved. It is an argument for the continuance of species and life as a whole.

A lineage does not end with one organism's death. The lineage ends with a larger group that carries similar adapted traits that are not found in other groups, such as those traits defined in the taxonomic classifications from species to domain. Because all life is theorized to have emerged from one common ancestor, each individual life form carries its own path that can be traced directly back to the common ancestor. A group of these individuals together as a species, who share near-identical traits, carry a unique lineage. When one of these branches carrying biological knowledge of the entire species is erased, there is absolute loss of lineage.

If the lineage of the eukaryotic branch in the phylogenetic tree of life had been terminated by an extinction of the last eukaryotic common ancestor, which was a single-celled organism, almost all forms of complex life that exist today would not have evolved. This is an example of the potential of lineage. At any given point in time, a species must not be judged to be insignificant based on perceived inferiority or lack of complexity. Like the single-celled organisms that evolved into all of life as we know it on Earth, each lineage holds great potential.

An extinction, or absolute loss, happens when the genetic information is no longer passed on through a lineage. Thus, a common ancestor which speciates (branches) into two different species arguably does not go extinct, because its lineage is still continuous (Mclennan, 2010). We can imagine that current branches will continue to evolve and speciate. Using the phylogenetic tree of life, here are some inferences about the potential of a lineage:

1. The higher the amount of species diversity at a given point in time, the higher the chance for speciation of a lineage at that point in time.
2. The less amount of species diversity at a given point in time, the greater the potential for speciation of a lineage in the future.

If we are to accept these inferences, we can conclude that all lineages at any point in time hold potential for speciation. During times of high diversity, a lineage is more likely to branch. When there is less species diversity, each lineage holds a huge amount of potential. This potential matters because, as we saw with the single-celled eukaryote, a great amount of life could come from that lineage no matter how insignificant it may seem at the time. Extinction of a single species, the termination of a lineage, is absolute loss of incredible potential.

The lineage must be respected as having a moral relevance to all life. Just as the sun which is the origin of all energy for life on Earth must not be purposefully destroyed, the lineages of life also must not be destroyed. Purposeful extinction is wrong, because it betrays the lineage of life, of which we are a part.

Biodiversity

In order to have biodiversity there must exist a wide variety of genes both between species and among species (United Nations, 1992). Human actions have reached a scale of worldwide environmental destruction, one where our land management has ended in absolute loss of species and ecosystems that might have lasted for thousands of years to come. These environments hosted unique lineages that were tailored to their ecosystems – lineages which are now lost forever. Loss of biological diversity on a worldwide scale means that we have caused the absolute loss of billions of lineages.

If we as moral agents are obligated to learn from our harmful mistakes, then we must look back on those human developments that caused extinctions and acknowledge that there

were alternatives to these destructive actions, especially in the case of the Palouse where many times the alternatives were recommended by scientists yet still ignored (Black et al., 1997). Ethical alternatives exist which can procure our human needs without causing absolute loss. This is where our ethical obligations reside: choosing the option which does not endanger the lineages of life.

Duty and Restoration

Andrew Light wrote that philosophers of science and the environment should seek to influence environmental policies, in order to influence real change in the world (Light, 2003). I make the following argument about our duty as moral agents to make restitution for harms and losses we have caused, specifically those caused to lineages and their nurturing ecosystems as occurred on the Palouse.

Restoration of the Palouse Prairie ecosystem will not result in an ecosystem equivalent to that of the original prairie. Planting native species will help aid in ecosystem function, but the landscape is now changed by the introduced species that have gained advantage on the Palouse. However, although the restored ecosystem would not be equivalent, some ecosystem functions would regain function. For example, restoration would provide more pollinator pathways, increase soil biodiversity and resilience, regrow biological soil crust to help prevent erosion, and restore ecosystem functions which are not maintained in an agricultural landscape. Restoration can also help strengthen any lineages which have been endangered, such as those organisms endemic to the Palouse. Thus, the action of reparation on the Palouse is necessary and beneficial.

In current times nearly all ecosystems on Earth have been affected, directly or indirectly, by humans. The idea of nature as a separate entity from humans is out of date. It is good to value and preserve these landscapes that are less altered than not, and to attempt to protect and restore them to our ability; however, acceptance that humans will always be contributors to their

ecosystems is imperative for absolving the harms already inflicted to those lineages. As we make restorations as reparation, we must remember that humans exist as residents of the ecosystem. In a resilient ecosystem, humans and non-humans alike will hold responsibilities to one another (Whyte, 2018).

Eric Katz focused his argument on restoration and wrote that an ecosystem is "fundamentally different" once it is altered by humans, and only is restored to serve human interest (Katz, 2003). This means that the ecosystem will never be the same once it is restored, but also that humans are not regarded in the same way as the rest of living organisms. I agree that even if we can imagine a theoretical replacement ecosystem in which every single property and soil nutrient are exactly the same as the original, it would be practically impossible to do so in real life. So yes, a human grown forest is different from a non-human grown forest. However, I argue that restoring a forest, or even designing a forest and managing it, would allow the living residents to have their own purpose and good, thereby serving more than just human interest. Even if humans had influence on how the forest was created, that does not change the essential biological mechanisms of which the living beings are comprised. Human-made artifacts can be used by animals for their own purposes, and in large cities (artifacts) non-human living beings are adapting and living out their lives to the full extent of their purpose. A tree planted by a human hand is still a tree. Even if restoration is created for the purpose of human benefit, the intent of its creation has no physical or biological alteration on the functions of the ecosystem itself, meaning that an ecosystem ought not be valued by the intent of its creators, but by the quality and quantity of diverse lineages which reside within.

As Andrew Light argued, a restored ecosystem has an advantage over an ecosystem damaged by humans and left on its own (Light, 2003). I agree and argue that humans cannot be separated from their ecosystems. As moral agents we can only interact positively or negatively

with them. For example, restoration of an agricultural landscape is overall a positive alteration of the land given its benefits to greater amounts of lineages in the ecosystem. Conversion of an entire functioning ecosystem to agriculture (specifically agriculture which demands complete dominance over the land when there are sustainable, positive agricultural practices) is an overall negative. This form of agriculture predominantly benefits one lineage, the *homo sapiens,* as well as the limited lineages of crops and domesticated animals which cannot measure up to the diversity of lineages found in an ecosystem.

Katz also explained that human-attributed value of a restored forest is less than that of a non-human grown forest (Katz, 2003). I argue that a change in human value, much like intent of the creator, makes no change in the biological functionality of the forest. Therefore, even though a restored ecosystem will not have the same human-attributed value or perfectly recreate the original landscape, restoration is still a beneficial interaction, and therefore the right action to take as reparation for our unethical destruction of the ecosystem.

Conclusion

In an attempt to make these ethical arguments applicable to our every-day lives and the choices we must face going forward, I will suggest that all lineages be granted the following freedoms, for the benefit of all life on this planet:

1) Freedom of environment: humans ought not destroy those environmental pressures which drive natural selection in a landscape.
2) Freedom of perpetuity: humans ought not end a lineage purposefully or make land-altering decisions that will lead to the end of a lineage.
3) Freedom of adaptation: humans ought not prevent a lineage from following its own unhindered course of evolution.

The classification of lineage is granted to a group of living organisms that share unique genetic traits. For example, one species carries a lineage, while the genus also carries a larger lineage. A lineage is a perpetual string of life formed by the passing of genetic information between generations of living organisms and is not defined by a single organism, but by a group of organisms.

There is a difference between protection of a lineage and leaving a lineage unhindered. As reparation, we must protect and restore those lineages we have damaged. But this does not hold us to the obligation of protecting every lineage that exists on earth, because the process of evolution itself may lead to the extinction of some species regardless of human cause. The point of un-hinderance is that we do not prevent a lineage from adapting and evolving over time. Human developments can and necessarily will cause some destruction of ecosystems, which is only morally acceptable when all rules are followed. Freedom of environment maintains the ecosystem under which lineages are adapting and prevents large disturbances that may harm the lineage.

Ultimately, it is our moral obligation as humans to make ethical choices in our interaction with the land, and not to hinder the lineages which reside within our ecosystems. The lineage of life is shared between all organisms, and protecting one helps ensure that the process of life itself is not betrayed for all living things. Lineage, much like the lives of all organisms, need not have an ultimate purpose in order to have moral relevance. As demonstrated on the Palouse Prairie, the actions of the few can have devastating consequences for an entire ecosystem, which is why I recommend that if these freedoms are impeded upon, then reparations made in the form of restoration must occur – including restorations to the Palouse Prairie.

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