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1 Ecosystem services and non-human labor

A key model for conceptualizing the relational structure of oysters within the econo-ecosystem¹ of the Chesapeake Bay is the ecosystems services model². Although in not inherently an economic model, when combined with neoliberal ideas the ecosystem services model allows for the inclusion of the labor of non-human organisms into the economics of the system by modeling the value of the products of this labor if it was performed by humans within the market (Costanza et al., 1998). The idea behind the ecosystem services model is that the quantification of market value for the products of non-human labor will incentivize the conservation of the ecosystem that supports that labor through market forces³. In the case of oysters, researchers have documented a long list of ecosystem services that are provided by oyster reefs, including water quality improvement, shoreline stabilization, and habitat creation⁴. Grabowski et al. found that the market value of the ecosystem services provide by oyster reefs substantially exceeded the market value of the oysters if they were harvested for meat⁵ thereby suggesting that the market should incentivize the creation of sanctuary reefs (i.e., reefs that are not open to harvest). This conceptualization of oyster reefs as the providers of ecosystem services embeds the reefs and the labor of the oysters within the capitalist market system and relies on market

¹The econo-ecosystem highlights the interdependency of human and non-human systems and recognizes that “nature” is the product of non-human labor (Barron & Hess, 2020)

²Although the idea the ecosystems provide services to humans is not new, the contemporary idea of ecosystem services was formalized by the United Nations Millennium Ecosystems Assessment which defined ecosystem services as “benefits people obtain from ecosystems” and divide these benefits into provisioning services that create the resources humans need, such as food and water, regulating services that maintain environmental variability within ranges of human tolerance, supporting services that create and maintain the biophysical systems that humans depend upon, and cultural services that provide for the intangible benefits humans derive from nature (Reid et al., 2005)

³(Costanza et al., 1998)

⁴(Grabowski et al., 2012; ?, ?)

⁵The highest value ecosystem services provided by the oyster reefs, according to (Grabowski et al., 2012) was shoreline protection. When this service was included in the analysis, the reefs recovered their cost of construction within 2 years of construction. However, even when shoreline protection was omitted from the analysis, the reefs recovered their cost of construction within a decade.

23 forces and capitalist values to define conservation goals. The problem with this
 24 approach is that the goals of the capitalist system, to maximize productivity and
 25 profit, means that the ecosystem services model does not actually incentivize
 26 conservation but in fact incentivises intensification⁶ and the maximization of
 27 value through optimization and efficiency increases.

28 An example of the co-option of non-human labor for the maximization of
 29 production and profit can be seen in the movement to harness the power of
 30 soil microbiota to create soil fertility⁷. There is increasing recognition that the
 31 fertility of the soil is the result of the labor of soil microbiota and therefore the
 32 productivity of a farm has changed from being “an activity carried out predomi-
 33 nantly by human bodies to an activity carried out by the soil biota under human
 34 management”⁸. The recognition of this ecosystem service (i.e., the creation of
 35 soil fertility), by soil biota, has not lead to the conservation of soil ecosystems
 36 but has rather lead to the “direct and indirect manipulation [of the lives of the
 37 soil biota] in the name of capital accumulation through e.g. greater efficiency
 38 and productivity. . .”⁹. Although Krzywoszynska do not explicitly reference the
 39 ecosystem services model in their example, it is clear that the farmers that they
 40 interview see the nonhuman labor of the soil biota primarily through the lens
 41 of the services they provide. Krzywoszynska notes that for the farmers, “what
 42 matters about agrarian soils. . . is not so much what they are but what they can
 43 do”¹⁰. This emphasis on the “services” that the soils provide when combined
 44 with the goals of a capitalist system — namely the accumulation of surplus
 45 value — results in a representation of the system that invites reduction. If the
 46 system is not a “system” per se, but rather an aggregation of ecosystem services,
 47 then there is no barrier to the isolation and optimization of those services in the
 48 name of production. For the farmers interviewed by (Krzywoszynska, 2020) the
 49 primary goal of their “collaboration” with the soils was “the promise of greater
 50 farm productivity that soil biota enable”¹¹.

51 An alternative to the ecosystem services model for understanding ecosystems
 52 is the foundation species model. In the foundation species model the persistence
 53 of an ecosystem is facilitated by one or a few species that create biotic and abi-
 54 otic habitat for the other species in the system and stabilizes the biogeochemical
 55 environment¹². Unlike the ecosystem services model of ecosystems, the founda-
 56 tion species model is not explicitly defined by its relationship with humans or
 57 human activities. Humans are incorporated into the ecosystem in relation to the
 58 existing structure and processes created by the foundation species. The nature
 59 of human relations is not explicitly defined as in the case of the ecosystem ser-
 60 vices model, where benefits flow from nature to humans¹³. Because foundation

⁶need to see (Bommarco, Kleijn, & Potts, 2013)

⁷(Krzywoszynska, 2020)

⁸(Krzywoszynska, 2020, p. ?)

⁹(Krzywoszynska, 2020, p. 239)

¹⁰(Krzywoszynska, 2020, p. 234)

¹¹(Krzywoszynska, 2020, p. 243)

¹²cite Foundation species here

¹³(Costanza et al., 1998)

species are strong interactors¹⁴ human-caused alterations to their abundance or function will have disproportionately large effects on the ecosystem. Hemlock forests create a unique physiochemical environment due to the impacts of their leaf litter on soil nutrient content, soil moisture, and light availability, that supports a unique community of facilitated organisms¹⁵. However, hemlock forests do not reestablish themselves following harvest by humans but are replaced by hardwood species¹⁶, so the exploitation of hemlock trees as a raw material results in not only the co-opting of the metabolic labor of the hemlock trees but undermines their creative power within the system. The application of the ecosystem services model to this system would recognize that in addition to the market value of the wood provided by the forest, the hemlock forest might also provide services that are valuable to humans, such as recreation, habitat for other valuable species, or a repository of bio-products such as medicine. As a result, the total value of the forest to humans could exceed the market value of the wood and the market should drive its preservation¹⁷. Although under this analysis, the forest may be preserved, the forest ecosystem has been reduced to simply a spreadsheet of services. Battistoni writes¹⁸

Turning ecosystems into property requires that they be represented for the market as an array of individualized services that fails to adequately reflect their actual functioning or necessary independence; thus the complexity and relationality of what is being preserved is often lost as ecosystems are divided into packages of services. . .

The “complexity and relationality” of the ecosystem that Battistoni refers to here is precisely what is created by the foundation species. It is through the relationships with the other species in the system that the foundation species “creates” a unique ecosystem. In this sense the ecosystem is not an aggregation of services but the result of the emergent properties of organisms in relation.

The foundation species concept shows that the ecosystem that emerges from the labor of the foundation species is more than just a representation applied by humans but has biological materiality. The ecosystem is a “thing” that is created by the relational structure and emergent properties of its constituents in collaboration with the labor of the foundation species. Therefore, as Battistoni notes, the ecosystem has “necessary independence” as well. Through the recognition of the ecosystem’s materiality and creative agency, the ecosystem becomes not only economic but also political. That is to say that the ecosystem and its members are represented not by the value that they bring to the market but as co-creators, as Battistoni says “as a collective distributed undertaking of humans and nonhumans to reproduce, regenerate, and renew a common world”

¹⁴Strong interactors are species that have an impact on the structure or function of an ecosystem that is disproportionate to either their abundance or the impact of other species in the system [CITE strong interactors here]

¹⁵(?, ?)

¹⁶(?, ?)

¹⁷(Costanza et al., 1998)

¹⁸(Battistoni, 2017, p. 11)

99 through “hybrid-labor”¹⁹. This idea is also represented by extending Marx’s
100 concept of “species-being” to nonhumans, where nonhumans as well as humans
101 labor within a relational framework with others for their own wellbeing²⁰.

102 Any attempt at conservation risks creating a distinction between the “natu-
103 ral” and the “human”, and then seeking to erase the “human” from the “natu-
104 ral” to return to a preferred “pristine” state. Latour classically showed that the
105 distinction between the nature and culture is a myth of modernity but nonethe-
106 less it remains a compelling and persistent model influencing our interactions
107 with the environment. For our present analysis, it becomes relevant in the appli-
108 cation of the ecosystem services model to conservation. The ecosystem services
109 model is “the idea that we should care for the non-human world because of all
110 the services it provides to humans to maintain the world we need and want”
111 ²¹. In this conception the needs and wants of humans seen as distinct from the
112 needs and wants of the non-human and therefore permits the exploitation of
113 non-human labor to serve the needs and wants of humans. However, this model
114 fails to recognize the interdependency of the human and non-human worlds for
115 the co-creation of “nature” ²². Barron and Hess propose the concept of the
116 “econo-ecological” system, which highlights the interdependency of human and
117 non-human interactions. This model alludes to the same relational structure
118 that ecologists have recognized in the foundation species model, where the struc-
119 ture and function of the system is the result of facilitating interactions between
120 its members, what Barron and Hess call “in-kind” labor interactions. In this
121 type of relational structure, the labor of one species provides the conditions
122 necessary for other species to thrive.

123 In my attempt to put ecological models and humanist frameworks in conver-
124 sation, I am coming up against an issue of “translation” between the two fields.
125 The humanist emphasis on “thriving” and “well-being” that is captured in Fair
126 and McMullen description of “species-being”, whereby a species is capable of
127 applying its labor for its own welfare, does not map well to ecological under-
128 standings of the success for species, which are rooted in the Darwinian idea of
129 “fitness”. From the perspective of biological evolution, fitness is the number of
130 reproductively mature offspring that an individual produces. So if one squirrel
131 individual produces 4 reproductively viable offspring, and another squirrel
132 individual produces only 3 reproductively viable offspring, then the former is
133 considered to have greater fitness. This matters, of course, because the princi-
134 ple metric of “success” in evolutionary biology is the temporal transference of
135 genetic information, which is done through the production of viable offspring.
136 This narrow definition of “success” is not easily reconciled with humanist ideas
137 of “thriving” or “well-being”, since they produce a conundrum whereby we can
138 recognize that from a human perspective these terms do not simply mean the
139 production of viable offspring, and in the case of a feminist ideas²³, may explic-

¹⁹(Battistoni, 2017, p. 6)

²⁰(Fair & McMullen, 2023)

²¹(Barron & Hess, 2020)

²²(Barron & Hess, 2020; ?, ?; Krzywoszynska, 2020)

²³()

itly reject reproduction as a definition of well-being. On the other hand, since it is impossible to know the experience of non-humans²⁴, applying human-based definitions of thriving or well-being to non-humans is irrevocably fraught. For the purposes of this project then, I am drawn to the idea that “thriving” and “well-being” are connected to being able to participate in the full suite of ecological relationships that reflect a species’ evolutionary history.

Evolutionary history reflect the synthesis of relational structure and creation, since changes in the structural and genetic information of a species²⁵ are linked to environmental (i.e., relational) factors that an individual encounters. This transfer of information and matter through time by the combined processes of biological evolution and metabolism aligns with the connections between matter and semiotics in new materialist ideas²⁶ where matter and meaning are entangled and arise from the “world’s process of becoming”²⁷. This act of co-creation of biomass and information, matter and semiotics, linked through a temporally specific relational structure represents in the most explicit way, what it means to be an individual and a species. Tsing describes the process of “alienation” as being removed from the context in which the developed or exist. The specific ecological relational structure of a species and the history that created it most basically this context of development and existence. Therefore, alienation from the specific ecological relationships that reflect a species’ evolutionary history represents alienation from “thriving” and a species capacity to labor toward its own “well-being”, that is to manifest its species-being²⁸, irrespective of whether a species is producing viable offspring.

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²⁴(Fair & McMullen, 2023)

²⁵Structural information refers to the specific arrangement of materials that make up an individual of a species. The structural information is created through the process of development by the genetic information, which is the specific sequence of nucleotide bases in the DNA molecules of the individual’s genome. The two forms of information are inextricably linked in that the structural information (i.e., the biological configuration of the organism) is needed to use the genetic information and the genetic information *specifies* the structural information, mostly by specifying which enzymes the individual can synthesize.

²⁶(Iovino & Oppermann, 2012)

²⁷(Iovino & Oppermann, 2012, p. 453)

²⁸(Fair & McMullen, 2023)

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