Edge, Boundary, Assemblage, Territory: From Ecology to STS and Back Again (with stops in Socially Engaged Art and Critical Plant Studies)

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This paper emerged out of my note taking and sketchbook practice. In the long gap between my MFA degree and joining the PhD program at RPI nine months ago, I did a lot of casual, unstructured reading related to the field of ecology. I followed my interests from text to text, regularly jotting down or highlighting terms or phrases that tickled my brain in pleasant or intriguing ways. This reading ranged from articles published in professional ecology journals, which I had to weasel from behind paywalls, to popular science books one might pick up at an airport book shop.

Over the past three months of engaging with Science Studies in a more rigorous and in-depth way than I did as a casual civilian reader, I've discovered a cumulative pattern that is continuous with my notes from my pre-RPI life. This pattern extends across reading in fields that are relevant to my research and practice, including ecology, feminist science and technology studies (STS), socially engaged art (SEA) and critical plant studies (CPS). I've noticed, again and again, adorning the pages of my sketchbooks and piling up in my Zotero notes, an accretion of terms that I associate with ecology, but that also have a relationship to geography. There are many such terms, but those that appeared regularly in my notes include **edge**, **boundary**, **assemblage**, and **territory**. In a sense these are "ecogeographic" terms, abstractions that are used to describe how topography, biotic and abiotic features, and the organisms embedded in them are layered upon

one and other.[1] This paper is an attempt to investigate why I am tantalized by ecogeographic terminology. I want to use the following pages to think more deeply about what work terms like these do as they flow between ecology and STS, and how those flows in turn effect my work with SEA and CPS.

The four fields at the center of this inquiry, ecology, STS, SEA and CPS, are relatively young within what might be described as their "parent" disciplines: ecology within the natural sciences, STS within the humanities, SEA within contemporary art, and CPS as an outgrowth of animal studies. In each of these fields I find an emphasis on multiplicity and fluidity, and a tradition of defining self in relationship to more powerful, more institutionally defined fields with longer histories. As such, each of these fields can be read as still in formation, and in some ways, adverse to ever solidifying. While a full review of the genesis and development of these fields is beyond the scope of this paper, I will attempt to provide cursory summaries of each, fully aware that this task is somewhat absurd, given these fields' reticence to be pinned down and given easily demarcated edges.

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[1] Ecogeographic is not a term I was familiar with prior to using it here. In fact, I assumed it was a neologism that I would coin and define on my own terms. However, The Oxford English Dictionary defines ecogeographic as "Relating to or regarding location and environment; of or relating to ecogeography", which they define as "The combined study of the ecology and geographical distribution of organisms; (also) the geographical distribution of an organism in relation to its ecology". According to the OED it was first used in 1950, in the American Journal of Botany. I have never encountered either term ecology articles or textbooks; rather I've seen biogeography used to cover similar ground, thus I will appropriate "ecogeographic" for my purposes here, but appreciate the slippery possibilities for multiple meanings."Ecogeographic | Definition of Ecogeographic in English by Oxford Dictionaries," Oxford Dictionaries | English, accessed May 2, 2018, https://en.oxforddictionaries.com/definition/ecogeographic; "Ecogeography | Definition of Ecogeography in English by Oxford Dictionaries."

I practice what I call social-ecological art, a form of art practice that draws on both ecology and SEA. I will define ecology in more depth shortly, but to attend to it briefly here, most definitions revolve around the study of interrelations between organisms and environments, and state the the field draws on influences from biology, chemistry, geology, and mathematics, among others.[2] SEA is a relatively young field of contemporary art, emerging in the early 2000s, that puts a premium on social exchange and participation, rather than the creation of objects or passive audiences.[3] It has roots in exchange-oriented, dematerialized art practices like Dada, Allan Kaprow's Happenings of the 1960s, and Suzanne Lacy's new genre public art of the 1980s and 90s, but practitioners also draw on influences from feminist education theory, theater, and ethnography, among others.[4]

One of the methodologies I use to combine ecology and SEA into social-ecological art can be described as "public fieldwork". It involves using the strategies and tools of ecology to do publicly accessible, participatory experiments and fieldwork that in turn generate experiences, materials, and data, all of which I frame as art. Much of my work in this area revolves around relationships between humans and plants, in particular feral and weedy plants that are found in habitats seemingly dominated by human activity. This focus on the vegetal has lead me to the

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[2] Lorenzo Bramanti and Giovanni Santangelo, "Ecology through Time, an Overview," *Rivista di biologia* 99 (2006) N. 3, no. 3 (2006): 395, https://doi.org/10.1400/57247.

[3] Tate, "Socially Engaged Practice – Art Term," Tate, accessed May 2, 2018, http://www.tate.org.uk/art/art-terms/s/socially-engaged-practice. The Tate's "Art Terms" website defines socially engaged art as art practice that is "collaborative, often participatory and involves people as the medium or material of the work."

[4] Pablo Helguera, *Education for Socially Engaged Art: A Materials and Techniques Handbook* (Bethesda, MD: Jorge Pinto Books, 2011), xi-x. Noticing a gap in handbooks for artistic practice involving social interaction, Helguera wrote this short handbook to compliment an upwelling in theoretical work around the role of SEA. In it he defines tools and techniques for working effectively in the field, emphasizing the importance of an approach that is grounded in pedagogy and communication.

emerging field of CPS, which draws on plant biology, animal studies, feminist STS, and ecology. Potential genealogies for this barely-formed field abound, but many cite philosopher Michael Marder's 2013 book *Plant-Thinking: A Philosophy of Vegetal Life* as a key text that precipitated the field's formation.[5] In it Marder calls on contemporary society to account philosophically for vegetal ways of being, developing a new respect for plant life.[6] Core to CPS is the concept of "plant blindness". Frequently invoked by Marder and other CPS scholars, the term actually comes from botany, where it is defined as "the inability to see or notice the plants in one's own environment, leading to the inability to recognize the importance of plants in the biosphere and in human affairs."[7] Finding ways for modern humans, who are often estranged from non-human nature, to reconnect with the agency of plant life is a thread that runs through the field of CPS.[8]

In working between ecology and SEA, and drawing on STS and CPS, I often find myself bumping up against, skirting around, darting through, and becoming entangled in boundaries, edges, assemblages and territories, both literal and metaphorical. These structures sometimes fall where I expect them to be, and often where I don't. In either case, when I stumble across them I also tend to find generative, productive terrain, however thorny or painfully murky the landscape

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[5] Nealon, Jeffrey T. "Preface." In *Plant Theory: Biopower and Vegetable Life*, 1 edition. Stanford, California: Stanford University Press, 2015. http://www.sup.org/books/extra/?id=23486&i=Preface.html.

Stark, Hannah. "Deleuze and Critical Plant Studies." In *Deleuze and the Non/Human*, 180–96. Palgrave Macmillan, London, 2015. https://doi.org/10.1057/9781137453693_11.

"Critical Plant Studies Is Now a ThingCritical-Theory.Com." Critical-Theory (blog), February 23, 2013. http://www.critical-theory.com/critical-plant-studies-is-now-a-thing/.

[6] Michael Marder, *Plant-Thinking: A Philosophy of Vegetal Life* (Columbia University Press, 2013).

[7] William Allen, "Plant Blindness." *BioScience* 53, no. 10 (October 1, 2003): 926–926, https://academic.oup.com/bioscience/article/53/10/926/254897.

[8] Prudence Gibson, *The Plant Contract: Art's Return to Vegetal Life* (Brill Rodopi, 2018), 2-3.

may seem. Of course here I am using ecological metaphors, and mixing them with physical, lived experiences. This layering and reflexivity is confusing, but again generative. I hope this paper can play productively in this realm of representation and fleshy, lived experience.

Following the flow of ecogeographical terms as they move from ecology into STS and back again provides an opportunity to watch how edges and boundaries build and erode, solidifying or destabilizing territories and assemblages, and how the resulting silt and nutrients eddy into SEA and CPS. In charting these flows I will focus on concepts and phenomena related to my selected ecogeographical terms as they are defined in ecology and STS. Along the way we will encounter a series of binaries that both intrigue and frustrate me, including field/laboratory, studio/street, natural/artificial, flux/balance, art/science, animal/plant and human/nonhuman.

Before defining my selected terms further and investigating how they might function as binary breakers, I will devote a few pages to exploring how the term ecology itself came to be, and how it gets characterized as a discipline. I will start with several perspectives drawn from STS, and conclude with a characterization from within the field itself. This will provide at least a brief glimpse into the origin of the term and the workings of the field that originally introduced me to the ecogeographical terminology I find so enticing.

As described in Sharon E. Kingsland's history of population ecology, the German Darwinian scientist Ernst Haeckel first employed the term *ökologie* in 1866.[9] The original meaning of the

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[9] Kingsland, Sharon E. *Modeling Nature: Episodes in the History of Population Ecology*. 2nd ed. University of Chicago Press, 1995. http://www.press.uchicago.edu/ucp/books/book/chicago/M/bo3630803.html, 11.

term, coming from Latin, is "the study of households", but Haeckel meant for this new science to address "the relations of the organism to the environment, including all the conditions of existence, both organic and inorganic".[10] While the opening sentence to Kingsland's book describes ecology as "the study of patterns in nature, of how those patterns came to be, how they change in space and time, and why some are more fragile than others", Haeckel's emphasis on relations seems key to me, and lacking in Kingsland's definition focused on patterns.[11] Regardless, Kingland's exploration of the frictions that arose from 1930 to 1970 between descriptive work carried out through field observations and the later rise of theoretical ecology dependent on mathematical modeling, is relevant to my artistic fieldwork practice. It gets the play between field and laboratory, abstraction and reality that animates and troubles some of the binaries mentioned earlier.

Tracing an earlier tension in ecology between field biology and laboratory experiments, Robert F. Kohler also defines a focus on relationality as key to the formation of the discipline. He describes an unstable beginning for ecology, as practitioners sorted out allegiances to both physiology and natural history. Emphasizing the late 19th Century emergence of the term in the United States and Britain, he provides a definition formulated at the 1893 International Congress of Botany, which decreed ecology to be a subset of physiology that attends to "the interrelations of organisms and their mutual adaptations."[12] The chair of the committee, American plant physiologist Joseph C. Arthur, later expanded that definition to include the relationships between

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[10] Kingsland, *Modeling Nature*, 11.

[11] Ibid., 1.

[12] Kohler, Robert E. *Landscapes and Labscapes: Exploring the Lab-Field Border in Biology*. University of Chicago Press, 2002, 75.

organisms and their habitats or environments, which as Kohler describes, "was in fact the problem that became the core of the new discipline of ecology".[13] In Kohler's analysis those who take on the title "ecologist" have continued to focus in this area to this day, even as the field as a whole has struggled to find its place between experimental, lab-based experimentation and field-based observation, both in a methodological and epistemological sense.

A different perspective associated with feminist STS can be found in Carolyn Merchant's *Ecological Revolutions,* which traces ecology, both as concept and term, through its use in environmental history. She starts with Marx and Engels, who emphasized the dialectical interaction of production and ecology, in which humans live thoroughly interconnected with the rest of nature. This interconnection can be described as a dispersed "inorganic body" that integrates every human well beyond the boundary of flesh and blood.[14] She marks the arrival of the term "ecology" in the United States as 1892, a year before Kohler's summit reference, and gives credit for its introduction to Ellen Swallow Richards of MIT, an early "reasonable use" reformer responding to the environmental ills of the industrial revolution in the North Eastern United States.[15] This genealogy emphasizes the long history of ecology has as a rallying concept for environmentalists and others concerned with questions of public health, resource extraction, and environmental justice.

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[13] Ibid., 75.

[14] Merchant, Carolyn. *Ecological Revolutions: Nature, Gender, and Science in New England*. 2 edition. Chapel Hill: The University of North Carolina Press, 2010, xix.

[15] Ibid., xxi.

The above perspectives on ecology are drawn from STS, and it seems appropriate to provide a perspective from within the field itself. In their 2006 article "Ecology through time, an overview", ecologists Lorenzo Bramanti and Giovanni Santangelo attempt, as they describe it, "to condense the major events in the history of Ecology into short 10 sections."[16] Like others, they describe ecology as a science of relationships among organisms and their environments, but express dissatisfaction with the ability of this definition to encompass the magnitude of ecology's potential contribution to contemporary science.[17] They are confident of the field's contemporary relevance, as indicated here:

> In little more than two generations, a new science has emerged and developed into a fundamental part of our lives, spurred on by increasing interest in "natural systems" and concerns over the environmental changes we are witnessing.[18]

But, like Kingsland and Kohler, they cite the relatively recent flourishing of ecology, and describe the motivation for their text in terms of shoring up the field's legitimacy. They seek to present ecology to "scientists of various fields" as its own "true science", in the hopes of "stimulating curiosity and laying the base for further insights."[19] As practitioners of ecology writing from within the discipline, they call on others to recognize, legitimize and further

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[16] Lorenzo Bramanti and Giovanni Santangelo, "Ecology through Time, an Overview". For simplicity's sake I've identified Bramanti and Santangelo as "ecologists", but in actuality they are also between disciplines, as is common for researchers whose work focuses on ecosystem science. A more accurate description might state that Santangelo is professor in the Department Ethology, Ecology and Evolution at the University of Pisa, with expertise in Zoology, Marine Biology, and Ecology and Bramanti is a researcher at the French National Center for Scientific Research with a focus on Marine Ecology and Conservation Biology.

[17] Ibid., 397.

[18] Ibid., 395.

[19] Bramanti and Santangelo, "Ecology through Time, an Overview," 396.

institutionalize the field, even while finding strength in the way the field "eclectically applies" multiple disciplines to its work.[20]

Through this brief tour of the emergence of ecology as a term and its growing pains as a discipline, we see a common emphasis on the relative youth of the discipline, its somewhat outsider status with regard to more "rigorous" hard laboratory sciences, and its tendency to pull "eclectically" from multiple disciplines. These characteristics make this a rich field for generating terms with which to think through rough edges, blurring boundaries and crumbling borders in other fields and in the physical world we inhabit. It is in these crumbling edges that I find the structures, systems, ideas and organisms that drive my work in social-ecological art. Naturally, when I saw similar language used to describe the emergence of STS as a field, I was intrigued.

Given my relatively shallow exposure to the field of STS, a brief overview of the way I understand and interact with it may be helpful. I first encountered the field through the work of Donna Haraway, whose feminist approach to STS made its way into one of my undergraduate art classes in 2001 in the form of her now seminal "Cyborg Manifesto".[21] As I've become more familiar with STS, I've come to understand that it provides a suite of approaches for identifying and unpacking the way boundaries and margins function in the maintenance of power relationships and the building of knowledge hierarchies. Often these power flows and hierarchies

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[20] Ibid., 395.

[21] Donna Haraway, "Cyborg Manifesto." *Simians, Cyborgs, and Women: The Reinvention of Nature,* 1 edition (New York: Routledge, 1990); Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (Harper Collins, 1990).

are referred to using terms I am familiar with from my long engagement with the ecological sciences, and define problematics that are familiar to me from my own experiences navigating between the ecological sciences and the arts.

According to the 2016 *Handbook of Science and Technology Studies*, STS was a young and barely defined field when the first handbook was published in 1977. The editors of the 2017 handbook site the genesis of the first handbook in a 1971 meeting during which "a group of scholars identified 'a need for some sort of cross-disciplinary mode of access to this entire spectrum of scholarship' addressing issues of science, technology, and society".[22] Reflecting on this genesis a half century later, they offer the following definition of STS:

> Science and Technology Studies—STS for short—is an interdisciplinary field that investigates the institutions, practices, meanings, and outcomes of science and technology and their multiple entanglements with the worlds people inhabit, their lives, and their values.[23]

This definition, while focused on people, institutions, and disciplines, does not read too differently from many definitions of ecology. The importation of metaphors from ecology to STS has not been lost on the field. From Susan Leigh Star's 1995 edited volume *Ecologies of Knowledge* to Atsushi Akera's 2006 article "Constructing a Representation for an Ecology of Knowledge", the field has been self-reflexive about the salience of representing the flows of

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[22] Ulrike Felt et al., eds., "Introduction to the Fourth Edition of the Handbook of Science and Technology Studies," in *The Handbook of Science and Technology Studies*, fourth edition edition (Cambridge, Massachusetts: The MIT Press, 2016), 1–26.

[23] Ibid., 1.

knowledge and power in ecological ways.[24] While the editors of the 2016 handbook do not cover this in their introduction to the volume, a perusal of the index and citations makes it clear that the use of ecological terminology and metaphor continues. The editors do emphasize that while the field has solidified greatly since its emergence in the 1970s, it remains less defined and more open to questioning than many other fields, a "perceived fragility" that is related to its ongoing emphasis on "plurality and openness to neighboring fields as well as the relative partiality of its institutionalization."[25] Ecology, while it has a longer history and is more broadly institutionalized, continues to give and take from neighboring fields in ways that are also productive and destabilizing.

With that cursory exploration of ecology and STS behind us, it is time to look at how ecological metaphors function in the wild, that is, on the pages of texts drawn from the various disciplines in question. As noted previously, I've chosen to focus on terms I describe as "ecogeographical", meaning they reference the relationships between biotic and abiotic entities, organisms, and topography. I encountered my selected terms (edge, boundary, territory, and assemblage), through my long engagement with the ecological sciences. I have applied them to my work in social-ecological art over the past seven years, and only recently took note of them in STS and CPS, where I found new dimensions of meaning that are pertinent to the work I'm engaged in. In the following pages, I will compare situated applications of these terms from different sources, allowing their employment in ecology texts to bump up against uses drawn from STS, social-

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[24] Susan Leigh Star, ed., Ecologies of Knowledge: Work and Politics in Science and Technology (Albany: State University of New York Press, 1995); Atsushi Akera, "Constructing a Representation for an Ecology of Knowledge: Methodological Advances in the Integration of Knowledge and Its Various Contexts," *Social Studies of Science* 37, no. 3 (June 1, 2007): 413–41, https://doi.org/10.1177/0306312706070742.

[25] Felt et al., "Introduction to the Fourth Edition of the Handbook of Science and Technology Studies,"11.

ecological art, and CPS. For the ecology definitions, I will pull from the fourth edition of the comprehensive Oxford *A Dictionary of Ecology,* a reference volume aimed at ecology students and available in many university libraries.[26] For examples from other fields I will pull from the highlighted passages and handwritten notes that brought me to write this paper, buttressed by more recent reading on knowledge ecologies in STS. Along the way I'll weave in instances where I find these terms to be relevant to my on-the-ground work with urban ecosystems and the plants and people embedded in them. We'll begin with edge, a term I encountered early in my ecology education.

Edge[27]

Allaby:
The change in the number of species occurring in the zone where two habitats are in contact. Since this zone may contain biotic elements from both habitats and some unique to itself it may be rich in species, but because those species are ill-adapted to the immediately adjacent habitat, the rate of local extinction is usually high at **edges**. Predation, in particular, is greatest at a habitat **edge**. The effect occurs because the overlap region supports some species from both adjacent ecosystems and some peculiar to itself. Ecologists now regard the **edge** effect as a sign of ecological deterioration. The fragmentation of habitats causes an increase in **edge** areas, but a decrease in the internal areas of ecosystems, leading eventually to a loss of species from all affected ecosystems and an increase in **edge** species, which are usually commonplace.

Haraway (drawing on Tsing):
Even more tardily in my agility training dilemmas, I remembered that contact zones called ecotones, with their **edge** effects, are where assemblages of biological species form outside their comfort zones. These interdigitating **edges** are the richest places to look for ecological, evolutionary, and historical diversity…Such contact zones are full of the complexities of different kinds of unequal power that do not always go in expected directions…Rethinking "domestication" that closely knots human beings with other organisms, Tsing asks "What if we imagined a human nature that shifted historically together with varied webs of interspecies interdependence?" Tsing calls the webs of interdependence "unruly **edges**"… with Tsing's approval, I would add that the same is true of dogs, and it is the human-dog entanglement that rules my thinking about contact zones and fertile unruly **edges**…

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[26] Suzanne Teghtmeyer, "LibGuides: Natural Resources and Ecology Research Guide: Ecology Reference Resources," accessed May 4, 2018, //libguides.lib.msu.edu/c.php?g=96186&p=626054; K.L. Carriveau Jr., "A Dictionary of Ecology," *CHOICE: Current Reviews for Academic Libraries*, 2011.

[27] Donna Haraway, *When Species Meet* (University of Minnesota Press, 2008), 216-17.

I first learned the meaning of "edge" as it is used in ecology as an undergraduate in a community ecology class in the early 2000s. I was smitten. The term captured my imagination, and made my mind move. Later in my undergraduate career I ended up studying the edges between rice fields and wild swamps for a field ecology project. After graduating, as a young artist living in Los Angeles, I made paintings and drawings of the places where concrete rivers met the city and the sea. In those edges I found a rich, aesthetically interesting landscape where I could encounter the melding of habitats and maybe see an interesting bird or other city-dwelling wild thing.

As demonstrated in the Allaby definition above, in ecology the term edge is most often used as part of the phrase "edge effect". In this use, edge refers to the geographical range where two habitats come together, also sometimes referred to as ecotones. The "effects" of this edge can be multiple and variable. In some situations higher biodiversity is present at edges, because the transition zone between habitats "may contain biotic elements from both habitats and some unique to itself."[28] A common example is an organism that uses open grassland for grazing but shelters in brush or forest most of the time. (Or maybe a painter who needs her studio for even light and detailed work, but can't paint without access to the rough, wild edges of the city, where she finds her motivation to work). An edge habitat must be passed through repeatedly, and staying closer to the edge provides easier access to each habitat.

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[28] Michael Allaby, "Edge Effect," in *A Dictionary of Ecology* (Oxford University Press, 2015), http://www.oxfordreference.com/view/10.1093/acref/9780191793158.001.0001/acref-9780191793158-e-1798; Donna Haraway, *When Species Meet* (University of Minnesota Press, 2008), 218-19.

As noted in the Allaby definition, even given the species richness that comes from organisms moving between multiple habitats, the rate of local extinction can also be high at edges. Edges shift over time, and organisms may not adapt easily to habitats immediately adjacent. Predators also know to look for prey here, where organisms might be stressed, distracted, or vulnerable due to being in transition. This could apply to a tree battered by wind and weather at the edge of a forest and thus made vulnerable to parasitic fungus, as much as it does to a rabbit taken by a hawk. As Allaby points out, the meaning of "edge effect" has also shifted over time, as ecological degradation has become more of a concern. Habitat fragmentation due to anthropogenic effects creates more and more edge habitat, leading to the shrinkage and quality decline of what Allaby calls "the interior areas of ecosystems."[29]

Haraway's, and by extension Tsing's, invocation of edge is clearly tied to its definition within ecology, but is expanded to include the cultural and social diversity that can be found at edges or "contact zones", as Haraway dubs them. Ecological change often feeds back into, or is precipitated by, social and cultural change, making it necessary and reasonable to track "naturalcultural, political, ecological and semiotic entanglements" rather than attempting to look at ecological change, fragility, and resurgence as unique phenomena.[30] Haraway uses ecological metaphors to soften edges and entangle concepts that might, using another set of metaphors, be read as overly mechanized, causal in a unidirectional sense, or otherwise excessively simplified. As Tsing asks "What if we imagined a human nature that shifted historically together with varied

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[29] Ibid.

[30] Haraway, *When Species Meet*, 218.

webs of interspecies interdependence?" For both Haraway and Tsing, natureculture is a hybrid mesh and should be analyzed as such.

This brings me back to concepts both Star and Akera emphasize in their work on knowledge ecologies. In his article, Akera describes how the ecological metaphor is often applied "only as a general reference to the complexity, contingency, and indeterminacy associated with the process of knowledge production." While both Star and Akera do seem to draw on this use of the metaphor by setting up the indeterminacy and multiplicity of an ecological view of knowledge in opposition to, or as a mediating force of, approaches drawn from militaristic, industrial, or other highly deterministic sources, they are interested in a more rigorous, perhaps more literal importation of the actual *techniques* employed by ecologists attempting to visualize ecological systems. In the introduction to *Ecologies of Knowledge*, Star states "thus by *ecological* we mean refusing social/natural or social/technical dichotomies and inventing systematic and dialectical units of analysis."[31] It is these "systematic and dialectical units of analysis" that hold the most promise for Akera. He is drawn to the "highly structured" "layered" and "metonymic" representation of parts to wholes, which he sees as fundamental to ecology as a discipline. Responding to what he reads as a systematic flattening of relationships in the work of posthumanist scholars like Latour, he writes:

> Nevertheless, this invocation [Latour's] of the ecological metaphor differs from the highly structured representations used in the discipline of ecology, where an explicit understanding of metonymic relationships that exist at different scales remains an important focus of analysis…While an ecology of knowledge may be quite different

[31] Star, *Ecologies of Knowledge*, 2.

> from an ecology of nature, the real value of the metaphor may rely on upholding the distinction between different scales of analysis.[32]

While I am convinced that layering and scaling are essential to understanding the world and its problems, I have to wonder if how Haraway and Tsing would respond. I am intrigued by Akera's diagrams, and have indeed attempted to make my own layered and metonymic diagram, layering the ruderal ecosystem of the Ingalls Avenue brownfield in Troy onto my own social-ecological art methodology and practice. But Haraway and Tsing strive not to allow natureculture to bifurcate; a theory of representation that separates knowledge from the fleshy world of everything else would seem counter to the way they use ecology. Surely there are scales within which it makes sense to separate out a part of a system and look at it in isolation, but an ecology of knowledge that looks at itself as "quite different from an ecology of nature" seems to miss the embodied nature of being (and thinking!) that is so essential to scholars of feminist STS.[33]

Over time, the naturalcultural instantiation of the term "edge" has crept into my lexicon as my artistic practice has drifted from painting and drawing to the social-ecological work I do now. Rather than turning to edge habitats for inspiration to drive representational work in the studio, now much of my art practice actually happens in spaces that get described as edges or margins. These are spaces where smooth pavement meets rugged rubble, or pristine lawn gives way to

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[32] Akera, "Constructing a Representation for an Ecology of Knowledge," 416.

[33] I am well aware that I may not fully have absorbed either Star or Akera's approach to knowledge ecologies, and also acknowledge the utility of sometimes, temporarily, bracketing the natureculture amalgam in order to address how power operates to expropriate free/cheap labor from what has traditionally been defined as "nature" (i.e. women, the colonized, biotic resources, to follow Carolyn Merchant and Jason W. Moore & Raj Patel's logic); Carolyn Merchant, "Dominion over Nature," in *The Death of Nature: Women, Ecology, and the Scientific Revolution* (Harper Collins, 1990), 164–90; Jason Moore and Raj Patel, *A History of the World in Seven Cheap Things* (University of California Press, 2017).

riotous wild plants. To me, like any organism, these edges are full of opportunity and interest, but also dangerous and unpredictable. I hop walls and climb over fences to go between the city's habitats, looking for pockets of feral wilderness in the smooth facade of the neoliberal urban landscape. Sometimes I scrape a knee or bruise a shin, other times I experience withering looks from vigilant neighbors or duck out of view of private security guards. But more often then not, I'm greeted with enthusiasm by those who also find solace and inspiration in engaging edges. Sometimes I meet fellow urban foragers, birders out with binoculars, or kids with spray paint, and even if we don't interact, we generally share a brief conspiratorial acknowledgement of our interaction with these marginal landscapes.

Boundary[34]

Allaby:
Boundary layer: The layer of air that lies immediately adjacent to a surface and in which the atmospheric conditions are strongly conditioned by contact with the surface.
The planetary **boundary** layer comprises the air between the surface and an average altitude of about 500 m, within which the air is strongly affected by surface conditions and wind speeds are reduced by friction with the surface.
Boundary current: The northward- or southward-directed ocean-water current which flows parallel and close to a continental margin. Such currents are caused by the deflection of eastward- and westward-flowing currents by the continental land masses. **Boundary** currents on the western margins of ocean basins, such as the Gulf Stream and the Kuroshio Current, are deep, narrow, fast-moving currents; currents along the eastern **boundaries**, such as the Canaries Current and the California Current, tend to be relatively shallow, broad, diffuse and slow-moving.
Boundary zone: A time line that is based on either the appearance or the disappearance of a key species or fauna. Associated faunas and sediments may transgress a zonal **boundary.**

Star:
Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites…
Grinnell then transformed this agreement into a resource for getting more money. He became one of the primary people in charge of preserving California. He made extensive alliances with conservation groups. This provided him with a definite but still weakly-constrained and weakly- structured base. Furthermore, the geographical concepts he wanted to advance were built on this kernel of support for California preservation. He needed a baseline for his geographical theories and comparisons, as the conservation movement needed and wanted information about the natural baseline threatened by development interests. At the core and beginning of his work, then, he placed a common goal and conventional understanding, with **boundaries** from several different worlds which coincide. These coincident **boundaries**, around a loosely-structured, **boundary** object, provide an anchor for more widely-ranging, riskier claims.

Boundary is more flexible in its use in ecology than edge, and has many appending terms that make its meaning more specific, like "current" and "layer". In the Allaby examples above, boundary is used to demarcate a spatial relationship formed by flows of matter, like that between two zones of the atmosphere, or between currents in the ocean. But in ecology, as in other fields, the term is also sometimes used in a more temporal sense, in phrases like "boundary zone" and

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[34] Allaby, "Boundary Layer,"; Susan Leigh Star and James R. Griesemer, "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39," *Social Studies of Science* 19, no. 3 (1989): 393, 410.

"boundary stratotype."[35] In this context it indicates the temporal limits of a species' existence, that is, its distribution in *time*, in addition to its distribution across the Earth's surface. Star's use of boundary in the now well-worn STS term "boundary object" could be said to employ both meanings of the term, temporal and spatial. In the passage above, while looking at Grinnell's boundary work at the Berkeley Museum of Vertebrate Zoology, Star identifies how Grinnell pushes his sphere of influence to its limits, forming new a new boundary when and where he meets the influence of other groups and a common purpose can be found. At this particular boundary, natural history specimens, and ideas about them, become boundary objects. They simultaneously serve multiple purposes and publics who come together at a boundary that didn't exist in the past, and may not survive long into the future.[36]

Prior to my recent exposure to STS, I would have told you boundaries were similar to edges: both are hybrid, layered spaces of possibility and risk. But the boundary object concept as teased out by the comparison above allows me to identify some of the boundaries and boundary objects I work with, as distinct from the edges I inhabit and move across. These are objects and spaces where I sense simultaneous, hybrid functions and meanings, formed at the intersection of fluid temporalities and flows of knowledge and power. One such object, which functions both as an abstract symbol and a concrete, fleshy organism, is the Asiatic dayflower plant, also known as *Commelina communis*. I've been working closely with this plant over the past five years because

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[35] "A specified rock section within which the time line ('golden spike', boundary zone) occurs that marks the standard demarcation between chronostratigraphic units. In practice such time lines are usually based on either the appearance or the disappearance of a key species (see index fossil) or other taxon. Associated faunas and sediments may transgress zonal boundaries. The term 'boundary stratotype' has also been used in the sense of the time line itself."; Allaby, "Boundary Stratotype."

[36] Star and Griesemer, "Institutional Ecology, 'Translations' and Boundary Objects," 409-10.

it provides a rare treasure: light fast blue pigment for my weedy watercolor palette.[37] Now I'd like to think through how it functions as a boundary object pulling together weed scientists, plant chemists, urban ecologists, stay-at-home moms, and a social-ecological artist.

First, a quick introduction to the naturalcultural history and status of this plant. Considered native to much of Northeastern Asia, Asiatic dayflower was historically cultivated in large quantities in Japan, for use as a source of blue dye prior to the introduction of synthetic blue pigments. In this context it was coddled by humans for generations and developed into a larger-petaled cultivar known as *C. communis var. hortensis*.[38] Since that time it has spread throughout Asia, Europe, and Eastern North America, and it acts differently in each place.

C. communis is found in growing large populations on copper mine tailings in China, where it shows an incredibly high tolerance for heavy metals, leading to research on its role as a hyperacculumlator and possibility for phytoremediation practices.[39] In New York City it is generally tolerated as a "wild flower" and is known to foragers as an edible.[40] More recently the species has showed up in the midwestern United States, where it is considered a "noxious weed"

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[37] Ellie Irons, "Invasive Pigments and Feral Hues: The Spectrum of an Urban Plant Community," *Landscape Architecture Frontiers* 3 (June 1, 2015): 136-43.

[38] F. Pennell, "What Is Commelina Communis?," *Proceedings of the Academy of Natural Sciences of Philadelphia* 90 (1938): 31–39.

[39] W. L. Xiao et al., "Bioaccumulation of Heavy Metals by Wild Plants Growing on Copper Mine Spoils in China," *Communications in Soil Science and Plant Analysis* 39, no. 3–4 (February 1, 2008): 315–28, https://doi.org/10.1080/00103620701826415.

[40] R. Swegman, "The Beautiful Dayflower | Wildflowers of the West Village," accessed May 4, 2018, https://wildflowersofthewestvillage.com/2010/07/30/the-beautiful-dayflower/.

because it is exhibiting tolerance to RoundUp, Monsanto's glyphosate-based herbicide.[41] In the novel ecosystem built around GMO soybeans and herbicides, Asiatic dayflower has reached the status of a "superweed".[42] Forging lifeways as a cultivated dye plant, an urban wildflower, a phytoremediator, or monoculture disruptor, this plant pushes back against any attempt to frame its existence according to singular categories. When I pluck a dayflower in Brooklyn, where it's squeezed up against a metal fence to stay out of reach of the mower's blades, I see a boundary object *par excellence*. Is it a superweed, a wildflower, a hyperaccumulator, a dye plant? It holds these identities in layers, functioning to foment conversation and exchange between me, a social-ecological artist in New York City, and those I encounter in my artistic exploits, from an agricultural researcher based in the midwest who's trying to head off the next superweed, tp an urban ecologist working in the brownfields of Chicago where heavy metals and dayflower go together like peanut butter and jelly, to a stay-at-home mom in Maine who wants to make toxin-free paint with her daughter. We all come to this wily, weedy organism with different expectations, and form new boundaries, contingent and quickly dissolved, at our meeting points.

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[41] M. Frey and R. App, "Exotic Plant Management Team Program: 2013 Annual Report. Natural Re-Source Report NPS/NRSS/BRMD/NRR—2014/781," Biological Resources Division (U.S. National Park Service)- Exotic Plant Management Teams, 2013, https://www.nps.gov/orgs/1103/epmt.htm.

[42] Santiago M. Ulloa and Micheal D. K. Owen, "Response of Asiatic Dayflower (Commelina Communis) to Glyphosate and Alternatives in Soybean," *Weed Science* 57, no. 1 (January 1, 2009): 74–80, https://doi.org/10.1614/WS-08-087.1; According to its originator Richard Hobbs, a novel ecosystem is a "system of abiotic, biotic, and social components (and their interactions) that, by virtue of human influence, differs from those that prevailed historically, having a tendency to self-organize and manifest novel qualities without intensive human management."; Hobbs quoted in James R. Miller and Brandon T. Bestelmeyer, "What's Wrong with Novel Ecosystems, Really?," *Restoration Ecology* 24, no. 5 (September 2016): 577–82, https://doi.org/10.1111/rec.12378.

Assemblage[43]

Allaby:
Assemblage: A collection of plants and/or animals characteristically associated with a particular environment that can be used as an indicator of that environment (e.g. in geobotanical exploration). The term has a neutral connotation. Its use does not imply any specific relationship between the component organisms, whereas terms such as 'community' imply interactions.
Assemblage zone: A stratigraphic unit or level of strata that is characterized by an **assemblage** of animals and/or plants. An **assemblage** zone is named after one or more of the distinguishing fossils present, which are chosen without regard for their total time ranges, so that the **assemblage** is of purely environmental significance.
Life **assemblage**: A fossil community that is interpreted as representing a former living community. Most **assemblages** interpreted as life **assemblages** represent only a small fraction of a former community.
Death **assemblage**: An assemblage of fossils of organisms that were not associated with one another during their lives. The remains were brought together after death, often by the action of currents.
Psuedospecies: An **assemblage** of individuals of somewhat dubious taxonomic status that are regarded as a single species for the sake of numerical analysis of data.

Tsing:
The concept of ***assemblage*** is helpful. Ecologists turn to **assemblages** to get around the sometimes fixed and bounded connotations of ecological "community". The question of how the varied species in an **assemblage** influence each other—if at all—is never settled: some thwart (or eat) each other; others work together to make life possible; still others just happen to find themselves in the same place. **Assemblages** are open-ended gatherings. They allow us to think about communal effects without assuming them. They show us potential histories in the making. For my purposes, however, I need something other than organisms as elements that gather. I need to see lifeways—and nonliving ways of being as well—coming together. Nonhuman ways of being, like human ones, shift historically. For living things, species identities are a place to begin, but they are not enough: ways of being are emergent effects of encounters. Thinking about humans makes this clear. Foraging mushrooms is a way of life—but not a common characteristic of all humans. The issue is the same for other species. Pines find mushrooms to help them use human-made open spaces. **Assemblages** don't just gather lifeways, they make them. Thinking through **assemblages** pushes us to ask, how do gathering sometimes become "happenings", that is, greater than the sum of their parts?

The term assemblage has been widely circulated in STS, and are some characteristics on display in the Allaby definition above that suggest why. As Allaby writes, the term implies a "collection" of organisms that can be found in the same geographical area. Of course in STS no term gets to be "neutral", but Allaby's assertion of neutrality here is made in contrast to more deterministic,

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[43] Michael Allaby, "Assemblage," in *A Dictionary of Ecology* (Oxford University Press, 2015), http://www.oxfordreference.com/view/10.1093/acref/9780191793158.001.0001/acref-9780191793158-e-440; Anna Lowenhaupt Tsing, *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (Princeton: Princeton University Press, 2015), 22-23.

causal uses of related terms in ecology, like "community", which implies known interactions between organisms. Tsing echoes this idea when she writes that ecologists use the term "to get around the sometimes fixed and bounded connotations of ecological 'community'."[44] This openness to not-knowing, and to using terms that suggest indeterminacy, is as described previously, one of the key ways ecological metaphors are used in STS.

I have selected Anna Tsing's use of the term because it's one of those "brain ticklers" that I've been digesting in my notes and highlights. I could have started with Deleuze and Guattari, or perhaps Manuel DeLanda's digestion of Deleuze, but these points of entry have never enlivened me in the way that my original exposure to the "edge effect" did as a young student of ecology.[45] I find, again and again, that I am most drawn to the ecological metaphor when it is employed in ways that invoke the messy, muddy, lively world. Both Haraway and Tsing ground their use of metaphor in physical experience of the biotic and abiotic world. Perhaps it is the ethnographic approach that I am drawn to here, and the camaraderie of attempting to record the world as it might appear through another's eyes (or ears, or soles of the feet, or root tips, even). Not an attempt at empathy, necessarily, but rather a kind of ecological thought that asks us to try, even knowing we'll fail, to structure our perception in more-than-human ways.

This realization brings me to critical plant studies, where the use of ecological metaphors abounds, but is employed in ways directed at allying ourselves with the ontologically alien world

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[44]Tsing, *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins,* 22.

[45] Gilles Deleuze and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi, 2 edition (Minneapolis: University of Minnesota Press, 1987); Manuel DeLanda, "Deleuze and the Open-Ended Becoming of the World," 1998, https://www.cddc.vt.edu/host/delanda/pages/becoming.htm.

of the vegetal, rather than better understanding our own patterns of knowledge creation. Marder asks us to embrace the *difference* of plant life, rather than hunting for evidence of human-like "intelligence". If anything, Marder is interested in seeing humans think more like plants, rather than emphasizing how plants think like humans:

> I explore the potential of phytocentrism for the "greening" of human consciousness brought back to its vegetal roots, as well as for tackling issues related, among others, to the use of biotechnologies and dietary ethics.[46]

In Marder's coining of the term phytocentrism, in opposition to zoocentrism and Anthropocentrism, and in his exhortation to bring thinking back to its "vegetal roots," I see echoes of themes running throughout scholarship that adopts ecological metaphors. As in my own work, and in the work of Haraway and Tsing, the subject at hand is not just well-described by ecological metaphors, it actually IS ecological. But isn't everything? If we apply this lens, maybe it's not ecological metaphors we need, perhaps we just need to embrace the view that *everything is ecological*. Not in an "everything is connected to everything else" flattened systems thinking way, but in a Harawayan "nothing is connected to everything; everything is connected to something" way.[47] This sentiment allows for the metonymic approach put forth in Akera's analysis of ecological metaphor. Some connections matter more than others, and power

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[46] Michael Marder, "For a Phytocentrism to Come," *Environmental Philosophy* 11, no. 2 (2014): 237.

[47] Barry Commoner, *The Closing Circle: Nature, Man, and Technology*, 1st edition (New York: Random House Inc, 1971); Donna Haraway, "Tentacular Thinking: Anthropocene, Capitalocene, Chthulucene," e-flux Journal #75, September 2016, http://www.e-flux.com/journal/75/67125/tentacular-thinking-anthropocene-capitalocene-chthulucene/. Here Haraway cites Thom van Dooren's assertion that "The brand of holist ecological philosophy that emphasizes that 'everything is connected to everything,' will not help us here. Rather, everything is connected to something, which is connected to something else. While we may all ultimately be connected to one another, the specificity and proximity of connections matters—who we are bound up with and in what ways."; Thom van Dooren, *Flight Ways: Life and Loss at the Edge of Extinction* (Columbia University Press, 2014), 60.

relationships will always come into play. If I've learned anything from STS, it's been a reinforcement to be attendant to the flows of power.

Territory[48]

Allaby:
Territory: the area occupied by an animal, or by a pair or group of animals, which it or they will defend against intruders
Territoriality: The establishment, demarcation, and defence of an area by animals, normally during mating ritual. Once **territory** has been established the animals can exist without disturbance and with sufficient food for the offspring. Evidence shows that among **territorial** species individuals without a **territory** rarely breed.

Mengist:
But what is at stake? In this era of eco-political meltdown, the most vulnerable lives are at stake. Both academics and organizers will have to forge alliances between creative scholarship and social/ environmental justice movements that reach beyond all boundaries. Fortunately, there is still time to tune into the beat of the vegetal kingdom—*the first rhziomatic* ***territory***—where the movements of our green friends have *always already* been *animated* by rhythms that sustain life and love among inhabitants of the earth.

To close, I'll make a final comparison of an ecogeographical term across disciplines. "Territory" is widely used in both colloquial and academic settings. Here I compare Allaby's definition to a use of the term coming from a CPS-inflected article, and find the Allaby definition lacking. While Allaby's definition clearly demarcates territory and territoriality as the province of animals. Given what what Western science has finally acknowledged about plants in recent decades, they most certainly can hold and defend territory. That capability is no longer the

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[48] Michael Allaby, "Territory," in *A Dictionary of Ecology* (Oxford University Press, 2015), http://www.oxfordreference.com/view/10.1093/acref/9780191793158.001.0001/acref-9780191793158-e-5596; Nathanael Mengist, "Thinking with Flowers; or, Becoming Plant Conscious to Sustain Life and Love on Earth," unpublished paper presented at the Society for Science, Literature and the Arts Conference, Arizona State University, November 2017.

domain of the animal alone.[49] Allaby's unqualified use of the term animal provides an opportunity to apply an ecological metaphor to the field of ecology itself, taking that layered, hybrid, and unstable approach and deploying it against the animal/plant divide.

What would ecology look like if its practitioners adapted a CPS-inflected approach to the vegetal? In *The Plant Contact*, a recently published book on the intersection of critical plant studies and art, Prudence Gibson draws on Michel Serres concept of the natural contract to ask how art might help us establish a new contract with vegetal life. If we now perceive nonhuman nature as inanimate and exploitable, a "plant contract must embrace animism in its attempts to return us to the source."[50] It is not enough to see plants as real and alive, rather than as passive furniture, thus overcoming "plant blindness". We must also find a way to understand our vegetal cohabitants as *animate*. Based on forays into the field with several field ecologists, I know that some of them have this understanding of the vegetal embedded in their approach to the world. But when it comes to knowledge sharing in formal settings like dictionaries and journals, that tacit knowledge doesn't always get inscribed as "fact", a phenomenon that is also noted by Natasha Myers in her exploration of scientists who practice molecular modeling.[51] It is here that

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[49] As described on the website of the International Laboratory of Plant Neurobiology: "Plants are dynamic and highly sensitive organisms that actively and competitively forage for limited resources, both above and below ground; they accurately compute their circumstances, use sophisticated cost-benefit analysis, and take defined actions to mitigate and control diverse environmental insults. Plants are capable of a refined recognition of self and non-self and are territorial in behaviour. This new view sees plants as information processing organisms with complex communication throughout the individual plant."; "About Us," LINV - International Laboratory of Plant Neurobiology, accessed May 4, 2018, http://www.linv.org/about-us/.

[50] Prudence Gibson, *The Plant Contract: Art's Return to Vegetal Life* (Brill Rodopi, 2018), 50; Michel Serres and Felicia McCarren, "The Natural Contract," *Critical Inquiry* 19, no. 1 (1992): 1–21, accessed April 30, 2018, http://www.jstor.org/stable/1343752.

[51] Natasha Myers, *Rendering Life Molecular: Models, Modelers, and Excitable Matter* (Durham: Duke University Press Books, 2015).

I see a ripe opportunity for language born in ecology, then sculpted by STS, to cycle back around and settle into the territory from it they arose, subtly altering the terrain to be more productive for future endeavors.

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